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A Case Study of Collaboration in Science  
Education: Integrating Informal Learning  
Experiences into the School Curriculum

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**A Case Study of Collaboration in Science  
Education: Integrating Informal Learning  
Experiences into the School Curriculum**

**by**

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**Dissertation**

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## **Dedication**

To Ben and Emily, with love.

## **Acknowledgements**

I would like to gratefully acknowledge the participants in this study. I have enjoyed working with and getting to know each of them.

I would also like to express my gratitude toward my dissertation committee members for their support and wisdom. I am deeply appreciative of my advisor, Dr. Lowell J. Bethel, who has patiently provided continual guidance throughout my years of graduate study. Sincere thanks are given to Dr. James P. Barufaldi, Dr. Angela Calabrese Barton, Dr. R. H. (Dick) Richardson, and Dr. Donna L. Vliet, for their support of this project and their encouragement in my academic development.

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**A Case Study of Collaboration in Science  
Education: Integrating Informal Learning  
Experiences into the School Curriculum**

Publication No. \_\_\_\_\_

Amy Michelle Robertson, Ph.D.

The University of Texas at Austin, 2003

Supervisor: Lowell J. Bethel

This is a study of a collaboration between multiple stakeholders in science education for the purpose of creating educational field trip experiences. The collaboration involves four major facets of science education: formal education at the elementary and university levels, informal education, and educational research. The primary participants in the collaboration include two elementary school teachers, a scientist from a local university, an informal educator from an environmental education site, and the researcher acting as a participant

observer. The coming together of these different sides of science education provided a unique opportunity to explore the issues and experiences that emerged as such a partnership was formed and developed.

Strongly influenced by action research, this study is a qualitative case study. The data was collected by means of observation, semi-structured interviews, and written document review, in order to provide both a descriptive and an interpretive account of this collaboration. The final analysis integrates a description of the participants' experiences as evidenced in the data with the issues that arose from these experiences.

The evolution of the collaborators' roles was examined, as was the development of shared vision. In this study, there were several factors that significantly affected the progress towards a shared vision and a successful collaboration. These factors include time, communication, understanding others' perspectives, dedication and ownership, as well as the collaborative environment. Each collaborator benefited both professionally and personally from

their participation in the collaboration. In addition, the students gained cognitively, affectively, and socially from the educational experiences created through the collaboration. Steps, such as working towards communication and understanding others' perspectives, should continue to be taken to ensure the collaboration continues beyond the term of the current key participants.



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## **Chapter I: Introduction**

### **BACKGROUND**

#### **Collaboration in Education**

Recently, there has been a call for systemic reform in the educational system of the United States. Implementation of systemic reform mandates that every aspect of the system and its participants become involved in change to produce effective and sustaining outcomes (Anderson, 1993). Within the domain of science education, Sussman (1993a, p. 239) emphasizes that,

reform of precollege science education will be most effective when it is part of an educational transformation program that includes the K-12 system, preschool, colleges and universities, adult education, and informal education centers.

Because systemic change is about changing all aspects of a system, it is imperative that all its members are collaborators. Because of this, the emphasis in education is now leaning more toward a theory of collaboration (Spector, Strong, & King, 1995). This change is evident by the amount of recent

educational research that involves the concept of collaboration.

Collaboration is defined by Winer and Ray (1994, p. 33) as a "mutually beneficial and well-defined relationship entered into by two or more organizations to achieve results they are more likely to achieve together than alone." Underlying this theory of collaboration is the belief that "each person interprets the world through his or her own perspective, and that human beings must interact with each other in order to construct societal truth" (Spector & Spooner, in Spector, et al., 1995, p.179). Within this sociocultural theoretical framework, knowledge is co-constructed and situated in the course of social activity (Lave & Wenger, 1991).

Barufaldi (2000) and Spector, et al. (1995) have discussed several elements present in successful collaborations within science education. Barufaldi (2000) states that a shared vision is the most important component in collaborations. Participants in a collaboration must have the same expectations of objectives, strategies, and goals (Barufaldi, 2000; Spector, et al., 1995). In addition, communication is



vital in order to have a truly shared vision within a collaboration (Barufaldi, 2000; Spector, et al., 1995). Communication is also key for the partners to realize the interconnectivity among individuals (Barufaldi, 2000). Participants must trust and respect each other by understanding and valuing each other's unique knowledge base (Spector, et al., 1995). Moreover, ownership and commitment on the part of the partners is important for successful collaborations, and these require time to develop (Barufaldi, 2000). Spector, et al. (1995) emphasize the importance of intrinsic motivation as a driving force of collaborations. Barufaldi (2000) adds that commitment to the collaboration needs to be supported by an adequate financial base as well as incentives and rewards.

General collaboration research is also in agreement with these characteristics of successful collaborations (e.g., Hord, 1986; Mattessich, Murray-Close, & Monsey, 2001; Winer & Ray, 1994). In addition, the Institute of Museum and Library Services (1996) also suggests striving for similar characteristics in museum/school partnerships. This

is the theory of collaboration upon which this study is built.

### **The Need for Collaboration in Informal Education**

It has been recommended that collaborative projects be implemented in schools to enhance the value of out-of-school experiences (Dori & Tal, 1998). Such "out-of-school" educational science experiences most often take the form of field trips to informal education sites such as nature centers, zoos, aquaria, and museums. Research in the field of informal education recommends the use of field trips as an instructional method, citing social, affective, and cognitive gains by students. Because of the unique learning opportunities available at informal institutions, contemporary goals of educational reform also encourage the use of field trips as an educational method (e.g., *Benchmarks for Science Literacy*, 1993; *National Science Education Standards*, 1996; *Texas Essential Knowledge and Skills*, 1997). The National Science Teacher Association's (NSTA) position statement on informal science education (1998, p.54) also "recognizes and encourages the

development of sustained links between the informal institutions and schools."

In order to be most effective, field trips must be planned as an integral part of the curriculum, rather than as an isolated activity or merely as enrichment (Hofstein & Rosenfeld, 1996; Orion & Hofstein, 1994). One of the most apparent ways to effectively integrate the field trip into the formal school curriculum is through collaborations between formal and informal education systems (Hicks, 1986). Ramey-Gassert, Walberg, and Walberg (1994, p.360) note that there needs to be an emphasis on "long-term, sustainable collaborations...which better meet the needs of both teachers and students." *The National Science Education Standards* (National Research Council, 1996, p. 58) also suggest creating "optimal collaborative learning situations in which the best sources of expertise are linked with the experiences and current needs of the teachers." In order to improve science education, informal and formal educators should form partnerships as co-developers of field trip programs and curricular materials to be used in the classroom before and after field trips (Texas SSI Action Team,

1999). This would help insure that the classroom activities and the field trip activities correspond and connect with each other. Furthermore, this would help bridge the goals of informal educators with the goals of classroom teachers. These types of collaborations can increase science learning opportunities for both students and teachers (Ramey-Gassert, et al., 1994).

In order to add another perspective on both education and science, it would benefit the collaboration to include a university research scientist. Formal science educators at the university level can aid collaborations by filling any gaps that there may be in science content knowledge (Clark, 1996).

Additionally, it would be advantageous for a researcher that is familiar with the current research literature in both formal and informal education to participate in the collaboration. The concept behind this type of collaboration is to connect theory and practice in education so that they reciprocally inform each other. (Grisham, et al., 1999). This kind of collaboration would be an appropriate place for

researchers to help shape quality programs that serve as models of learning, reflection, and innovation.

### **A Brief Overview of the Collaboration Under Study**

This is a study of collaboration between multiple stakeholders in science education for the purpose of creating educational field trip experiences. The collaboration involves four major facets of science education: formal education at the elementary and university levels, informal education, and educational research. The primary participants in the collaboration include two elementary school teachers, a scientist from a local university, an informal educator from an environmental education site, and the researcher acting as a participant observer. In addition, there are several other secondary stakeholders such as the principal, other teachers, another scientist, and volunteer field trip guides. These collaborators came together during the 2000-2001 school year in order to create environmental field trips and the surrounding classroom curriculum.

## **PURPOSE**

The purpose of this study is to examine in detail the nature and process of collaboration between formal education, informal education, and educational research for the purpose of creating educational field trip experiences. Spector, Strong, and King (1995, p.179) state, "an understanding of the multitude of perspectives held by the varied stakeholders in science education is essential if we are to ensure that all of us work toward common goals." Examining this case in detail will expand the limited knowledge base of collaborations between formal and informal science education. This knowledge base will provide a springboard for future research in this field of education. In addition, such knowledge will potentially provide practitioners in science education with insights into the issues and experiences involved in the establishment of collaborations between these stakeholders.

## **STATEMENT OF THE PROBLEM**

What are the issues and experiences that emerge as formal education at the elementary and university

levels, informal education, and education research are brought together to form a collaborative relationship for the purpose of creating an educational field trip experience?

#### **RATIONALE**

What is needed is insight into the essence and experience of collaborations between the various stakeholders in science education in order to inform practitioners of potentially superior methods of implementing science education reforms. Despite the potential benefits of such collaborations, there is a limited knowledge base about such collaborations. Although there is much documentation and research on individual partnerships between formal and informal education, between formal education and scientists, and those involving education researchers, there is not much in the literature on collaborations involving all of the stakeholders in science education.

Furthermore, although there have been a few studies done on collaborative projects involving informal education sites (e.g., Institute of Museum and Library Services, 1996; Prabhu, 1982), there has

been little on the nature of the collaborative experience for the participants. The literature on collaboration between formal and informal education has focused mainly on the basic structure and products of these collaborations, not the process. For instance, the Institute of Museum and Library Services (1996) has compiled a brief overview of a few museum-school collaborations throughout the country. Although the descriptions of the programs state the particular collaboration's purpose and organizational structure, the overview of the collaborations does not give a detailed account of the participants' perspectives and experiences throughout the collaborative process.

If we are to truly understand whether the beneficial results are due to collaboration or to a few devoted individuals, we need to understand the process. It is important to gain detailed knowledge about the interworkings of how these collaborations develop and the roles the participants take.



## RESEARCH QUESTIONS

The general guiding question of the study is:

*What are the issues and experiences that emerge as formal education, informal education, and education research are brought together to form a collaborative relationship for the purpose of creating an educational field trip experience?*

This question is purposefully broad in scope to allow room for issues to arise from the case study. There are three more specific issues that developed from the literature, which initially focused this research.

**1. How does shared vision develop? In what ways is the vision shared and understood among the partners, and in what ways is it not?** A shared vision is one of the most important characteristics of a successful collaboration (Barufaldi, 2000; Mattessich, et al., 2001). It is important to know if the participants' ideas are compatible about how such collaborations should be conducted and if the participants have a basic understanding of the roles and responsibilities of their collaborative partners. It is also important to know if the participants'

ideas are compatible about what a successful field trip should look like. These factors play a major role in the effectiveness of collaborative events.

2. In what ways are the unique perspectives and knowledge bases of the individuals acknowledged and respected by the other collaborative members? In what ways are they not? In what ways are these perspectives incorporated into the shared vision? A mutual understanding of the multiple perspectives held by the varied stakeholders in science education is essential if the participants are to work toward common goals (Spector, et al., 1995). The knowledge is not held by only one of the stakeholders, but totally in the socially constructed collaboration of all the partners.

3. How will each individual benefit from the collaboration in terms of development of their practice or in terms of gaining a better understanding of their own practice or the practices of other stakeholders in science education? What additional benefits will the participants receive from the collaborative experience? One of the defining characteristics of a collaboration is that it is

mutually beneficial to the participants (Winer & Ray, 1994). Whether or not the participants benefit from the collaboration has definite implications on the level of commitment the individuals will exhibit.

These questions are chosen before the start of data collection because they proved to be important issues in other instances of collaborative research. My aim is to achieve a thorough description and understanding of the case under study. For this reason, as new issues become apparent the questions will be expanded upon and new questions will be added to the list. Parlett and Hamilton (in Stake, 1995) call this "progressive focusing." The questions that will arise during data collection and analysis are as follows:

**4. Did the students benefit from the educational experiences created through the collaboration? If so, in what ways did they benefit?** Because the collaboration's main purpose is to create beneficial educational field trip experiences for the students, it is important to understand how the students will benefit. Whether or not the students benefit largely

determines whether or not the collaboration is successful.

**5. How are the collaborators' roles and responsibilities created? How do these roles evolve over the course of the collaboration?** The ways in which the roles are created have implications on the collaborators' dedication to their roles and the collaboration in general.

**6. How does communication (or lack thereof) influence the collaboration and resulting educational experiences?** From the beginning, it is evident that communication is a significant factor in determining the success of the collaboration. Communication is also an important factor in other collaborations (Barufaldi, 2000; Mattessich, et al., 2001; Spector, et al., 1995).

#### **LIMITATIONS AND DELIMITATIONS**

This analysis is a case study. The case study has been criticized because single cases are not beneficial towards advancing grand generalizations since they are poor representations of populations of cases (Stake, 2000). However, some generalizations

within the particular case can be made of future occurrences and different situations within that case. Moreover, case studies aid in refining theory, suggesting complexities for further investigation, as well as helping establish limits of generalizability (Stake, 2000). Furthermore, Stake (1995; 2000) suggests that generalizations are made by the reader. "The utility of case research to practitioners and policy makers is in its extension of experience" (Stake, 2000, p.245). Readers bring to a case study their own experiences and understandings, which lead to generalizations when this new information is added to their prior experiences (Stake, 2000). Stake (1995) describes this as "naturalistic generalization." Similarly, Merriam (1988, p.13) describes case studies as heuristic, meaning they "can bring about the discovery of new meaning, extend the reader's experience, or confirm what is known."

The case study researcher must assist readers in this construction of knowledge by writing the story with enough thick description so that the reader has the opportunity for vicarious experience that will aid in making comparisons (Stake, 1995; 2000). To aid in

the thick description, I will spend extensive time gathering data and I will assume the role of participant observer. Participant-observation allows the case study to be perceived from the viewpoint of an "insider," which can be invaluable to producing an in-depth description of the case's phenomena (Yin, 1994). I will act as a full participant in all collaborative events.

However, one of the major problems with participant-observation is the possibility of the participant role requiring too much attention relative to the observer role (Yin, 1994). Erlandson, Harris, Skipper, and Allen (1993, p. 96) note that when acting as participant-observer, "the researcher's activities, which are known to the group, are subordinate to the researcher's role as a participant." While in the field, I will take field notes that will be expanded upon in a field log after the observations. The formal meetings will be audio recorded, which will relieve me, as the participant observer, of some of the pressure of taking detailed field notes while participating. This also will allow for a more removed view of my role during collaborative events.

As Emerson, Fretz, and Shaw (1995, p.57) state, "members' voices and views most clearly are heard by faithfully recording their accounts and dialogues."

Furthermore, case studies in general are limited to the level of integrity and sensitivity of the researcher (Merrriam, 1988). Because the researcher is the primary instrument of data collection and analysis, he or she must be keenly aware of potential biases that can affect the final product (Merriam, 1988; Yin, 1994).

I will keep a reflective field journal in which I will write any analytic ideas as well as my experiences and reflections on the collaborative events. This will also be a place for me to explore my own assumptions, beliefs, and perspectives to help me to be continually alert to my own subjectivity. Glesne (1999) affirms that being aware of one's own subjectivity will help prevent distortion of the participants' voices with one's own perspectives. Furthermore, I will try to express my perspectives and potential biases to the reader and let them draw their own conclusions about the trustworthiness of the study.

The issue of trustworthiness is also addressed by means of triangulation, member-checking, and peer review. Triangulation of both the data sources and data collection methods will help establish the most complete and trustworthy description of the research findings. The participants in the study completed a member check of the transcripts and data analysis. This will be done in order to allow participants to verify or elaborate on their statements (Glesne, 1999). In addition, peer review and debriefing will be conducted throughout the study to provide feedback to the researcher and increase trustworthiness. A collaborative look at the findings will help point out other perspectives of the data to explore. Methods such as peer review, member checking, and triangulation of the data sources and data collection methods will help insure that my own perspectives do not infest the reconstructions of the participants' perspectives (Merriam, 1988). It is important to remember that subjectivity can never be eliminated, its effects can only be minimized (Glesne, 1999).



## ORGANIZATION OF THE STUDY

A review of the literature in Chapter Two provides the context and theoretical framework for the study. Chapter Two examines the literature on general collaboration theory and contains a discussion and review of the research on collaborations between the various stakeholders in science education.

Chapter Three outlines the research design and methods employed. A description of data collection and analysis procedures is included. The issue of trustworthiness will also be discussed.

Chapter Four contains the data description and analysis of the study. An overview of the collaboration in this case includes background information about the program and the collaborators, as well as a general timeline of collaborative events. The issues analysis addresses the research questions that were laid out before the study began and those that will emerge during the study.

Chapter Five consists of an overview and discussion of the influential factors of the collaboration and the implications of the data.

## Chapter II: Review of the Literature

### THEORY OF COLLABORATION

#### Definition of Collaboration

Collaboration is defined by Winer and Ray (1994, p. 33) as a "mutually beneficial and well-defined relationship entered into by two or more organizations to achieve results they are more likely to achieve together than alone." Mattessich, Murray-Close, and Monsey (2001, p. 4) add,

The relationship includes a commitment to mutual relationships and goals; a jointly developed structure and shared responsibility; mutual authority and accountability for success; and sharing of resources and rewards.

Although some authors use the terms *cooperation* and *coordination* interchangeably with *collaboration*, most of the literature regarding collaboration theory differentiates between these three terms (e.g. Corrigan, 2000; Hord, 1986; Mattessich, et al., 2001; Winer & Ray, 1994).

Winer and Ray (1994) set these three terms on a continuum. Cooperation, which is characteristic of short-term, informal relationships, is on the lower-

intensity end of the spectrum with less risk, less time needed, and fewer opportunities. Resources and rewards are separate among the individual organizations.

Coordination is in the middle of the spectrum, characterized by a little more planning and understanding of missions. Authority still resides with the individual organizations, but resources and rewards are more shared.

Collaboration is on the higher-intensity end of the continuum. More time is required for collaboration. Risk is also increased, but so are the opportunities. Collaboration is differentiated from cooperation and coordination by "a more durable and pervasive relationship. Collaborations bring previously separated organizations into a new structure with full commitment to a common mission" (Mattessich, et al., 2001, p.60). Collaboration creates a new entity that is able to produce something that individuals or organizations could not produce alone (Corrigan, 2000). Control is shared, but can be unequal, and authority is determined by the collaborative structure (Winer & Ray, 1994).

## **Characteristics of a Successful Collaboration**

Based on a survey of collaboration research, Mattessich, et al. (2001) provides an overview of twenty factors that influence the success of collaborations. They considered general collaborations, including those formed by nonprofit groups, government agencies, and other organizations. They grouped these factors into six major categories:

### *1. Factors related to the environment*

These factors include a favorable political and social climate and a history of collaboration in the community. Also, the collaborative group needs to be viewed as reliable and competent in the community.

### *2. Factors related to membership characteristics*

An appropriate cross section of collaborative members should have mutual respect, understanding, and trust of one another. The members must also see the collaboration as in their self-interest and be able to compromise when necessary.

### *3. Factors related to process and structure*

Clear roles for the collaborative members should be developed. Multiple levels within each partner organization should have some involvement in the collaboration. Also, members should feel ownership in both the process and the outcome of the collaboration. Furthermore, it is important for the collaboration to be flexible and adaptable and develop at an appropriate pace.

### *4. Factors related to communication*

Open and frequent communication is important to the collaborative process. In addition, personal connections through informal relationships produce better and more informed collaborations.

### *5. Factors related to purpose*

The collaboration will be more successful if there is a shared vision with a unique purpose that incorporates concrete, attainable goals.

#### *6. Factors related to resources*

These factors include sufficient funds, staff, materials, and time. Skilled leadership, including organizational and interpersonal skills, is also important.

Similar to the factors mentioned by Mattessich, et al. (2001), Barufaldi (2000) and Spector, et al. (1995) have discussed several elements present in successful collaborations specifically within the field of science education.

#### ***Shared Vision***

Barufaldi (2000) states that a shared vision is the most important component in collaborations. Participants in a collaboration must have the same expectations of objectives, strategies, and goals (Barufaldi, 2000; Spector, et al., 1995). In addition, through shared responsibility and authority, there must be an equal empowerment among the partners. This means that there should be an equal opportunity for participation, although all partners may not contribute equally (Barufaldi, 2000). Spector, et al., (1995) state that there should not be a strict

*quid pro quo* structure. At each level of the collaboration, the degree or intensity of collaboration will vary (Barufaldi, 2000). Cole and Knowles (1993) suggest "negotiated and mutually agreed upon involvement where strengths and available time commitments to process are honored" (p. 486). While it is suggested that the goal should be a shared authority among the major collaborative partners, Winer and Ray (1994) suggest that there is often an initiator that organizes and facilitates the process. It is not important which particular partner takes this role. It is more important that this person has good organizational and interpersonal skills (Winer & Ray, 1994).

### ***Communication***

Communication is vital in order to have a truly shared vision within a collaboration (Barufaldi, 2000; Spector, et al., 1995). Spector, et al., (1995, p. 179) emphasize that people "come to collaborative initiatives with different expectations for (1) intended outcomes, (2) acceptance of responsibility, and (3) norms for behavior." These different expectations develop from the collaborators' different

experiences in group situations and their particular styles of interpersonal interaction. To avoid pitfalls, Spector, et al., (1995) suggest that collaborators spend time exploring each other's expectations of the collaborative process itself.

Communication is also key for the partners to realize the interconnectivity among individuals (Barufaldi, 1998). Participants must trust and respect each other by understanding and valuing each other's unique knowledge base (Spector, et al., 1995). Underlying this theory of collaboration is the belief that "each person interprets the world through his or her own perspective, and that human beings must interact with each other in order to construct societal truth" (Spector & Spooner, in Spector, et al., 1995, p.179).

### ***Ownership and Commitment***

In addition, ownership and commitment on the part of the partners is important for successful collaborations. Spector, et al., (1995) emphasize the importance of intrinsic motivation as a driving force of collaborations. The collaborative members must see the collaboration as in their self-interest. They



must believe that "the advantages of membership will offset costs such as loss of autonomy and turf" (Mattessich, et al., 2001, p. 16). Barufaldi (2000) adds that commitment to the collaboration needs to be supported by an adequate financial base as well as incentives and rewards.

### ***Adequate Resources***

Barufaldi (1998, p. 8) notes that within most successful collaborations the resources are "pooled or jointly secured."

Perhaps the most imperative resource to a collaborative group is time. Ownership and commitment require time to develop (Barufaldi, 2000). The extensive communication that is required to develop trust, respect, and a shared vision also demands much time.

Not only does collaboration rely on the existence of these factors, collaboration can actually increase the amount of elements such as trust, shared vision, and communication in a community by building stronger relationships (Mattessich, et al., 2001). General collaboration research also emphasizes these characteristics of successful collaborations (e.g.,

Hord, 1986; Mattessich, et al., 2001; Russell, 2000; Winer & Ray, 1994). In addition, the Institute of Museum and Library Services (1996) suggests striving for similar characteristics in museum/school partnerships. This is the theory of collaboration upon which this study is built.

#### **THE NEED FOR COLLABORATION IN SCIENCE EDUCATION**

The resources available for public education are limited, with many competing demands. Good science teaching will always be relatively expensive, and each school district will need knowledgeable and persistent science advocates if it is to maintain an emphasis on high-quality science education (Alberts, 1993, p.2-3).

This need for "knowledgeable and persistent science advocates" is one of the reasons why research as well as state and national guidelines recommend collaboration in science education. One specific area of science education where collaboration is useful is in the integration of informal learning experiences into the school science curriculum. The following is a description of the formal/informal science education dichotomy and the usefulness of including informal education in the school science curriculum.

## Formal and Informal Science Education

Two specific facets of science education exist: formal science education, or science learning in the school, and informal science education, science learning outside of the school (Wellington, 1990). The main differences between formal and informal learning experiences that have been noted in the literature are discussed in Table 1.

Table 1: Characteristic Comparison of Formal and Informal Learning Environments

Formal/In-School Learning	Informal/ Out-of-school Learning
Mandatory participation (Crane, 1994; Hofstein & Rosenfeld, 1996)	Voluntary participation (Crane, 1994; Hofstein & Rosenfeld, 1996)
Assessed (Hofstein & Rosenfeld, 1996)	Non-assessed (Hofstein & Rosenfeld, 1996)
Curriculum-based (Crane, 1994; Hofstein & Rosenfeld, 1996)	Non-curriculum-based (Crane, 1994; Hofstein & Rosenfeld, 1996)
Lack of social motivation (Greenfield & Lave, 1982)	Motivated by social contribution (Greenfield & Lave, 1982)
Teacher directed (Greenfield & Lave, 1982; Hofstein & Rosenfeld, 1996)	Learner directed (Greenfield & Lave, 1982; Hofstein & Rosenfeld, 1996)
De-contextualized (Greenfield & Lave, 1982)	Contextualized (Greenfield & Lave, 1982)

Crane (1994, p.3), provides this definition for informal science learning:

Informal science learning refers to activities that occur outside the school setting, are not developed primarily for school use, are not developed to be part of an ongoing school

curriculum, and are characterized by voluntary and opposed to mandatory participation as part of a credited school experience.

The literature often describes formal and informal education with a strict dichotomy. Formal education is described as in-school learning in which participation is mandatory, and the learning experiences are more structured and de-contextualized. Formal learning is directed by state and national curricula, teacher-led and usually assessed and evaluated. On the other hand, informal, or out-of-school learning, is characterized by voluntary participation in more social activities that are not directed by assessments, curricula, or teachers. Instead, informal learning is more student-interest directed in a specific context. However, Crane (1994, p.3) makes the definition of informal education more inclusive by adding that,

Informal learning experiences may be structured to meet a stated set of objectives and may influence attitudes, convey information, and/or change behavior. Informal learning activities also may serve as a supplement to formal learning or even be used in schools or by teachers, but their distinguishing characteristic is that they were developed for out-of-school learning.

Crane's (1994) supplement to the definition allows for informal education to include some formal learning in some situations. Indeed, informal, or out-of-school educational science experiences often take the form of school field trips to informal education sites such as nature centers, zoos, aquaria, and museums. It is in more complex instances of informal learning such as these that the line between formal and informal science education begins to blur.

#### **The Benefits of Informal Education in the School Curriculum**

Because of the unique learning opportunities available at informal institutions, contemporary goals of educational reform encourage the use of field trips as an educational method (e.g., *Benchmarks for Science Literacy*, 1993; *National Science Education Standards*, 1996; *Texas Essential Knowledge and Skills*, 1997). In addition, research in the field of informal education recommends the use of field trips as an instructional method, citing social, affective, and cognitive gains by students.

First of all, informal learning is often in a social context (Kimche, 1978). Students on field trips are with their friends, their teacher, and those working at the field trip site. Students benefit socially from the interactions they often have with others during informal learning experiences. The National Science Teachers Association advocates informal science education, because informal learning experiences often extend into the social realm by "presenting the opportunity for mentors, professionals, and citizens to share time, friendship, effort, creativity, and expertise with youngsters" (1998, p.54). Furthermore, "peer interaction in learning can be an important support for education" (Semper, 1990, p. 51). Students can learn from each other through discussions, joint experimentation, or vicariously through others' informal learning experiences (Semper, 1990).

Several studies have also reported significant affective gains by students that have taken field trips including increased interests, attitudes, and motivations towards the subject of science (Benz, 1962; Flexer & Borun, 1984; Orion & Hofstein, 1991;

Stronck, 1983). Flexer and Borun (1984) conclude that visits to a science museum can be a valuable supplement to formal education, because they stimulate an interest in and generate enthusiasm for learning science concepts. This can be particularly beneficial at the elementary school level, where the foundation is created for the student's evolving attitude toward the study of science. Equally important, if students perceive a field trip as a fun experience, they will be more likely to participate in this type of learning activity later in life, when they are no longer in school (American Association of Museums, 1998).

Furthermore, the research suggests that participating in a field trip can, and frequently does, increase learning more effectively than traditional classroom instruction (Disinger, 1987). For example, Wright (1980) found that sixth grade classes that received a museum tour that was "hands-on" in nature displayed higher levels of comprehension and application of concepts in human biology than did classes that received only traditional classroom instruction. The hands-on experiences that occurred during field trips provided students with concrete

ways to assimilate and apply complex concepts (Wright, 1980). Informal education typically utilizes student-centered instructional techniques that involve concrete, inquiry-learning-based experiences within which students can interact socially (Hofstein & Rosenfeld, 1996). These aspects correlate with both current learning theory and recent reform efforts.

Although it has been found that field trips can produce cognitive gains, several studies (e.g., Kubota & Olstad, 1991; Falk, Martin, & Balling, 1978; Martin, Falk, & Balling, 1981) have demonstrated that novel field trip situations can create an adjustment process that directs students' attention too much towards the new environment and away from the learning events. In order to reduce this novelty, teachers should provide preparation in the classroom before the field trip takes place (Orion & Hofstein, 1994). In order to effectively accomplish this, the field trip must be planned as an integral part of the curriculum, rather than as an isolated activity or merely as enrichment (Hofstein & Rosenfeld, 1996; Orion & Hofstein, 1994).



## **The Need for Collaboration When Integrating Informal Learning Experiences into the Curriculum**

Because the integration of informal learning experiences within the formal school curriculum is beneficial (Orion, 1993; Orion & Hofstein, 1994), we need to know how to best accomplish this. One of the most apparent ways to effectively integrate the field trip into the formal school curriculum is through collaborations between formal and informal education systems (Hicks, 1986). In fact, the National Science Teacher Association's (NSTA) position statement on informal science education (1998, p.54) "recognizes and encourages the development of sustained links between the informal institutions and schools." Ramey-Gassert, Walberg, and Walberg (1994, p.360) note that there needs to be an emphasis on "long-term, sustainable collaborations...which better meet the needs of both teachers and students." *The National Science Education Standards* (National Research Council, 1996, p. 58) also suggest creating "optimal collaborative learning situations in which the best sources of expertise are linked with the experiences and current needs of the teachers."

