MAKING THE INFORMAL FORMAL: AN EXAMINATION OF WHY AND HOW TEACHERS AND STUDENTS LEVERAGE EXPERIENCES IN INFORMAL LEARNING ENVIRONMENTS

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FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Barbara P. Schneider
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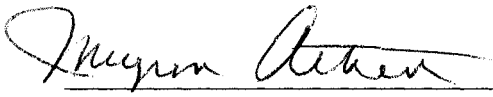

Dr. J. Myron Atkin, Principal Advisor

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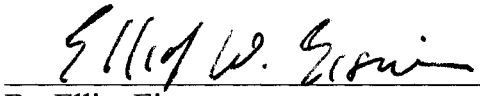

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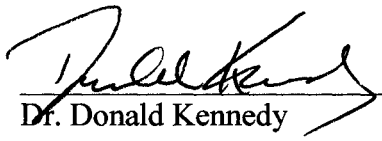

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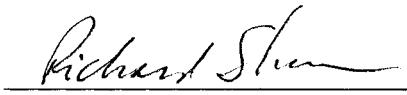

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Approved for the University Committee on Graduate Studies.

ABSTRACT

This study was an effort to understand the impact of informal learning environments (museums, aquaria, nature centers, and outdoor education programs) on school groups by developing a picture of why and how teachers and their students leverage experiences in these settings. This work relied on the self-reported visions for science education of formal and informal teachers as a means of creating a portrait or profile of the teacher visitor thus providing a new way to assess the quality of informal visits based on vision elements. My desire to begin by understanding classroom teachers' visions of education and how those visions aligned with visions of educators in informal settings stemmed from the belief that without some correspondence in goals and practice there would be no incentive for classroom teachers to build on informal experiences back at the school site. Since much of what visitors ultimately take away from an informal setting is influenced by subsequent experience, the ways teachers' appropriate informal learning to practice is critical.

To understand the connections among visions for education, teaching practice, and effects of collaboration between formal and informal learning environments, I chose to conduct multilevel, yearlong case studies at six school sites and their partnering informal centers. I employed a variety of data collection strategies. My goal was to provide a realistic representation of the multiple perspectives, experiences, and features of both school life and informal settings. I conducted extensive interviews with case study participants for the purpose of identifying their visions of education. I also interviewed teachers before, after, and in some cases during each field trip or classroom observation in an effort to understand how teachers' visions, or educational intentions

were being enacted both in their own practice, and through the informal experience in which they took part. To identify where the formal and informal experiences might intersect, I spent more than 250 hours observing school-based and field trip activities, in some instances observing while a class went on subsequent trips to different informal sites. Finally, two months after their field trip experiences, I conducted focus group interviews with students in case study classrooms to better comprehend their awareness of the intended and experienced curriculum as well as its impact as related to their formal and informal learning experiences.

In addition to this more intensive work with case study teachers, I gathered data from a broader group of participants in each of the two informal centers through surveys (n = 396) and one-time classroom teacher interviews (n = 36) in an effort to validate or confirm case study findings.

I discovered that central to informal and formal teachers' visions was a view of education as empowerment. I explored such goals as empowering students to conceive of themselves and their worlds differently, empowering students by sharing responsibility for what and how they learn, and empowering students by creating environments where everyone can contribute meaningfully. Much of what teachers did to leverage informal experiences in supporting their visions of education related to these goals. For example teachers used shared experiences in informal settings as a way for their students to gain better access to and understanding of the classroom curriculum thereby increasing student participation and allowing more students to be successful. In addition, pedagogical changes in the form of more hands-on, discovery and project based teaching were observed and reported by teacher participants resulting in an overall increase in science

instruction for some teachers. Teacher participants also changed their approach to content by basing their classroom curriculum on students' interests and questions developed during visits to informal settings. Consequently teachers noted that their students were connecting personally with the content they experience in informal settings. Through this change some students appeared more able to connect to traditional elements of school. Personal growth was another area of change in students. Increases in self-esteem, fieldtrip and classroom participation, and improved classroom behavior were reported and observed and improved the way the classroom functioned.

ACKNOWLEDGEMENTS

I am deeply indebted to my research advisor, Dr. J. Myron Atkin, for his continuing encouragement, interest, and assistance.

This work would not have been possible without the help of the dedicated informal center staff, classroom teachers and students who participated in this study. I would like to thank the ten educators (formal and informal) who so willingly shared their stories, their classrooms, and so much of themselves with me. Thanks to all the field instructors who not only tolerated my presence in their hiking groups but made me feel like a welcomed part of their groups.

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For completing me as a person and adding to my life outside of school through your humor, warmth, generosity of spirit, and at times sympathy, I thank Mary Ellen Hogan, Ann and Roger Bundlie, and Janet Coffey.

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My greatest thanks and love I reserve for my husband and two daughters (both of whom were born during the writing of this dissertation). David I can not express what your support, patience, and perspective have meant to me throughout this process. Your unflagging confidence in me was a true gift and buoyed my spirits in times of doubt; I would not have completed this work without you. To Hannah and Zoë I say thank you for reminding me of what really counts in life. The two of you have given me the best informal education a person could ask for.

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CHAPTER ONE: INTRODUCTION

The purpose of this study was to develop a portrait of how learning in informal settings (museums, aquaria, nature centers, and outdoor education programs in parks) might impact teaching and learning in schools. Specifically, I examined connections between visions of science education, teaching practice, and effects on students resulting from collaboration between schools and informal science centers.

Recognizing their shared mission to educate, schools and informal science centers are combining forces in increasing numbers in attempts to more effectively achieve their educational objectives. Seventy percent of museum directors have reported increases in the numbers of teachers and students served over the past five years, and now estimate that collectively, American museums provide nearly four million hours of educational programming annually (IMLS, 1999). Although many of these encounters typically involve only brief interactions between a particular informal center and a visiting school, a shift is apparent toward more formal and extended collaborations between these educational institutions (Chesbrough, 1998).

Many partnerships are inspired by the growing number of reform guidelines, state standards, and major funding agencies (NSF contributes $36 million annually to informal education) which advocate an approach to teaching science that should ideally result in improved understanding among students of what science knowledge is and how it is developed (AAAS, 1993; Nielson, 1997; NRC, 1996).

Despite endorsements of collaboration and a long history among informal centers as educational institutions (Danilov, 1990; Hammerman, 1980; Hein, 1998; Hudson,

1987), few empirical studies have examined how or why informal experiences might be integrated with, or differentiated from, school science (Falk, 2000; Mullins, 2000; Hein, 1998; NSB, 1998; Ramey–Gassert, 1994; Ramey et al., 1997; Griffin & Symington, 1997).

Poor communication is one possible cause of the lack of mutual awareness existing among these institutions (Harrison & Naef, 1985). However, because the purposes, origins, pressures, and, to a certain extent, audiences (in terms of whom they account to and serve), of schools and science centers differ, their visions of science education may be somewhat discrete. The extent to which visions diverge has implications for interactions between these educational establishments. Webb (1998) highlighted the importance of a consistent vision in his study of the alignment of expectations and assessments in math and science education. Webb claimed "if policy elements are not aligned, the system will be fragmented, send mixed messages, and be less effective." Only through alignment can meaningful changes in instructional decision-making and practice be possible.