To help insure that classroom activities and field trip activities correspond and connect with each other, informal and formal educators should form partnerships as co-developers of field trip programs and curricular materials to be used in the classroom before and after field trips (Texas SSI Action Team, 1999). Furthermore, this would help bridge the goals of informal educators with the goals of classroom teachers. Taking the best resources from both disciplines would improve the quality of science education.

Despite the apparent need for collaborations between formal and informal science educators, these types of close partnerships do not occur as often as they should (Martinello & Kromer, 1990). This may be because educators do not realize the need for such collaborations (Hicks, 1986). Preservice and inservice teachers rarely receive the education they need to plan and implement field trips (Gutierrez de White & Jacobson, 1994). A national survey of universities and museums indicated that although informal education sites provided a variety of resources that could be utilized by education majors

as well as teachers, awareness of the resources, along with developing strategies for integrating them with the school curriculum, was often an underexplored area in teacher education (Agar, 1980). Teachers' lack of knowledge of current research in informal education is evidenced by the fact that many teachers do not recognize the different learning opportunities at informal education sites (Griffin & Symington, 1997). In fact, both school administration and teachers often believe that field trips should be extracurricular (Falk, et al., 1978; Kaspar, 1998). The research states that when field trips are taken, teachers seldom use them as an integral part of the curriculum, making little effort to link topics being studied at school to the field trip (Disinger, 1984; Griffin & Symington, 1997; Orion, 1993). Orion (1993) suggests one barrier to integrating informal experiences into the curriculum is the existence of logistical limitations in a school system, such as a lack of necessary curriculum materials, time, and money. Furthermore, many teachers may be unfamiliar with the philosophy and organization of informal learning environments and so do not see a need to participate

in the field trip planning process (Griffin & Symington, 1997; Orion, 1993).

Similarly, there are several reasons informal educators may be hesitant to engage in collaborations with teachers. Informal educators often do not realize how informal settings differ from the classroom and how the two settings are complementary (Hicks, 1986). Moreover, Magill (1992) notes that sometimes, especially in the case of environmental education, informal educators are not trained or are minimally trained to use basic education principles. In addition, informal science education sites may sometimes be cautious of close collaborations because they view the severe structure of formal education as "threatening" to their autonomy (Semper, 1990).

One response to the problem of mediating research and practice is the inclusion of a university researcher in the collaboration. It would be beneficial for a researcher that is familiar with the current research literature in both formal and informal education to participate in the collaboration. The concept behind this type of collaboration is to connect theory and practice in

education so that they reciprocally inform each other. (Grisham, et al., 1999). This kind of collaboration would be an appropriate place for researchers to help shape quality programs that serve as models of learning, reflection, and innovation.

Furthermore, it has been recommended that science educators at the university level be included in science education collaborations, because they can fill any gaps that there may be in science content knowledge (Clark, 1996).

#### **RESEARCH ON COLLABORATION IN SCIENCE EDUCATION**

A rapidly increasing body of literature is springing from the field of education as educational institutions and other groups engage in collaborations using a variety of approaches and for a variety of purposes. Although there is not much in the literature on collaborations involving all of the stakeholders in science education, there is much documentation and research on individual partnerships between formal and informal education, between formal education and scientists, and those involving education researchers. Note that an essential

component in all of these collaborations is the classroom teacher. Although reform efforts come from many different sources, only the formal educators, specifically the classroom teachers, can provide the insights that materialize from extensive, direct experience in the classroom (Kyle, et al., 1991; Rutherford & Ahlgren, 1990). Furthermore, the reform movement can only succeed if formal educators have adequate knowledge and support systems (Sussman, 1993b). The classroom teacher is central to science education reform (Sussman, 1993b).

### **Collaboration between Formal Educators and Scientists**

Most K-12 formal educators have few, if any, science research experiences; yet their job is to teach how science works (Druger & Allen, 1998; Herwitz & Guerra, 1996). Research scientists are practiced and knowledgeable in science; yet, they are located at the universities and often have little contact with precollege students (Druger & Allen, 1998). The university scientists possess content knowledge, while the classroom teachers have knowledge of the students and schools (Richmond, 1996). To bridge this gap and

improve science education, we need the active participation of informed scientists in schools (Alberts, 1993). Sussman (1993b) states that these types of "science education partnerships are a very flexible tool for bringing rich scientific resources into the hands and minds of teachers and students" (p. 13).

Many different models for scientist/teacher collaborations have worked in different communities. One particularly successful and extensive collaboration is the Science and Health Education Partnership (SEP) between the University of California, San Francisco and the San Francisco School District. The goal was to improve science education in grades K-12 (Clark, 1996). The partnership was started on a small scale by facilitating individual one-on-one collaborations between teachers and scientists. A database was created that listed university scientist volunteers and other individuals who could provide resources (Clark, 1996). Although some of the alliances that were formed between individual teachers and scientists could be characterized as "one-shot activities," others

resulted in strong personal or institutional bonds (States & Clark, 1993). These strong, ongoing, one-on-one partnerships between individual teachers and scientists have been a key objective of the SEP (States, Brady, & Sussman, 1993). As the SEP progressed over time, the teachers and scientists created a variety of ways to improve precollege science education. The SEP's activities eventually expanded to include teacher workshops given by scientist/teacher teams, summer research internships for students and teachers, as well as a women's science club for female scientists, teachers, and students (Clark, 1996). The main focus of the SEP is the effect the partnerships have on the students. This is one of the most difficult outcomes to measure since the goals are largely long-range goals (Clark, 1996). For the components of the program that are funded by the National Science Foundation, a program evaluator interviews and surveys the participants. Program effectiveness has also been indicated by the increase in the level of teacher support and participation in addition to letters from the students



reporting the value they find in communicating with scientists (Clark, 1996).

As with the SEP, these types of collaborations often result in many benefits to the participants. For instance, during scientist/teacher collaborations, there are several benefits that the scientists have provided for the classroom teachers and their schools. First of all, the scientists offer access to technical information and material resources such as laboratory equipment (Chennell, 1999; Clark, 1996; States, et al., 1993). The scientists also can act as role models and mentors for the students by teaching them more about science careers (Chennell, 1999; Clark, 1996; States, et al., 1993). The collaboration can provide professional development for the teachers (Chennell, 1999; Herwitz & Guerra, 1996). The partnership may help change their perceptions associated with science from a "dry subject comprised of factual information" to one of "inquiry and discovery" (Herwitz & Guerra, 1996, p.32). Moreover, the added support can help build teacher morale (States, et al., 1993) and can increase teacher interest in science (Clark, 1996).

There are also several reported benefits that the university scientists receive from collaborations with classroom teachers. They report learning more about teaching and learning (Clark, 1996; Richmond, 1996). The scientists often discover different ways to teach to diverse groups of students (Richmond, 1996) and how to communicate better with different audiences (Chennell, 1999). This is an especially useful benefit that can be brought back to their undergraduate and graduate classes and can be valuable knowledge during the necessary interactions that the scientists have with the public (Chennell, 1999). In addition, scientists describe the enjoyment involved when connecting with the community (Clark, 1996). They enjoy working with and forming personal relationships with the teachers and the students (Richmond, 1996; States et al., 1993). The scientists come away from the collaborations with a better understanding of the schools and the circumstances and stresses under which teachers work (States et al., 1993). It also gives the university scientists satisfaction knowing that they are helping improve the science academic preparation of their own possible

future students (Clark, 1996). They tend to find the immediate feedback from the students rewarding in comparison to the often long-term research projects they are accustomed to (Chennell, 1999; Clark, 1996).

Despite these benefits, there are a few barriers mentioned in the literature that can obstruct successful partnerships between formal educators and scientists. First of all, cultural differences between classroom teachers and university scientists can hamper the collaboration. Clark (1996) says that it should not be taken for granted that scientists know how to work with teachers and precollege students. Although university scientists are usually formal educators themselves, their working and teaching conditions are very different from K-12 science teachers. Scientists are usually not used to working closely with others when teaching (Clark, 1996). Furthermore, teachers are strained with challenges that scientists have little experience with. For instance, rarely do university scientists have to confront behavior management issues (Clark, 1996). Clark (1996) suggests that scientists be given curricular information, experience as learners, and

strategies for teaching and classroom management. The other main barrier to scientist/formal educator collaborations is inadequate preparation. Sufficient communication about roles and expectations is necessary to make the collaboration successful (Clark, 1996). Clark (1996) states "too often, very well-meaning individuals from universities approach precollege education with the attitude that they are coming to 'fix the teachers' or 'fix the curriculum' (p. 956). However, they have very little practical knowledge of how to create valuable learning experiences for students with varying backgrounds. Both sides of the collaboration need to understand what each other has to offer the partnership (Clark, 1996).

### **Collaboration between Formal Educators and Education Researchers**

Educational researchers have been summoned to collaborate with practicing teachers in order to better inform educational improvement efforts (Kyle, 1994). The research reports varying types of collaborations between formal educators and education

researchers that span from those involving a program linking one school and one university, to wide-ranging partnerships that involve several colleges and several school districts. The most widely researched type of collaboration between formal education and educational research involves educating preservice teachers. One example of such collaborations that is widely supported is the professional development school (PDS) movement (Edens, Hult, & Gallini, 1999). PDSs have been established to move toward an improved concept of preservice teacher education with simultaneous renewal of schools and the education of educators through the connecting of the school and university cultures (Goodlad, 1993). Educators in the collaborating schools help preservice teachers learn the profession, while preservice teachers participate by bringing new ideas, viewpoints, and practices into school classrooms (Grisham, Bergeron, Brink, Farnan, Lenski, & Meyerson, 1999). Through the PDS process, classroom practices and teacher preparation change and evolve.

These PDS programs bring the goals of the school and university teacher preparation programs together to form a shared vision by linking practical knowledge

with scholarly pursuits (Barrett & Baker, 1994). The PDS model places a high priority on collaboration from multiple perspectives (Grisham et al., 1999). The knowledge is located in neither the university nor the school, but in the collaboration of the two (Cochran-Smith, 1991). Both sets of knowledge are essential for a full understanding of the situation. As the partners collaborate together, the dialogue about joint projects enables everyone to benefit from the socially constructed knowledge base. It is that knowledge base that provides a foundation for effective PDS projects (Grisham et al., 1999).

There are several PDS collaborations throughout the country, all diverse in organization and structure. They all work around a few guiding principles such as developing collaborative learning communities, improving preservice education, providing an exemplary K-12 education, and providing continuing education for professionals (Kochan & Kunkel, 1998). However, the programs are individually formed in ways that make sense for their own particular situations and needs (Kochan & Kunkel, 1998). Most of the literature on professional development schools

provides insights into what happens to the partners in individual collaborations and how these schools and universities change as a result of their collaboration in that particular situation (Knight, Wiseman, & Cooner, 2000).

Despite the popularity of the PDS movement, not all of these school/university collaborations have been successful. One of the main challenges to effective collaboration lies in the cultural and organizational differences between universities and K-12 schools (Sandholtz & Finan, 1998). For instance, education researchers and classroom teachers often have differing views about teaching and learning (Campoy, 2002; Sandholtz & Finan, 1998). The teachers are under constraints from the school and community to increase standardized test scores. These external pressures often encourage teachers to utilize quicker, more teacher-directed learning than the education researchers would prefer (Campoy, 2002). Furthermore, time limitations become a barrier to effective collaboration (Corrigan, 2000; Kochan & Kunkel, 1998). Teachers are already overloaded with responsibilities (Kochan & Kunkel, 1998). Moreover, university faculty

often shy away from PDS projects because of their labor intensive nature, which limits time to devote toward publications (Campoy, 2002). Lack of communication, which is sometimes related to a deficiency in time, is also cited as a barrier to effective collaboration (Bullough & Kauchak, 1997).

In an effort to alleviate some of the barriers to effective collaborations between universities and schools, it has been recommended that a *boundary spanner* be put into place (Campoy, 2002; Sandholtz & Finan, 1998; Stevens, 1999). Boundary spanners are viable liaison personnel who are comfortable and knowledgeable with both the university and school cultures (Sandholtz & Finan, 1998). Campoy (2002, p.7) describes the boundary spanner's role to include "worrying about daily activities, attempting to advance the development of the partnership, and endeavoring to smooth the functions and frictions between the partners."

In addition, effective communication and clarifying roles are essential to successful university/school collaborations (Cole & Knowles, 1993; Corrigan, 2000). Hord (1986) suggests



collaborating with change-oriented teachers and emphasizes that working with the principal of the school is imperative. Other suggestions for successful collaborations between education researchers and classroom teachers include having adequate resources, possessing mutual interest, and creating positive relationships (Badiali, 2000).

When school/university collaborations are successful, they provide benefits to all of the participants. These include professional growth for both the teachers and the researchers (Dyson, 1997), improved education for the students, and an increased awareness of the different cultures of other practitioners in education (Kochan & Kunkel, 1998). Personal benefits include enjoyment from working with the other participants (Campoy, 2002).

### **Collaboration between Formal Educators and Informal Educators**

The National Science Teacher Association's (NSTA) position statement on informal science education (1998, p.54) "recognizes and encourages the development of sustained links between the informal

institutions and schools." *The National Science Education Standards* (National Research Council, 1996, p. 58) also suggest creating collaborations that link "the best sources of expertise" with "the experiences and current needs of the teachers." To improve science education, collaboration is particularly important when developing field trip programs and curricular materials to be used in classrooms before and after field trips (Texas SSI Action Team, 1999). This would help insure that the classroom activities and the field trip activities correspond and connect with each other. Furthermore, this would help bridge the goals of informal educators with the goals of classroom teachers.

As the importance of informal education becomes more widely understood, more and more collaborations between formal education and informal education are forming. In formal/informal education collaborations, the informal educator provides knowledge of the informal site and the classroom teacher offers information on the students and curriculum (Prabhu, 1982). The literature describes collaborations with various purposes and structures. For instance, the

Institute of Museum and Library Services (1996) has compiled a brief overview of a few museum-school collaborations throughout the country. The descriptions of the programs illustrate the different types of purposes the collaborations may strive for, such as curriculum design, professional development, exhibit design, or software development. Also explained is how the partnership is organized. The different structures of the collaborations discussed included those that incorporated a museum-school coordinator and collaborations that involved multiple schools and multiple informal sites, or just one school and one informal site (Institute of Museum and Library Services, 1996).

Despite these summaries of the collaborations, the overview does not give a detailed account of the participants' perspectives and experiences throughout the collaborative process. In fact, there are not many studies that have discussed the nature of the collaborative experience for the participants. The literature on collaboration between formal and informal education has focused mainly on the basic structure and products of these collaborations, not

the process. However, a couple of studies do discuss the benefits that the collaborators receive as a result of the collaboration.

For example, Bainer, Cantrell, and Barron (2000) interviewed natural resource professionals that operate as informal science educators in long-term partnerships with schools and found that they gained much professionally during collaborations with formal educators. Specifically, their teaching improved enormously. In the study, the informal educators increased their understanding of effective teaching and the way people learn (Bainer, et al., 2000). Their communication and presentation skills improved. They learned to teach for different learning styles and became more creative in finding ways to interest their audience. Also, the informal educators gained a better understanding of teachers' needs, the district objectives, and classroom constraints (Bainer, et al., 2000). This professional development is especially important since informal educators often have not been taught how to educate (Bainer, et al., 2000; Hornung, 1987; Magill, 1992). This is particularly true in the case of environmental education where it is often a

natural resource professional who is responsible for educating the public at the informal education site (Magill, 1992).

In addition, the informal educators received several personal benefits from the collaboration. They enjoyed working with the students and teachers and reported making many friends (Bainer, et al., 2000). In this way, the collaboration added stimulation to their job (Bainer, et al., 2000).

Formal educators also benefit from formal/informal educator collaborations. Bainer and Williams (1996) found that teachers gained knowledge of environmental science and confidence in their ability to teach environmental education as a result of collaborating with natural resource professionals. Also, they increased the types of teaching strategies they used, incorporating more hands-on strategies and utilizing fewer traditional methods (Bainer & Williams, 1996). Understandably, the quality of the science education improved (Bainer & Williams, 1996).

Despite these benefits, collaborations between formal and informal education are not formed as often as recommended (Martinello & Kromer, 1990). This may

be because educators do not realize the need for such collaborations (Hicks, 1986). Many teachers do not recognize the different learning opportunities at informal education sites (Griffin & Symington, 1997). In fact, both school administration and teachers often believe that field trips should be extracurricular (Falk, et al., 1978; Kaspar, 1998). Most teachers do not see a need to participate in the field trip planning process (Griffin & Symington, 1997). In addition, informal educators often do not realize how informal settings differ from the classroom and how the two settings are complementary (Hicks, 1986). Differing views about learning and teaching styles and about education in general may be a major barrier to formal/informal education collaborations. Formal science education is generally more structured and learning is more independent (Ramey-Gassert, et al., 1994). On the other hand, informal science education is more open-ended, includes more social learning, and is more difficult to evaluate (Ramey-Gassert, et al., 1994). As with collaborations between scientists and classroom teachers (Clark, 1996), both the formal and

informal sides of the collaboration need to understand what each has to offer the partnership.

Finally, the Institute of Museum and Library Services (1999) suggests that the differences in organizational culture can affect communication. Therefore, it is important in any collaboration to understand each of the partners and keep communication lines open (Mattessich, et al., 2001).

#### **SUMMARY**

"A more durable and pervasive relationship" (Mattessich, et al., 2001, p.60) than either coordination or cooperation, collaboration is defined by Winer and Ray (1994, p. 33) as a "mutually beneficial and well-defined relationship entered into by two or more organizations to achieve results they are more likely to achieve together than alone." Several factors, including shared vision, communication, ownership, and adequate resources, influence the success of collaborations.

The best way to achieve systemic reform in science education is for all of the stakeholders in science education to become collaborators.

Specifically, it has been suggested that informal learning experiences offer a multitude of social, cognitive, and affective gains to students and such experiences should be incorporated into the school curriculum to maximize these gains. The most effective way to integrate informal learning experiences into the classroom curriculum (and achieve a more systemic reform in science education) is for stakeholders such as classroom teachers, university scientists, informal science educators, and education researchers to collaborate.

Research provides evidence that the participants in educational collaborations receive many benefits as a result of collaborating. These include both professional and personal benefits such as improved teaching skills, an increased awareness of different cultures in education, and enjoyment from the social aspect of working collaboratively.

However, collaborations between the major stakeholders in science education occur very rarely. The research on educational collaborations point to some challenges in similar collaborations that help explain this scarcity. The most often mentioned



challenges include cultural and organizational differences, different views about teaching and learning, a lack of communication, and a lack of time.

The educational collaboration literature suggests some activities and methods to alleviate some of the challenges and barriers to effective partnerships. These include having effective communication and adequate resources.

## Chapter III: Methodology

### PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study is to examine in detail the nature and process of collaboration between stakeholders in science education. The study examines the major issues that evolved from the case. With this in mind, the general guiding question of the study was:

*What are the issues and experiences that emerge as formal education, informal education, and education research are brought together in order to attempt to form a collaborative relationship for the purpose of creating an educational field trip experience?*

This general guiding question was purposefully broad in scope to allow room for issues to arise from the case study. There are three more specific issues that emerged from the literature that initially helped focus this research.

1. **How did shared vision develop? In what ways was the vision shared and understood among the partners, and in what ways was it not?** A shared vision is one of the most important characteristics of

a successful collaboration (Barufaldi, 2000; Mattessich, et al., 2001). It is important to know if the participants' ideas were compatible about how such collaborations should be conducted and if the participants had a basic understanding of the roles and responsibilities of their collaborative partners. It is also important to know if the participants' ideas were compatible about what a successful field trip should look like. These factors play a major role in the effectiveness of the collaborative events.

**2. In what ways were the unique perspectives and knowledge bases of the individuals acknowledged and respected by the other collaborative members? In what ways were they not? In what ways were these perspectives incorporated into the shared vision?** A mutual understanding of the multiple perspectives held by the varied stakeholders in science education is essential if the participants are to work toward common goals (Spector, et al., 1995). The knowledge is not held by any one of the stakeholders, but totally in the socially constructed collaboration of all the partners.

3. How did each individual benefit from the collaboration in terms of development of their practice or in terms of gaining a better understanding of their own practice or the practices of other stakeholders in science education? What additional benefits did the participants receive from the collaborative experience? One of the defining characteristics of a collaboration is that it is mutually beneficial to the participants (Winer & Ray, 1994). Whether or not the participants benefit from the collaboration has definite implications on the level of commitment the individuals will exhibit.

These questions were chosen before the start of data collection because they proved to be important issues in other instances of collaborative research. These questions were examined through the individual stakeholders' perspectives. Such knowledge allowed for a deeper insight and understanding of the characteristics involved in the establishment of both successful and unsuccessful efforts in creating working partnerships between stakeholders. Because my aim was to achieve a thorough description and understanding of the case under study, as new issues

became apparent, these questions were expanded upon and new questions were added to the list. Parlett and Hamilton (in Stake, 1995) call this "progressive focusing". The questions that arose during data collection and analysis are as follows:

**4. Did the students benefit from the educational experiences created through the collaboration? If so, in what ways did they benefit?** Because the collaboration's main purpose was to create beneficial educational field trip experiences for the students, it is important to understand how the students benefited. Whether or not the students benefited largely determines whether or not the collaboration was successful.

**5. How were the collaborators' roles and responsibilities created? How did these roles evolve over the course of the collaboration?** The ways in which the roles were created have implications on the collaborators' dedication to their roles and the collaboration in general.

**6. How did communication (or lack thereof) influence the collaboration and resulting educational experiences?** From the beginning, it was evident that

communication was a significant factor in determining the success of the collaboration. Communication has also been an important factor in other collaborations (Barufaldi, 2000; Mattessich, et al., 2001; Spector, et al., 1995).

### **RESEARCH DESIGN**

This is a study of a collaboration between multiple stakeholders in science education for the purpose of creating educational field trip experiences. The intent of this study is to provide both a descriptive and an interpretive account of this attempt at collaboration. Strongly influenced by action research, this study is a qualitative case study.

#### **Case Study**

In order to gain a holistic perspective of the collaboration, a qualitative case study design was implemented. There were several significant reasons why I chose a qualitative case study design for this particular research. First of all, the coming together of these different sides of science education

provided a unique opportunity to explore the issues and experiences that emerged as such a partnership was formed and developed. Merriam (1988) states that a case study is appropriate when one wants to develop a better understanding of the dynamics and processes of such a program in order to improve practice. Furthermore, Yin (1994) acknowledges that a primary rationale for using a single-case study design is when one is studying unique situations such as this one, which has not been examined in detail.

Another criterion for choosing to utilize a qualitative case study design depends upon the specific nature of the research questions and desired end products (Merriam, 1988; Yin, 1994). Merriam (1988, p.10) states that a qualitative case study design is chosen because the researcher is "interested in insight, discovery, and interpretation rather than hypothesis testing." Indeed, the goal of this study was to gain insights and understandings into this case and its issues, with emphasis on understanding the multiple perspectives on this single collaborative event. Because I come from the stance that perceptions of phenomena are socially constructed, a

thorough understanding of the issues involved in this relationship and how the experiences differed for each stakeholder was critical. The thick description obtained through prolonged, direct experience with the case study aided in reaching deep understandings of the different perspectives (Merriam, 1988).

In addition, there are other special features of the qualitative case study design. A case study is an examination of a contemporary, bounded system that consists of a phenomenon such as a program, event, or a process situated in a specific context (Merriam, 1988; Stake, 1995; Yin, 1994). Because of this, case studies are more concrete and contextual than other research knowledge. Case study knowledge, like our own experiences, are embedded within a context that makes the knowledge more concrete and vivid than the more abstract knowledge obtained from other research designs (Merriam, 1988). Furthermore, conducting a case study does not require any particular method for data collection (Merriam, 1988). In fact, one of the case study's unique strengths is its ability to utilize a variety of evidence such as observations, interviews, and documents (Merriam, 1988; Yin, 1994).



Qualitative case studies are characterized by the researcher spending extensive time on-site, personally in contact with the activities of the case, and reflecting and revising meanings of what is occurring (Stake, 1995; 2000). Although there are many different ways to tell the story of a case study, the important issues, perceptions, and theory may not be known at the outset of the research, because the case study content evolves throughout the entire research process (Stake, 2000).

Despite the strengths of case study research, the case study has been criticized because single cases are not beneficial towards advancing grand generalizations since they are poor representations of populations of cases (Stake, 2000). However, some generalizations within the particular case can be made about future occurrences and different situations with that case. Moreover, it is important to appreciate the significance of theoretical generalizability. Case studies can aid in refining theory, suggesting complexities for further investigation, as well as helping establish limits of generalizability (Stake, 2000).

Furthermore, Stake (1995; 2000) suggests that generalizations are made by the reader. "The utility of case research to practitioners and policy makers is in its extension of experience" (Stake, 2000, p.245). Readers bring to a case study their own experiences and understandings, which lead to generalizations when this new information is added to their prior experiences (Stake, 2000). Stake (1995) describes this as "naturalistic generalization." Similarly, Merriam (1988, p.13) describes case studies as heuristic, meaning they "can bring about the discovery of new meaning, extend the reader's experience, or confirm what is known." The case study researcher must assist readers in this construction of knowledge by writing the story with enough thick description so that the reader has the opportunity for vicarious experiences that will aid in making comparisons (Stake, 1995; 2000).

In addition to the limitations in generalizability, case study research also has other limitations. First of all, case studies require considerable time and money to conduct (Merriam, 1988). Furthermore, they are limited to the level of

integrity and sensitivity of the researcher (Merriam, 1988). Because the researcher is the primary instrument of data collection and analysis, he or she must be keenly aware of potential biases that can affect the final product (Merriam, 1988; Yin, 1994).

One way to be continuously alert to potential biases is for researchers to keep a reflective journal in which they explore their beliefs, assumptions, and perspectives (Glesne, 1999). Being aware of their subjectivity will help prevent researchers from distorting the voices of their participants with their own perspectives (Glesne, 1999). This type of researcher self-monitoring is termed "disciplined subjectivity" (Erickson, cited in Merriam, 1988). It is also important for the researcher to express her perspectives and potential biases to the reader and let them draw their own conclusions about the trustworthiness of the study (Merriam, 1988). In addition, methods such as peer review, member checking, and triangulation of the data sources and data collection methods will help reduce the effect of the researcher's own perspectives on the reconstructions of the participants' perspectives

(Merriam, 1988). It is important to remember that subjectivity can never be eliminated, its effects can only be minimized (Glesne, 1999).

In an effort to describe the case study framework for this particular research, I turn to Stake (1995; 2000) who describes two main types of case studies, intrinsic and instrumental. Intrinsic case studies are focused on learning about the particular case under study, "not because by studying it we learn about other cases or about some general problem, but because we need to learn about that particular case" (Stake, 1995, p. 3). On the other hand, instrumental case studies examine the particular case in order to achieve a more general understanding about a research question (Stake, 1995). This study falls somewhere between the intrinsic and instrumental case study paradigms. Because of its unique and progressive circumstances, I was interested in this particular case study and saw a potential benefit for the case by gaining an understanding of its issues, experiences, and multiple perspectives. In addition, knowledge of the case allows for a deeper understanding of the characteristics involved in the establishment of

successful and unsuccessful efforts in creating working partnerships between these stakeholders by contributing to the limited knowledge base in this area of educational research.

### **Action Research**

The general design of this study was also heavily influenced by action research. The goal of action research is for professional researchers and local stakeholders to collaboratively seek and enact solutions to real-life problems of major importance to the stakeholders within a given context (Greenwood & Levin, 2000). Action research consists of a continuous cycle of self-reflection that involves planning, acting and observing, reflecting, and replanning (Carr & Kemmis, 1986; Kemmis & McTaggart, 2000). Success is determined by whether or not the participants have a strong sense of understanding and development in their practices (Kemmis & McTaggart, 2000).

From the viewpoint of action research, theory and practice are not separated (Greenwood & Levin, 2000) and both are transformed during the research process

(Kemmis & McTaggart, 2000). A deep respect for both the researcher's and the participants' unique knowledge bases is a defining factor (Greenwood & Levin, 2000). "Action research is built on an interaction between local knowledge and professional knowledge" (Greenwood & Levin, 2000, p.96). Both types of knowledge are essential. The researcher's theoretical knowledge is important, but "only the local stakeholders have sufficient information and knowledge about the situation to design effective social change processes" (Greenwood & Levin, 2000, p.96). The diversity of experiences and expertise is viewed as an opportunity for the enhancement of the research/action process (Greenwood & Levin, 2000).

This particular case study falls under the action research description because of its combination of educational theory with the practices of both formal and informal science education. One of the major goals of this study was to improve the practice of designing field trip experiences collaboratively between local stakeholders in formal education, informal education, and educational research. With each new field trip, the collaborative partners in

this case study undertook a cycle of planning, acting and observing, reflecting, and replanning as suggested by action research. The members of the collaboration intentionally planned for this cycle of reflection about the field trips to occur during the meetings. A similar cycle of reflection on the general collaborative process also occurred, but in a more spontaneous manner.

Also, as with other examples of action research, this study was based on the belief that all of the participants have invaluable knowledge to contribute to the collaboration. For instance, the representatives from formal education had knowledge of the students' and teachers' needs, as well as the curriculum requirements. The informal education representatives had extensive knowledge of the informal education site and its resources, as well as a good understanding of informal teaching and learning styles. The scientists had a comprehensive understanding of the content incorporated into the program. In addition, I, as the educational researcher not only collected the data, but I also had substantial knowledge of current educational research

in both formal and informal science education to contribute.