However, schools and science centers each occupy space within a unique context. These contexts encourage certain characteristics or features that are distinct to these institutions. These features, or as Sarason (1996) called them, regularities, constitute a certain experience in science for children. Established norms for behavior within the formal or informal context shape how teachers and students interact–who asks questions, what types of answers are expected. The norms determine how physical space is constructed within these institutions and how time is allocated to emphasize certain content or pedagogical practices. Other differences arise over what constitutes knowledge

and how that understanding is assessed. Often these patterns meet with the expectations of parents, students, and policy makers; they have implications for curriculum and instruction.

Thus, when two or more groups embrace the same purpose–in this case a vision of science education--does it necessarily follow that they should share common features or approaches in supporting those purposes? Are there differing approaches that will suffice in achieving a common goal? If so, what are the implications for understanding and supporting relationships between schools and informal institutions in creating environments that optimize science learning?

Guiding Question

Where a high degree of overlap in the vision of science education occurs between formal and informal institutions, should there be consistency between what is practiced in the informal setting and what transpires in the school? Is significant learning more likely where consistency across context occurs, i.e., where similarities exist in pedagogy, curriculum, and/or expected outcomes–behavioral, attitudinal, and conceptual (Fig. 1)?

The conceptual framework depicted in Figure 1 provides a somewhat systematic, albeit idealized, progression suggesting the relationship between shared visions of science education, teaching practice, and effects on students understandings of science. Critical to this framework is the alignment of aims, goals, and beliefs of collaborating institutions. Aligned visions of science education allow for more focused and consistent approaches to practice, maximizing the potential impact on students. In reality, achieving complete alignment of visions of science education will be difficult. Adjustments will be made in response to numerous factors that influence these educational systems. For

example, time is a limiting factor in every classroom, and when faced with time constraints and/or other restrictions teachers must make choices. One choice might be to create the opportunity for a student-led inquiry into a more directed experiment or laboratory activity. Thus, although the science content may be aligned in many respects, aspects of the pedagogy might vary across settings. Those involved in these collaborations should be aware of potential constraints and of the impact of their choices on the science experiences of their students.

Goals

The goals generated for this study clarify the nature of relationships between informal and formal institutions. A primary goal was identifying the visions for science education typically espoused by teachers in schools and informal science centers and the differences and similarities between these visions. A related aim was to understand how visions of science education comport with practice within schools and informal science centers. That is, I wanted to (a) determine how teachers and informal center educators adjust to their individual contexts in reaching "shared" goals; (b) discern if some of these adjustments were more useful than others; and (c) distinguish what factors influenced (supported or impeded) the successful integration of informal experiences. Finally, I sought to understand how relationships between formal and informal institutions influence the science experiences/understanding of students, and in what ways these relationships might be supported in creating environments that optimize science learning.

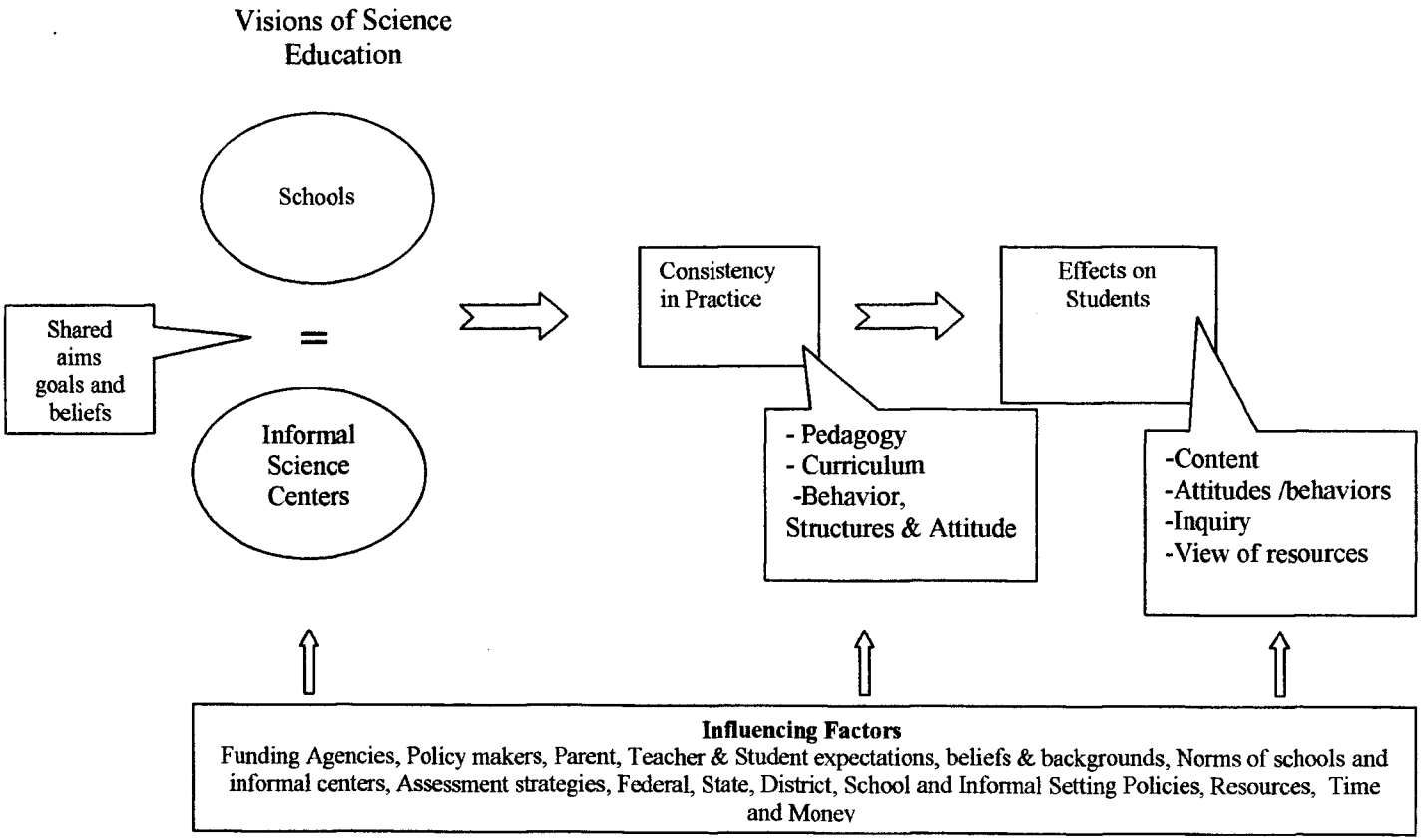


Figure 1 Conceptual Framework

CHAPTER TWO: A PRIMER ON INFORMAL LEARNING ENVIRONMENTS: PURPOSE, PRACTICE, IMPACT & RELATIONSHIPS WITH SCHOOLS

This section sets forth the historical or research basis for addressing some of the research goals described in chapter 1. It begins with a perspective on the purpose and practices of informal science centers and schools, examining how they have been similar or different both within and between the institutions over time. Next is a look at how school and informal center personnel have worked together in the past and how they are working together currently, including a review of what the literature tells us about the impact of those relationships. The section concludes with theoretical arguments to explain why informal education has historically remained at the margins of most school curricula despite a long history of legislation endorsing collaboration between these institutions, and current beliefs about what constitutes best practice in science education. The goal in this chapter was to offer the reader some background highlighting the history and direction of informal education as well as its accomplishments and remaining challenges. At the start of chapters 4 and 5, brief reviews of the literature pertaining to the conceptual ground covered within those chapters are provided as additional guideposts and rationales for why and how the study was conducted.

Purposes and Practices of Informal Centers

Throughout their history, whether a specific institution focused on the science of the past or of the present, on the technology of science, or on the wonders and workings of the outdoors, the purpose of informal science centers has been to support the public's understanding of science. Thus, despite what appears to be, and is, an overwhelming diversity of informal science centers, what stands out in a review of the literature is a

constancy of purpose and, despite certain distinctions, a constancy of approach (Danilov, 1982; Hammerman, 1974; Hammerman, 1980; Hudson, 1987; Larrabee, 1968; McManus, 1992). See Appendix A review of seminal institutions and the impetus behind their establishment and approaches.

The language describing the purpose of informal science education is peppered with phrases like: *to create an appreciation for and wonder of science*, or *to enhance awareness of the societal effects and outcomes of science*. Often linked to these goals are suggestions for their accomplishment. As revealed through the comments below, learning in informal centers should be entertaining and inspirational as well as educational.

> The Museum of Science, Boston was constructed to "open eyes, broaden horizons, to stimulate curiosity, rather than to include and to tell the public everything about science (Howe in Danilov, 1982, p 33).
>
> Museum of Science and Industry Chicago "should be created for the entertainment and instruction of the people . . .to gain a better understanding of their own problems by contact with actual machinery (Kogan in Danilov, 1982, p. 25).
>
> Fernbank Science Center (est. 1967) is "dedicated to bringing greater understanding and appreciation for our natural world to mankind . . . Fernbank activities are designed to offer the public an opportunity to increase their scientific awareness and enrich their leisure-time activities with enjoyable and constructive nature-related experiences (Fernbank Science Center in Danilov, 1982, p 35).

Although exhibits and activities within informal centers may feature as content the history of science, modern technology, or the big ideas and concepts of science, with the expectation that some of these concepts will be understood, the emphasis and most desired outcomes for the visiting public are increased awareness, enthusiasm, and inspiration.

In achieving these outcomes historians of informal science education have argued that informal centers have gone through a series of distinctive phases in their approach to providing educational experiences for public understanding of science (Danilov, 1992;

Hammerman, 1980; Hudson, 1987; McManus, 1992). Danilov's model divides museum/science center development into three phases (Hein, 1990; Hudson, 1987; McManus, 1992). Danilov's three phases are:

> *Phase 1: Object based*–Museums were seen as warehouses where collections were used as teaching material
>
> *Phase 2: Interactive with emphasis on science history*–Beginning at the turn of the 20th century, informal centers turned toward a more interactive model of exhibit presentation. Once again, real objects were the centerpieces, but during this phase of museum development these items were operational, often at the hands of a science center visitor. Science history was the featured content during Phase 2.
>
> *Phase 3: Interactive with emphasis on contemporary—Although* still interactive, exhibits during Phase 3 shift their content to focus on the more contemporary developments in science, and on big ideas in science rather than solely featuring objects.

Although Danilov's paradigm was conceived with museums and technology centers in mind, its basic structure also applies to the history of outdoor education. The Nature Study Movement served as the precursor to early outdoor education by bringing children into nature as a means of highlighting the changes wrought by science as manifest through urbanization. The content of these early programs glorified rural traditions of the past (Nash, 1968). Like their Nature Study predecessors, camping programs and current outdoor education programs still engage children in science through activities in the outdoors. However, environmental science and modern ecological principles (ecology as a field, led by A. Leopold, began late in the 1930s and 1940s) take precedence in today's programs.

The distinctions above are real; however, the fundamental principles underlying informal education weave through these differences. These threads include working with

real objects and real settings to generate new content knowledge, working within a social context, having the autonomy to choose activities, and being free from threats of formal assessment.

In summary, informal science centers provide exhibits and programming that highlight natural phenomena, human and animal behavior, and real-world applications of science (Semper, 1990). Although informal science center programs offer authoritative science content, their primary goal is to engage visitors through the "doing" of science. Provoking curiosity and leveraging that interest into new science understanding through multiple representations of a concept is the hallmark of an informal science center experience.

Purposes and Practices of School Science

In contrast to opinions about informal science education, beliefs about what and how science should be taught in schools and for what purpose have changed over time (Atkin, 1983; Jenkins, 1990; Shamos, 1998). Typically, these changes are triggered by public dissatisfaction with what our schools are doing and the perception that our nation is somehow falling behind our global competitors. When asked what schools should do to improve, everyone agrees: provide more and different instruction (Jackson, 1983). With each reform come additional goals and means of achieving them. An added complexity is the continuing uncertainty over whether or not the more or different science we teach to *all* students will suffice in providing the content and skills required for future scientists. Despite cries for priorities in science education (Atkin & Helms, 1993) the science expectations we have of children and our definitions of scientific literacy vary. In

reviewing scientific literacy, I uncovered countless criteria for what constitutes basic understanding in science. The short list below shows the often repeated highlights.

> Mastery of basic science content–language and principles (Jenkins, 1990, 1994; Millar, 1996)
> Understanding the methods or processes of science (Jenkins, 1994; Millar, 1996)
> Understanding the nature of science (science as a social enterprise) (Jenkins, 1994; Maarshalk, 1986; Millar, 1996)
> Possessing "scientific savvy"–not being bewildered or intimidated by new technologies (Prewitt, 1983)
> Understanding how science and technology impinge on public life (Miller, 1983; Prewitt, 1983)
> To improve in general the faculties of the mind–"habits of mind" (Dewey in: Shamos, 1995; Atkin & Helms, 1993)
> Awareness and appreciation of science (Shamos, 1995)
> Understanding and conducting inquiry as both the content and process of science (National Research Council–National Science Education Standards, 1996)

Accompanying each of these "understandings" is a distinct recommendation for practice, including any or all of the following: using "mental models;" reviewing real examples of scientific work; involving students in processes of science; employing culturally relevant content (ethnoscience); including environmental education to promote ownership of content; and promoting content coverage such as "less is more" as advocated in project 2061, and "more is more" as in SSC.