#### **SELECTION OF THE RESEARCH SITE**

I chose River Vista<sup>1</sup> as a research site because of its ability to attract collaborations by bringing different people together. River Vista, the field trip site, is a multi-purpose site that is built upon partnerships. It is used as a biosolids reuse facility for the city, is home to an environmental partnership of several nonprofit organizations, and has a research center for the local universities. This collection of associations provided many different human resources to draw upon including city workers, naturalists, university students and professors, and other community members. In addition, the site contains a rich array of ecological resources that made it an attractive site for an environmental field trip program. These include several different habitats such as riparian forest, ponds, almost four miles of river frontage, blackland prairie upland habitat, and trails that connect all of these

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<sup>1</sup> Names of places and people are pseudonyms.



habitats. The coordinator of the site was interested in creating an environmental education partnership with the nearby school in order to further utilize the vast amount of environmental resources available. His eagerness to collaborate made this site the prime candidate for the research.

The elementary school was also eager to collaborate. It is a rural school in a predominantly low SES area in which 63% of the students are considered economically disadvantaged (Texas Education Agency, 2001). At the time of this research, the ethnicity of the student body was approximately 29% African American, 49% Hispanic, 20% White, 1% Asian/Pacific Islander, and 1% Native American (Texas Education Agency, 2001). The school is located very near the field trip site, so they are both members of the same community. At the time, the school did not have a very extensive science program for the fourth and fifth graders and no science laboratory, so they were in need of some outside resources. Some of the teachers had been on field trips to the site before and knew the site coordinator. They were ready to

take the next step of making the field trips a bigger part of their curriculum.

### **PARTICIPANTS**

The collaboration involves four major facets of science education: formal education at the elementary and university levels, informal education, and educational research. The primary participants in the collaboration include two elementary school teachers, a scientist from a local university, an informal educator from an environmental education site, and the researcher acting as a participant observer. In addition, there are several other secondary participants such as the principal, two other teachers, a retired teacher, another scientist, and a volunteer field trip guide. A diagram (Figure 3) of the relationships of the participants in the study to the collaboration is in Appendix A.

#### **Formal Education: Elementary Level**

Of the formal educators at the elementary school who actively participated in the collaboration, one was a fourth grade teacher, Karen, and one was a fifth

grade teacher, Linda, both from the same elementary school. They volunteered to act as representatives in the collaboration for all of the fourth and fifth grade teachers at their school. Karen and Linda were also primary participants in the study. There are several secondary stakeholders in the case such as the principal, the other teachers, and approximately 225 fourth and fifth grade students who took the field trips but were not directly involved in the collaboration. Two of the other teachers who were not part of the core collaboration, Sam from fourth grade, and Rachel from fifth grade, as well as the principal, were secondary participants in this study. Catherine, a retired teacher from the elementary school, was also a secondary participant in the study, in addition to being a member of the collaboration. The students' schoolwork was also examined.

#### **Formal Education: University Level**

Another primary participant from formal education is Jane, a scientist and a professor who is affiliated with the biological sciences department at a local university. She was familiar with River Vista, having

done research there. She came to the group because she had an interest in sharing the site with young people and teaching them about the environment. There was also another scientist, Elissa, from a local community college who participated in the collaboration. She also took part because of her love of the site and a desire to teach young students science. She was a secondary participant in this study, but she ended up playing a significant role in the collaboration itself.

### **Informal Education**

Michael, the informal educator holds a full time position at the field trip site as its coordinator. He is extremely knowledgeable about the informal science education site and its resources. In addition, there are several volunteer field trip guides who are also stakeholders in the case but not directly involved in the collaboration, one of which is Beth, a secondary participant in the study.

## **Education Research**

I am acting as a participant observer in the collaboration, representing the side of science education research. I am a graduate student at a local university, pursuing a doctoral degree in science education. I am familiar with current research in both formal and informal science education. My past experiences in education will undoubtedly influence both my observations and the sense I make of them. I have not taught in a formal educational setting and have only briefly taught in informal settings. Most of my experience in science education has been spent creating curricula for informal education sites.

## **DATA COLLECTION**

Data was collected in order to describe and evaluate the collaborative process. In addition, data was collected to evaluate the field trips that resulted from the collaboration. This was done to discover how the primary goal of creating educational field trips was affected as the collaboration

progressed. The data collection period spanned from November 2000 until May 2001.

The data was collected by means of observations of planning meetings, semi-structured interviews with each major stakeholder in the collaboration, and written document review (See Table 4: Data Collection Timetable in Appendix B). The sources of data include both the participants directly involved in the case as well as secondary stakeholders. In addition, documents, such as student writings, vitas, memos, and the researcher's journal were investigated. The use of multiple data sources and types helped establish the most complete and trustworthy description of the research findings.

### **Researcher as a Data Collection Tool**

Because I, as the researcher, collected the data, the data reported is my construction of the data. The data was constructed from what I heard, how I heard what was said, and what questions I asked. My personality, my experiences in education, and my background affected how I heard and reported data. Furthermore, the other participants decided how to

represent themselves based somewhat on who I am, my personality, my background, and my relationships with them. I portray the voices of the participants, but I realize that they are filtered through me as a researcher. These are observations to keep in mind when reading this report of the research.

### **Observation**

As the data collection instrument, I assumed the role of participant observer. Participant-observation allows the case study to be perceived from the viewpoint of an "insider," which can be invaluable to producing an in-depth description of the case's phenomena (Yin, 1994). Erlandson, Harris, Skipper, and Allen (1993, p. 96) note that when acting as participant-observer, "the researcher's activities, which are known to the group, are subordinate to the researcher's role as a participant." I acted as a full participant in all collaborative events. All observations were overt, meaning the participants were made fully aware of the nature of the case study and the fact that they were being observed.

Observations of interactions, dialog, and nonverbal communications were noted during formal meetings and informal interactions. These meetings included planning meetings and follow-up meetings. During the planning meetings, we planned for the next field trip. During the follow-up meetings we reflected on the past field trip and discussed how to improve upon it.

While in the field, I took field notes that were expanded upon in a field log after the observations. Because one of the major problems with participant-observation is the possibility of the participant role requiring too much attention relative to the observer role (Yin, 1994), the formal meetings were audio recorded. This relieved me, as the participant observer, of some of the pressure of taking detailed field notes while participating. This also allowed for a more removed view of my role during collaborative events. As Emerson, Fretz, and Shaw (1995, p.57) state, "members' voices and views most clearly are heard by faithfully recording their accounts and dialogues." The audiotapes were immediately transcribed to aid in data analysis. With



a verbatim transcript, my hope was to reduce the impact of my own biases on the participants' perspectives.

### **Interviews**

According to Lincoln and Guba (1985), interviews serve several purposes that include obtaining people's constructions, reconstructions, projections, and verifications. In this study, interviews were conducted in order to gain insight into the participants' current constructions of their feelings, motivations, and concerns, their reconstructions of past collaborative events, and their projections of the collaboration's future. In addition, interviews were conducted for verification and elaboration of information obtained by other sources and the constructions developed by the researcher.

The primary partners in the collaboration (i.e., the informal educator, the two elementary educators, and one of the scientists) were interviewed four times, once at the beginning of the research period and after each of the field trips. Multiple interviews demonstrated how their perspectives evolved

over the course of the collaboration. Secondary participants in the collaboration (i.e., the principal, two other teachers, a retired teacher, another scientist, and a volunteer field trip guide) were interviewed twice, once near the beginning of the study and once at the end, to determine their perspectives on the collaboration.

A semi-structured format was used for the interviews. This type of interview format allowed specific information to be sought through basic guiding questions, while still allowing for emerging questions and issues to be explored. The exact wording of the questions and the order of the questions were not predetermined (Merriam, 1988). As with most case study interviews (Yin, 1994), the questions asked during the interviews were open-ended. This gives the respondents more freedom to express their perspectives in their own unique way (Silverman, 1993). Furthermore, the open-ended nature of the interviews prevented the imposition of strict limits to the inquiry by allowing respondents to raise issues that they feel are important (Fontana & Frey, 2000).

Many of the questions emerged from the observations of the collaborative events and previous interviews.

Interviews were conducted at a time and location convenient to the particular participant, either at the elementary school or the site. The interviews were audio recorded to ensure completeness and provide the opportunity to review the interview later. Each interview was transcribed within 24 hours to aid in data analysis. Sample interview transcript excerpts are located in Appendix C.

### **Document Review**

In addition, documents, such as student writings, vitas, written and electronic memos, and the researcher's journal were investigated. The benefits of utilizing documentation as a data collection method include its stability and the fact that it includes exact information such as the spellings of names and places (Yin, 1994). One important use of documents is the corroboration of evidence from other sources (Hodder, 2000; Yin, 1994). This was the primary purpose of documents such as written and electronic memos, vitas, and mission statements. In addition, I

investigated my own research journal in order to identify potential biases.

I also collected the students' regular classroom work that was associated with the three field trips. This consisted of both pre-trip and post-trip work, including quizzes, drawings, letters to the mentors and other student writings. The teachers, the scientists, and myself worked together to create the pre-trip and post-trip classroom curricula. The collected work was unidentifiable to the specific student out of the approximately 225 fourth and fifth graders who participated in the program, except as to which grade level and classroom to which they belonged. Their classroom work was the primary source of evaluation of the field trips from the students' viewpoints.

An annotated bibliography of these documents was kept. Annotated bibliographies facilitate storage and later retrieval during analysis (Yin, 1994). Within the annotation, I included a description of the contents of the document, as well as a description of the context of the document such as how the document came into being and the audience for which it was

intended. These considerations aided in interpreting and assessing the data sources by exploring the motives and assumptions behind the documents (Finnegan, 1996; Hodder, 2000).

### **DATA ANALYSIS**

"The analysis of qualitative data is best described as a progression, not a stage; an ongoing process, not a one-time event." (Erlandson, et al., 1993, p.111). Data analysis was done simultaneously with data collection and continued after data collection was completed. Data analysis done alongside data collection allowed me to focus and shape the study as it proceeded (Glesne, 1999). I kept a reflective field journal in which I wrote any analytic ideas as well as my experiences and reflections on the collaborative events. This was also a place for me to explore my own assumptions, beliefs, and perspectives to help me to be continually alert to my own subjectivity.

I drew from the general methodology of grounded theory in order to develop theory from the data. With this methodology, "theory may be generated initially

from the data, or, if existing (grounded) theories seem appropriate to the area of investigation, then these may be elaborated and modified as incoming data are meticulously played against them" (Strauss & Corbin, 1994, p.273).

Open coding was used, meaning the codes were created as the emerging data was collected (Charmaz, 2000). With open coding, "the investigator identifies potential themes by pulling together real examples from the text" (Ryan & Bernard, 2000, p.783). Grounded theorists believe that the data will better fit the categories when preconceived standardized codes are not used (Charmaz, 2000; Glaser & Strauss, 1967). The coding was conducted line-by-line through the transcriptions by defining actions or events within each line of data (Charmaz, 2000). As Charmaz (2000) suggests, this form of coding aided in focusing my attention on the participants' perspectives rather than imposing my own beliefs on the data. Then, more conceptual categories arose from these codes and helped to synthesize and explain the coded data as they were linked together in theoretical models (Ryan & Bernard, 2000). These more analytical categories

often subsumed several codes. The coding schemes also aided in developing a more specific focus to further data collection (Glesne, 1999).

Collected data and the corresponding codes and categories were reexamined periodically using the constant comparative method. The constant comparative method is a technique used to see how each new situation might fit and how it might not fit the evolving categories and theory (Glaser & Strauss, 1967; Merriam, 1988; Strauss & Corbin, 1994). The emerging analysis was modified and refined as conditions changed and more data was collected. Any holes in the data and theory were filled through a method of theoretical sampling, in which precise data was sought in order to shed more light on the emerging theory (Charmaz, 2000). Data collection was complete at the end of the 2000-2001 school year and when the categories were saturated, meaning any new data fit into the established categories (Morse, in Charmaz, 2000).

When data collection was complete and all of the categories were formed, they were reexamined both chronologically and holistically. The issues that

were incorporated into the final analysis included both those that originally guided the study and those that emerged from the study that seemed to be significant enough to affect the outcome of the collaboration. The final analysis (Chapter 4) integrates a description of the participants' experiences as evidenced in the data with the issues that arose from these experiences.

#### **TRUSTWORTHINESS**

The issue of trustworthiness was addressed by means of triangulation, member-checking, and peer review. Triangulation of both the data sources and data collection methods helped establish the most complete and trustworthy description of the research findings. The participants in the study completed a member check of the transcripts and data analysis. This was done in order to allow participants to verify or elaborate on their statements (Glesne, 1999). In addition, peer review and debriefing were conducted throughout the study to provide feedback to the researcher and increase trustworthiness. A



collaborative look at the findings helped point out other perspectives of the data to explore.

#### **SUMMARY**

This was a study of a collaboration between multiple stakeholders in science education for the purpose of creating educational field trip experiences. Strongly influenced by action research, this study is a qualitative case study.

The collaboration involved four major facets of science education: formal education at the elementary and college levels, informal education, and educational research. The primary participants in the collaboration included two elementary school teachers, a scientist from a local university, an informal educator from an environmental education site, and the researcher who acted as a participant observer. In addition, there were several other secondary stakeholders such as the principal, two other teachers, another scientist, and two volunteer field trip guides.

The data collection period spanned from November 2000 until May 2001. Data was collected by means of

observations of the planning meetings, semi-structured interviews with each major stakeholder in the collaboration, and written document review, which included some of the students' written work. Data analysis was done simultaneously with data collection and continued after data collection was completed. Open coding was used. The codes were then categorized and linked together to form theoretical models. The constant comparative method was used to examine and reexamine the data in order to develop the categories and theory. The issue of trustworthiness was addressed by means of triangulation, member-checking, and peer review.

## **Chapter IV: Results and Analysis**

### **DESCRIPTION OF THE COLLABORATION**

#### **Background of the Collaboration**

The foundation for the informal education program began in the fall of 1999 with the goal of bringing the elementary school's 4th graders to River Vista to learn about local ecology and ecosystem processes. Two of the fourth grade teachers (Catherine and Linda) were familiar with River Vista as a bird watching site and contacted Michael, the site's coordinator, to discuss their interest in bringing their students on a field trip. Michael, who is always interested in expanding the facility's uses, worked with the teachers to plan the trips. Over the year, 110 students visited three times and were led on tours by volunteers from various environmental groups and students from local high schools and colleges. These field trips were largely impromptu and not formally structured. Although the field trips were reportedly fun and beneficial to these underprivileged and underexperienced students, there were few if any links to the classroom curriculum.

During the 2000-2001 school year, the same students who came the previous year came back as 5th graders, and a new group of 4th graders started the program as well. With my interest in helping connect the field trips to the classroom curriculum and the scientists' interest in expanding the science content of the trips, we were added to the original group. Thus our small collaboration had formed, all of us excited to make the field trip experiences even bigger and better than before. Michael captured the enthusiasm of all the collaborators, observing,

We have had so much success with so little. Now we have so many more resources. We can't do any less than we did last year, which was huge (MI1, 10/24/00)<sup>2</sup>.

### **General Account of the Collaborative Events**

The collaborators met at least once before and after each field trip (See Table 5: Collaborative Events Timetable in Appendix D). Anyone involved in the collaboration was invited, but not all of the teachers, administrators, and mentors came to the meetings. However, the two representative teachers,

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<sup>2</sup> Citations are structured as follows: (MI1, 10/24/00) means Michael's (M) first interview (I1) which occurred on 10/24/00

the informal educator, the two scientists, a few mentors, and I came to nearly all of the planning meetings. The goal was to have at least these core members of the collaboration present at the meetings, and it was only on rare occasion that anyone was absent. During the planning meetings we discussed the topics that we wanted to cover, the field trip activities that would be appropriate, and possible classroom curricula. Often one planning meeting for each field trip was not enough; so further planning was done in other meetings, by phone, or email. During follow-up meetings, we discussed how the field trip functioned, and where improvements might be needed. At the end of the year, all of the collaborators had a social dinner together in celebration of the informal education program.

The meetings were held in the evenings after the teachers got out of school. The meetings were casual and friendly in nature. We sat in a conference room located at the site around a large table, eating snacks that one of us had brought. The meetings were mostly business because we had so much planning that needed to get done. During the meetings the

collaborators discussed field trip details ranging from the mundane logistics (e.g., dates and times of the field trips) to more substantive issues such as curricular content. However, we still had a lot of fun, telling stories and joking with each other. No one officially led the meetings, and they were not very structured. But Michael would try to keep us on task when we strayed off topic. There were always diversions such as when one of the scientists' brought in her cockroaches or a teacher let her dog roam around the conference room.

The three field trips were held in November 2000, late February/early March 2001, and in May of 2001. Each grade level was split into two groups that came on different days. So each field trip was given over four days. For instance, half of the fourth grade would come on Monday, the other half on Tuesday; and half of the fifth grade would come on Wednesday and the other half on Thursday. Each day, groups of 8 to 12 students and three or four mentors were formed. There were usually two to four students for each mentor. The teachers, the scientists, and I all participated as mentors during the field trips.

All of the volunteer mentors were educated before each field trip. The field trip training days were each half-a-day on a Saturday. The mentors were taught the science content that would be covered during the field trip. They also took a run-through of the field trip day, visiting the locations that they would take the students. In addition, the mentors were informed of the backgrounds of the students and the best way to guide their learning (e.g., by asking questions and finding what interested each student). Discipline issues were also discussed.

Before and after each of the field trips, the teachers were responsible for presenting pre- and post-field trips activities in the classroom. Also, before each of the field trips, the scientists introduced the students to the upcoming field trip topic with what we called a "dog and pony show." The scientists went to each classroom and informed the students about what they could expect to see and do on the next field trip and gave them some background knowledge to work from. For instance, before the bird field trip they discussed in detail some of the birds that the students were likely to see during the field

trip. They also reviewed general characteristics of birds and the different bird habitats found at the site.

### **Description of the Collaborators**

To better understand the collaboration, it was first necessary to understand the backgrounds of the individual collaborators. Their background in education and in science as well as how they became a part of the collaboration extensively affected their goals, actions, and motivations.

#### ***Formal Educators-Elementary Level***

##### Karen

Karen was the representative fourth grade teacher for the collaboration. She has been teaching at the elementary school for five years. Karen has a degree in both English and education, but has been developing a real interest in science and the environment. She commented that she has basically "grabbed at any opportunity in this area" (KI1, 10/24/00). She has been the recycling contact for the school, a job she now shares with Linda. She has seized upon many opportunities to further her science teaching skills



by participating in environmental education workshops, as well as participating in another research project studying mathematics and science in minority populations. At the time of the collaboration, she was expanding her own knowledge of nature and the environment by spending her Saturdays working on obtaining her Master Naturalist certification. She keeps a nature journal and enjoys learning during the field trips alongside her students. When Catherine retired from her teaching job, Karen accepted the role as the fourth grade contact person.

#### Linda

Linda is the fifth grade representative in the collaboration from the elementary school. She asked the grade level leader if the fifth grade could take the field trips in addition to the fourth grade students. She was told yes, as long as she would be in charge of it. Linda was happy to do this since she had been the one to start the connection with River Vista, even though the grade level leader was generally the one responsible for organizing field trips.

Linda had taught nine years of fourth grade in public education, and this was her first year to teach fifth grade. She moved up a grade with her students from the previous year. Before teaching in public schools, Linda worked with at-risk youth for four years in a program that incorporated environmental education. She had also taught emotionally disturbed children for eight years.

Linda's love of nature was evident to me from the first time I interviewed her in her classroom. There was a caged bird squawking on the steps of the trailer where the class is located. In one corner of the room there was a large rabbit in a cage, and her dog came to school with her and roamed the classroom every day. Linda has taken the initiative to start several environmental education activities for the school. She created a composting area for the entire school. She believes in experiential learning and has used this methodology to help students create a learning garden behind the school.

#### The principal

The principal of the elementary school had been in the district for over 20 years as a teacher, a

vice-principal, and now a principal. She wanted her role to be as "a facilitator and a supporter" (PI1, 10/23/00). At first she did not know much about the program, but Linda and some of the other teachers told her how good the field trips were and how so many people were participating. So the principal wanted to learn more about the program. She liked the idea of this program because River Vista was in the community and because so many people were contributing.

#### Catherine

Catherine taught elementary school for 25 years, 24 years were in public education and one year in a private school. She had been teaching fourth grade at the elementary school until she retired the year before. Catherine originally became interested in River Vista through a bird watching hobby. Subsequently, she took her classes on field trips to River Vista for many years, originating the connection between the school and the site. Even though she retired, she wanted to help out with the field trips this year because it was fun the previous years and she was excited about it and wanted to see it continue to grow. Catherine wanted to see the science program

enhanced at the school because in her words, "it is faltered" and "has been put on the backburner for too long" (CI1, 10/24/00).

She personally loves being outdoors and learning about nature. She also sees value in experience-based education, which is why she has never regretted going on a field trip. She describes herself as a generalist, "I know a little bit about a whole lot of subjects" (CI1, 10/24/00). However, she states that she does not feel like she has an in-depth knowledge of science.

#### The other teachers

Besides the two teachers that were primary participants in the collaboration (one representative from fourth grade, Karen, and one from fifth grade, Linda), there were eight other teachers that participated in the field trips. Two of these, Sam and Rachel, were interviewed about their thoughts and experiences.

Sam is a fourth grade teacher and has taught for four years. He has worked in the past in a different school district as the science coordinator for the grade level. As with all of the fourth grade

teachers, he teaches his class all subject areas (science, mathematics, social studies, and language arts).

Rachel is a fifth grade teacher. This was her first full year teaching. She teaches reading, language, and spelling. She has never taught science, and mentioned that she was not even sure what the 5<sup>th</sup> grade objectives are for science. Her partner teacher, Linda, teaches Rachel's students mathematics, science, and social studies. As far as the field trips are concerned, Rachel states that, "if Linda plans it, I pretty much feel safe that it is meeting the [students] needs" (RI1, 12/8/00).

### ***Formal Educators-University Scientists***

#### Jane

Jane is a research scientist in the biological sciences department of the local university. She has taught only at the undergraduate and graduate levels. She has had few experiences with young children. In our first interview she mentions that, "doing field days for elementary aged children is a new experience. I didn't have my own children, so it will be a big learning curve" (JI1, 10/23/00).

Jane had been involved in different research activities at the field trip site before and knew it and the people that worked there well. One of the main reasons Jane participated in the collaboration is because of her love of the site. She elaborated,

I guess first and foremost because it is an interesting site from an ecological perspective with the diversity of habitats. It is close, it is accessible, it is interesting at all levels of education. So it has become a passion for myself to help make that a real and valued place (JI1, 10/23/00).

Also, she was very interested in watching the students learn and be mentored by the volunteers while gaining an understanding and appreciation of the environment.

#### Elissa

Elissa had been teaching biology courses at the local community college for the previous ten years. She had taken community college students on field trips to the field trip site. This is how she first became associated with River Vista. When she heard about the upcoming elementary school field trips, she was interested in helping. She too had a love of the site and wanted to share it with the students. As she states, "I had been going out there for years. It is

a neat place and they needed help and so there I was" (EI1, 1/27/01).

Another motivating factor in Elissa's decision to collaborate with the group was the desire to improve science education. She had seen in her community college students many misconceptions about science and she wanted to improve upon this. She explained,

If you like something, and appreciate it, then you want to share that knowledge, and you want people to understand it and understand it properly. It is the kind of thing where a lot of science is taught improperly and a lot of concepts are either not done or done very poorly...I get that in my college students (EI1, 1/27/01).

Although Elissa had never formally taught children, she was interested in starting with students when they are young and "help them see a little bit more of what science is really about" (EI1, 1/27/01).

### ***Informal Educators***

#### Michael

Michael is the coordinator for the field trip site, River Vista. He coordinates all of the groups and agencies that are associated with the site. He has a true talent for bringing people together to work. In addition, he is a naturalist who has a broad

knowledge of the site and its ecological makeup, from the soil to the birds. A newspaper article describing his work depicts him well:

He has a vast knowledge of the ecology of things, not just relating to sludge but to all facets of ecology. And his address book is phenomenal. He knows lots of people and has a good rapport. He has a way of linking people up. (Beach, 2000, p.E4)

He had been affiliated with River Vista for more than five years. Michael has a background in philosophy, specializing in environmental ethics, and is working on his Ph.D. in geography. He taught high school in the Peace Corps and was teaching some college courses. He has an interest in urban ecology and had come to realize that people encounter nature in the cities, and so that is where it should be learned. Accordingly, he wanted to create a mentoring program for students at the site with an emphasis on community building. He had given many tours of the site to students each year, but he envisioned something more meaningful with the students from this particular elementary school. He had already started a closer connection with Linda and Catherine the previous year and wanted to expand upon it this school year.



Michael's main goal for the program was to give the students experiences that will engage them and interest them in science. He wanted it to be useful for the teachers, but he wanted to keep it informal. Michael explained what kind of program he envisioned.

In terms of an initial engagement and the process of becoming engaged with a place and nature and ecology, that formal stuff is very limited...I think what we are trying to do is open up a world to them... That to me is the goal of this kind of program with 4<sup>th</sup> and 5<sup>th</sup> graders. And as they move on, it can get more focused in on formal techniques and the formalities of science. It is sort of like the old Mr. Wizard show. It gets the kids engaged and then the other stuff will come. That is how I see this program. It is much more a program like that. And I will resist the formalization of it as much as possible. If it fits the [state's standards] and all of that, that is a given, it has to help the teachers that way. But when the kids are here, it is about that energy (MI4, 5/21/01).

Michael wanted to keep this an informal program that is not weighed down by too many formalities. He stated,

There is no way that this will ever be formal. Number one, because I won't allow it, ...Number two because the mission of this site is to treat biosolids. That is always going to influence what is possible. This isn't a nature center, it is not a school, it is something other. That is what we have to respond to. There is always going to be these variables. It is much healthier to stay loose and less formal about it,

but just collaboratively do things...let that creativity go. That is what River Vista needs (MI3, 2/2/01).

### Mentors

The volunteers that helped with the field trips, or "mentors" as we called them, came from a variety of walks of life. They included high school students, college students from education and science departments, professors, Audubon birders, Master Naturalists, and city workers. Their experience teaching and their background knowledge in science both varied from person to person. Their only commonality was their desire to help students learn about what River Vista has to offer.

### ***Education Researcher***

I am a graduate student at a local university, pursuing a doctoral degree in science education. I am familiar with current research in both formal and informal science education. I have not taught in a formal educational setting and have only briefly taught in informal settings. Most of my experience in science education has been spent creating curricula for informal education sites.

I first became associated with River Vista through a class I was taking at the university. It was then that I met Michael and learned about his desire to create a field trip program with the elementary school. This being my area of interest, I asked if I could participate.

## **ISSUES ANALYSIS**

### **Roles of the Collaborators**

Though I have laid out a description of all of the participants in the collaboration and have labeled them *the informal educator*, *the scientists*, *the classroom teachers*, and *the education researcher*, this is for mere ease of identification. As you will see in this next section, none of us fell under just one of these labels. In fact, there were many tasks to which all of us contributed. For instance, each of us acted as a mentor during the field trips and all of us had input into the field trip curriculum and organization. Throughout the collaboration, we all crossed the boundaries of these labels and took on several roles and different responsibilities.

From the onset of the collaboration we did not have defined roles. Elissa mentioned that this was a problem when planning the first field trip because, "you have all kinds of assumptions of who is going to do what, and those may not be valid" (EI2, 5/22/01). While this may have been true, everyone else in the collaboration appreciated the fact that we were able to choose our own roles and let them evolve over the course of the year. One reason that most of the participants wanted undefined roles was because they felt it would allow everyone's input to be heard about all aspects of the field trips. In a way, they felt it kept the lines of communication open. Karen stressed the need for less rigid roles,

I like it because then the people feel free to speak up on any issue. I think if I felt like Jane is really perhaps going to be in charge of curriculum or I am simply going to be logistics or whatever, then we wouldn't get the ideas in every way. I really like it when people feel free to speak. I think it is good (KI3, 4/4/01).

Linda commented that she also prefers to work that way because she has a "hard time being stuck in a slot" and valued the fact that "everybody has the opportunity to contribute if they want to" (LI3,

2/2/01). Jane appreciated having undefined roles for much the same reason. She said,

I like that. I like to think of us all on the same playing field...all with equal input. That works if we all listen very carefully to the other people's input...The fact that we didn't have any roles maybe means that we stay more open to helping each other (JI3, 2/1/01).

Because everyone had a voice in every aspect of the collaboration, this meant that no single person had complete authority over an aspect of the collaboration or resulting field trips. Whenever possible, we tried to create any final decisions from a compromise of perspectives. In the end, everyone agreed that the collaboration was successful because of the many viewpoints that went into creating the field trips. Even Elissa who was originally worried about having undefined roles agreed that, "ultimately it worked out pretty well" (EI2, 5/22/01).

In addition, having no clearly defined roles from the beginning allowed for people to choose their own roles based on both their expertise and their interests. This is the main reason that Michael valued having undefined roles. He explained,

I would rather work that way. I think for creativity, to let those emerge with people's

interests and their strengths...just let that emerge. To me that is what is neat about River Vista because I went through the same thing in creating my job here. I never expected to do this. I never knew I could do this. ...So I want to see that happen for other people. ...This can be a place where people sort things out for themselves. ...I like how we haven't defined roles in a very fixed way. We have something to get done and let's get it done (MI3, 2/2/01).

He believed that this informal way of doing things was something that makes River Vista different and special.

That is the opportunity we have here because it is a blank canvas we get to paint on. And we don't have to paint the same stuff that everybody else does. Certainly this program, at one level we can look at it and it is a standard environmental education informal field trip thing. But as you get into it, you realize the dynamics are much different because we don't have a lot of structure in that formal sense to it. It is evolving, it depends so much on the different personalities involved. And that to me is really exciting. That is what is different about River Vista" (MI4, 5/21/01).

People were allowed to step out of their box, learn more about their interests and abilities, and take on roles based on these interests and abilities.

And that is exactly what happened in the collaboration. Everyone felt free to provide ideas and then to work on jobs in which they were interested and felt comfortable. Depending on what needed to get

done, different people just did it because they were dedicated to the field trip program. Jane explained,

It is really helpful to have the diversity of people. And the nice thing about this team ...is that we haven't had to coerce anyone into doing the things they know how to do and can do. Each has come forward and said "I've got this..." So that makes it really nice. In a way we are an ideal team in that sense because everyone tries their very best to do what they are supposed to do...the best they can (JI3, 2/1/01).

As time went on, we started to have a little more definition to the roles that we were playing in the collaboration and the tasks that each of us would undertake. However, this did not develop because an authority figure assigned jobs, it emerged out of our individual interests and expertise, as well as our specific motivations for participating in the program. The following is a description of the roles each of us played in the collaboration and how they transformed over the year. See Table 2 for a summary of the collaborators' roles and their impact on the collaboration.

Table 2: Role and Impact Summary Table

	<b>Roles (&amp; Role Changes)</b>	<b>Impact on Collaboration</b>
<b>Karen</b>	Educated others about the school and students	Relevant, level-appropriate curriculum
	Representative for 4th grade	Motivated, informed 4th grade teachers
	Curriculum development (Created more as collaboration progressed)	Field trips were more connected to curriculum
	Presented curriculum to students (Began to teach at a higher level and had higher expectations)	Better teaching
<b>Linda</b>	Educated others about their curricular needs	Field trips were more connected to school curriculum
	Representative for 5th grade (Less connection as time progressed)	Others had to help with communication
	Presented curriculum to students (Motivated to extend teaching)	Better teaching
<b>Catherine</b>	Linked school & collaboration	Increased support from administration
<b>Principal</b>	Supporter in the background (Encouraged teachers to use curriculum more)	More motivated teachers
<b>Other Teachers</b>	Presented content to the students (Amount of content varied with each field trip & each teacher)	Influenced how prepared the students were to learn and how connected the field trips were to the curriculum
	Curriculum development (More involved in curriculum creation as collaboration progressed)	More teacher ownership and involvement with curriculum



Table 2: Role and Impact Summary Table, cont'd

	<b>Roles (&amp; Role Changes)</b>	<b>Impact on Collaboration</b>
<b>Jane</b>	Content resource	Richer content
	Mentor for field trips (Began to take more of a leadership role)	More organized field days
	Organizer-informed volunteers	More organized volunteers
	Presented content to students (Began to teach to different learning styles)	Better teaching
<b>Elissa</b>	Incorporated accurate and high level content	Raised the bar for students and teachers
	Brought students to volunteer	More volunteers
	Presented content to students	Exposure to more science
<b>Mentors</b>	Content resources for curriculum Varied depending on mentor expertise	Richer content
	Related to students	Connections made with the students
	Suggested changes in trip structure	Improved field trip structure
<b>Michael</b>	Site coordinator	Good use of site resources
	Organizer-during field trips	Organized flow of field trips
	Bringing together of resources	Good use of human resources
	Mediator during meetings	Smoother flowing meetings
<b>Researcher</b>	Encouraged integration of field trips	Field trips flowed more with the curriculum
	Curriculum development (Less involved in curriculum creation as collaboration progressed)	More teacher involvement with curriculum
	Coordinator-set up meetings	Helped keep collaboration functioning
	Researcher	Monitored progress of collaboration
	Mentor during field trips (Taught more to different learning styles)	Better teaching

### ***Formal Educators-Elementary Level***

#### Karen's Role

One of the most important roles that Karen played was to help the members of the collaboration gain a better understanding of the realities at the school and the lives of the students so that we could all find the best way to make the field trips and associated curriculum accessible for them. Karen explained how she was able to bridge the gap between the collaborators and the students' needs:

That has been my role, to communicate how to get the content across. I don't think it is so much telling ya'll what the content is, although I did tell you a list of [objectives] and lots of ideas from my classes. The biggest challenge always is how to actually get that into their heads and have it truly gel and stick. Anybody can look into a book and see. I can provide that. But my role has been to say to the group, "this would probably really work, this would probably really help to get it to stick or make it work" (KI4, 5/14/01).

The background of these particular students was especially important information to understand in order to teach them most effectively. Karen stated,

And that is I guess where I come in and Linda comes in. Their social maturity, their interests...the kind of books they are reading,

what is funny to them, what is interesting to them.. (KI1, 10/24/00).

She was a continual advocate for her students and their interests and abilities. She was very good at standing her ground when she thought that a certain decision was not in the students' best interests. For example, she constantly made sure that the content level of the curriculum was not so high as to discourage or overwhelm her students.

In addition, as the fourth grade representative, Karen acted as a liaison between the collaboration and the other fourth grade teachers. Karen discussed why she felt particularly effective at this role.

I think I am a pretty good mediator...like taking this and going back to the grade level from here and presenting it in a way that does not make people feel burdened or overwhelmed. I really, really try to take it and make them feel like it is completely integrated into exactly what they are already doing. Because I know how they think. ...So I have been the link. I feel comfortable with my role. I have been able to do that and soothe their anxieties and help them accept something different and invest a little effort (KI4, 5/14/01).

Indeed, Karen did prove to be a very valuable link to the other fourth grade teachers. Because of her efforts, the other teachers presented much of the curriculum and felt very satisfied with the program.

Although Karen helped create the classroom curriculum from the beginning, she contributed more as the year progressed. Michael noticed this change and expressed how encouraged he was by it.

Well, you look at Linda, and especially Karen taking much more ownership of the program. Karen bringing in stacks of materials...taking it much more seriously. This isn't just a free day, this is part of the educational program (MI3, 2/2/01).

Karen mentioned that she enjoyed "creating fun ways of learning" and this program provided a forum in which she could do just that (KI4, 5/14/01). Working on integrating the field trip with the curriculum supplied a creative outlet for Karen.

#### Linda's Role

Linda, as the fifth grade representative teacher from the elementary school, performed many of the same roles as Karen, but for the fifth grade. In the planning meetings she would tell the rest of the group about their science curriculum needs. She would explain to us about any special situations with her students, or how to modify activities to best suit the children. She also provided information such as the best days and times for the fifth grade trips. She helped create the curriculum some, but not to the same

extent as Karen. She was very dedicated and passionate about the program, but did not seem to have as much time to contribute to planning the curriculum as Karen did.

However, in the classroom, Linda spent a lot of time focusing on the curriculum with the students, often tying in a learning garden she created with the field trip topics. Towards the end of the year she expanded the program's reach even farther by bringing in some of the collaborators and other mentors to help learn with the students in the school garden. This type of enthusiasm and energy for creating extraordinary, alternative learning activities is what made Linda a great asset to the collaboration.

#### The Principal's Role

The principal said that because all of these people were investing in her children, she wanted to invest back. She wanted her role to be as "a facilitator and a supporter" (PI1, 10/23/00). She came to the first planning meeting and mentioned that she wanted to come on one of the field trips. However, she never was able to come on any of the field trips. She stated that she would like to be

completely involved, but she had too many other responsibilities. Even so, she was a very supportive principal. She allotted teacher development time for the teachers to plan the collaboration for the year (the very first planning meeting), and also continually encouraged the teachers to connect the field trips with the curriculum. She also designated resources so the teachers and students could be involved. Furthermore, she passed information about the program on to the school board.

#### Catherine's Role

As a retired teacher from the elementary school, Catherine played an important role linking the school with the rest of the collaboration. Because she had brought her previous students to River Vista on field trips, she really believed in the program and wanted to help make it successful. She helped in any way she could, from mentoring during the field trips, to photocopying the curriculum, to providing helpful information for the trainings based on her experiences as a formal teacher of students in that school. Karen and Linda especially valued her added input about how to structure the field trips and about what the

students could handle. Karen pinpointed why Catherine was valuable to the collaboration,

Catherine's distance is good too. The fact that she is both a teacher and a retired teacher is really quite good. She is not too close to the picture anymore, but she knows what the picture is. That is really good (KI3, 4/4/01).

Catherine felt that her most significant role was to connect the administration with the program and get their support for it. She explained,

I feel like my role has been to be a liaison between here and the school...to talk to the principal or check with teachers on various things or the central administration like the adopt-a-school program. I just feel like I like to serve in that capacity...

I talked with [the person] who is in charge of community relations for [the school district] about getting adopt-a-school forms and getting everyone who has contributed all of this time some recognition from the district. I have talked with [the principal] at length last summer to get this series of field trips approved as an official part of the science curriculum. She in turn talked to the elementary curriculum director and got it approved. I think just getting official approval and just making sure that we could have things like buses and the time allotted for 3 field trips (CI2, 5/23/01).

During the school year, she continually talked to the principal and gave her updates on the field trips and how the teachers were working with the curriculum.

She also wrote up a summary of the collaboration's activities for the district newsletter.

Catherine's role in linking the school with the collaboration was vital, because it created crucial support from the administration. It helped that she was a retired teacher from the school, because she knew who to talk to and the best way to go about it. This was a role that probably could have been done by one of the representative teachers, but they did not have as much time to do such tasks in their already overburdened schedules.

#### The Other Teachers' Roles

In the beginning, the other, non-representative teachers did not play a large role in the collaboration. They mainly received the curriculum and other information from their representative teacher Karen or Linda, presented the curriculum to the students, and then went on the field trips with their students. All of the fourth and fifth grade teachers came to the very first informational meeting, but only the representative teachers, Karen and Linda, came to the other planning meetings. For the most part, the other fourth and fifth grade teachers



appreciated having a representative teacher and liked not having a major role in the collaboration. Sam, a fourth grade teacher explained the importance of having a representative teacher:

Her being the liaison for you guys is very valuable for me. I can express "this is what was good, this is what was bad." We did that. All of the 4<sup>th</sup> grade teachers got together. ... I like having it with a representative. It kind of frees us up to do other things, and yet still have a voice (SI1, 12/8/00).

When asked if he would like to come to one of the field trip training days to learn more of the content of the trips, Sam stated that he would rather have that information disseminated through his representative, Karen.

As the collaboration progressed, most of the teachers played a bigger role in creating a successful field trip experience for their students. Many of the teachers began to create curriculum that coincided with the field trips and presented more of the curriculum that was provided for them. While the teachers seemed to increasingly gain ownership in the program and they all valued the field trip experiences, they were happy to have a representative

teacher do most of the planning rather than add to their already overburdened schedules.

### ***Formal Educators-University Scientists***

#### Jane's Role

With a background and interest in science, one significant way in which the scientists helped shape the field trips was through aiding in the development of the science content and participation in its dissemination. This role was demonstrated in the many tasks that the scientists chose to undertake. Jane, a very energetic and enthusiastic participator in the collaboration, assumed many different responsibilities.

The major way in which the scientists relayed science content to the students was through what we called the "dog and pony shows." These were presentations that the two scientists gave to each class before every field trip. The objective of these presentations was to "prepare the kids to recognize and feel and enjoy and observe what they are going to see at River Vista" (JI4, 5/22/01). In addition to

the classroom curriculum that helped prepare the students for the trips, these presentations were pre-lessons designed to get the students acquainted with and excited about what they were going to learn on the upcoming field trip. The scientists used this classroom time to introduce the science concepts that the students would encounter during the field trip. Jane created most of the visuals and other learning tools for these "dog and pony shows" and then presented the content with Elissa.

In addition, Jane helped create much of the classroom curriculum and many field trip activities. She was especially involved in the construction of the last field trip's activities because it covered soil life, her research specialty. During the mentor training days, she helped prepare the volunteers by giving them mini-lessons and other content resources to learn from.

Jane played an organizer role in the collaboration by keeping all of the volunteers informed about meetings and field trips. Moreover, by the end of the year, Jane started to take more of a leadership role during the field trip days. Michael

noticed, "Jane was much better at being able to just get on the bus and tell them where to go" (MI4, 5/21/00). Because she became more familiar and comfortable with the routine, she was able to help orchestrate the field trip days when Michael needed help.

#### Elissa's Role

As with Jane, Elissa also provided input about science content and helped in the creation of the learning materials. Her main goal for the science content was to "keep out things that aren't really accurately being portrayed...and try to make them a little bit more accurate or valid (EI1, 1/27/01). Elissa was more adamant about keeping the content at a higher level than Jane was, and this was one of the most significant ways in which Elissa influenced the collaboration and resulting education experience.

During the creation of the dog and pony shows, Elissa was most responsible for organizing the presentation. As Jane said, "she's done a lot more teaching, so she has got much more of the formal layout in her head" (JI2, 12/13/00). "She has an ability to plot a sequence of what we are going to

teach...to flow and what we need to cover" (JI4, 5/22/01). Because she had more experience in organizing similar presentations in an effective manner, she took on this responsibility.

In addition, Elissa was responsible for getting many of her students at the community college involved with the program. She offered them class credit for mentoring during the field trips.

### ***Informal Educators***

#### Michael's Role

Michael was our main contact person at the site. An important role that Michael played during the planning phases of the field trips is that he would tell the group what was feasible to do out in the field. He shaped the field trip curriculum by suggesting alternate ways of doing activities that would be most effective given the nature of the site and the number of students that would be out on the trails. For instance, on the last field trip we had decided it would be good for the students to have a study plot in the forest. But when Michael went out to the predetermined area for the plot, he realized

that it was not going to work because it was too overgrown and the students would have to trample over a lot of vegetation to reach the plot. So, he decided to create study plots along the trail. The students still got the experience of evaluating the study plot, but in a safer, more efficient manner.

In addition, because of his knowledge of the field trip location, Michael handled most of the logistical work on site that needed to be done before and on the field trip days. He mowed the trails and made sure the buses could get wherever they were supposed to get. On the day of the field trips he assigned mentors to each group of students and planned out the route we would take and make sure everything went smoothly. Everyone was happy that Michael did this because he was good at it. As Jane said, "We get there and Michael knows how to organize the groups and say who is going to do what. He just seems to know how to do that. It has worked every time" (JI3, 2/1/01). However, this was not a role that Michael asked to do. He felt that everyone expected him to do it, so he did. He explained,

It all sort of hits me on the day that they come.  
It is very funny. Up until that day, Jane and

Elissa and everything is being done and then they get here and everyone just looks at me ..."How do we do this now?" "Where do we go?" "Alright, group 1 will go this way, and group 2..." That is always very funny to me. ...But I think the expectation is that I am in charge when they get here.

I asked Michael if he minded having this role, and he said,

I am very good at making order out of chaos, so it is a role that I am comfortable doing. I don't like doing it. But I know I am good at it, so fine. And given just how much energy Jane puts out and Elissa puts out and you put out before...and the teachers...before getting here...ok, I can do this (MI3, 2/2/01).

Michael's "organizer" role was not necessarily based on his interests, but his expertise. It needed to be done, and he was the best person for the job, so he stepped up and helped. In a way we all co-constructed his identity and role in the collaboration by the expectations that we placed on him.

In the collaboration there was no overarching authority figure leading the group. However, Michael did act as a coordinator. Through the vast resources of people he knew, he would bring people together to work in the collaboration. He said, "So my role now, I think, is to find people like you who want to do this stuff and offer that opportunity and then step

back and let it be your thing. And provide support, but not control" (MI1, 10/24/00). He would work on getting enough volunteers and would help Jane prepare and educate them before each field trip. He would then suggest to the volunteers, based on their individual interests and abilities, how they could help some of the core collaborators prepare for the field trips. For example, one of the university student volunteers was an artist. So he told her to help Jane if she was going to do some kind of educational illustration for the dog and pony shows.

Moreover, during the planning meetings Michael would often act as a mediator and help keep everyone on task. Everyone appreciated the fact that he kept the meetings as efficient as possible. Karen commented, "It was nice to have him keep us on track in the meeting, to keep us on the ball" (KI3, 4/4/01). I think Michael had this role because of a seemingly innate ability to work well with groups.

An additional duty that Michael had in the collaboration was dealing with the money issues. Not many financial resources were required for these field trips because everyone volunteered their time. Thus,



money was not really a huge issue. The school paid for the buses to and from the site as well as paper for the curriculum notebooks. However, there were a few supplies that were needed for the field trips. The site had received a grant from which some money was allotted for the education program, and it was Michael's job as site coordinator to use it.

Getting money out of our grant is a complicated process. Some of that I don't think has been heard. I try to teach everybody just how frustrating that is. Yes, we have money for this program, but that doesn't mean I can just spend it at my whim. I have all this paper work (MI4, 5/21/01).

These roles that Michael played were unchanging throughout the collaborative year. He was good at them, and no one else felt they had the knowledge and background to fulfill these duties.

#### Mentors' Roles

The mentors helped guide the students on the field trips and also provided occasional content information for the curriculum. The role that each individual mentor played varied from field trip to field trip based on the topic of the trip. For instance, some mentors were avid bird watchers and provided more input on the bird field trip. One

mentor that was a botanist created much of the classroom curriculum for the plant and soil life field trip. The mentors contributed what they knew best, and then were at the trainings to fill in the gaps.

The mentors were invited to the follow-up meetings. Not all of the mentors came to these meetings, but those that did, often provided suggestions on improving the field trips. Because they witnessed how the different groups of students responded to the field trip activities, their input was vital to making changes in how we structured the trips.

Relating on a personal level with the students during the field trips was a constant role that each of the mentors performed. Many of the mentors remarked how they created relationships with the students that grew throughout the year. These personal relationships with mentors helped bring the field trips to life. Their enthusiasm and knowledge energized and informed the students.

## ***Education Researcher***

### My Role

One of my main motivations for wanting to participate in the collaboration was to encourage the use of field trips as an integral part of the formal school curriculum. Because of my educational research background and firm belief that pre- and post-activities surrounding field trips can make an effective educational experience, I was excited to enter a collaboration that was eager to try this. Originally, the scientists did not have specific knowledge of the virtues of integrating the field trips in the curriculum. So, one of my roles became to help others understand some of the crucial points in informal science education research. Jane explained how my description of what the research says piqued her interest in the field trips.

To be honest, it was your points of view, your input...I would have always volunteered, but...it is a challenge to try to coordinate their curriculum, the [objectives], the place-based outdoors hands-on site...that is a challenge and that is exciting ...I didn't understand. You were the one that really put a context to field days that was intriguing to me (JI1, 10/23/00).

The teachers seemed to know that integrating field trips into the curriculum was beneficial, but were not doing a lot of it. I initiated the curriculum development associated with the field trips. For the first field trip, the scientists and myself created most of the curriculum, with some input from the teachers. But then, after the first field trip, the teachers developed more and more of their own activities. Perhaps this was because they saw the difference in having the preparation.

Another role that I ended up playing was that of a coordinator. Originally, I had not expected to take on such a role, but in a way it made sense. I was always the one with the most and latest information because in addition to all of the meetings, I also saw everyone for interviews and other research activities. I wanted to have all of the information and see all of the email correspondences for research purposes. Thus, I became the one responsible for setting up meeting dates, and when anyone had a question about something, I was usually the one they would ask. I was described as, "the central hub that we all went to when we weren't sure what else was going on" (EI2,

5/22/01). For communication between meetings, we mainly used the email list of the primary collaborators. However, it would not be unusual for instance if Jane said, "When you see the teachers, tell them this." I facilitated communication because I most frequently saw all of the collaborators.

My role as a researcher was subordinate to my other roles in the collaboration. Nevertheless, the research did play an important part in the collaboration. After each of the field trips, I analyzed the students' work and the general level of preparation that each class received and reported this back to the rest of the collaboration after each field trip. We then used this information to assess what the students had learned and to make changes in the curriculum or to figure out where we might be lacking. When discussing this process, Karen stated, "It helps me. Our field trips are really getting better because we are learning" (KI2, 12/14/00). Michael also mentioned how the evaluation of the students' work helped the other teachers feel that this was a valid educational program.

Doing this kind of evaluation...what the students are getting out of it...The feedback from that has

helped a lot in terms of the collaboration, because it has helped the teachers buy in more to the program. (MI4, 5/21/01).

In addition, after each interview or planning meeting, I gave the collaborators a copy of their transcripts to look over. Surprisingly, this had a beneficial effect other than just to double check my transcription. If a person was unable to come to a meeting, the transcription proved a valuable way to catch up on what was discussed. Furthermore, some of the participants gained a better understanding of themselves and the other collaborators by reading through the meeting transcriptions again. For instance, Karen said that reading over the transcripts "is making me remember how I used to be, it is making me see how I have changed, it is also helping me to assimilate what other people have to say and how I can bring that into this" (KI4, 5/14/01). Although at one of the meetings she felt frustrated that no one seemed to hear her when she talked about her students' special needs, when she later read over the transcript and she realized that actually "it was really considered." She said, "it was really implemented. That was so nice, that that was heard" (KI3, 4/4/01).

Reading over the transcript helped her understand the other collaborators' viewpoints and intentions a little better. Catherine mentioned this benefit also, she said it helped her "review how everybody is thinking and what the key issues are that everybody stressed" (CI2, 5/23/01).

In summary, each of us played multiple roles in the collaboration. Because the roles were not dictated from the beginning, there was some question at first of who was doing what. Fortunately, everything got done for the first field trip. By the second field trip, the roles of each of the participants were more stable. There was no overarching authority figure in the group, but several of us took leadership roles in different areas at different times. The roles were never set in stone and did vary some depending on interests or individual time limitations. However, we had a good idea of who was going to take care of particular tasks, and we learned to trust that everything would be accomplished. Because each of us was dedicated to the field trip program, someone would always volunteer if something needed to get done. Although this may not

always be the case for other collaborative groups, our group of collaborators seemed to help each other and even modify our roles in order to accomplish tasks when necessary.

### **Shared Vision**

In general, the main goal of the collaboration was to create a beneficial educational experience for the students. This vague main goal was shared by all of the participants at the start of the collaboration. However, the collaborators' original visions of what a "beneficial educational experience" looks like differed to some degree, as did our visions of how to achieve this goal. These differences were related to the participants' definitions of successful field trip experiences and their definitions of learning.

### ***The Collaborators' Original Visions***

I examined the field trip qualities the collaborators most valued by directly asking each participant what their definition of a successful field trip was, as well as through other comments and actions. There are certain characteristics of a successful field trip that all (or nearly all) the



collaborators agreed upon. These responses consisted of both the qualities of the actual field trip structure and the characteristics of the student outcomes.

Field trip structure:

- Low student to mentor ratios
- Corresponds with the classroom curriculum
- Flexibility during the field trip

Student outcomes:

- Excitement for the students
- Experience the environment
- Learn the content

Although the collaborators did agree on these characteristics of successful field trips, some of our other areas of focus for developing the field trips differed. These differences were mainly due to diverse backgrounds and experiences and distinct ideas about what forms learning should take.

Michael, the informal educator, considered himself the "loosest" when it comes to the definition of education and what "counts" as learning (MI3, 2/2/01). He stated that he does not "have a fixed image of what counts as education in this program

beyond getting the kids outside and getting them engaged" (MI3, 2/2/01). He added, "I do not have huge goals for science for these kids. I want them to come away with an excitement for observation and engagement. All of those are the foundation of what would make someone want to do science" (MI2, 12/14/00). He felt that much of the tension found within the program lies in the participants' different definitions of teaching science. "Teach them *Science*...with the big S or to have science as a part of an experience that they have" (MI2, 12/14/00). In the first planning meeting he mentioned that he prefers "to gather experiences rather than facts" (PM1, 10/24/00).

In making the field trips successful, the factors that he seemed most concerned about had to do with the site and the logistics of the trip. These included safety, low student to mentor ratios, and place-based appreciation of the site. He also emphasized the virtues of mentoring, which was one of his most important personal goals for the program. This involved learning from each other and creating social

bonds between all involved, including the students, teachers, and mentors.

The teachers appeared to have their minds on all aspects of the field trips. Due to their past experience with field trips, they were especially concerned with the logistics of the trip. Also, the teachers seemed to be the most worried about making the learning experience relevant to the students' lives and backgrounds. Most of the teachers desired a learning experience that met their district objectives. However, some of the teachers did not seem to have learning as a main goal for the field trip.

The scientists were not originally as concerned about the role of logistics in a successful field trip, and were mainly worried about affective and educational goals of the trip. However, they soon realized the importance of having all the organizational issues to be in order. Jane and Elissa had somewhat differing views on learning, largely due to the fact that they both learned in different ways. They both look at science and nature in a holistic manner, but Elissa finds it easiest to store

information in her mind by naming and categorizing organisms. It is not as vital for Jane to have a name for an organism. By the end of the school year, Jane began to believe there were many different ways of learning. She mentioned that she came to this understanding by watching some of the teachers. She states, "Linda rewards whatever and however they [the students] are relating...So I try to emulate her" (JI4, 5/22/01). This realization also helped her relate to the other members of the collaboration. She realized that some of the different ideas about what the educational field trips should look like were due to each of our own different ways of learning. Jane began to more clearly understand the other collaborators' viewpoints by gaining a better understanding of what kind of learners they were.

My main goal was to make the field trips flow with the classroom curriculum. This is due to my reading of educational research that professes the virtues of having connected and continuous learning experiences. I believe that learning can take many forms, some of which cannot be adequately expressed with content-focused tests. To me, some of the most

important learning is an affective increase in interest and appreciation for science. So, I wanted to focus on making the learning interesting and relevant for the children. However, I did worry about the field trip objectives tying into district science objectives only because I knew the pressure the school was under not to "waste time." I did not originally place as much emphasis on the logistics of the field trips. This was probably because I had never had to coordinate hundreds of students and many mentors on field trips before.

So even though each of us had a different emphasis in mind for the field trips, we all agreed that it should provide a beneficial educational experience for the students. As Jane said, "I think we are all on the same page. I think we probably have different mechanisms for getting where we want to go, but that only enriches the soup" (JI2, 12/13/00). The collaborators' different priorities played a significant role in the negotiation and development of the shared vision. The following is a description of how the participants came to better understand and share a more unified vision of how the educational

experiences should be structured as well as how the collaboration could best function to accomplish this task.

***Development of the Educational Experiences and  
Our Shared Vision***

Field Trip Organization and Logistics

There was not much controversy over the general field trip topics. The field trip topics were chosen at the beginning of the school year based on the collaboration's resources and goals. The chosen topics for the field trips were as follows:

1<sup>st</sup> field trip (fall): water and aquatic insects

2<sup>nd</sup> field trip (winter): birds

3<sup>rd</sup> field trip (spring): plants and soil

These topics were chosen by the group for several reasons. First of all, they are the most logical topics for the site based on the available ecological resources. In addition, the teachers suggested a few of their science objectives such as ecosystems, water quality, and decomposition, which coincided with these resources and helped create the field trip topics. Our "people resources" in the group also helped shape the topic selection. Because of the many volunteers that were avid birders, it was advantageous to have a

bird field trip. Additionally, Elissa had an interest and background in insects, which is largely why we had a slight insect focus during the aquatic life field trip. And Jane has a research background and passion for soil life, which was extremely useful for the third field trip.

The order in which these topics were covered during the field trips was largely determined by what was best available at the site at specific times. For instance, we wanted to present an overview of the site during the first field trip, which easily flowed with the water ecosystems topic since we visited the ponds, the river, and the greenhouse. The bird field trip was best during the winter when most birds were migrating to the site, and the plants were most accessible during the spring.

One point of contention occurred when we failed to strictly keep on topic during the first field trip. Although the official topic was *water and aquatic insects*, the students did visit the birding shelter at the pond and looked at birds during the trip. One of Michael's goals for this field trip was to give the students an overview of the site, which included

important places such as the birding shelter. The scientists did not object to including other topics because one of their goals was to show interconnections among the organisms. I was not particularly worried about making a stop to the birding shelter or even discussing the birds which the students obviously were looking at while we were presenting the ponds. Research in informal education states that an environmentally new place creates a "novelty effect" which directs students' attention toward the environment and away from structured learning activities (Falk, et al., 1978). Becoming geographically familiar with the site was important for the students' future learning. However the teachers did not like how we drifted from the agreed upon topic. Sam, one of the fourth grade teachers, explained why this worried him.

One of the huge parts that the kids loved about this was the 15 minutes at the bird shelter. But that is a whole other field trip. And they might become...and I don't know because I haven't been with them yet...they might become a little bored on the next field trip and say 'we have already done birds.' Even though it was only 15 minutes. So maybe just to keep it totally separate, that way it can leave them wanting more (SI1, 12/8/00).



Karen reiterated how important it was to keep her students' interest peaked.

When we did the birds that time, we hadn't studied that yet. It was like revealing a secret. I didn't want them to know the prize yet. You save those, they are precious (KI4, 5/14/01).

The teachers were especially concerned about keeping the students' interest level high, because they had never taken a series of several field trips to the same place. Fortunately, the teachers reported that their students were still very interested on the bird field trip despite having gone to the birding shelter on the first trip.

After the teachers communicated their concern about straying off topic during the field trips, the rest of the collaborators had a better understanding of why it was important to stay on one topic. So, on the second field trip we tried to stick to the theme. However, some other organisms were discussed during the field trip, but only as being in interrelationships with birds (the field trip topic). Everyone was happy with this field trip and thought it was successful.

On the third field trip, the discussions did drift a little more to insects than had been planned, even though the official field trip topic was plants. Because it was springtime, the insects were abundant and the students were all very interested in them. The teachers did not mind that we strayed off topic this time though. Karen explained why she believed it was appropriate to stray off topic during the last field trip.

We were ready to integrate more at the end. I felt comfortable with that because it was our last trip of the year. And when we did go off track we were really back-tracking to what we already knew. We weren't going to something that was coming up... This time, when we strayed we went to insects, which we had already studied. We noted the relationships, the birds, soil life and plants as more of interrelationships. We had touched on all of that, but now it was just gelling. So it was just taking it a step forward, it wasn't completely foreign. So I like that, particularly for the last field trip (KI4, 5/14/01).

The teachers became comfortable with the students making connections between organisms and between topics we had already discussed. Perhaps in future years, we need to stop at the birding shelter and look at the ponds during the first field trip, but not discuss the birds in any detail. That would help ease

the teachers' concerns during the first field trip. I do not know that we all came to a totally shared vision of how the field trip topics should be organized. We all still have our own perspectives and interests in how the topics are discussed. However, through communication and an increase in understanding of the teachers' perspectives, in the end, we had more of a shared vision of how to approach the topics. We found a way to incorporate everyone's ideas and make everyone happy.