Each of these recommendations has direct implications for the classroom. As the teacher's science education responsibilities increase, science education goals become more difficult to attain (Atkin, 1983; Atkin & Helms, 1993). With each added responsibility comes additional competition for the teacher's priority or attention. Thus, although the purposes and practices of science education in schools and those of the informal center have converged at various times, it is likely that informal science education might receive only partial or shifting attention within the school's domain.

How well new curricula and goals mesh with the expectations and structures produced in a school will predicate a teacher's decision about what and how to teach.

In the last section, I delineated the underlying principles or practices that characterize teaching and learning in informal settings. A picture of the structures that undergird teaching and learning in schools follows.

Overall, schools rely on content as conveyed through written language; students engage in the learning process predominantly as individuals rather than in groups; what and how students learn is highly structured by the teacher. Finally, formal assessment determines how much they know and what they should know. The possible implications of these differences for the inclusion of informal science education in schools are addressed in more detail later in the document.

How Schools and Informal Centers Have Worked Together

Since their inception, informal science centers have had an educational mission encompassing both active research in science, and public education through programs and exhibitions. For a large portion of their history, particularly within the last 40 years, informal centers have viewed supporting schools as a principal objective; for many, especially those involved in outdoor education, supporting schools has been their sole purpose.

Credited as being the "first contemporary science and technology center" (Danilov, 1982, p 29) the Palais de Découverte (1937) broadened the popular conception of science center education through its innovative services. New offerings, which today would be considered basics, included public lectures, field trips, study camps, outreach programs, and laboratory facilities for adolescents. Efforts at the Palais de Découverte,

with most of its funding from the French Ministry of Education, provided the inspiration for the creation and conversion of numerous other science centers in Europe and in the United States (Danilov, 1982; Hudson, 1987).

In the United States, the Museum of Science in Boston (1949), the Oregon Museum of Science and Industry (1954), and the Exploratorium (1967) in San Francisco further expanded the role of science centers in education by directing their services at schools. The Oregon Museum of Science and Industry coined its "suitcase" school exhibit program (Danilov, 1982, p34), whereas Exploratorium founder Frank Oppenheimer was criticizing the "passive pedagogy" of schools and arguing for the integration of "participatory materials" into the local school system (Oppenheimer in Larrabee, 1968, p167).

The 1950s and 1960s also posted fundamental changes in outdoor education. During this period the camping stereotype grounded in Rooseveltian ideals gave way to programs that more closely identified with the schools' courses of study. Outdoor school, outdoor laboratory, and "school in the woods" began to replace the words *camp* or *camping* in program titles describing outdoor educational experiences. Changes in phrasing were accompanied by the creation of teaching manuals, guidebooks, and special teacher training sessions addressing the value and purpose of learning science in the outdoors (Hammerman, 1980).

Many of these changes were triggered by federal legislation that provided funding for the development and support of informal programs for schools. By 1951, 32 states contained school forests (Hammerman, 1980; Larrabee, 1968). For example, the Fernbank Science Center, a 65-acre nature forest preserve started by the Dekalb County

school system, was funded by monies allocated through the National Defense Education Act (NDEA) and the Elementary and Secondary Education Act (ESEA). Fernbank, one of many "school forests" provides "special programs [designed to] bring enrichment to existing school curriculums from kindergarten through graduate school, and quality in-service programs for teachers" (Fernbank Science Center, in Danilov, 1982, p36). In total, more than $5 million was spent on 89 projects involving outdoor education between 1966 and 1967 (Hammerman, 1980). Attention to program diversity and to service to school groups was also evident in science museums and technology centers during this period. See Appendix A for examples of informal science center programs and services available through state and federal funding.

Ironically, although the NDEA and ESEA ultimately advanced educational opportunities for very different student populations, the belief behind efforts in supporting informal education was that science education could be supported by involving students in informal learning experiences.

Even though the field trip with its 75-year history (Prather, 1989), still serves as the principal conduit for interaction between formal and informal settings, services provided by informal science centers have diversified over time in efforts to better serve students. There is no indication that this trend is stopping (Falk & Dierking, 2000; Leeming et al., 1998). Most science centers today have education departments offering wide arrays of "school-only" programs, including kit-based lessons, school site visits, museum tours, and professional development sessions for teachers (Hein, 1991, 1998; Ramey-Gassert et al., 1997; Simmons, 1996; www.astc.org/resource/index.htm). Whereas the priority that education departments might garner within a particular science

center may vary in relation to that enjoyed by exhibit designers (Rawlins, 1981), the fact that overall science centers are devoting more attention to schools now than ever before suggests their singular importance to the educational purpose of these institutions (Doering, 2000; Falk & Dierking, 2000). By some estimates, as many as 20% of all U.S. elementary school teachers who receive professional development in science get that training through science centers (Inverness Research Associates, 1996). According to a survey of member institutions conducted by the Institute of Museum and Library Services, 87% of museums reported substantial use of school curricula or standards in shaping educational programming for science (IMLS, 1999). With this increased focus on schools has come the continued expansion of services, including a growing number of recent attempts at long-term partnerships (Chesbrough, 1998).

Effects of Informal Programming

Several scholars have examined the value of recent formal partnerships between schools and informal centers. However, much of this work has focused on the practical benefits of these collaborations, emphasizing the value that museums offer schools through collections and science expertise, and the contributions of schools to informal centers in the form of eager minds and increased attendance (Hirzy, 1996; Torri, 1997). In instances where research has focused on the criteria for partnering, typically only the perspective of the informal setting was considered (Chesbrough, 1998; Prather, 1989; Silberman, 1999).

Although more studies have been conducted to determine what effects informal learning experiences have on students, these were generally limited in scope, addressing only a single visit to an informal institution and concerned primarily with attitudinal and

behavioral changes toward the specific center or environment in which the activity or program took place (Bocarro & Richards, 1998; Dettmann-Easler & Pease, 1999; Henderson & Fox, 1994; Leeming et al., 1998; Price & Hien, 1991; Ramey-Gassert, 1997; Rennie & McClafferty, 1996; Semper, 1990). Other issues involve the type of data gathered; largely anecdotal work in this field has been characterized as "craft wisdom" or something other than systematic research (Hein, 1998; Hwang, 2000; Leeming et al., 1998, Ramey-Gassert, 1997; Richards, 1998). Despite their limitations, these studies provide consistent evidence and consensus as to the positive impact of informal science education.

Changes in affect have received significant attention in the science center literature. One can find numerous papers asserting that visits to informal centers generate enthusiasm and curiosity in students (Borun et al., 1996; Falk, 1985; Csickemihayli, 1995; Koran et al., 1984; Price & Hien, 1991; Ramey-Gassert, 1994; Rennie & McClafferty, 1996; Semper, 1990; Wellington, 1990). Frequently these studies relate such changes to the welcoming, interactive, and student-centered nature of many informal environments (Bickford, 1993; Bielick &Doering, 1997; Blud, 1990; Doering et al., 1993; Eratuuli & Sneider, 1990; Falk & Dierking, 2000; Hein, 1998; Hilke & Balling, 1985; Koran et al., 1984; Patterson & Bitgood, 1988; Peart, 1984; Price & Hien, 1991; Ramey-Gassert, 1994; Rennie & McClafferty, 1996; Semper, 1990; Stevenson, 1991; Tuckey, 1992), suggesting that free-choice environments capture students' curiosity and enthusiasm, providing the necessary motivation to engage students in science activities.

Heightened public awareness of new advances in science as well as improved attitudes toward the study of science has always been central to the goals of informal science educators. Not surprisingly, these features are frequently measured outcomes of informal experiences (Basile, 2000; Bogner, 1999; Hanna, 1995; Hines et al., 1987; Kellert, 1984; Leeming et al., 1993; Ma & Bateson, 1999; Price & Hien, 1991; Ramey – Gasset, 1994; Rennie & McClafferty, 1996; Ryan, 1988; Semper, 1990; Simmons, 1991; Wellington 1990). In the statement below, Oppenhiemer (1970) described the connections between awareness and attitude that are established in informal settings.

> The importance of familiarity with the wonders of nature goes far beyond the instantaneous pleasure it elicits. This familiarity changes the way in which people view themselves and alters their relationships with nature and other people.

In addition, researchers have reported on the importance of social interactions that occur in informal settings, pointing out the spontaneous way in which these exchanges take place (Crowley & Callahan, 1998, 2001; Egana, 2001; Doering, 2000; McManus, 1992; Mullins, 1998; Price & Hein, 1991; Roberts, 1997; Semper, 1990). Many exhibits and activities in informal settings are designed so as to require more than one person and "intelligence" in order to operate successfully. So in essence, what science centers may do best is provide better access to science content and experiences than schools can offer, for a broader group of people.

Perhaps of greatest interest to those engaged in promoting students' understanding of science content is the demonstrated capacity of informal science center visitors to remember specific information about what they have seen or experienced (Bogner, 1998;

Falk & Dierking, 2000; Gillet et al., 1991; Hines et al., 1987; Leeming et al., 1993; Stevenson, 1991, Tunnicliffe, 1996; Wright, 1980).

Although any or all of these effects could conceivably enhance a student's willingness and capacity to learn science back at the school site, research on informal science education has not considered how effects on students are, or could be, leveraged by school teachers over time. Nor has it considered how continuity in pedagogical approach or content across formal and informal settings might enhance the effectiveness of interactions between these institutions. Consequently, we know little about what happens at the school site as a result of visits to informal centers (Falk & Dierking, 2000; Gass, 1984; Hein, 1998; McManus, 1992; Ramsey-Gassert, 1994; Ramsey-Gassert et al., 1997). Unfortunately, what we do know suggests that schools and informal science centers are not maximizing the potential of working together.

Although most teachers, administrators, and parents acknowledge the potential value of a an informal learning experience (Kasper, 1999; Lieberman & Hoody, 1998; NEETF Roper Starch, 1997; Simmons, 1996) in general, it seems they are uncertain about how to use informal centers as learning resources (Brigham & Robinson, 1992; Griffin & Symington, 1997; http://www.eelink.net/Survey2001.pdf; Simmons, 1996), "expressing vague or limited learning goals for their excursions"(Griffin & Symington, 1997, p 775). Visits to informal centers are typically treated as stand-alone experiences by teachers and are poorly linked with topics being studied at the school site (Atkin & Atkin, 1989; Griffin & Symington, 1997). In most cases, little or no classroom preparation or follow-up accompany visits to informal centers (Atkin & Atkin, 1989; Griffin & Symington, 1997; Kubota & Olstad, 1991) despite considerable evidence

suggesting students who receive pre-trip preparation learn more than students who have not been prepared (Bailey, 2002; Falk et al., 1978; Gennaro, 1981; Griffin, 1998; Kubota & Olstad, 1991).

Teachers' agendas (intentions and perceptions of the field trip experience) also impact the overall effectiveness of the visit because they influence student perception of the visit (Griffin & Symington, 1998; Schneider, 2002). In their meta-analysis, Dierking and Falk (1994) noted a correlation between prior knowledge and learning (Shettel et al., 1968; Dierking & Falk, 1994). People with more science knowledge learn more than do visitors with less prior knowledge. This finding suggests that teachers' framing of and preparation for field trips can significantly increase the learning opportunity for students. Field trips linked to the school curriculum result in higher learning gains for students (Anderson, 1999; Falk & Dierking, 2000; Griffin & Symington, 1997; Price & Hein, 1991).

In addition to serving as educational experiences for students, visits to museums are professional development opportunities for classroom teachers. It is estimated that close to one-third and maybe as much as one-half of professional development for science teachers occurs in informal centers (Bartels, 2001). Furthermore, teachers who visit informal sites are more enthusiastic about and teach more science (Price & Hein, 1991), signifying possible changes in teachers' knowledge, attitudes, and behavior as outcomes.

Why has informal science education remained at the margins of schools' curricula?

Several causes explain the apparent failure of schools and informal science centers to connect in more meaningful ways. Griffin and Symington (1997) cited teacher

"intimidation" associated with "lack of strategies in the 'kit' for facilitating learning in this environment" (p775) as two possible explanations for the disconnect between the informal site and the school. Lack of self efficacy (Lane et al., 1996), management issues (Marka, 1973), logistical issues and safety (Orion & Hofstein, 1997; Simmons, 1998) were also commonly noted challenges for teachers when considering informal experiences.

But perhaps, as Dow suggested in a recent e-mail exchange on the Informal Science Education Network, the issue is a form of the "two-culture problem" caused by the inability or unwillingness of informal science educators to "really understand the curriculum and professional development issues from the teacher's and school system's point of view." Questions and frustrations in the informal education community over how to "get teachers to incorporate the stuff [curriculum materials] you give them into their existing lessons" triggered Dow's response. What strikes me in his observation is how central culture is to the nature of relationships between informal science centers and schools. This goes to the heart of my own interest, which was to determine how informal science centers and schools can work together to offer meaningful science opportunities for children while circumventing or melding conflicting educational cultures.

Posch (1993) described the two-culture problem as the "intrusion of dynamic elements into a primarily static educational culture" (p 37). Because informal science center practices are in conflict with traditional notions of school, these programs are marginalized within the school. Posch conceded that in some schools structures exist that support informal education, allowing the informal curriculum to become a more integrated part of the overall school system. But in most cases the inclusion of informal

science education in the formal curriculum relies on the diligence of a particular teacher and his or her desire and ability to intelligently adjust within existing school structures. There is much available evidence in support of the view that what is taught and how is dependent on the teacher's interest, ability, and the flexibility of the work environment (Atkin, 1983; Cuban, 1986, 1992; Eisner, 1992).

Summarily, in trying to understand how informal education can become more useful in supporting science opportunities for children in schools, this research paid heed to the teachers who implement these programs, while monitoring the structures that support or impede their efforts.