Another initial point of contention had to do with finding the right level of structure and organization for effective field trips. The first field trip was very structured. The students had many stations that they had to get to at certain times, and the stations were often very far apart. Michael was the one that originally laid out the plans for the day, which was surprising because of the comments that he had made about field trips during our first interview. He stated,

I probably should have said this about the field trips in the beginning, what I most like about the field trips for these kids is giving them space. It is hard to have an unsuccessful field trip to River Vista. If you just leave the kids alone, just guide them through so that they don't

hurt themselves, let them observe, that is a huge success. ...I want to build on that basic experience. Give them time outside, give them unstructured time. Or make the structures loose enough that they don't feel like they are being forced to do what the adults want them to do. Let them claim this place as their place (MI1, 10/24/00).

Despite these views, Michael created several stations for the students to visit so that they could get acquainted with the site and so that they would not get too crowded together. He knew that it would be a lot of walking, but thought it would be necessary since there were so many students coming on each day. In the planning meeting he pointed the route out on the map and said, "this would be walking, this would be trekking. People like you, team leaders have got to just keep on, keep on moving" (PM1, 10/24/00). At that time Elissa replied, "Yeah, but they are supposed to be looking at stuff, aren't they?" (E, PM1, 10/24/00). She was worried that the students would not have enough time to stop and look at things. The scientists were interested in the students having time to look at many aquatic insects in the greenhouse. The classroom teachers and I did not really express an opinion at this time as to how to structure the field

trips. Really, none of us knew exactly what would work.

After the first field trip experience, there seemed to be a general feeling among the collaborators that the field trips should not be so highly structured. The teachers thought that the students were too pressured for time. Karen commented, "We were rushed...It was too much and too fast and not as exploratory...self-initiated exploratory" (KI4, 5/14/01). All of the mentors were exhausted after the field trip also. In agreement, Michael stated,

One of the things that I saw from this visit is that we don't need to launch them on a really long hike. We can spend more time just going slowly...It is a real challenge to get them spread out on the site and moving in a sequence. Either we need to get rid of the idea of stations so that they can move in different patterns, or figure out a better way to get them spread on the site (MI2, 12/14/00).

So for the second field trip we devised a scavenger hunt for the students to do, which eliminated the need for set stations. The students were given more freedom to spend time looking at whatever they were interested in. Everyone agreed that this field trip format was far superior to the previous one. Michael explained,

I think the structure of it was better...that they did this scavenger hunt. I think that worked much better than having stations that they go to.

...it engaged them in the learning. They weren't just having to get from one point to another and then someone tell them what was happening. They had things that they had to do. And it was kind of a game...to get those scavenger hunt things together. It also was a little less structured so that they could move at their own pace. All they had to do was come to the bird shelter at a particular time. The rest of the time they just wandered.

...Kids that age need boundaries. So maybe that is the distinction...boundaries versus structures. I think the kinds of activities that we have developed for them are more boundaries for their experience as opposed to a structure. (MI3, 2/2/01).

We all did come to an agreement on the most effective level of structure and organization for the field trips. In this instance however, we did not come to an agreement by considering everyone's differing viewpoints and coming to a best compromise. In this case, we all came to a shared vision by trial and error. Through experience, we all happened to agree in the end that there was one clear best way to do it, at least for these students in this context.

### Content Level of the Curriculum

The major divergence of opinions involved the level of the content that was to be incorporated into the field trips and surrounding classroom curricula. Everyone agreed that the students should learn something on the field trips, but the group members of the collaboration disagreed on what that something should be. In most cases, the scientists tended to push for higher content level than the teachers thought was suitable. The informal educator and I were usually somewhere in the middle of the continuum.

These conflicting ideas about the content level were discussed somewhat before the first field trip, but were largely glossed over. Elissa mentioned that she felt she was getting mixed signals from the teachers. She commented that in one instance they would say that it "was great...it was fine" and then later say, "it was too much" (EI1, 1/27/01). In the beginning, most of the teachers' suggestions about the content level came in the form of stories about how low their students were, rather than direct complaints

about the content being too high. This was probably out of politeness because the group was not as comfortable with each other at first.

While the collaborators' thoughts were not originally openly stated to the rest of the group, they did individually discuss their feelings with me in confidence, as the researcher. The teachers tended to agree that the first field trip and surrounding classroom curriculum were often too complex for most of the students. Some of the teachers protested that some aspects were too "abstract for the kids" (RI1, 12/8/00), that we "tried to cover too much," and that the scientists "expected a little more than they [the students] were capable of" (LI2, 12/14/00). Most of the complaints were about the inclusion of a taxonomy lesson and the scientific names of the insects. At first, the scientists suggested that they should "challenge the ones that might be most interested and drag the others along" (JI1, 10/23/00). Michael suggested that because they are university professors, their expectations of what the students need to know are higher. The scientists struggled over "how much of the memorization, how much of the jargon, how much



of the vocabulary they [the students] need in order to go out in the field and actually observe and be able to understand what they are observing" (JI2, 12/13/00). Elissa emphasized that she did not want "to assume for them [the students] that they cannot learn" (EI2, 5/22/01).

After the first field trip, the rest of us, with the exception of Elissa, did agree that the content was too difficult for the students at times. Elissa commented that the teachers' expectations of the children were too low. She suggested that if the teachers had reinforced the topics more, then the students would not have had so much difficulty with the subject matter. By the second and the third field trips, the topic of content level was discussed at length. I suggested to Karen that we openly discuss with the rest of the collaborators some of the ideas she had relayed to me during an interview about her students' needs. She stated, "I would actually appreciate it if you shared my comments about our unique needs/population" (KE, 12/5/00). This helped open the dialogue about expectations related to the content level.

So, in the next meeting the teachers more openly expressed their perspectives on the content level. In support of their perspectives, Michael encouraged the others, "Are you hearing these classroom teachers say we need to keep it more limited, we need to keep it more focused" (MI3, 2/2/01). Appreciatively, Karen noted, "Michael has always been extremely respectful to what it is like in the trenches in here" (KI3, 4/4/01). Karen also valued the way that Jane paid attention to what they were saying. She commented, "she [Jane] actually kind of listens to me, a lowly school teacher...you know, saying what these kids are like from this age group and this culture. And she has been reinforcing and receptive and encouraging for me to share suggestions and made me feel like I was not overstepping my bounds. She made me feel okay about it (KI2, 12/14/00). In return, Jane appreciated the fact that the teachers expressed their concerns. She said that Karen especially had been "forthright in some of the things she has said, and that has been really valuable to me. She is outspoken. I think she does it to be constructive, and I like that (JI3, 2/1/01). After the second planning meeting, Karen

felt that "everybody got heard" and that "we had made it [the curriculum] better" (KI3, 4/4/01).

After these discussions, some of the collaborators' viewpoints regarding content level did begin to incorporate the ideas of the other collaborators. Jane was really trying to learn from the teachers what was appropriate for the students. She began to discuss topics using many different methods of teaching such as demonstrating with words, pictures, analogies, both visually and verbally. In addition, although they still did not want to frustrate the students, the teachers did begin to realize the importance of having high expectations. Sam mentioned that it was good for the students "to be challenged and realize there is more out there to learn" (SI2, 5/16/01). Some of the teachers were surprised to see what their students could learn. This was the case for one exercise that required the students to categorize different insects. Sam explained,

I was worried ahead of time that it was going to be too difficult for the students to be able to distinguish between each one of the categories, but it wasn't. So the kids actually put them where they belonged. I thought it was above the

kids' level, but it turned out that it wasn't  
(SI1, 12/8/00).

Through communication and experience with each other in the collaboration, each of us learned at least some of the virtues of the others' perspectives. While these small, yet significant viewpoint changes were made, the collaborators, especially the teachers and the scientists, still seemed to possess fundamentally differing views regarding the level of the content. The scientists still pushed for higher level content, while the teachers still maintained that they did not want the curriculum to be too challenging.

Despite the different opinions about content levels, we found ways to integrate everyone's ideas into the field trip experiences and classroom curriculum, because we each had a basic knowledge of each other's viewpoints. For example, for the second field trip (birds), we had first decided to do a "scavenger hunt" for specific birds on a list. This list was intended to give the students more focus during the trip, as the teachers requested. The scientists suggested adding more complex items to the scavenger hunt list. These included certain behaviors

and ecosystem relationships to look for, such as mutualism, parasitism, and commensalisms. Elissa emphasized using the scientific terms for these interactions. She did not want us to be too limiting and assume that the students could not learn the "biology words." At first, the rest of us were more reluctant about stressing the technical terms.. especially commensalism. Elissa suggested that the words are not that technical and we adults just had a phobia because we did not know what commensalism meant. This was probably true.

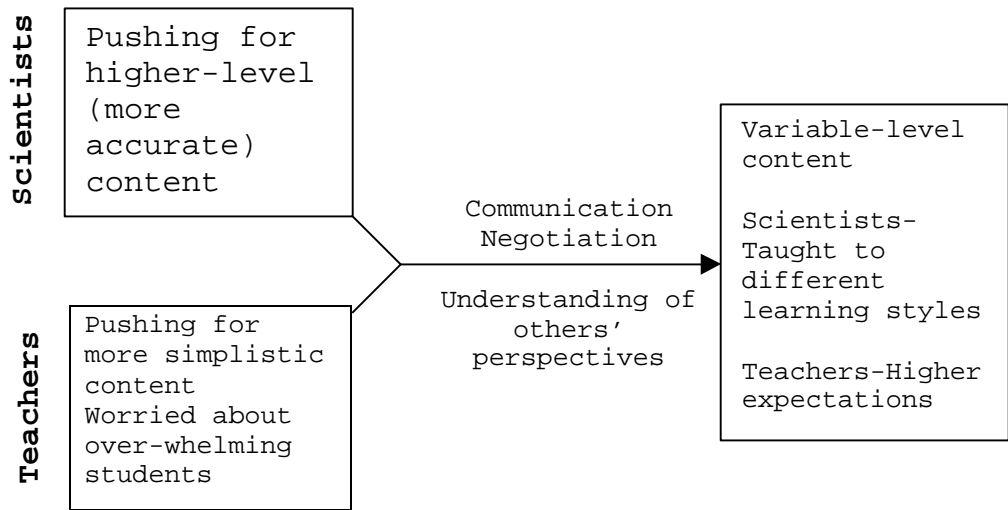
In the end, during the dog and pony show the scientists prepared the students for the field trip by introducing these terms and writing the term and the representation of the terms using pluses and minuses on the board. For instance mutualism is a  $+/+$  (meaning both organisms are benefited by the interaction), parasitism is a  $+/-$  (one organisms is benefited, one is harmed), and commensalism is a  $+/0$  (one organism is benefited, one is not affected). Both the technical terms and the plus/minus representations were placed on the scavenger hunt lists. Although the teachers thought that the content

could be too high level, they agreed that the scavenger hunt was good because it was flexible. It was set up in an open-ended manner, so that the students had many options and could go as far as they wanted. If they noticed a complex relationship, then that was great. If they simply noticed a bird, then they could just write that down. The teachers appreciated the fact that the scavenger hunt included complex and basic skills so that everyone could be successful and everyone could be challenged without being overwhelmed. The scientists were happy that the concepts and ecological terms were introduced.

Although the resulting field trip curriculum did not look exactly like what any of us had originally envisioned, we all agreed that final product benefited the most students possible. The field trip was flexible enough to let the students be creative, but gave just the right amount of focus. There were complex and more basic concepts from which to select. The students could either write out their data or draw it if they were more inclined to do so. The scavenger hunt did indeed prove to be successful. The students were engaged and on task and often surprised the

adults by what they had learned. Everyone seemed pleased with the end product. See Figure 1 for an illustration of the conflict over the content level and the outcomes that resulted from the collaboration.

Figure 1: Conflict Over the Content Level



### Classroom Curriculum Challenges

Originally, I was probably the one most interested in connecting the field trips to the classroom curriculum. Because of my knowledge of education research, I have a firm belief that field trips are more meaningful and successful if they are

an integral part of the curriculum. Several studies have shown that students will learn more if they are cognitively, psychologically, and affectively prepared before the field trip and they receive follow-up activities afterwards (e.g., Orion & Hofstein, 1994).

Fortunately, all of the primary participants in the collaboration agreed that it was a good idea to have pre- and post-field trip activities for the classroom. Michael, the informal educator, especially stressed that we connect the field trips with the classroom curriculum. He had an understanding of the pressures that the teachers were under to help the students perform well on the standardized assessment tests. He said, "Tell us what you need to help you get your kids through that" (MI1, 10/24/00). He emphasized that we need to,

make the field trip part of that process rather than something that takes away time from it. It shouldn't be just time out from school. It should be an enhancement of what is going on in the classroom (MI1, 10/24/00).

To start with, the scientists went into each class before each of the field trips to give a mini-lesson (the dog and pony show) in which they reviewed concepts that would be discussed during the



field trip and to let them know what to expect. While this did really help the students prepare for the trip, it was not the same as having the field trip as a part of the classroom curriculum. So, we decided to put suggested curricular activities in a notebook for all of the students.

We put forth great effort to make the curriculum useful for all the teachers. The collection of classroom activities included science activities as well as many lessons in the other subject areas. The principal had explained to us that, "what has happened traditionally is that the subjects that were tested on the state accountability tests is what we put the most emphasis on. You might do science every other week" (PI2, 5/31/01). Because the school, and thus the teachers, put a lot of stress on the state tested subjects of mathematics and reading, we included many learning activities that were directed towards these objectives while also covering the relevant science content. For instance we would include reading passages and questions that were about relevant science topics. We were hoping that by doing this, the teachers would realize they did not have to take

away too much time to teach science, since they were already under great pressure with the other subject areas. This integration still appeared to be necessary even though Linda informed us that, "science is going to be tested on the [state standardized test] in two years. So now they are giving us permission to teach science again" (LPM1, 10/24/00).

In addition, I also wrote out all of the state objectives that each activity met, whether it was in science, mathematics, reading, or another subject. In hopes of gaining the teachers' support and excitement for the program, we provided these corresponding standards in order to show the teachers that these were academically relevant activities. In the planning meeting for the first field trip Linda encouraged the idea of writing out the objectives,

That would be very helpful for the teachers that are not as enthusiastic about science...that would be perfect. Then they can see...especially the two new fifth grade teachers are very concerned about going by the book. So that would be great for the objectives to be there and they could see (LPM1, 10/24/00).

The list of corresponding state objectives was also given to the principal in order to create support from the administration.

For the first field trip curriculum, both Linda and Karen provided lessons for the notebooks. Linda suggested a mapping activity of the site, which I helped create. And Karen provided a biological indicator key for a water quality activity. Catherine also suggested a food web activity. The scientists and I developed the rest of the activities and background information. The scientists and I did much of the work for the curriculum notebooks, because we had the most time to work on them. We did not mind doing this because we really wanted the field trips to be part of the school curriculum. Karen acknowledged that the teachers knew they should integrate the field trips into the curriculum but often could not or did not.

You have done a lot of legwork with the notebooks that we probably would not do on our own. And it is true that we know that field trips need to tie in and be related. But you have been vital with actually providing us with those resources...with actually making it happen. Teachers know the talk, they just don't necessarily walk that walk. You helped us to do it and made it easy to do that...we just need more help, we need more resources, and you have done that (KI4, 5/14/01).

With this in mind, the scientists and I created the classroom curriculum with some suggestions from the

representative teachers, Linda and Karen. The two representative teachers, approved the activities before they were put into the notebook. However, the other fourth and fifth grade teachers did not make any suggestions (although they were welcome to do so), and the notebooks full of activities were just given to them. Linda and Karen were to explain the curriculum to these other teachers.

Despite the effort and thought that we put into the curriculum for the first field trip, some of the teachers, especially in the fifth grade, did very few of the activities. The fourth grade teachers presented several curricular activities in the classroom, each doing four or more. However, two of the fifth grade teachers did very few activities, and two other fifth grade teachers who taught only language arts did none. Catherine suggested these explanations,

They have to know that they are accountable and maybe [the principal] had not talked to them before about the fact that this is what she expected them to teach. They could have just let science slide because so much pressure is on the [standardized test] subjects, and they didn't see it as a way to address reading, and math, and writing. Maybe some are just uncomfortable with science and reluctant to teach it no matter how

you present it to them or the tools that you give them (CI2, 5/23/01).

One fifth grade teacher, Sally, who taught science did not seem at first to view utilizing the trips in the curriculum as a priority. For instance, she was explaining to me why she wanted the fifth grade field trips to be on March 8 and 9 rather than the planned February 22 and 23. She showed me the calendar and said that March 6 and 7 are their practice-standardized tests and March 10 is spring break. She said "the kids will really need a break after the [practice tests] and they will be wild before spring break, so that is why those dates are good for the trip" (Journal entry, 1/18/01). From these comments, it seemed to me that at least this teacher viewed field trips as a blow-off day rather than educational. I wrote in my journal,

This really disappointed me. I actually was a little angry because so many people were putting in their time and effort to make these field trips educational and fitting it into the curriculum (Journal entry, 1/18/01).

This same teacher did few activities for the first field trip and seemed unhappy going into the trip. Sally and her partner teacher made comments that they did not know what was going on. It was

obvious that we needed to do more to educate, encourage, and excite the teachers about the program.

I believe that there was a lack of explicit communication between Linda and the rest of the fifth grade teachers. Karen had mentioned that there were "some team problems in the fifth grade this year. There are some personality conflicts, and different styles...that is going to have an impact on communication" (KI3, 4/4/01). The lack of communication was indeed noticeable. For instance, one of the fifth grade teachers did not even know that there were reading and language arts activities in the notebook for the first field trip. Because Rachel only taught language arts and reading, she did not even see a need to open the activities. Moreover, she added, "I didn't even know what they were going to be learning about. So if I had known that I could have maybe pulled something in" (RI1, 12/8/00).

The communication in the fourth grade was more effective than in the fifth grade. For instance, Sam mentioned that Karen "was great about communicating" and helped him by showing him how he could use the notebook (SI2, 5/16/01). He commented on how having

Karen as a representative in the collaboration benefited him.

Karen, being on my grade level, had much more contact with it. And to be honest, when we were given materials, that is one thing. But to have somebody who is actually been at meetings with you made a huge difference. Because then I could look at it and say 'I get it but which one should I do first? How should I do this activity? Why am I doing this one?' And she was able to tie it all in and get me into it. Just having a physical person there...I could walk 5 steps and she is there. She has already been in the meetings with you, and she knows why you chose what you did. That was invaluable to me. That made me, or inspired me to do the activities much more so than if it had just been a sheet of paper. So the fact that you guys included her made a big difference for me (SI1, 12/8/00).

Karen described the efforts that she went to in order to make the other fourth grade teachers feel comfortable with the curriculum.

I really, really try to take it and make them feel like it is completely integrated into exactly what they are already doing. Because I know how they think. They think 'oh no, this and the TAAS.' So I have been the link. I feel comfortable with my role. I have been able to do that and soothe their anxieties and help them accept something different and invest a little effort (KI4, 5/14/01).

So while having a grade level representative teacher in the collaboration was successful for at least some of the fourth grade teachers, it was not

enough for some of the other teachers to have a representative. This was especially true when their representative was not as communicative as she could have been. They needed more direct information and ownership to buy into the program and really have their heart into it. This made me realize that you cannot just impose curriculum changes on to teachers if they do not buy into it. You have to involve them and educate them. They have to understand why it is important or they will just do whatever they want (or whatever is easier).

We made it a goal to help motivate the other teachers to get more involved with the second field trip. We used the scientists' presentations as a way to encourage the teachers to work with the curriculum. Jane suggested,

I don't see how they [the teachers] want any more than they have to do, because they have to do so much. So we have got to make it not something on top of everything else...If they would give that time that we come and do the presentation, just that time alone, if we are good we ought to be able to get them hooked so that they then use the materials (JI2, 12/13/00).

Additionally, Catherine made sure that the principal helped encourage the teachers. She said,



I was concerned because at the first field trip it seemed like some teachers had not prepared their students...So I did talk to [the principal] about that concern because so much work had gone into all of the pre- and post-activities and field trips here that I wanted the kids to get the full benefit. So she said she would take it upon herself to talk to the teachers and stress that this was the science curriculum, that this was going to be what they would implement before the February field trip (CI2, 5/23/01).

Catherine did not do this to get any of the teachers in trouble, because this would have really hurt our relationships with them. We just wanted the teachers to know that the principal supported the curriculum.

Karen also suggested, "The more organized and the more prepared we are, the better. That is where the teacher needs to not stress out" (KI2, 12/14/00). So we gave ourselves more time, and we brought the curriculum to the teachers earlier for the second field trip because there were some teachers who liked to plan months in advance. In addition, before the second field trip, we tried to increase the amount of communication with the other teachers and encouraged their input more. Once they became more knowledgeable about the program and of the curriculum notebooks, experienced the field trips, and became more familiar with River Vista, they seemed to gain more ownership

in the program and started participating more. Furthermore, through an increase in communication, there was a greater understanding and respect between the other teachers and the rest of the collaborators. As Jane stated, "we all knew each other and knew a little bit more about each other and knew how each of us worked...They knew us better, we knew them better" (JI4, 5/22/01).

On the second field trip, one of the biggest changes was seen in the teachers' attitudes and participation, especially Sally's. With much more time before this field trip, Jane personally handed each of the fifth grade teachers the bird curriculum and a synopsis of the presentation the scientists were going to give in class. They seemed very appreciative of this information and communication. Sally said, "good, this will help me plan" (Journal entry, 2/7/01). This comment was relieving because from her previous comments it seemed that she did not have any interest in connecting the field trip with the curriculum. Furthermore, Sally, who teaches science and mathematics in fifth grade, did more pre- and post-activities for this field trip than she did for

the first one. When I visited the fifth grade teachers to tell them what to expect on the field trip, Sally mentioned that the students had been quizzing each other on the birds (Journal entry, 2/19/01). She even gave me a reading passage and questions that she had developed for the curriculum. This teacher, who mentioned that she had never done a bird unit before, said she was, "looking forward to it" and was "eager to get started" (Journal entry 1/30/01). This was an amazing transformation from being the "unhappy" teacher from the first field trip. As Karen said, perhaps Sally did know to integrate the first field trip into the curriculum (and maybe even wanted to), but just did not have the resources, time, or information about the program and field trips to do so.

Even Rachel, who teaches language arts in the fifth grade, put more effort into connecting the field trip to the curriculum. She made efforts to relate the field trip to a book the class was reading. Despite the changes that we made in communication, the one fifth grade teacher that teaches all subject areas to the gifted class still only had her students

complete a few of the pre- and post-activities. However, the rest of the fifth grade teachers taught much more of the curriculum.

The fourth grade also did much more preparation and follow-up for the second field trip. When I visited, the fourth grade hall was covered in bird pictures and stories. Also, one of the teachers told Michael that she usually did not do much science because she does not feel comfortable with it, but she is doing much more science this year (Journal entry, 2/27/01). It is evident from comments such as this one that the planning and curriculum was of help to at least some of the teachers. Because the fourth grade was about to take the writing portion of the state standardized test, all of the classes did many of the writing activities that were included in the curriculum notebook for practice. For instance, one of the teachers mentioned that her students wrote a narrative about *'one day I woke up and I was a bird...'* and said that, "it was one of the best writings that they have ever done" (Journal entry, 2/19/01). The students' experiences with birds through the field

trip curriculum made it easier for them to write about that topic.

You could really tell the difference that the classroom preparation made. The students were much more interested and on task during these field trips. Some of the classes did bird reports before the field trip, and during the trip the students would say, "I wrote about that bird" or "that was my bird" and then they would tell the rest of the group about that bird (Journal entry, 2/26/01).

Despite the progress made with the classroom curriculum between the first and second field trips, all of the classes did less preparation and follow-up in the classroom for the third field trip. When asked about this, Linda said, "It was [the standardized test]. It was all because of [the standardized test] (LI4, 5/21/01). Unfortunately, we had some scheduling conflicts for the third field trip. The teachers wanted to do it after the last standardized assessment tests were taken, but we needed to do the trips before the local university schools got out because many of our volunteers were from the university. This forced us to schedule the field trips only a couple of days

after the elementary school assessment tests. Worried about the students' ability to concentrate on the field trip so soon after the state assessment test, Michael asked the teachers in the planning meeting, "But how will the kids be? Will this be an effective experience? Just to do it is not really the point" (MPM3, 4/5/01). Karen assured us that the students would be in fine form for the field trips.

The field trip did end up being an effective experience for the students, but perhaps not as effective as it could have been. The teachers did not have much time to prepare their students ahead of time for the field trips, because they were busy preparing for the standardized tests. Although we tried to incorporate some mathematics activities in the curriculum to aid in this preparation, still not much of the curriculum was presented. There was too much pressure on the assessment test for the teachers to spend energy on the field trip.

Another possible reason there was a disparity in the amount of classroom activities done over the course of the three field trips may be in part because of the different ways that the curriculum was

disseminated. For the first field trip, Catherine and I made copies of the curriculum for all 225 students. Because this was time consuming and costly, we decided to allow the teachers to make copies for their own classes of only the activities they were interested in doing. However, this was less convenient for the teachers. In our last interview together, Sam explained,

The pre-activities actually I think were better at the first field trip. They weren't quite as well organized for the final trip. I think part of that was just more that you wanted the teachers to have more choice in what we wanted to do. So we found some good stuff. I would just say that because the activities weren't as structured, we probably didn't do as many of them. For example, the whole packet was given to us for the first one and we simply gave those out to each kid. But for the second one it was a little bit less structured. And the third one was just handed to us and we decided what to Xerox. I don't know if that was for budgeting issues or just to give us more freedom. We did some pre activities, we just did a little bit less than we did on the first field trip.

Researcher: Because they were not run off?

Sam: Yes, to be quite honest. If they are already done there for us it is a lot easier to go ahead and say turn to page so and so as opposed to making sure we have exactly what we want ahead of time. It just facilitated the pre-activities a lot more on the first field trip (SI2, 5/16/01).

He added,

And I guess this is a little bit selfish...I am sure that I am perfectly capable of making copies...but having those done ahead of time as it was for field trip number one facilitated it a lot more and made it easier as a teacher. So if that could be done for all three field trips, I think that would be great (SI2, 5/16/01).

It was interesting to find out that for at least one teacher, merely having to make copies of some parts of the curriculum for students was a barrier to preparing the students for the field trip. I am still not sure if this was a display of a lack of motivation and ownership in the field trip experiences, or simply due to a lack of time.

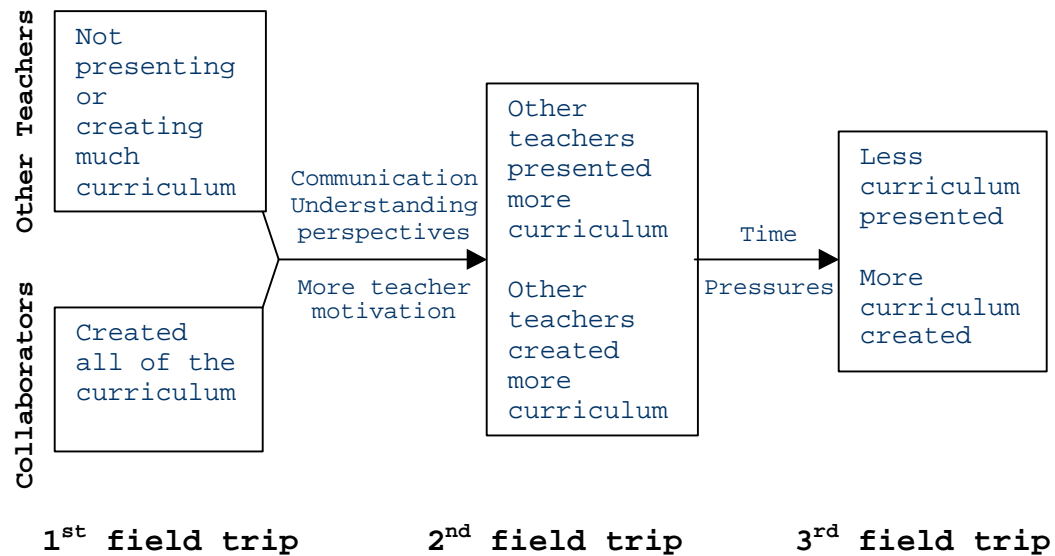
Even though fewer activities were done in the classroom when compared to the second field trip, all the classes still did some activities before and after the field trip. Furthermore, more of the teachers and mentors helped in developing the classroom curriculum. Linda and Karen, as well as some of the other teachers provided several activities for the curriculum. The teachers' ownership and involvement in the program increased throughout the year. As Karen stated after the last field trip, "the teachers have become more and more enthusiastic about this partnership!" (KE,



5/8/01). She added, "I am very, very pleased. I like the way the teachers have gotten more into it. They have created more on their own...added to it. Even some of the more reluctant ones have" (KI4, 5/14/01). Several of the mentors also helped to create the classroom curriculum for the last field trip.

Because of improved communication and experience with the collaboration, the other teachers' motivation and dedication towards the program increased, as did their involvement and support, causing us to have more of a shared vision about the classroom curriculum. Indeed, this dedication resulted in more use and contribution to the classroom curriculum. However, having the vision of a field trip integrated in the classroom curriculum and a desire to achieve that vision is not always enough. Time and other pressures at the school such as standardized assessment tests limited how far we could get with that vision. See Figure 2 for an illustration of the curriculum challenges that the collaboration faced and a depiction of the role changes within the other teachers.

Figure 2: Classroom Curriculum Challenges



### ***Was the Shared Vision Achieved?***

From the very first field trip, everyone in the collaboration agreed that we had achieved our original main goal of creating a beneficial educational experience for the students. It corresponded with our broad definitions of a successful field trip. There were low student to mentor ratios and the field trip was incorporated into the classroom curriculum. The field trip was exciting for the students, and they did

learn about the environment. Karen explained how even this first field trip was successful for her students.

The aspects of the field trip such as the close ratio of attention and the things we are doing on the field trip and the pre and the post...all of that really adds to the learning. We have a lot of kinesthetic, untraditional style learners... In my opinion, this collaboration and these trips make more of an impact with these kinds of kids...culturally, economically different kinds of kids who come up against more environmental problems. I think this has more of an impact on these kids because for whatever reason they tend to have a different learning style. This is perfect for that learning style (KI4, 5/14/01).

Despite this accomplishment, none of us were satisfied with the experiences just being successful. We believed that the experiences could be better, and we wanted to maximize the utility of the vast array of resources available. As seen in the previous examples of how we developed the educational experiences, our individual visions for the field trips evolved over the year while becoming more similar to one another. As Jane explained, "the first one had a lot more rough spots here and there. We were still figuring things out too. As it went on, between the teachers getting more together and we were more together, it got better" (JI4, 5/22/01). Karen agreed that the field trips have "just evolved. They have grown and grown

and grown" (KI4, 5/14/01). When asked what she thought made the field trips improve Karen replied, "It is just really refined and worked out and planned here....We have so much input and are learning so much from each other and previous experiences" (KI4, 5/14/01).

Although we probably did not each possess the exact same idea of how to structure the field trip experiences, our visions were much more shared by the end of the year. Despite our different priorities, cultures, teaching and learning styles, and pressures, we did come to a middle ground. Sometimes it was because of compromise, and sometimes it was because we were learning and creating something better together. A combination of communication and listening in order to really understand others' viewpoints helped most in synchronizing our intentions. In addition, ownership and dedication to make the field trips better and a sense of community, which grew over time also contributed to a more shared vision.

Ultimately, to gain a comprehensive picture of whether or not the main goal of the shared vision was achieved, it is necessary to take a closer look at the

students' experiences. The students' experiences during the field trips and with the supporting classroom curriculum were explored through their schoolwork, their letters to the mentors, and the teachers' and mentors' responses. For the students, the positive outcomes of the program were displayed in three major areas including cognitive, affective, and social gains.

#### Cognitive Gains

The students' schoolwork and thank you letters to the mentors demonstrated substantial gains in science content learning. The learning that occurred ranged from simple to more complex concepts. The more straightforward concepts included the names of organisms and general characteristics of these organisms. For instance, one student recalled, "I learned that Northern Mockingbirds are grey but when they fly they have white patches under their wings." Moreover, Linda mentioned that she noticed that back at the school "they are out in the gardens or out in the playground finding bugs now. And they can tell if they are beetles and they can name them" (LI4, 5/21/01).

Higher-level concepts that the students mentioned included understanding the relationships between organisms and adaptations of organisms to their environment, as well as application of their new knowledge to their lives. For example, one student remarked, "My most favorite thing to see was the tortise shell and it was cracked open by a predator that ate it." Linda commented about her students,

They have a knowledge of creatures they never knew before, or never could relate to before, or that never mattered before. It is really fun to see now that they can see plants and the insects on it, and they can see the relationship between the plant and animal (LI4, 5/21/01).

In addition to what the students learned on the field trips, Karen stated that because of the collaboration's support, her own teaching in the classroom was "getting away from the bottom of bloom's taxonomy and more to truly application and analysis and synthesis (KI4, 5/14/01).

Based on the students' writings, the fourth grade increased in cognitive gains from the first to the second trip. The fifth grade completed fewer writing samples for the second field trip, so it was difficult to compare the students' learning. Both the fourth and the fifth grades made reference to the most

interrelationships and other complex concepts in the third field trip writings. This is probably, at least in part, due to the changes made with the curricular content level, and more motivated teachers as the collaboration progressed. In addition, the three field trips visited the same site, so we were able to build upon and connect the curricular content.

We were ready to integrate more at the end... We noted the relationships, the birds, soil life and plants as more of interrelationships. We had touched on all of that, but now it was just gelling. So it was just taking it a step forward (KI4, 5/14/01).

Furthermore, the students became more aware of science careers and science as a practice in general. Many of the students commented on how they wanted to have jobs like the scientists that they met. One student said, "Maybe some day I will be entomologist like you". Another student added, "The field trip made me feel excited because learning so many new things. I didn't know that learning plants could be so much fun. I want to be a scientist when I grow up."

The students learned certain science skills such as observing, data recording, and how to use different types of tools in science investigations. Several of

the mentors noticed that the students' observation and data recording skills improved over the year. Elissa noted that the students "seemed to have more of an idea of what they were supposed to be doing. By the third trip they were looking for a place to write stuff down...Some of them, even without the format, were writing down location and descriptions" (EI2, 5/22/01). Jane added, "I think they were a lot more savvy about looking for things, having some concept of what they were looking at, and being able to identify some things....They were really finding more stuff and focused a little better" (JI4, 5/22/01). Because the students were taught the skills needed to be successful on the field trips, they were much more engaged. Linda explained,

And on the field trip we talk about being observant and there are certain skills and processes that they need to be looking to fine tune. And once we get into the field, they don't have to even think about what they are supposed to be doing...they are doing it because they are so into it (LI2, 12/14/00).

#### Affective Gains

Gains in the affective domain relate to emotions, attitudes, appreciations, and values. Several studies have reported significant affective gains by students



that have taken field trips including increased interests, attitudes, and motivations towards the subject of science (Benz, 1962; Flexer & Borun, 1984; Orion & Hofstein, 1991; Stronck, 1983). Similar outcomes were demonstrated with these students.

The field trips were a valuable supplement to the classroom curriculum, because they stimulated an interest in and generated enthusiasm for learning science concepts. In fact, Linda said that her students "want to do research after they come back" (SI4, 5/21/01). She said, "it is really fun to watch because they really do get into it" (SI2, 12/14/00). Jane noticed that the students seemed to gain interest over the course of the three field trips. After the last field trip she noted, "these kids were really more into finding things and looking at stuff on this trip. I think they had a higher level of appreciation and interest" (JI4, 5/22/01). The students' interest in future science learning was often displayed in their writings. They would make comments like, "the next time we go I hope that I will be able to see my bird the American kestrel." In their letters to the mentors, the students would sometimes seek further

information by asking questions such as, "I just want to know if you will write back and describe what kind of sound it makes when it is calling its mate."

The students felt pride in their own learning. One student expressed her sentiments, "the field trip made me feel good about myself because I was learning new stuff and [a mentor] was calling me a scientist." This gratification from learning and increased interest in science is important at the elementary school level, where the foundation is created for the students' evolving attitude toward the study of science. The development of a positive mind-set towards science is especially critical for these students who are from backgrounds that are largely underrepresented in science careers.

Furthermore, the students gained an appreciation and respect for living organisms and the environment. They expressed a need to take care of the environment and its inhabitants and started to realize how living organisms are beneficial to humans. One student wrote, "I have liked looking at things and watching things and now I know how important plants, soil,

water, and birds are to the world." Another student adds,

The field trip made me feel appreciative for living things outside. Because before when I didn't know better I use to kill the insects. But the field trip made me realize how much insects help us in many different ways.

Equally important is the fact that the students had an enjoyable experience during the field trips. We were all surprised and elated to read student statements such as "I had one of the best days of my life." Furthermore, the students created a positive connection to the site. As the students became more familiar with the site through their repeated experiences on the field trips, the mentors noticed more place-based ownership in the site. They enjoyed visiting certain places that they liked and were familiar with. Jane recalled, "It was nice to hear the kids say 'this is where we saw redwing blackbirds last time'" (JI4, 5/22/01). Many of the students mentioned having a favorite space at the site, and most of the students were eager to visit again. Linda said,

They keep wanting to go back, which is quite impressive. There was never a complaint about going back like 'oh, not again.' It was like

'oh, what are we going to see this time!' They are very eager, and that is really amazing (LI4, 5/21/01).

This outcome is vital, because when students perceive a field trip as a fun experience they will be more likely to participate in this type of learning activity later in life, when they are no longer in school (American Association of Museums, 1998). In fact, some of the students made comments such as, "I wish I could come next year with my family" and "I enjoy [the site] and maybe I'll come in the summer."

#### Social Gains

Not only did the students make a connection to the site and nature in general, they also formed bonds with the myriad of people involved with the program. Because of small group ratios and multiple visits to the site, the students and the mentors formed strong friendships in many cases. Both the students and the mentors learned each other's names and anticipated being in the same group during future trips. One student in a letter to her mentors illustrates,

I want to thank you for guiding us around [the site]. I have had a lot of fun with all four of you because you helped me make a velcrow plant crown. [A mentor] told us about killdeer, [another mentor] told us about a poisenus plant,

and [another mentor] helped me catch a bug. It was a fun day with all of you. I hope I get you next time.

Jane also noticed, "a lot of the kids recognize me and are comfortable enough to come up and say hello and share something" (JI4, 5/22/01). The students enjoyed sharing their learning experiences with the mentors, often mentioning it as their favorite part of the field trip. One mentor, Beth, shared her experiences,

I had the same group come through every single time. And that was excellent...that was incredible I think because I knew their names, they knew me, they knew what we did, they knew the games, they knew the places we liked to go together. I knew about their families...and that helps make big connections I think (BI2, 5/23/01).

The teachers also expressed the countless advantages of the multigenerational aspect of the mentor population, from the inspirational high school and college students to the nurturing "grandmotherly types with the Audubon." Karen commented,

I can't believe what [the students] say. They are obviously very touched by how friendly the volunteers are...And for them to have one day with a big person giving them a whole lot of strokes is just huge...it benefited and motivates them to learn too (KI4, 5/14/01)

In addition, the students profited from experiencing the field trips with their classmates.

Their memories of the trips were often connected to the experiences that they shared with their classmates. For instance, one student wrote about how she and a friend hunted for pecans during one of the field trips. They also learned many things vicariously by witnessing their friends' encounters with the environment. Several statements were made in the students' writings such as, "[My friend] found a feather next to the greenhouse." The social aspect with their peers helped make the field trips memorable learning events.

Although the three major areas of benefit including cognitive, affective, and social gains can be identified, they cannot be easily separated from one another. The impact that this field trip program had on the students can best be understood by looking at each student's holistic experience. In their letters, the students rarely referred to just a fact, an emotion, or an interaction. Each field trip was an entire experience for them. Their experiences were connected to people, information, emotions, and a place, all intertwined and reinforcing each other. A

sample of this effect is displayed in a student's post-field trip letter:

I learn that a lot of plants were mostly on the ground of the Upper trail view and I liked the saw bugs or roly pollys. I liked the way [a mentor] told me how fun and he said I am a good explorer. I am and I love the way it felt and I kinda stand taller that day. I felt a lot proud of me. I liked the way I found things.

This student connects some of the organisms that he saw, learned about, and was interested in to particular places at the site. The ability to experience learning first-hand in the environment gave a context to the information that he was learning. Also, this student had a good learning experience and felt pride in his own learning and observation skills largely because of a mentor's positive comment. We can only imagine the full extent of the effects this simple interaction will possibly have on this student's motivations towards science and learning in general. As seen in this example, the richness of the field trip site and the personal interactions with the well-trained mentors helped make this a *whole* learning experience, which allowed the students to gain not just cognitively, but affectively, and socially as well. It is difficult to say how long these positive

effects will last. However, with continued reinforcement (such as upcoming field trips to River Vista), these experiences are likely to be solid building blocks for future successes in science.

#### Negative Outcomes

Although most of the outcomes for the students were positive, there were a few negative responses mentioned in the students' schoolwork and letters to the mentors. Most of the students' negative reactions to the field trips involved environmental discomforts. Some of the students commented that the temperature outside was too hot or too cold. There were also complaints about mosquitoes, gnats, and other insects. Because the site is the city's biosolids processing facility, there were comments about the field trip being "stinky," but the students seemed to get used to this after the first field trip. In addition, the students complained about being tired because there was too much walking during the field trip. After the first field trip we reduced the amount of walking, but the students still protested about this aspect on all three field trips. Despite these few negative responses from the students, I believe that the main



goal of creating a beneficial educational experience was achieved.

### **Benefits of the Collaborators**

In addition to the benefits the students received, the adults participating in the collaboration acquired many benefits. One of the defining characteristics of a collaboration is that it is mutually beneficial to the participants (Winer & Ray, 1994). Whether or not the participants benefited from the collaboration helps explain their actions and motivations throughout the year and has implications on the level of commitment the individuals will exhibit in the future. Table 3 contains a brief summary of the collaborators' benefits.

Table 3: Benefits of the Collaborators

		Learning	Improved Teaching	Enjoyment	Other
Formal Educators—Elem. Level	Karen	<ul style="list-style-type: none"> <li>-science content</li> <li>-looking at science as a system</li> <li>-about collaboration</li> <li>-about good teaching practice</li> </ul>	<ul style="list-style-type: none"> <li>-taught at a higher level</li> <li>-learned about logistics of field trips</li> <li>-had higher expectations for students</li> <li>-better integrate field trips into curriculum</li> </ul>	<ul style="list-style-type: none"> <li>-enjoyed creating fun ways of learning</li> <li>-enjoyed working with the group</li> <li>-enjoyed seeing children excited and happy</li> </ul>	<ul style="list-style-type: none"> <li>-curriculum resources</li> <li>-support from others</li> <li>-motivation and renewed hope</li> </ul>
	Linda	<ul style="list-style-type: none"> <li>-science content</li> <li>-about collaboration</li> <li>-about good teaching practices</li> </ul>	<ul style="list-style-type: none"> <li>-encouraged to do more</li> <li>-motivated to try something different</li> </ul>	<ul style="list-style-type: none"> <li>-enjoyed working with the group</li> <li>-enjoyed outdoors and nature</li> <li>-increases hope for public education</li> </ul>	<ul style="list-style-type: none"> <li>-curriculum resources</li> <li>-support from others</li> </ul>
	Education Researcher	<ul style="list-style-type: none"> <li>-science content</li> <li>-about formal education and teachers</li> <li>-about informal education</li> </ul>	<ul style="list-style-type: none"> <li>-better able to teach to different learning styles</li> </ul>	<ul style="list-style-type: none"> <li>-enjoyed working with the group and students</li> <li>-enjoyed field trips and nature</li> </ul>	<ul style="list-style-type: none"> <li>-dissertation work</li> </ul>

Table 3: Benefits of the Collaborators, cont'd

		<b>Learning</b>	<b>Improved Teaching</b>	<b>Enjoyment</b>	<b>Other</b>
<b>Formal Educators—Univ. Level</b>	<b>Jane</b>	-science content -more about elementary school and public ed. -more about the site	-learned about different learning styles -became able to engage different types of students -learned about integrating field trip in curriculum	-enjoyed working with the group and students -enjoyed seeing mentoring happen -enjoyed helping teachers	-increased faith in collaboration
	<b>Elissa</b>	-about elementary education in public schools	-learned about different learning styles	-enjoyed seeing students learn -enjoyed seeing teacher learn	-her students gained knowledge
<b>Informal Educators</b>	<b>Michael</b>	-strengths & weaknesses - logistical aspects of field trips	-insight into own teaching practices -challenged to find more valid ways of assessment	-enjoyed working with the group -enjoyed accomplishing his goals for the site	
	<b>Mentors</b>	-science content -about elem. education and informal education	-learned that different students have different learning needs	-enjoyed working with mentors and students -enjoyed sharing nature with students	-some received course credit

### ***Formal Educators-Elementary Level***

Although all the classroom teachers that were interviewed reported benefits due to the collaboration, the teachers that most directly participated in the collaboration benefited most.

All of the teachers gained science content knowledge, often during the field trips right along with the students. Karen describes one of her learning moments during the third field trip.

I was really proud of myself because I knew some things, because you had prepared me. I recognized lamb's quarters. And I even got to have a little question with Beth about a plant. She had thought something was mesquite, and I guess I had grown up enough around mesquite to know it wasn't mesquite. It was something else. That was really fun. We were learning and we were the grown-ups and the kids saw that. I had been trained a little and she had been trained a little. We could teach and learn in front of them. That is great because they see us getting excited (KI4, 5/14/01).

The scientists helped the teachers look at science as more of a system rather than a collection of facts. Karen explains how the scientists taught her to take specific facts and content areas and apply them on a larger scale: "[Elissa] is reminding me to take that [information] into a bigger cycle and always

take that and apply it to the big picture. Of course Jane does too, the two of them" (KI4, 5/14/01).

The teachers also gained knowledge about better teaching practices. For instance, the collaboration and resulting field trips reinforced the value of hands-on, experiential learning. Linda says, "I have always been an advocate for it, but now I am totally a firm believer" (LI4, 5/21/01). Linda also realized that a low student-teacher ratio is key. She explains, "I can't serve the students the way they need to be served and the way that I want to serve them when there is 20 or so in my classroom" (LI2, 12/14/00).

The teachers that primarily participated in the collaboration, Karen and Linda, learned more about the process of collaboration. Linda says that she learned "that I have to be flexible, that my way isn't the only way" (LI4, 5/21/01). She says that it is important to "be open to different approaches." She also stated that, "the different components that come in teaches me something every time about people, about humans" (LI4, 5/21/01).

All of the teachers received resources in the form of background information, handouts, and notebooks with curriculum activities. The support from others in the collaboration also benefited the teachers. As Linda states, "We need a lot of help. The interest in it is very encouraging. It makes me feel good about teaching...that we have that opportunity and partnership" (LI2, 12/14/00). Karen reiterates, "It is nice to have a reminder that there are other sources rather than just workbooks. There are people" (KI4, 5/14/01). Karen goes on to describe how the support that she received from others in the collaboration helped her with the difficult reality of teaching fourth graders.

People are going to reinforce this with me, so I feel more supported and not like I am barking up a tree. It is people helping me with my reality, and they have helped a lot...Sometimes you get a little tired. You get a little...not hopeless, but you get a little like 'scrap this, we are just going to get to the bare nicks and bones.' But with all of this wonderful support I am given renewed hope on truly effectively communicating certain things that I probably would not attempt. That is wonderful. I am being taught that 'yeah, you can do this, you just need a little help, you need some resources, you need a little support' (KI4, 5/14/01).

Over the course of the collaboration, Karen came to the realization that she needed the kind of support and extra motivation that the collaboration provided.

What I like about this is that it is inspiring me to not take the easy route, write it off, or just do workbooks, or not address that area. Teachers need renewing...we need inspiration. That is what I think about when I think about myself in this. Once again, just like when I come back from a great workshop, 'yeah, that is why I chose to do this and love this. Oh yeah, I do really like teaching.' The fact that I need renewal and inspiration and support and resources...I need to remind myself to have that and to keep doing that. I want to be the kind of teacher that survives...I am going to find out what is healthy. And this collaboration has definitely helped me to realize that...that I want to stay on a higher plane and really that I need that (KI4, 5/14/01).

Linda also expressed how the collaboration and the support structure behind it gave her a sense of encouragement about teaching.

I really had become quite discouraged with public education. And River Vista has been one of the most positive things we have done this year as far as showing me that there is still some hope for public education. As long as we can have these kind of partnerships and collaborations, then maybe there is hope still (LI4, 5/21/01).

This sense of support, in addition to the science content and the lessons learned about teaching, helped improve the formal educators' teaching abilities.

First of all, the teachers felt motivated to go further with their science teaching and really use the field trip days as learning experiences. Linda explains,

The preparation that you all help us with before leads us into it. The lessons they come in and do, the workbook...that is all key. I think that gets the teachers on the right track. Because teachers, we get lazy about it too. A field trip is kind of...it can be a blow off day (LI2, 12/14/00).

Karen adds,

I think that it keeps the teachers on their toes. You know with our population, the reading, the math, and the writing are first. Social studies and science are on the backburner. This is forcing us to keep those upfront, make sure our kids are up to date in those areas (KI1, 10/24/00).

Karen explained how she also became more motivated to teach at a higher level and to have higher expectations for her students.

Researcher: Can you describe to me the level of preparation your kids had?

Karen: Birds, that is pretty rote, it is pictures to words. But with Elissa and Jane coming in and talking about those relationships and bigger picture ecosystems, and cycles, and herbivores, it has gotten wider. So the teaching has gotten better. Like those review sheets I just gave you. I am forced to get away from just the knowledge.



Researcher: You are talking about your teaching?

Karen: My teaching is getting away from the bottom of Bloom's taxonomy and more to truly application and analysis and synthesis. It is more of the bigger picture. I am trying it out on them. I am trying to have higher expectations for them.

Researcher: Because of what Jane and Elissa have done? Or are you just trying to do more, or...?

Karen: Well, they have taught me and reminded me. It is like it is worth it because we are going to see it...It just gives me more incentive to take it to a higher plane in an area I might not normally, because I have no reason to (KI4, 5/14/01).

Karen also mentioned that she wrote in her self-appraisal for the principal that the collaboration helped her teaching by allowing her to integrate the field trips into the state standards and tests and other content areas while making the learning relevant. This was important because there is so much pressure to focus on the state standardized tests and the content areas that are tested.

An additional benefit that the teachers reported was a sense of enjoyment. All of the interviewed teachers mentioned that they had a good time on the field trips. Linda and Karen enjoyed working with the

other people in the collaboration. In an interview Karen affirms,

I really liked meeting you all...I have enjoyed our collaboration. I have enjoyed participating in it and looking at it as you were, as a fly on the wall. I liked the adult side of it. I guess teachers...that is so often our complaint...we are with kids a lot and sometimes we want things on a higher plane. It is just nice to be around adults. I like talking about things that I am usually on my own on (KI4, 5/14/01).

Karen also specifically mentioned that she took pleasure in "creating fun ways of learning" (KI4, 5/14/01). In agreement, Linda states, "I am driven by trying to do something exciting and different, and these field trips meet all of that" (LI2, 12/14/00).

The principal and elementary school in general benefited due to the improved science teaching and increased teacher motivation. The students' and teachers' broader exposure to science, and the cognitive, social, and affective gains of the students also benefited the elementary school as well as the school district. The school gained recognition in the district for the collaboration, and portrayed it as an example partnership in the district newsletter.

### ***Formal Educators-University Scientists***

As with the elementary teachers, the scientists also benefited by learning content and more about education and collaboration, and by improved teaching and a sense of enjoyment.

Even though the scientists were often thought of as the "content specialists," they learned a lot during the collaboration and resulting field trips. They learned new science content such as information on different kinds of birds or macroinvertebrates. In addition, they gained a better understanding of the material they had previously known, because they had to teach it to a different audience than they were used to.

Both Jane and Elissa gained a better understanding of public education at the elementary school level as well as the working conditions for elementary teachers. Jane describes how working in the collaboration helped her become more aware of public education in this community.

It has been very nice to be around some kids and to have a reality check on schools and teachers and kids. I can isolate myself from all of that very easily in this academic ivory tower. That has really been good for me to understand at a

community level a little bit about what is going on in a community that I am not a part of, or am not used to being a part of. I have now, in a way, become a little part of that community (JI4, 5/22/01).

Michael reiterates, "It has helped them [Jane and Elissa] to understand the school better. I think it has been really good for both of them to understand what that kind of education is like" (MI4, 5/21/01).

During the collaboration, Jane and Elissa also gained insight on the stresses and demands put on the teachers. Jane remarked, "I have a real appreciation of the hard, unrewarding work that teachers put in....That was good for me to understand, because I didn't understand that before" (JI4, 5/22/01). Elissa also mentioned that she learned about the "strains the teachers have with [the standardized] tests (EI2, 5/22/01). Furthermore, Jane gained a better understanding of why science cannot always be a top priority to the teachers. Other classroom subjects such as mathematics and reading appear on standardized tests, so these are often emphasized. Also, many of the teachers did not have science as a specialty or did not have much science in college, and so they did not have an extensive understanding of

science. Once she understood this, she shared this insight with the other volunteer mentors that participated on the field trips. Jane stated in a follow-up email to the volunteer training that took place before the second field trip,

Some of the five fourth grade teachers and five fifth grade teachers are more comfortable teaching "birding" or "science", so some children will have had more opportunity to learn about these birds. At present, science is not a tested curriculum for either the 4th or the 5th grades. Our phrasing as mentors should probably never include "you should know this" or "your teacher should have taught you this." Teachers are already constrained and pressured as to what they have to teach. We as mentors are there to embellish whatever they have managed to present. We can certainly share our passion for birds, plants, nature, the out-of-doors (JE, 2/19/01).

Jane truly began to understand and respect the teachers' perspectives, and she helped share this knowledge with others in the collaboration.

Moreover, Jane especially learned a lot about teaching and learning. In particular, Jane began to better understand that people have individual differences in their optimal learning styles. After the classroom teachers discussed their students' different individual needs with all of the collaborators, the scientists began to more

consciously incorporate different ways of teaching in their lessons to the students. Jane explained how she noticed improvements in her teaching during the second field trip.

We have progressed in addressing the needs of the different kids. That was one of my objectives for the second [field trip]...to try to understand to have kinesthetic, visual, verbal, to repeat things a number of times, to try to do all of that a little better...I felt like I was learning and I was doing a little better (JI3, 2/1/01).

Furthermore, the students themselves also helped reinforce the importance of finding different ways to engage different people in learning. Jane explained how this was a real challenge during the field trips and how she had learned to try to keep her mind open to different ways of approaching the learning events.

Any teaching I do ever, I will be much, much more aware of how to engage everyone's learning style...I have learned that directly from the kids. It blew my mind when the kid grabbed the map and was focused on that. She was not really engaged and then she grabbed the map, and she was the map guide the rest of the morning. The other time was when the little boy was bored and he said, 'I am bored.' And when we got to Michael and he gave him the collection sack...wow! That little boy was totally engaged then (JI4, 5/22/01).

In addition, Jane's extensive interactions with Elissa during the collaboration helped emphasize to

Jane the differences in the ways in which people learn. Their learning differences became apparent as they tried to figure out the best way to present the science material to the students. Jane explains the differences in the ways that she and Elissa understand and remember science concepts.

Elissa and I have actually butted heads, always in a collaborative and learning way, in how we learn. We do that every time. I learn more from stories and will remember things and don't have to have names. She learns by having things named. I can't say how she does it, because that is not the way my brain works. But when she has the name, then she remembers the context. She of course focuses on that. I focus on story telling. Which is probably good, because then we had to try to strike a balance in how we present this...I have learned to think of a different kind of process from her (JI4, 5/22/01).

Jane also learned more about field trips and how to make them more educationally useful. I provided her information from my studies of informal education and better ways to integrate field trips into the classroom curriculum. Both the elementary teachers and I emphasized the inclusion of some of the state objectives into the field trip curriculum. During the collaboration and three field trip experiences, Jane focused on having "pre-activities and post-activities to reinforce...to prepare them to see through their own

eyes the most possible when they are at River Vista....And then to reinforce what they have seen afterwards with those activities" (JI1, 10/23/00). She states,

It is a challenge to try to coordinate their curriculum and the [standardized state] requirements, the place-based outdoors hands-on site...that is a challenge and that is exciting. I didn't understand...you were the one that really put a context to field days that was intriguing to me to try to improve on (JI1, 10/23/00).

Another way in which the scientists benefited from the collaboration was through the pleasure that they received from their participation. Jane especially enjoyed working with the people in the collaboration. In our second interview she remarked,

I like all of ya'll. I like working with all of the people involved. I really enjoyed getting to know Catherine more. That has been a real pleasure. And Karen and Linda are just delightful, so different and yet so delightful. And of course Michael and [others] have been long time partners and collaborating partners, so I know that it is always going to be really a pleasure working with them. And that makes it exciting (JI2, 12/13/00).

Both of the scientists also commented on how they enjoyed witnessing the collaboration's successful results. Jane articulates,



I was delighted with the energy on the part of so many people. So I think the collaboration, in my opinion went really well. There was a real diversity from retired teachers, to teachers, to college students, to high school students. That was a real pleasure to see happen, the whole concept of mentoring really did happen. So, that is my first joy in the whole thing (JI2, 12/13/00).

Elissa commented that what motivated her was that the collaboration was "doing some good. There have been positive outcomes. The kids have learned. The teachers have learned" (EI2, 5/22/01). Jane added that this experience has increased her faith in collaboration. She explains, "this doesn't come naturally to me. I really prefer doing things by myself" however, "it has been an absolute pleasure to work with our core team....It was definitely well done. That is a tremendous relief. It showed me that collaboration can work" (JI4, 5/22/01).

### ***Informal Educators***

Even after just the first field trip, Michael mentioned how he had already "learned so many things" (MI2, 12/14/00). He discussed how he learned many pragmatic ways to improve the field trips, such as the best ways to get the groups of students around the field trip site and how to structure the field trip

days. He also learned more about the people involved in the collaboration, and "of what people are good at and what they are not so good at" (MI2, 12/14/00). This helped him direct people to do different tasks for the field trips.

Michael also gained more insight into his own teaching practices and beliefs about education. He had thought that a major goal in education should be to develop a consciousness in people, and he felt that this experience was an affirmation of that process. He found it very satisfying "to see the fourth and fifth graders begin to develop a consciousness of their own place in the world and of other organisms in the world, and that they live in a place as opposed to just anywhere" (MI4, 5/21/01). He also realized that he had set up the university courses he teaches with that same goal in mind. In addition, this experience with the students challenged him to always try to find more valid ways to assess learning. He explains,

Education is about learning and not measuring. That is why exams to me are kind of ridiculous and artificial ways of gauging learning. And we need structures that let us evaluate learning as opposed to measuring knowledge. That is the challenge for me (MI4, 5/21/01).

He explains how he witnessed so much learning from the students, and everyone else that participated in the field trips, and that this was difficult to measure. The fact that they were able to discuss topics together was proof of their learning.

These kids, the fourth and fifth graders...what is neat to see is that they can come to me and talk about blood weed or talk about turkey vultures. Then I will talk to a professor who is talking to this other person who may know something about this...they are all talking from a common ground (MI4, 5/21/01).

He goes on to discuss how formal science education is designed to be limited, because it does not often provide opportunities for the students to explore and discuss their learning as in informal education situations such as this one. He also states, "I certainly learned the limitations of formal scientific practice in exciting these kids" (MI4, 5/21/01). He believes that field trips to River Vista can help the students become engaged with a place and nature and ecology. "What we are trying to do is open up a world to them" (MI4, 5/21/01).