CHAPTER THREE: RESEARCH METHODS

The purpose of this study was to examine visions of science education, science teaching practice, and effects on students resulting from collaboration between schools and informal science centers.

Design Overview

To understand the connections among visions for education, teaching practice, and effects of collaboration between formal and informal learning environments, I chose to conduct multilevel, yearlong case studies at six school sites and their partnering informal centers. I employed a variety of data collection strategies. My goal was to provide a realistic representation of the multiple perspectives, experiences, and features of both school life and informal settings. I conducted extensive interviews with case study participants for the purpose of identifying their visions of education. I also interviewed teachers before, after, and in some cases during each field trip or classroom observation in an effort to understand how teachers' visions, or educational intentions were being enacted both in their own practice, and through the informal experience in which they took part. To identify where the formal and informal experiences might intersect, I spent more than 250 hours observing school-based and field trip activities, in some instances observing while a class went on subsequent trips to different informal sites. Finally, two months after their field trip experiences, I conducted focus group interviews with students in case study classrooms to better comprehend their awareness of the intended and experienced curriculum as well as its impact as related to their formal and informal learning experiences.

In addition to this more intensive work with case study teachers, I gathered data from a broader group of participants in each of the two informal centers through surveys (n = 396) and one-time classroom teacher interviews (n = 36) in an effort to validate or confirm case study findings. Figure 2., Research Design, provides a general overview of the study design.

Study Sites

This research took place at Yosemite National Institutes '(YNI) three national park locations (Headlands Institute, Marin CA; Yosemite Institute, Yosemite CA; Olympic Park Institute, Port Angeles, WA), at the Children's Discovery Museum (CDM), San Jose, CA, as well as in schools that had registered for programs at each of these sites. YNI and CDM were selected for this study for three reasons:

1. The established working relationships, knowledge, and access I had developed through my experiences as an evaluator at these sites
2. My belief that although specific content, time spent by participants on site, and age groups of those served varied significantly between these two settings, teachers' motivations and expectations for attending these institutions are similar and bear directly on my research question
3. "Replication logic" (Yin, 1993). I deliberately selected more than one informal site in hopes of replicating study findings across a larger sample.

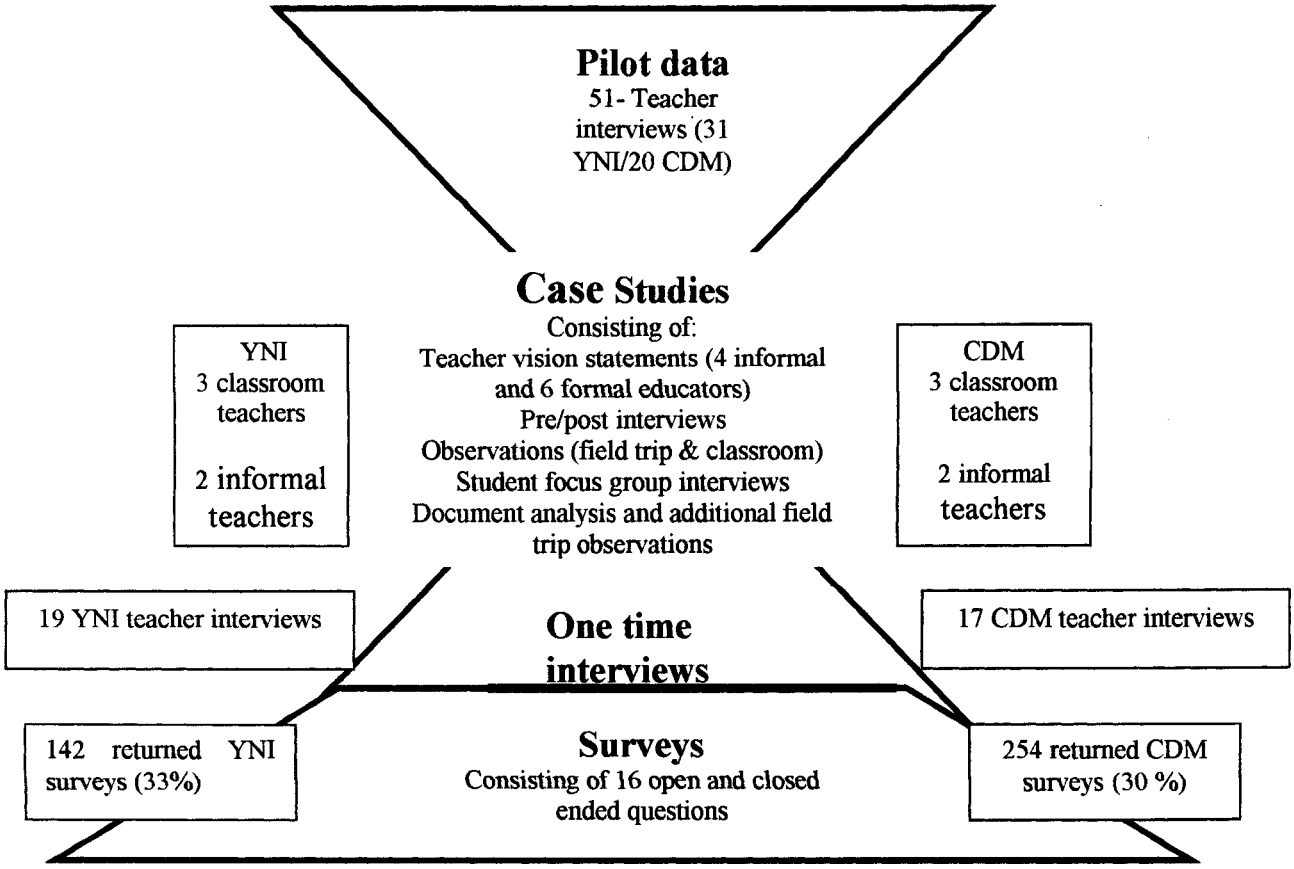


Figure 2 Research Study Design

Yosemite National Institutes

For 30 years YNI has provided residential outdoor education programming for students in kindergarten through grade 12, with specific emphasis on grades 4 through 8. In 1999, YNI worked with more than 32,000 children. Teachers self-select for these experiences; many of them have been participating in YNI programming for more than 8 years. Because of their lengthy experience in working with YNI, a sense of collaboration, or implicit partnership, has emerged between teacher participants and YNI instructional staff.

Children's Discovery Museum

CDM provides hands-on discovery-based learning primarily for children pre-kindergarten through grade 4; CDM offers 15 permanent exhibits and numerous visiting displays. In addition to programs at museums, CDM offers students from kindergarten through grade 6 a variety of school-based programs. For the past five years, CDM has been engaged in a specific school/museum partnerships (BioSITE–Students Investigating Their Environment) with five schools in San Jose, CA. Classroom teachers representing CDM's more intensive school partnerships as well as those taking traditional field trip visits to the museum floor were involved in this study. CDM reaches approximately 90,000 visitors a year.

Case Study Participants

In addition to general availability and willingness of classroom teachers to spend time reflecting with me on their teaching vision and practice, three criteria were used in selecting participants for case study work: years of teaching experience, variety of institutional contexts, and levels of responsibility for or interest in teaching science. With one exception, case study participants were identified during an initial phone interview

designed to collect general information about YNI and CDM teachers' motivations for taking field trips. All case study teachers were registered to take their students on a fieldtrip to YNI or CDM during the1999-2000 school year. Table 1 shows some basic characteristics of the six (school teacher) case study participants and of the contexts in which they work. Data within the categories represented through this table are self-reported by teachers.

Years of Teaching Experience

I wanted teachers representing a range of teaching experience. During the pilot phase of this work, it became apparent that the majority of visitors to both YNI and CDM were veteran teachers with more than 10 years of classroom experience. Although one might argue that this statistic suggests weighting the sample in favor of those most likely to participate, I thought it important to understand the role of informal experiences from the perspective of the novice teacher and to learn why so few, in proportion to their veteran colleagues, were participating.

Institutional Context

I thought it too restrictive to focus only on teachers' visions in searching for the explanatory variables that influence if and how teachers use informal experiences. District policies, school culture, and community influences, to name a few, may also impact relationships between formal and informal educators. Thus, selecting case study teachers representing a variety of institutional contexts became important. Case study participants from public and private, urban and rural, low-, middle-, and high-income, and low-, middle-, and high-achieving schools were involved in this research. Some worked in school districts with clearly expressed priorities for specific content, whereas others had more flexibility/autonomy in creating curriculum.

Table 1 *Characteristics of Case Study Teachers and their Schools*

Characteristic	T. Menutti	P. Lynn	A. Brooks	E. Williams	R.Tubbs	B. Lim
Informal site	CDM	CDM	CDM	YNI	YNI	YNI
Years teaching	10	32	2	15	5	24
School Type	Public	Public	Public	Public	Public	Public
Socioeconomic status of students (teacher report)	Low income/ ESL	Low income/ESL	Middle–high income/ Caucasian	Low–middle Caucasian	Middle–high income/ Asian/Caucasian	Middle income / Caucasian/ Asian
District priority	Literacy	Literacy	Writing/Math	Flexible	Flexible	Environmental R.O.P.E. S
Grade level	4th	2nd	3rd	5/6	7/8	5
Self-described science competency	Fair	Good	Fair/poor	Good	Good	good
Responsible for or teaches science	No	Yes	No – but teaches some	Yes	Yes	yes
Science required	No	No	No/yes	Yes	Yes	yes
School academic achievement record	Low	Low	High	Low-mid	High	High
Teacher report of parent involvement	Low	Low	High	Medium	High	High
Nature of involvement with informal settings	Adopted school partner grade level	Self-select grade level trip	Self-select grade level trip	Self-select	District wide-20 yr. tradition	Principal/Grade level trip
No. of trips per year	Once every two weeks - CDM	2/year	6 +	Varies	Varies	4+

Subject Matter Responsibility

Through my experiences as educator, program director, and evaluator for informal learning environments, I felt there was a bimodal distribution in the science interest and experience level of teacher participants. Teachers either had no interest, experience or responsibility for teaching science and were using the trip as their entire science curriculum, or they were incredibly interested and experienced in teaching science and used the trip as one piece of their overall science curriculum. I was interested in seeing if this impression held true empirically and how this distinction was represented in teachers' overall visions of education or in the ways they leveraged the informal learning environment within and outside the domain of science. Addressing this interest involved teachers who represented a range of science interest, experience, and responsibility.

Case Studies

Multilevel case studies conducted at various school sites and their partnering informal center served as a principal strategy for data collection. Case studies were chosen as a method of research because they allow for in-depth analysis and contextualization of learning environments.

Initial cases, involving two classroom teachers, provided a mechanism for honing early research questions and for identifying recurring themes or ideas that were examined more fully with an additional group of four teachers. This approach is referred to as progressive and thematic sampling (Miles & Huberman, 1984), and was useful in identifying and validating important ideas or "generalizations" made from preliminary study findings (Eisner,1998). An illustration of how this approach worked is encapsulated in the following example: My initial hypothesis featured shared visions of science education as an important predictor of consistency in practice between formal and

informal institutions. However, in working with teachers it appeared that the presence of a formal (required) curriculum also strongly influenced teacher practice and effects on students. Consequently, I looked for teachers who would illuminate the relative importance of a formal curriculum to consistency in practice between formal and informal sites.

Data from seven sources were collected in an attempt to understand the visions of formal and informal educators and how these visions influenced, both within and beyond the field trip, what teachers and students experienced. The data for the case study participants came from (1) tape-recorded descriptions of their visions; (2) pre-trip interviews; (3) follow-up interviews; (4) classroom observations; (5) field trip observations; (6) focus group interviews with students following their CDM or YNI field trip experience; and (7) document analysis or observations of additional field trips to other informal sites (see Table 2 Data Collection Activities–Case Study Teachers).

This use of multiple data sources offered a variety of ways to access teachers' visions and teaching practices while insuring construct validity by allowing me to verify my perceptions of the data, and by providing concurring and confirming data (Denzin, 1989).

Vision Statements

As part of my preliminary research preceding this study, I conducted more than 50 interviews with participants in CDM or YNI programs. During those discussions nearly all teachers indicated that a primary justification for involving their students in informal experiences stemmed from a shared philosophy about what and how science should be taught. Consequently, characterizing the visions of science education espoused by those involved in formal-informal relationships seemed an essential first step in this

research process. In capturing teachers' visions I hoped to determine what beliefs and practices best represent formal and informal education and how they are similar or different.

In the context of a school reform effort directed at mathematics instruction, Webb (1998) described three approaches to identifying and assuring vision alignment: sequential development, expert review, and document analysis. These approaches determine educational visions at the level of the school or the district, often relying on policy elements such as written standards for curriculum and assessment. However, as their titles and description suggest, these methods do not consider teachers' beliefs, and therefore may ignore an integral element in identifying and aligning visions of science education held by those in formal and informal settings. Thus, although certain aspects of these approaches were included in my efforts to determine science education vision, they were augmented by a more teacher-oriented inquiry.

I found a model for capturing the more personal visions of teachers in the work of Nott and Wellington (1995) *Critical Incidences in the Science Classroom* and *The Nature of Science*. In their study, Nott and Wellington relied on descriptions of classroom science lessons from *Critical Incidences* as prompts to probe teachers for their understandings and uses of the nature of science. In my study, a classroom vignette designed to provide concrete examples of science pedagogy, resources, concepts, and outcomes, served as the basis for conversations about teachers' visions of (science) education (see Appendix B). The vignette used in this study is from a cross-national study of science and mathematics in the Survey of Mathematics and Science Opportunities. Although names and some particulars were changed to fit a U.S. context

and the practical needs of this study, it remains largely as it appears in *Characterizing Pedagogical Flow: An investigation of Mathematics and Science Teaching in Six Countries* (1996) p. 160. Teachers from formal and informal settings were asked to read the vignette and discuss with me aspects of the description that resonated—or seemed counter to—their own ideals of practice.