The collaboration experience also benefited Michael because of the excitement and satisfaction of accomplishing his goals for the site. His mission for

River Vista was to increase partnerships and creative programs while empowering people to make a change. He explains his pleasure in seeing this goal being realized.

To see all of those people empowered, that is the most satisfying thing to me. I have always envisioned River Vista as a place where we can do stuff like that. And to see it actually happening is really an exciting thing (MI4, 5/21/01).

Michael also explains how he enjoys working with the people involved in the collaboration and how the people have made the collaboration a joyful and successful endeavor.

That building of community is why it has been so much fun around here. We have attracted these characters...Jane, Elissa, you...It is just a delightful group of people to be with. And all of this other stuff we get done is just an outflowing of the fact that we all basically like each other (MI3, 2/2/01).

The volunteer mentors that helped guide the students during the field trips also received several benefits from the experience. They learned science content knowledge from the mentor training days that Jane provided before the field trips, as well as during the field trips from other mentors in their group. Beth remarks, "we always had the material that

we needed to tell them [the students]. If not, I knew I would learn it on my way from everyone else" (BI2, 5/23/01). The mentors provided support for each other, so that no single person felt like he or she needed to know everything before the field trips. Catherine stated, "I have been very grateful for those who know more than me...to give me the confidence to go out and help the kids on the field trips" (CI2, 5/23/01). Another mentor mentioned that with "each different group that he was with, the different mentors that were there, he would learn different things. One person would know these plants, and other people would know different things" (EI2, 5/22/01). The mentors all had different backgrounds. There were high school students, college students, birders, botanists, retired teachers, and many more. Everyone had different background content knowledge, so they learned from each other.

The mentors also learned more about the students and elementary education during the mentor training days. Beth stated, "knowing what they are learning and what you can do for them, to help them, was helpful" (BI2, 5/23/01). The mentors also learned

about the students and their specific needs during their time together on the field trips. Beth explains, "we had different levels of kids. You wouldn't know if you get the really sharp group or the lower group. But it is easy to accommodate" (BI2, 5/23/01).

Catherine, who is a retired teacher from the elementary school, also noted that she gained a better understanding of informal education.

I learned that I love the informal teaching, the hands-on and the outdoor teaching, especially in science. Science is the real world and how it works. You can get a limited amount of knowledge from books, but you need to be out in it, and I am glad that I have had the freedom this year to concentrate on that (CI2, 5/23/01).

Catherine felt that she was not able to do much informal science teaching when she was a classroom teacher in the elementary school, and she was happy to be able to do more now.

The volunteer mentors also really enjoyed themselves during the field trip days. During the course of the year, the returning mentors, from many walks of life, got to know each other personally and a sense of community began to develop. Catherine remarks, "I have benefited by getting to know some

neat people on the team and I really appreciate their levels of expertise. I appreciate their levels of dedication. It has been just a neat time to work on a fun project" (CI2, 5/23/01). The mentors were also gratified when they knew that the program and what they were doing to help was valuable to the students. The mentors all had a general love of nature, and they enjoyed sharing this with the students. After the field trips, the students wrote letters to their mentors, thanking them and telling them what they learned. These letters were often really touching for the mentors to read.

Some of the college students that participated as mentors for the field trips did receive some extrinsic rewards for volunteering. They received credit in a course that they were taking. The other volunteer mentors did not receive any external benefits, except maybe the free donuts at the trainings and on field trip days.

### ***Education Researcher***

While researching and participating in the collaboration, I too benefited in many ways. Besides the valuable information I gathered from the research,

I gained personally as well. For instance, as with the other participants, I also learned a great amount of science content from others during the field trips and from helping to prepare the curriculum. After the field trip about birds I reflected in my journal about how I was astonished at how a whole new area of interest was opened up to me.

All of this work towards the field trip has made me very interested in birds. I am actually surprised because I have never been that interested in birds. I bought a bird field guide and I am starting my life list. You really do learn a lot from having to teach something (Journal entry, 2/9/01).

In addition, I learned more about formal education, the students, and the teachers. I became keenly aware that the students were often at various levels academically even though they were in the same class. After one field trip I wrote,

From the fourth grade, the two groups I had differed greatly in cognitive ability. I even had one kid that did not know his letters, while the other group was taking great data. This was an astonishing and sort of sad revelation to me (Journal entry, 11/16/00).

I never realized just how cognitively different two students could be and still be at the same grade level. This made me realize what a tough job the



teachers must have teaching at such vastly different levels. Moreover, through getting to know the teachers at the school on a personal level, I became more aware of the pressures that bombarded them.

Because of my greater awareness and appreciation of the challenges in formal education, I feel that my ability to teach elementary students in both formal and informal settings has improved. I suppose I had already known that students have different preferred ways of learning, and that it is necessary to adapt instruction accordingly. However, I had never really experienced it in such a real manner. From my experiences on the field trips, I feel like my teaching improved over the year. I reflected upon this development in my journal,

At first I felt like more of a tour guide than a teacher on the trips, just pointing out interesting things. Now I feel like I am letting the kids be more in control of their learning and what interests them. I ask better questions of the students and I know more ways to engage the different kids, whether it is writing, or drawing, or collecting, or discussing (Journal entry, 5/5/01).

I gained much knowledge and insight into both teaching and learning through this experience. My experience in the collaboration has made me realize the

importance of observation and apprenticeship in both pre-service and in-service professional development. Getting to know the practitioners and spending time in both the formal and informal educational settings has provided me a deeper understanding of the different practices, perspectives, and politics in each of these fields.

Another fortunate outcome of the collaboration was that I really enjoyed myself. First and foremost, I took pleasure in getting to know all of the people involved. I was able to get to know many different people from various walks of life with diverse interests. Many of the collaborators are sure to always be my life-long friends. I also thoroughly enjoyed working with all of the students over the course of the year.

Furthermore, I enjoyed the field trips and experiencing nature. After one of the field trips I commented in my journal, "I never knew how beautiful those birds were up close. I was loving it as much as the kids were" (Journal entry, 2/6/01). A sense of ownership and passion grew each time I visited the site.

In summation, we all benefited from the collaborative experience in our own distinct, yet similar ways. Every person in the collaboration learned something, whether it was science content, or about different practices in education, or about collaboration in general. In addition, each of us improved our own teaching abilities in some way. Furthermore, this was an enjoyable experience for all the collaborators.

#### **SUMMARY**

Multiple stakeholders in science education, including formal educators at the elementary and university levels, informal educators, and an educational researcher, came together for the purpose of creating educational field trip experiences. In the beginning, the collaborators had no clearly defined roles. However, more defined, although flexible, roles did evolve out of our individual interests and expertise, as well as our specific motivations for participating in the program.

From the start of the collaboration, the main goal of creating beneficial educational experiences

for all the students was shared by all of the participants. However, the collaborators' vision of what a "beneficial educational experience" looks like differed to some degree, as did our visions of how to achieve this goal. As we developed the educational experiences, our individual visions for the field trips evolved over the year while becoming more similar to one another. We came to better understand and share a more unified vision of how the educational experiences should be structured as well as how the collaboration could best function to accomplish this task. Communication, and the time to communicate were major factors in achieving a more shared vision. Effective communication allowed us to gain a better understanding of each other's viewpoints. In addition, communication helped motivate the other teachers by providing them with more information about the program and our intentions. A combination of communication, openness to understanding others' viewpoints, as well as a heightened sense of ownership and dedication to make the field trips educational contributed to a more shared vision and better educational experiences for the students. Table 3

provides a summary of the roles that the collaborators played, changes that occurred within the collaborators, and their impact on the collaboration and resulting educational experiences.

The collaboration's result, the integrated field trip experiences, produced a multitude of positive outcomes for the students. An exploration of the students' schoolwork, their letters to the mentors, and the teachers' and mentors' verbal and written responses revealed cognitive, affective, and social gains in the students.

The three main areas of benefit for all of the collaborators were:

1. Learning-This included learning science content, learning about different cultures in education, learning about better teaching practices, and learning about collaboration.
2. Improved teaching capabilities-This included teaching at an appropriate level for the students, adapting to different learning styles, and integrating field trips into the curriculum.

3. Enjoyment and pleasure-This included enjoyment from working with the others in the collaboration, enjoyment from seeing the students learn, and enjoyment from watching the collaboration work.

## **Chapter V: Discussions**

### **CONCLUSIONS**

The main goal of the collaboration was to create beneficial learning opportunities for the students by integrating field trip experiences into the elementary school curriculum. This is exactly what happened. The students benefited cognitively, affectively, and socially from these educational experiences. Not only was the curriculum improved, but many of the educators' perspectives on teaching and learning were transformed in a positive way as well. These dramatic changes within the elementary school did not occur because of money or power. These changes are attributed to interactions of individuals within a collaborative environment.

As found in other collaborative research (e.g., Barufaldi, 2000; Mattessich, et al., 2001; Spector, et al., 1995), the critical component to the success of this collaboration was the participants' shared vision. Although this vision was broad in scope and somewhat vague at the start of the collaboration, it

developed into a much more defined and truly shared vision through negotiation and experience.

### **Influential Factors in the Creation of Shared Vision**

Throughout the collaborative journey, there were several factors that significantly affected the progress towards a shared vision and a successful collaboration. These factors included time, communication, understanding others' perspectives, dedication and ownership, as well as the collaborative environment.

#### ***Time***

An enormous amount of time is needed for collaboration. Time was the primary limiting factor in what this collaboration could achieve. Time often limited the extent to which we could communicate. If we had more planning time, I am sure that we could have created an even better curriculum, and we certainly could have implemented more of the curriculum in the classroom had we more time. Because of the pressures on the teachers to spend most of their teaching time on the subject areas that are tested on the state assessment tests, less time was



available for preparing the students for the field trips. The amount of time that we had at our disposal also affected the speed at which we were able to gain a better understanding of each other's perspectives.

I found that as our collaboration progressed, the way in which we used our time evolved. Some aspects of the collaboration began to take less time over the course of the partnership. We learned more efficient ways of doing things and better ways to distribute jobs. Also, we became more focused. At the beginning we all had many grandiose ideas. However, once we realized the state of affairs of the collaboration and its limitations, we focused on more realistic and attainable goals. Moreover, at the beginning we spent a lot of time getting to know one another, becoming aware of each other's perspectives, and learning to trust one another. These activities were not as time consuming towards the end of the school year.

While we spent less time on some collaborative activities, we invested more time on others. As less time was spent trying to understand each other's perspectives and learning to trust each other, more

time was spent socializing and enjoying the community of people. This fact was evident when comparing the tone of the planning meetings. All of the meetings were social in nature, but in the latter meetings you could sense that everyone was more comfortable and friendly with each other. There was more joking and sharing of stories. Karen describes,

We are more comfortable now, so there is more humor. But we do know what the bottom line is and what the outline is better, so we can have a little more fun. I guess last time we got out the maps and talked about ideas and all. And the collaborations has gotten more fun because we know each other better, we know we have a sense of humor...and we know we all care about it and enjoy it (KI4, 5/14/01).

In addition, as the collaboration developed, it was evident that we needed to devote more time to communication. Because of misunderstandings and lack of information transmission, we had to spend much more time communicating, especially with the teachers that were not primary participants in the collaboration.

### ***Communication***

Communication was the most time-consuming aspect of the collaboration. Although telephone calls and email were often efficient means of communication, it was the face-to-face communication that allowed

everyone to best be heard. Yet, in-person communication takes much time. But it was a good use of time. Effective communication was vital in the process of analyzing how the field trip experiences were progressing. Communication of each collaborator's perspectives and viewpoints helped improve the field trip learning experiences. Our group's communicating skills improved throughout the year as we saw the need because of misinterpretations or other confusions. We had a fairly outspoken group, but the collaboration also had to be set up so that everyone felt like they could and did have a voice. In addition to verbalizing our needs and thoughts, we also all needed to be open to this communication and act as respectful listeners.

Once the core group was communicating, we realized that what was lacking was better communication with the other teachers outside of our core group. Because the other teachers often only received indirect communication, it needed to be clear. We found that it was important to have an organized and communicative representative teacher. This communication largely determined whether or not

we had mutual understanding and whether the other teachers had motivation and ownership towards the program.

### ***Understanding Others' Perspectives***

Understanding the other collaborators' perspectives was a key ingredient to creating a more shared vision. Time and experience working with the different collaborators, and especially effective communication, aided in creating mutual understanding of each others' perspectives. Once we had a better idea of people's different priorities, the different pressures they were under, and why people made the suggestions that they did, we were better able to incorporate these rationales into our own schema of how the educational experiences should be structured. Having a better understanding of the others' perspectives helped us realize that we were all just trying to create the best educational experience possible. With a trust that everyone had good intentions, we were able to listen to each other's ideas more openly.

### ***Dedication, Motivation, and Ownership***

The core collaborators (i.e., the two representative teachers, the two scientists, the informal educator, and myself) were all eager to collaborate from the beginning. We all joined the collaboration voluntarily and had a part in its formation. Plus, we all believed that the educational experiences that we were creating were going to be beneficial as well as educational. This fact was crucial in making the collaboration successful. It made us work hard at working together and trying to understand each other.

However, we found that you can have dedicated outsiders, but the classroom teachers have to buy into the curriculum. When it is all said and done, they decide the level of impact a curriculum is going to make. They have to feel like it is the best thing for their students and they must have the adequate resources to do it. The teachers most involved in the collaboration (the two representative teachers) were most motivated to use the curriculum. Their motivation came from participating in the collaboration's creation of the curriculum. They had

ownership in the curriculum. Furthermore, they received inspiration from getting to do interesting and creative curriculum planning and from forming community bonds. The other teachers that did not participate in the collaboration, did not know the thought put into the educational experiences, did not know most of the collaborators or where we were coming from. They had no real reason to be dedicated to the program or be motivated to use the curriculum.

We found that it was important to have an organized and communicative representative teacher. The collaborating teachers were key to motivating the other teachers in their respective grade level. They could speak to their needs and their fears because they knew them and already had a trust built up. They could show them how to use the curriculum so that they would not have to figure it out for themselves.

It took more time and experience for the other teachers to be motivated to work with the curriculum. But, at the end of the year almost all of the teachers felt dedicated to the field trip program and were eager to participate the following year. At the close of the collaboration's first school year, the core

collaborators were even more dedicated to the collaboration than they were at the start, because they saw that it was successful and they received many benefits from collaborating.

### ***Collaborative Environment***

The biggest influence on the success of the collaboration was the individuals. The collaborators by and large, determined whether or not anything was accomplished. However, the institutional environments involved in the collaboration did have a significant influence. The field trip site, River Vista, is a multi-purpose site that was built upon partnerships, and thus was primed for collaboration. Creating such partnerships was actually in the informal educator's job description. In addition, the supportive school administration was also key to the success of the collaboration. The principal provided funds for buses for the field trips. She also encouraged all of the teachers to use the curriculum that the collaboration created. She even dedicated one of the teachers' inservice education days at the beginning of the year to help plan for the collaboration.

Despite the fact that the participants were eager to collaborate, there were some aspects of the context in the elementary school that worked against a successful implementation of the program. For example, the teachers had the least flexible time to meet for collaborative events. Except for the beginning of the year meeting, the teachers did not have any time that the school set aside for collaborating. They had to use what little personal time they had to meet and plan the curriculum. Furthermore, the district-wide emphasis on the subject areas that are tested on the state standardized tests was a limiting factor in what the collaboration could accomplish. Many of the teachers were skeptical about spending time on anything that did not directly prepare their students for these tests.

As with the elementary school, the universities that the scientists were affiliated with were not exactly handing out rewards for participating in the collaboration. The time that they spent collaborating came from their personal time and time that could have been used for research or other professional activities more valued by the university.



So, in this case, there was a mixture of positive and negative environmental factors that affected the outcome of the collaboration. There were indeed some impediments that the dedicated individuals in the program had to work against to create a successful collaboration.

These important factors that influenced the collaboration coincide with the findings from other collaborative research (e.g., Barufaldi, 2000; Mattessich, et al., 2001; Spector, et al., 1995).

#### **IMPLICATIONS**

My recommendation for creating a collaboration in science education or any other field is to first and foremost have a shared vision. A vague shared vision is enough to bring groups of people together, but must be defined in order for the collaboration to progress. In order to define and develop shared vision, based on my findings of this study I recommend:

- Dedicate ample time towards collaboration in order to effectively communicate and get to know one another.

- Communicate openly and often in order to gain understanding, as well as build trust and relationships.
- Strive to understand each perspective so that they can be incorporated into the vision.
- Find ways to foster the motivation and ownership that is necessary for persevering through negotiations towards a shared vision.
- Cultivate a positive and encouraging collaborative environment.

#### **PROMOTING THE DEVELOPMENT OF SIMILAR COLLABORATIONS**

It is important to keep in mind that every collaboration will be different because of different participants, different places, and different situations. Each collaboration will have to figure out the best way of working together and will have to do the collaborative work of communicating and striving to understand the perspectives of the other collaborators in order to form a shared vision.

However, in light of the components deemed essential in this collaboration and their concurrence with important factors in other collaborations as illustrated in the education literature, I have a few recommendations for encouraging the development of other similar collaborations. First and foremost, you need people that are motivated and committed to collaborating. One way to increase the number of collaborators is to teach education students (preservice, and inservice) how to collaborate. Although a course on collaboration would be appropriate in any department, and certainly other potential collaborative participants such as scientists, informal educators, and researchers could benefit significantly from a greater knowledge of collaborative skills, it is the teachers that need to understand the benefits of collaborating during curriculum development because they will determine whether or not it gets presented to their students. Educators should be given insight into developing shared vision using skills such as effective communication and understanding others' perspectives and cultures. They need to learn about their

collaborative resources, including community members in informal education and at local colleges and universities. Moreover, teachers need to learn about the potential benefits of collaboration, both for themselves and their students. In addition, it would be advantageous for teachers to learn about the benefits of integrating informal learning experiences into the school curriculum and the role that collaboration can play in this endeavor.

Furthermore, there needs to be a system-wide effort to help prime institutions for collaboration. Key personnel at education institutions need to be educated on the virtues of collaboration in education. Home institutions need to provide educators with time specifically dedicated to collaboration and more rewards for their collaborative endeavors. This will help encourage collaboration among science education practitioners by creating a more collaborative environment.

#### **FUTURE OF THE COLLABORATION**

We did a lot of the "dirty work" in this first year of collaboration. We opened the doors of

communication, we got to know each other, and created better ways to implement educational experiences. In future years the collaboration should be able to start with fewer impediments to success.

And although we had a successful year, the future of the collaboration is always uncertain. The process and outcomes of the collaboration will likely change as the collaborators gain even more experience and as the collaborative structure is modified. A few of the teachers, as well as the principal, will be changing schools. I will be leaving as well. Having new people move in and out of the collaboration will be a challenge. The collaboration is bound to be at least different. As Barufaldi (1998, p. 5) states,

Changes in goals and objectives, funding patterns, support, human resources, personnel, and state and Federal mandates, may give rise to the rethinking of purpose and mission, which may eventually result in a newly created vision within the system.

Steps should be taken to ensure the collaboration continues beyond the term of the current key players. For instance, whoever is with the collaboration next year will have to continue to put effort towards communication and understanding others' perspectives. This will need to be a continual process, no matter

who is included in the collaboration. Jane suggested having a retreat before the next school year with all of the fourth and fifth grade teachers. She hopes to use opportunities like this to get to know all of the teachers so that she knows how to best help them, and so that they will be more motivated and dedicated to the program.

Furthermore, new collaborators must be educated about our work to date. Though, with each new person joining the collaboration comes new and fresh ideas. In fact, when asked about these changes, most of the present collaborators were not worried. Michael said in response,

the fixed point will be this place. It is here....And that is why I think this will work, because this is a neat place and it is going to continue to attract neat people...This program just feels so creative and positive that we will find a way to make it continue" (MI3, 2/2/01).

So the collaborators might change, and the roles might evolve; but I doubt that the overall goal of creating effective educational experiences will change. Even in the face of major change, I have faith that the collaboration will transform and progress into something even better because of the experience that we have gained, the bonds that we have

formed, and the dedication that so many people have to the collaboration.

In fact, as I am now writing my concluding remarks on the study, the collaboration is in its fourth year since the study began. Although I have not been a part of the collaboration since the first year, I am aware that it continues to be very successful. After the second year, the collaboration won the Excellent Partnership Award for the elementary school. And in its third year the collaboration won the Excellent Partnership Award for the entire school district. Obviously its achievements and acknowledgement have grown over the years, despite changes in some of the key collaborators.

#### **FUTURE RESEARCH**

This study set out to answer the question, *What are the issues and experiences that emerge as formal education, informal education, and education research are brought together to form a collaborative relationship for the purpose of creating an educational field trip experience?* I believe it has succeeded in doing so. However, in the process, it

has raised many more questions including some pertaining to this particular case, as well as those pertaining to the larger discipline of collaboration within education.

This study focused on the first year of collaboration. It would be interesting to find out how the collaboration progresses in the years to come. How will the collaboration change as the collaborators within it change? How can the collaboration's impacts expand further than just the fourth and fifth grades while still keeping it intimate and effectively communicating? Is it possible to expand the collaboration based on the resources that are currently available? Will the collaboration be able to continue on a volunteer basis, or will personnel need to be hired for its continuation?

Furthermore, each of the collaborators mentioned that one of the benefits that they received from participating in the collaboration was that they learned much about teaching and learning. However, will the participants' improved teaching and learning skills and knowledge carry over into contexts other than the domain of the field trip curriculum? For



instance, will the scientists carry over some of their newly acquired teaching skills to their university classes? Will the elementary teachers start to integrate all of their other field trips into their curriculum? It would also be very interesting to know what long-term benefits, if any, the collaboration's resulting educational experiences have on the students that participated in the program.

The findings from this case are not beneficial towards grand generalizations for other collaborations, because the situation changes with different collaborators, in different environments, and under different circumstances. However, it would be interesting to synthesize information about different collaborations, in different contexts, and from different perspectives. What might emerge from a meta-analysis may have greater impact on education reform efforts, because more generalizations could then be made.

Even though the study cannot be directly generalized to other collaborations, the issues that arose in this case can be used as springboards for further investigations. For instance, before I

started this study I was under the impression, based on educational research (i.e., Kaspar, 1998), that the teachers in the collaboration did not integrate field trips into the curriculum because they did not view them as educational. However, I found that the teachers in this collaboration, for the most part, understood that it was important to integrate field trips into the school curriculum; they just did not have the time and resources to do so. As Karen stated, "it is true that we know that field trips need to tie in and be related...we just need more help, we need more resources" (KI4, 5/14/01). The teachers needed support. This leads to the question, would teachers in general be more apt to utilize field trips as an integral part of the school curriculum if given more time and support? What kind of assistance and resources are most beneficial in helping teachers integrate the field trips?

In addition, this is an example of a rather small-scale collaboration. In this case, the smallness of the collaboration may have made it possible to succeed. It allowed us to get to know each other, understand each other's perspectives, and

communicate more effectively. The secondary participants in the collaboration, (i.e., the other teachers not directly involved in the collaboration) were much harder to reach due to less direct communication. It took much longer to understand their needs and for them to gain ownership and dedication towards the program. What does this mean in terms of having larger-scaled collaborations that affect entire school districts? How can more far-reaching collaborations be created while still keeping the trust, ownership, and communication that was so important for this smaller collaboration? Is this possible, or is it necessary to have several smaller, local collaborations to be effective?

#### **CLOSING REMARKS**

After having participated in this collaboration I am optimistic about the prospects for systemic reform in science education, and I am convinced that collaboration is the key. I sincerely hope that I have provided constructive insight into the nature and process of collaboration between these stakeholders in science education. I am confident that this case can

function as an example of how collaboration can be an effective tool for science education reform. Furthermore, I am hopeful that this case can provide insights to practitioners in other fields wishing to bring about change through collaboration.

## Appendix A

### Relationships of the Participants in the Study to the Collaboration

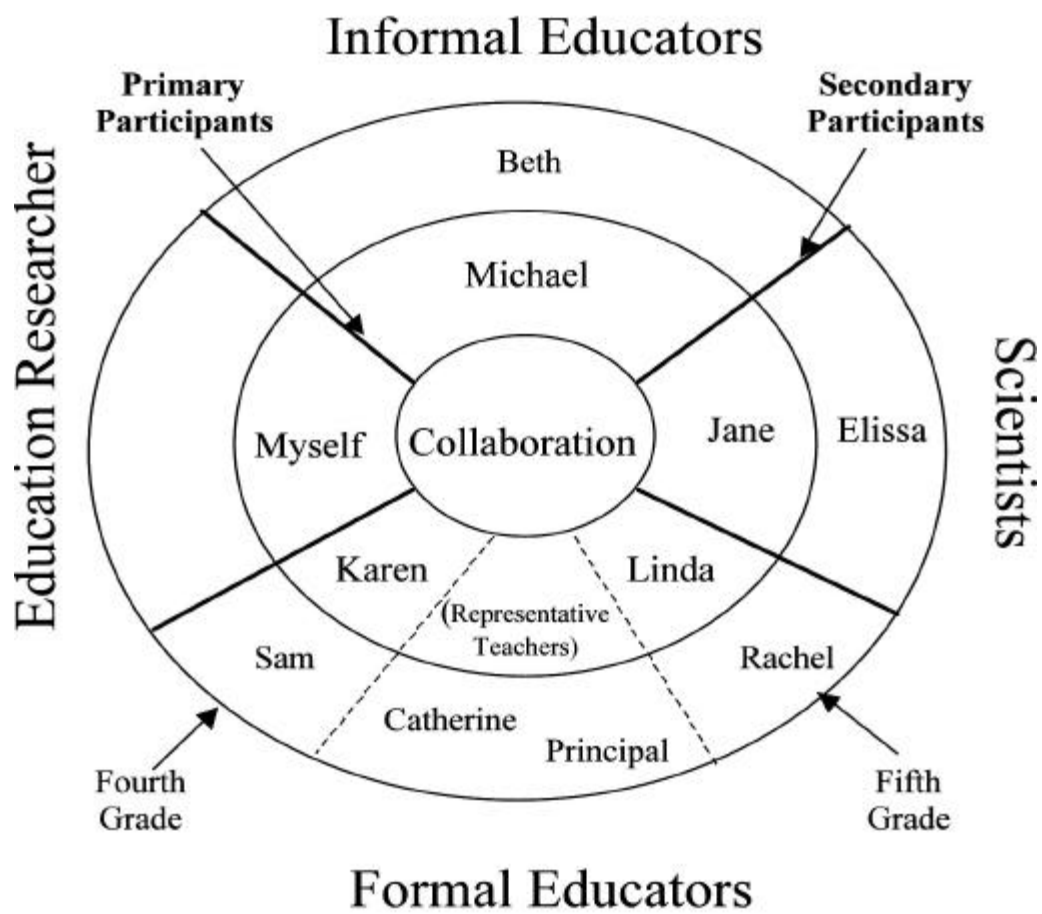


Figure 3 Relationships of the Participants in the Study to the Collaboration

## Appendix B

### Data Collection Timetable

Table 4: Data Collection Timetable

Date	Event	Data collected
Late 10/2000	Interview 1 for all participants except other teachers	Semi-structured interviews/Audio Recording
10/24/2000	Planning Meeting 1	Observation/Audio Recording
11/2000	Field trip 1	None
Early 12/2000	Interview 2 for primary participants and interview 1 for other teachers	Semi-structured interviews/Audio Recording
12/14/2000	Follow-up meeting for Field trip 1	Observation/Audio Recording
1/10/2001	Planning Meeting 2	Observation/Audio Recording
Late 1/2001	Pick up notebooks	Document Retrieval
Late 2/2001- Early 3/2001	Field Trip 2	None
Early 4/2001	Interview 3 for primary participants	Semi-structured Interviews/Audio Recording



Early 4/2001	Pick up notebooks	Document Retrieval
4/5/2001	Planning Meeting 3/ Follow-up for Field Trip 2	Observation/Audio Recording
Early 5/2001	Field Trip 3	None
Late 5/2001	Interview 4 for primary participants and interview 2 for secondary participants	Semi-structured Interview/Audio Recording
Late 5/2001	Follow-up for Field Trip 3	Observation/Audio Recording
Late 5/2001	Look at notebooks	Document Retrieval
Late 10/2000 -Late 5/2001	Email Correspondence	Document Retrieval

## Appendix C

### Sample Interview Transcripts

**Excerpt from Karen Interview 4 - 5/14/01**

Researcher: How was that trip compared to the first two?

Karen: They are getting mixed in. Everybody loved the birds. We were all well trained and so were the volunteers. So I guess the biggest difference is between the last two and the first one. The first one wasn't as fun as the second two.

Researcher: What did that have to do with?

Karen: We were rushed. The greenhouse was not a happy experience, I have already talked about that. It was too much and too fast and not as exploratory...self-initiated exploratory. But the second two...beautiful. So to me it is really comparing to the first one. The birds was great too.

Researcher: And in the first one you mentioned that you would prefer to stay more focused on topics,...we had done a bird station. What about in this last one, we didn't always stay focused on plants because a lot of the insects are interesting to them.

Karen: We were ready to integrate more at the end. I felt comfortable with that because it was our last trip of the year. And when we did go off track we were really back-tracking to what we already knew. We weren't going to something that was coming up. When we did the birds that time, we hadn't studied that yet. It was like revealing a secret. I didn't want them to know the prize yet. You save those, they are precious. It is my carrot. This time, when we strayed we went to insects, which we had already studied. We noted the relationships, the birds, soil life and plants as more of interrelationships. We had touched on all of that, but now it was just gelling. So it was just taking it a step forward, it wasn't

completely foreign. So I like that, particularly for the last field trip.

Researcher: Can you describe to me the level of preparation your kids had, comparing the three trips?

Karen: Well, it is hard to say. Birds, it is pretty rote, it is pictures to words. But with Elissa and Jane coming in and talking about those relationships and bigger picture ecosystems, cycles, herbivores... It has gotten wider. So the teaching has gotten better. Like those review sheets I just gave you. I am forced to get away from just the knowledge.

Researcher: You are talking about your teaching?

Karen: My teaching is getting away from the bottom of bloom's taxonomy and more to truly application and analysis and synthesis. It is more of the bigger picture. I am trying it out on them. I am trying to have higher expectations for them.

Researcher: Is that because of what Jane and Elissa have done, or is it just because with time you are trying to do more or...?

Karen: Well, they have taught me and reminded me. It is like it is worth it, kind of, because we are going to see it. Everybody got a 50 on this first quiz...the science review. I wasn't surprised. I got on the board and wrote a bunch of notes and we talked about it and then we did it again. It had all been seen before, but it just takes that long to gel. So they took it again and truly the majority of them got a B or higher. It just gives me more incentive to take it to a higher plane in an area I might not normally because I have no reason to. I hate to say that, but it is the truth.

Researcher: Can you explain to me what the reason is, that you have for these topics?

Karen: Well, because we have seen it, we are going to see it again. I want them to have the reason to look forward to it next year. I want them to be motivated to write a thank you letter. I want them to feel a bigger sense than "I can identify a bird." I want them to have more of a...I do care that they can take this to other places. They can use this in writing, they can use this in math, they can use this in ethical considerations and make a choice. I am more motivated personally to do it because we are going to actually, kinesthetically get out there and see it and do it and see a difference. In composting and recycling...in my room we do those things. On the field trips we see those, and do those, and talk about those, and people are going to reinforce this with me. So I feel more supported and not like I am barking up a tree. I will give an example. My first year, I did a unit on humane education. It was like knocking my head against a wall. That is the area of nurturing animals...and they have a whole curriculum with that. Studies have shown that if you don't learn to love, then you will not be loving...just respecting life. I attempted this with some 6<sup>th</sup> graders...alone. There were no field trips, there were no volunteers, there was nothing else. It was me alone in the classroom. I couldn't take the comments that I was hearing. I can see it in Jane and Elissa when the kids yell out "oh, my daddy shot one of those." It is hard. And when you are alone and you know that no one is going to reinforce or take it along and connect it....I said "ok, we will not be discussing this again this year." It turned into a button to push with me..."let's talk about how we strung up that cat..." It was sick. And one sick kid in the room affects everyone. Now I have more of a reason. It is worth it to go a little further and a little higher.

A: So is that something that is harder for you to do outside of these trips?

Karen: Yeah, it is because I am not going to have hundreds of adults making an individual impact. I am not going to have their personal input. It would simply be me lecturing to them. That just goes on dead ears. This experience, this collaboration makes it effective. Not that I lecture, I don't have to. I can just apply. It is coming out of them now. I don't have to say, "this is why this is a good thing" or "this is why we care." I don't ever want to preach to them, it always comes back to haunt you if you do. They know. But if you do it in a more inferring why it will come back to you in a beautiful way. They will say "Somebody plucked that flower, it is going to die now. What good is it now?" And I will say "Let's put it on the compost pile, that is the good I know to do with that." They are starting to get the picture. They really are.

#### **Excerpt from Linda Interview 4 - 5/21/01**

Researcher: So how was the last field trip compared to the first two?

Linda: I thought it was very good. I never thought of which one was best.

Researcher: Did you have a favorite one?

Linda: I liked them all. I like different parts that we did. I really thought that they identified the plants, they were pretty good about that and they had gotten better about the bugs and the birds. I think they all grew upon each other. I don't think there was any one that was better than the others. They improved, but because of the students' retention of their information I think. It got better because of that.

Researcher: What about the structure of the field trips, which one did you prefer...or which aspects did you prefer?

Linda: I liked the scavenger hunt a lot. I think that is a great idea for them to have something specific to look for. I am trying to remember if last time was a little looser in the scheduling...about getting somewhere at a certain time. That lends itself to us better to have a little flexibility like that. It seems that there were more volunteers the last one. It seemed like there was enough adult supervision, which was great. Of course I had Jane, which makes a big difference, but I had her last time too. She is really good with my difficult boys. If I have learned anything it is that student/teacher ratios are a huge part of the success. When we do things in the garden and there is only 2 adults with 24 kids, it just doesn't work. You just can't do it. But with the way we have it set up over there, it really makes a huge difference.

Researcher: As far as the amount they can learn or...?

Linda: Both. They have easy access to an adult so they can ask for information. If I have to pull off and reprimand one of my challenged children, then there's other adults that can take over and continue with the rest of the group. That is a huge thing because nobody misses out that way. If I am having to chew on a kid and I don't have any backup, then they all kind of have to wait for me to finish. It is a real drag. That happens often in the real world.

Researcher: And did you find that the volunteers were knowledgeable?

Linda: Yeah. I am trying to remember...on the bird one, I can't remember who was our birding one...but I think this one, they were the most...we had Bob, he was

really good as well. He really knew his plants. So I think they were more informed this time...they knew their plants better than some knew their birds.

Researcher: And what about as far as handling the kids?

Linda: Oh, yeah. They were really very good. No problems at all.

#### **Excerpt from Sam Interview 2 - 5/16/01**

Researcher: Do you think the level of preparation for the field trips was just a good for the later ones?

Sam: Yes. Especially having been to River Vista several times. Also, it was part of our science curriculum. So they had already learned some about soil in our own curriculum before they got there.

Researcher: Can you tell me a little bit about communication...do you feel like you had all of the information that you needed?

Sam: Yeah, absolutely. Having Karen as our liaison between was really helpful. That meant that I didn't have to go to all of the meetings to find out what was going on, but I could ask her if I had a question...."What should I do about this or that?" She was great about communicating to us. And then yourself as well...coming in and asking what we need.

Researcher: Would you suggest doing the three field trips to River Vista again next year?



Sam: Yeah. At first I was really worried about it. I thought, "Gosh, the kids are going to get bored." But they didn't. They really enjoyed it. I think especially having those hands-on activities at the end kept them really interested. There is a lot to see there. I think it was very valuable.

Researcher: Did it hold your interest?

Sam: Absolutely it did. I learned as much from the experts that we had walking with us on each field trip as the kids did. Yes, it was nice.

Researcher: Even though we had covered some of the same stuff in the three field trips...because you had mentioned in the first one that you would rather not have the birds...?

Sam: Yeah, we had some carry-over. So we had the birds when we were supposed to be focusing on insects. But it is difficult not to because you have kids walking around and looking at some wonderful birds. You can't tell them not to look at it. But as far as the planning goes, maybe the Audubon society members could be there just for the bird one as opposed to during the insects.

Researcher: But did you think that was a problem, because you mentioned that...

Sam: If you are going to make a change, that is one change that I would suggest. Because then the kids say "We have already done that."

Researcher: Do you think on the second field trip that they were kind of like that...

Sam: No, I was worried that they were going to be bored, but no they still seemed very interested.

Researcher: What do you think the students got out of the field trips?

Sam: Oh, a lot. Science should be hands-on and when it is not, it is bookish and it is not real. Having something tangible that you can say "we are going to learn about soil." And I was able to use that even in our own science books. We are learning about all the different layers of soil and I was able to tell them "and you are going to go out and look at this" "you are going to see this and touch this." That makes a world of difference. They come back excited about science as opposed to just reading a page.

Researcher: And what did you get out of the field trips?

Sam: I learned a lot, to be honest. Several names of insects and plant life that I was not aware of. I think also it just reinforced to me the value of the hands-on activities that we just talked about. That is something I learned.

Researcher: How do you think the field trips can be improved?

Sam: I guess the only change that I have suggested so far is not having the Audubon society members there during the insects. Save them for the birds day. And I guess this is a little bit selfish,...I am sure that I am perfectly capable of making copies,...but having those done ahead of time as it was for field trip number one facilitated it a lot more and made it easier as a teacher. So if that could be done for all three field trips, I think that would be great. If it can't, then that is fine. It isn't something that I can't do.

**Excerpt from Rachel Interview 1 - 12/8/01**

Researcher: Good. And what did you think about these data sheets? How did that work?

Rachel: It was just so hard, I think because there was so much stuff. My kids rarely wrote anything down because we were constantly going and seeing and they were picking up stuff. Finally by the end we had a little bit of down time and the girls were like..."let's get out our journals and jot some notes down." But by that time they had pretty much, not really forgotten because she helped them recall a bunch of information, but... It just seemed kind of hard for them to stop every time and write something down. I think they got just as much from not writing stuff down. Picking it up and touching the duckweed and picking the berries. I think that was more helpful. But at the same time, they need to write it down so that they know. I don't know, that is a toss up.

Researcher: If there is anything else you can think of...

Rachel: If you can come up with ideas for classificatory or persuasive, narrative, or how-to...we could always use some ideas. I guess more, instead of just science books, more story books. For instance, I was reading James and the Giant Peach...that would be a good way.

Researcher: Ok

Rachel: And you might want to talk to Sally, she also teaches science. I don't even know if Linda has talked to her about what she has been doing with the books. And I don't know if she has them or knows. So you might want to talk to her about it.

Researcher: Ok, that sounds like a good idea.

Rachel: I will show you our pictures...my boyfriend had a camera and he actually let the kids take the pictures. [pictures of the field trip up on the wall]

Researcher: And how did you find the scientists that came to the classroom?

Rachel: Kind of abstract for the kids, I thought.

Researcher: Do you mean it was above their heads?

Rachel: Probably. I can't even remember what they talked about, but it was higher-level things for the kids. They were just spewing it off, like kingdom and... I don't know if they have learned those words.

Researcher: In what ways can they help make those presentations better?

Rachel: I don't know. Especially if you are going to be using those big terms, maybe show them. But I don't know how they could show them. I liked how they brought in some of the critters to show.

**Excerpt from Catherine Interview 1 - 10/24/00**

Researcher: So what can we do to make this a successful field trip?

Catherine: The one coming up?

Researcher: Yeah

Catherine: Success now, as far as school is concerned, the bottom line is the [state assessment] test. So making sure that there are some key objectives addressed in the pre activities and the activities out here and post-activities. But it will be successful if they learn basic science...observation, writing down what they observe, classifying when they get back, following up with some type of project or activity where they draw on what they learned here. Since science will be taught as a [state assessment] test in the next year or two we can justify getting them prepared. I like the idea of just teaching them science out here. If the rest happens, fine.

Researcher: And so what benefits do you see in us having this collaboration, where we are working with the teachers and the site, and all of the different aspects of it.

Catherine: A great benefit in collaboration...as a teacher I am very limited in my knowledge...an in-depth knowledge of science or any subject. I am a generalist...I know a little bit about a whole lot of subjects. So I am always looking for people who are experts in their fields. I want to draw them into the experience in the classroom so the kids can benefit from more than I can give them or teach them. This field trip out here has just been phenomenal because we have experts from the university and Audubon society and Master Naturalists and some other organization...what is it called...River Watch. Then there were high school students from their science classes that had a lot of knowledge too. Any time you can pull together a team to meet a single objective it is powerful.

Researcher: And do you envision any problems with this collaboration...any possible drawbacks or...

Catherine: Well, communication...keeping communication open is really hard when you are working with so many different groups and to make sure we are all on the same page---That we all do have the same objective in mind and that we are going to actually follow through. There may be some that will and some that don't. And there may not be...lets see, how can I put it...someone checking up that they are. That just happens. I think that just keeping communication open and making sure that people feel comfortable and confident. A lot of teachers that don't have science backgrounds, or even an interest in science, they might not be so interested in participating but have to. So getting them enthused and participating in the pre and post-activities I think is a challenge. It is always easy just to come out and bring the kids. But to make it valuable you have to do the pre-activities so that they know what they are looking for to learn and the post-activities too.

Researcher: So, what is motivating you to continue to participate in the collaboration, because you are clear and free!

Catherine: I know I am free! I don't know, I am possessed I guess. (laughs) This was the most fun thing last year. This was the project that I was most excited about and I just want to see it continue. I enjoyed all of the people that I worked with and I saw that it was really valuable for the kids. I just wanted to be available to assist in whatever way was appropriate to enhance the program or go in and teach one of the classes' pre-activities or post-activities--if they want me to, I don't know what they want me to do. Or to be trained to help actually lead out here. I am just very enthusiastic over the whole plan of the program.

Researcher: What do you personally hope to get out of this?

Catherine: Hmmmm...personally... Well, I would like to see...Ok this is personal, not what is going to happen at school. Of course I want to see the science program enhanced at school, it is faltered, it has been put on the backburner for too long. So that has been a goal, to get science enhanced at school. I want to learn more. I am curious. I haven't given up learning. When I come out here for these trainings and on field trips I learn something new, so that is sort of a personal satisfaction for me...to be involved in learning new things or helping to expand a program.

**Excerpt from Principal Interview 1 - 10/23/00**

Researcher: Earlier in the year you and the 4<sup>th</sup> and 5<sup>th</sup> grade teachers came out to River Vista—I think it was during your inservice days.

Principal: Right

Researcher: I was just going to see if you could speak to what prompted you to come out.

Principal: Well, last year when this got started, Linda is very much into the environment, so she said something to me about last year. And she was like, 'Will you support us?' And I said, 'Yes I will'. But I really didn't know too much about it. But I heard bits and pieces. They came back and they were like, 'The kids loved this'. And I got some pictures and we did a little newsletter article about it. And I began to get more and more informed about it. I still am not as informed as I would like to be, I'd like to completely understand everything, but I just have too many other responsibilities.

Researcher: Of course...

Principal: But this year when they said they were going to carry it on from 4<sup>th</sup> to 5<sup>th</sup> and wanted to get the 5<sup>th</sup> grade teachers involved, and that there was going to be this planning meeting, then I, yes, I definitely want to go. I did go, and I learned a lot more than I knew before. But I had to leave before all of the planning was done, there was another meeting I had to go to. So, that's what inspired me to get more involved and it was a chance for me to learn about what was going on.

Researcher: And, that time, for the teachers, that was during their inservice?

Principal: mm,huh.

Researcher: What would they have been doing otherwise, if they hadn't come out there?

Principal: They probably would have been working, as a grade level, planning units of study for the year...doing the same thing.

Researcher: And, is that something, going out to the site and everything that you do for other field trip sites?

Principal: No

Researcher: And why do you think that this one is different?

Principal: Well, this is part of our community, in River Vista, that's one reason. I think that there are a lot of places that classes go for field trips that are just set up as a field trip kind of place. So going there to learn about what they have to offer is different than this. This is a project that is



going on between our school and the local university and other universities and researchers. I feel like this is a situation where your business or group is investing in our children and that makes me want to invest back.

Researcher: You've approved 3 field trips this year for the 4<sup>th</sup> and 5<sup>th</sup> graders?

Principal: Right.

Researcher: And that is a significant amount for one place.

Principal: Right.

Researcher: And I was going to see why that was that you did approve that many.

Principal: Because it is close, it is something that is in our community. It is something that I think we are very lucky to be a part of, to have the partnership that we have—all of those things. Probably more than anything, that we are neighbors.

#### **Excerpt from Jane Interview 2 - 12/13/00**

Researcher: What aspects of the field trip do you feel went particularly well?

Jane: I was delighted with the energy on the part of so many people. So I think the collaboration, in my opinion went really well. There was a real diversity from retired teachers, to teachers, to college students, to high school students. That was a real pleasure to see happen, the whole concept of mentoring

really did happen. So, that is my first joy in the whole thing. The second thing that went really well is that I learned a lot. That is a personal pleasure, to learn that much. I learned about how the teachers...what they have to deal with. I at least got a taste of that. And then I learned a lot of the material itself. So that is fun for me. I had never done aquatic benthic macroinvertebrates. So that is personally and selfishly fun. I guess there is, in your mind, always room for improvement. But given that two days were rainy and we were traumatized by the possibility of very wet kids and what to do.....and two days were clear but chilly....everyone adapted and made the best of it. And it went quite well. And then we got the gift of it didn't actually rain from 10 to noon. That was a real blessing. But again, that enthusiasm and spirit really pleased me. People could have been down or negative, and they simply weren't. They just said "Oh, we'll do with what we've got." So that was neat. All the teachers that came seemed....of course we are all on our best behavior when encountering each other....but they seemed to enjoy it. That was a real pleasure. The kids obviously enjoyed being out there and I can't say that I felt that everyone of them went away with many concepts of macroinvertebrates, but they certainly went away with some appreciation of some of the life that is going on in different bodies of water. I think all of them will take that home with them. So that is nice to feel....I hope I am right on that, but I feel I am. And some students were just absolute jewels. They would ask a question and give a context for asking that question which meant that they really had thought about what they were going to see...or thought enough about it that now when they saw it, it makes sense to them. So that was an absolute delight.

Researcher: You were mentioning that you learned a lot about the teachers.....what specifically...?

Jane: Well, as I went around I called them all saints for a number of days. They work long hours, never seem to have a moment to themselves. I admire that they can stay centered and functioning as a teacher rather than just becoming insane. This is what I might do. I really admire the way they dealt with the classes. Some classes, it seemed much easier to keep those kids focused. Other classes, it seemed really hard to keep the kids focused. And they all did such a wonderful job. I really admire them. It just brings it...not having children myself, I don't get into elementary school. So it has been a very long time since I have been involved. So I really admire that effort that I saw those teachers put into it. I hope, and this is one of the areas I think we can improve on...it was one of the things I learned....being a scientist, I had forgotten that everyone doesn't have a fairly extensive basic understanding of science. So the teachers that didn't do science as a specialty or didn't have much science.....and it made me think back when I taught biology to nonmajors. I realize now at the time I taught biology at the university to nonmajors I said I am going to assume this may be the only biology they ever get. And I tried to present it in a context that would give them things to remember that they could actually use or enjoy rather than just learning about coeloms and acoeloms and things that bore me to tears. And this made me think, oh this is true. That may have been the only biology that some teachers get. So, one of the things that I would like to try to do in the next field days, and some of the teachers have said this, is to give them more heads up, more understanding of what we are trying to cover....try to give them the basics so they can then embellish those basics for the kids.

**Excerpt from Elissa Interview 1 - 1/27/01**

Researcher: Considering that you are volunteering all of these late nights, I was wondering what motivates you to help with the field trips.

Elissa: Insanity probably. Just kind of being in education, you end up realizing the need for it. And being in science, I like science. And one of things, if you like something, and appreciate it, then you want to share that knowledge and you want people to understand it and understand it properly. It is the kind of thing where a lot of science is taught improperly and a lot of concepts are either not done or done very poorly...there is a lot of general public knowledge that is completely erroneous about things. They have very cut and dry ideas about science and things that are just complete misinformation. I get that in my college students. And to try to undo the kind of damage that is done by teaching them something wrong, basically wrong, is very difficult. The simple concepts that they were taught were black and white, glossed-over as if it were that the people that were teaching it to them didn't understand it or they just thought it is just a little white lie and they will figure out the truth later. It gets so ingrained because it is taught to them over and over again as if this is the way it is. It is a wrong interaction, it is a wrong way of looking at it. To get them to change that around...because once they have built up their entire infrastructure of knowledge around these erroneous pieces of information and the erroneous links that they have made,...to get them to undo that means they have to break down everything they have learned. And they don't want to do that...your brain doesn't want to do it, doesn't want to accept the foundation is wrong. It is really hard to get them to learn it properly. So if we can get some basic stuff early on done right, maybe we can head this off so that it is easier for them later to understand stuff

properly. It is just so difficult to get people to relearn. There is no point really in having someone learn something wrong in the first place. It is better not to teach it to them at all, and have them come in with a clean slate. But unfortunately, that is not what ends up happening. You tend to remember something most strongly the way you first learn something. That imprint tends to stay. It doesn't matter how many times you tell them something, it is different from what they thought it was when they first came into the class, and over 50%, when that test comes up, they go back to their first impression of it and get it wrong. It is really hard to fix those little problems that seem so innocent before, but really have large repercussions down the road.

Researcher: So what do you think that you can do to help fix that...if that is one of your reasons for volunteering?

Elissa: Well, I am trying to implement a program in whatever input I can give into what is going on, where something can be done in a better way than what is being done now. I can try to keep out things that aren't really accurately being portrayed...try to make them a little bit more accurate or valid in terms of how it is being used. I have tried to head that off in the past a little bit. I try to see if we can, by interacting with the kids, help them see a little bit more of what science is really about. Let them see that there are things out there that you don't often think about and don't often seem impressed about...the things that you are most familiar with can be interesting...there is other stuff to look for and that you really need to know what you are looking for and you will see lots more stuff than you did before.

Researcher: So why specifically at River Vista, because there are a lot of places where you could volunteer?

Elissa: Because I know people out there and because I have been going out there on field trips. Because Jane and [her husband] are involved and they are just sort of down the hall. It is sort of a fortuitous thing where it all kind of came together because I had been going out there for more than 10 years. I had been going out there for years. It is a neat place and they needed help and so there I was.

Researcher: This may sort of get out what you were talking about before, but what role do you think scientists could or should play in elementary education?

Elissa: I think they can provide information on how to present topics...provide a scheme on how to present information better than it typically has been, and in a more updated fashion, and in a more realistic fashion so that you are not teaching them wrong stuff. It is not a matter of making it more complicated or anything, but it is a matter of making it accurate. I mean there are simplifications that are done that are just wrong. You can simplify things without making it wrong. So that is kind of the way to look at something. And people outside of the field won't realize it, they will think something is just simple and very easy. They think it is too complicated, so they will just say this. But to them, they think it might mean the same thing, but it doesn't really. It really doesn't, it is a very different sort of thing when scientists see it. No, you are not saying the same thing at all. Teachers that don't know that might think that it doesn't matter, and it can. That is one of the things, as an expert in that field, you can provide input and say "you really should not present this information this way, you should not be using these terms in the way that you are doing that. You really should be using this set of terms or doing it this way and finding ways to make that accessible to them." And the teachers know their classroom, but as a scientist you know that field. So bringing those

2 together and having both sides being able to see each other's side a little bit and saying "Ok, we need to have these things in there, how about I rearrange it this way, what do you think? Is that ok or is it still wrong?" Having that sort of a thing going on is something that scientists can certainly contribute to elementary education.

**Excerpt from Michael Interview 3 - 2/2/01**

Researcher: How do you think the collaborative process is working?

Michael: Thank god you are there. I think that you've helped with that with facilitating communication...keeping an eye out for potential problems like the bird pictures disappearing. These materials...just like you said, the materials made a big difference this time. The teachers had to decide what to photocopy. And I think that is a lot of your doing. The collaborative process, I think we are all just feeling our way through that. I am really out of it really. Jane has taken...I can't be a big part of the collaboration because I don't have the time or focus. Jane and Elissa have really jumped in there to do a bunch of stuff. So I don't have to be in there...I don't want to step on their toes. They are into it, so that is great.

Researcher: Do you mean with the pre activities and stuff?

Michael: It all sort of hits me on the day that they come. It is very funny. Up until that day Jane and Elissa and everything is being done and then they get here and everyone just looks at me ..."how do we do this now?" "Where do we go?" "Alright, group 1 will go

this way, and group 2..." That is always very funny to me. It happened the last time too.

Researcher: And do you think they were supposed to have planned it before?

Michael: Oh no, we had talked it out before. But I think the expectation is that I am in charge when they get here. That is always a surprise to me, especially on the last visit. So much of it was done beforehand and all that preparation. But when it got here, that initial moment was chaos. Teachers saying "I didn't know that" And I know they knew it. But everyone is thrown out there at the beginning. And it always seems to come back to me to get everybody in order, get the teams set up. No, don't go in now, one team at a time go to the restrooms...to get that flow going. And once that flow gets going, it is fine and I don't have to do as much, especially the last visit. Once we got everybody up to the site there was really not much for me to do so that I could float between and keep an eye on things. The first 15 minutes was chaos. But I think it will be that way every time.

Researcher: Is that a role that you would rather not have?

Michael: Chaos I never like. I am very good at making order out of chaos, so it is a role that I am comfortable doing. I don't like doing it. But I know I am good at it, so fine. And given just how much energy Jane puts out and Elissa puts out and you put out before....and the teachers....before getting here....ok, I can do this. But combining that with having snacks for everyone ready and coffee and making sure people get nametags on and all of that stuff, those mornings are hectic for me. But, that's alright. That is part of my job.

Researcher: Well, and it has been mentioned that we don't really have very...like at the beginning we didn't



set out roles...this is your job, this is your job...  
What are your comments on that? Do you find that that  
is a problem?

Michael: No. I would rather work that way. That I think makes some folks involved here anxious because they like to have clearly defined roles. I think for creativity, to let those emerge with people's interests and their strengths...just let that emerge. But if you dictate it at the beginning...like Kathy and say "Ok Kathy, here is what you are going to do." She doesn't know what she wants to do. To let her go and hang out with Jane and offer some help and maybe from that will emerge something that she really wants to do but didn't realize that she could do. To me that is what is neat about River Vista because I went through the same thing in creating my job here. I never expected to do this. I never knew I could do this. I don't know what this is. There aren't any job descriptions for this. So I want to see that happen for other people. Because so many people that show up here like Kathy and other folks that are transitioning from jobs or school, the ones transitioning from jobs have tried to do that and realized they are not that thing. They don't know what they are. The university students are all looking for that box, and we all know there aren't any really useful boxes that way. This can be a place where people sort things out for themselves. This program I think is a ....I like how we haven't defined roles in a very fixed way. We have something to get done and let's get it done. And if Jane wants to do a drawing,...she was great, it was a beautiful drawing. Now, what I have done for this visit, because Jessie who is one of the interns is also an artist, I have said "Jessica, help Jane if she is going to do some kind of a drawing because it took Jane so long." But that was an experience in something that was good for Jane and it also gave an opportunity for me to recognize that Jessica could probably help with that.

Researcher: Do you think that we have sort of begun to form our own roles throughout the year?

Michael: Yeah, oh yeah.

Researcher: And what do you think those are?

Michael: I don't know if I have labels for it. I haven't thought that much about the roles. I think that, like I was saying...communication, the kind of coordinating that you do...the bringing the expertise on materials, development. Jane and Elissa bringing all of the scientific knowledge and that kind of creativity.....being able to bounce that off of you and you more realistically saying "well maybe the teachers are going to be more interested in doing this" and then they go along. The teachers giving more feedback. I think the teachers have changed their roles, from what I can see.

#### **Excerpt from Beth Interview 1 - 5/23/01**

Researcher: Can you tell me some qualities of what you think of when you think of a successful field trip?

Beth: Just to make sure that they take back the knowledge. I know when I was taking the kids through, my main goal is more than memorizing specifics was to make them love it. Because if they love it, then they will learn about it eventually, if not then. So I guess, just to have them take back good memories, fond memories and think of science as a great, wonderful, fun experience. Because a lot of them came in the first time with the attitude of "Oh, I hate science."

Then by the end they were liking it. So I always pointed out "this is science!"

Researcher: In what ways did the trainings help to meet your needs as far as helping you make it a successful field trip?

Beth: Well, they taught me a lot. I am no expert in any of it, so to know the basic things that they are learning gives you a good place to start to know what you should focus on or what you should emphasize. And also, to get to know the other people that are here. Because having those connections is really neat. Knowing what they are learning and what you can do for them, to help them, is helpful. They were very helpful.

Researcher: In what ways were the trainings falling short of meeting your needs?

Beth: I don't know. Not too much actually. If you had any question or anything you could just ask. I felt really comfortable with the kids. We always had the material that we needed to tell them. If not I knew I would learn it on my way from everyone else.

Researcher: So did you always feel like you knew what was going to happen on the field trip?

Beth: Pretty much. I know that kids will be kids...like that kid that jumped in the pond. You don't expect those things. They learn and they are fun. I think that by giving them a lot of room to grow...maybe it is just the way I have been schooled...with giving the kid a lot of room to explore and make their own mistakes. But, by not being a teacher, a dominating teacher, but a helpful friend that knows more...I think that is great. Everything went really well. We had different levels of kids. You wouldn't know if you get the really sharp group or the lower group. But it is easy to accommodate, I think.

Researcher: Have you had a lot of experience with kids before?

Beth: Yeah, I babysit a lot. I spent a lot of my life around kids. I love them. I love taking the time to be around them and teach them...especially to love nature. Because I had a lot of that when I was little...introduction to nature and being outdoors and loving it and protecting it. I think that is what really has stuck through the years more than anything...the love for it. If you love it then you will take care of it and learn about it. That is what I want to pass on.

Researcher: How is the organization of the field trips progressed? How is the organization of this last field trip compared to the first two?

Beth: Oh, I think it is a lot better to have just the one focus and the rest of the time to do whatever, then to try to shuffle everybody through at a certain time and certain thing. A lot of the time they will be completely enthralled by something and you have to say "oh, we have to move on." It is better to just let them just sit there with whatever they go wow about. I think the last field trips were a lot better in that sense.

Researcher: In what ways do you feel you were personally able to have an impact on the way the field trips were structured?

Beth: Each individual can give something different. I really enjoyed being with the kids, because I think they have a good time when we have our games and they come out learning things. I think everybody has a lot to do with it...how the trip goes and how you are going to teach it or show them around.

## Appendix D

### Collaborative Events Timetable

Table 5: Collaborative Events Timetable

Date	Event
8/10/2000	Meeting with all 10 teachers and principal
10/24/2000	Planning meeting 1
Early 11/2000	Dog and pony shows for field trip 1
11/11/2000	Mentor training for field trip 1
11/2000	Field trip 1 (insects and aquatic life)
12/14/2000	Follow-up meeting for field trip 1
1/10/2001	Planning meeting 2
Early 2/2001	Dog and pony shows for field trip 2
2/17/2001	Mentor training for field trip 2
Late 2/2001- Early 3/2001	Field trip 2 (birds)
4/5/2001	Planning meeting 3/ Follow-up for field trip 2
4/21/2001	Mentor training for field trip 3
4/2001	Dog and pony shows for field trip 3
Early 5/2001	Field trip 3 (soil and plant life)
Late 5/2001	Follow-up meeting for field trip 3/ End of the year dinner

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## **Vita**

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Amy is a member of several honor societies including, Phi Kappa Phi, Kappa Delta Pi, Pi Lambda Theta, and Sigma Zeta. She has also collaborated with several local informal science education sites to aid in field trip curriculum development.

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