These exchanges highlighted teachers' preferences for content and practice, and allowed for discussions about approaches and topics they did not consider important. This technique made explicit patterns in practice that might be implicit in a teacher's vision of education. For example, one case study teacher indicated that the attention given to plant identification or "naming plants" in the vignette seemed distracting from her goals for what science students would learn in her classroom. She felt that the more important elements of the vignette were the time spent in the outdoors among the plants, and the curiosity and questioning that such an experience would inspire.

For this teacher, this was the heart of good (science) teaching. Instead of "forcing the identification of plants"—which she conceded may very well be a part of what kids were interested in learning—she would build subsequent lesson plans on students' questions about their field experience. She felt confident that important subject matter content would emerge from this activity. Although discussions around the classroom prompt were designed to be open-ended, teachers were encouraged to talk about aspects of their visions within five specific domains: purpose, pedagogy, content, resources, and assessment in determining what beliefs and practices best represent formal and informal education and how they are similar or different.

Table 2 *Data Collection Activities With Case Study Teachers*

Classroom Teacher	Informal center visited	Vision Interview	Pre-interviews	Field trip Observations	Classroom Observations	Post Interview	Focus Groups with students	Other Document Analysis and/or Additional Field trip
T. Menutti	CDM/Bio	√	√ (multi)	√ (multi –day)	√ (multi-day)	√ (multi)	√	√
P. Lynn	CDM	√	√ (multi)	√	√ (multi-day)	√ (multi)	√	√
A. Brooks	CDM	√	√	√		√	√	√
B. Lim	YNI/HI	√	√	√	√	√ (multi)	√	√
R. Tubbs	YNI/YI	√		√ (multi-day)		√		√
E. Williams	YNI/OPI	√	√ (multi)	√ (multi-day)	√ (multi-day)	√ (multi)	√	√

Note. For two of the teachers listed above (A. Brooks and R. Tubbs) some data were not collected; in those instances the category was left blank. The reason for incomplete data collection was lack of teacher availability in the case of R. Tubbs and the decision not to do classroom follow-up curriculum as planned in the case of A. Brooks.

Table 3 *More Data Collection Activities With Case Study Teachers*

Informal Setting Teacher	Informal Center	Vision Interview	Fieldtrip Observations	Post Interview	Other Document Analysis and/or Additional Field trip
S. Derby	CDM/Bio	√	√ (multi –day)	√ (multi)	√
J. Martin	CDM	√	√	√ (multi)	√
P. Devine	YNI	√	√(multi-day)	√	√
R.	YNI	√	√ (multi-day)	√	√

In addition to responding to the classroom prompt, case study teachers were also asked to identify formal curricula, examples of existing programs, or elements from district, state, or national standards that they felt best represented or were counter to their visions of education. These data served as an additional sounding in accurately profiling the teachers' visions of education, and highlighted connections between aspects of the teachers' institutional context and their personal visions. For one case study teacher, her district's emphasis on reading and math achievement consumed a large portion of her teaching day. The particular reading program the school/district purchased was very prescriptive. It demanded that a set amount of time and mode of instruction be applied to reading each day. The teacher explained that between the demand for specific reading and math curricula, and mandatory API test preparation, much of her teaching day was consumed, leaving little time for her to pursue her self-described thematic, multidisciplinary, and open approach to teaching.

To help insure that I had accurately captured their educational visions, I conducted feedback interviews with the 6 classroom teachers and 4 informal educators. I wanted to give participants the opportunity to respond to interview transcripts by inviting them to modify, clarify, or share additional information with me in creating the most accurate portrayal of their educational visions possible.

These visions of science education were then used to create frameworks for examining field trip and classroom practice. Where visions were similar between formal and informal institutions, I expected that certain emphases on content and on practice

would be shared, allowing for a more seamless science experience for students across learning environments.

Interviews and Observations

Characterizing the variety of ways formal–informal relationships were manifest in practice, how teachers and students suggested the informal experience changed them and/or their work, as well as noting the contexts that supported these efforts, was the primary focus of observations and interviews (these were done in addition to the vision interviews with teachers). I conducted a series of exchanges with case study teachers involving three interviews and classroom and field trip observations that occurred in the following sequence: (a) pre-observation interview for gathering information on the teachers' motivations, purposes, and preparation practices for participating in the informal experience. These interviews were also designed to probe into teachers' visions more fully and to ask about the meaning of that vision within the context of the classroom and field trip experiences I would observe; (b) observations of classroom practice with a focus on pre-trip preparation and integration of informal content and pedagogy;(c) informal science center observations to examine alignment with teachers' stated purposes and practices; (d) a follow-up interview to garner teachers' assessment of the informal experience's worth and relevancy for her students; (e) post-trip observations with an eye toward identifying changes in teacher practice as a result of the informal experience, and alignment of post-trip activities with those observed during the informal experience; and (f) a "final" interview where the teachers' activities and practices were compared with those of the informal setting and her overall vision, and implications for her students'

science experience, were discussed. Through this final interview I hoped to learn what had changed or remained consistent in participants' visions and how their context supported or suppressed their goals.

Field trip Observations

I spent more than 250 hours observing school-based and field trip activities Field trip observations were single- or multi-day depending on the informal site the class was visiting. For example, at the CDM visits typically lasted only 1 to 2 hours, the exception being BioSITE programming, which was 1 to 2 hours every two weeks. In the case of YNI, observations were considerably longer in duration, covering 3 to 5 full days in succession. The primary purpose of these observations was to help me identify areas where classroom and informal experiences might intersect in relationship to both the classroom and informal teachers' expressed visions. Specifically, I looked for instances where the teacher's purpose, pedagogy, content, and hoped-for impact on students seemed to overlap or diverge from what happened during a visit to an informal site. During these observations I assumed the role of participant observer. I hoped that taking an active role in field trip activities would enable me to become "one of the group" and give me better access to the student experience. Although my primary focus was on YNI or CDM field trip experiences, at the teachers' request I also participated in field trips to new destinations with two of my case study classrooms. After, and in some cases during these observations I asked the teachers to describe how this experience meshed with their goals. These conversations helped to clarify and augment my own impressions of how

this experience fit within the teachers' practice, and offered another occasion to further tune my take on teachers' visions.

Classroom Observations

Classroom observations of the six case study teachers consisted of visits to the classrooms and tape-recorded reflections after each class. I scheduled these visits with guidance from the teachers; making sure to select dates that they felt best represented an extension of the field trip and connection with their vision. The duration and number of classroom observations varied by teacher. Some teachers designed the informal experience to be a fully integrated part of their curriculum, spanning the entire school year or marking period; in such cases I observed multiple days/weeks in succession or, when appropriate, spread my observations out over time. Before each set of visits, I asked the teacher to briefly describe the lesson I was about to observe—its purposes and goals, as well as how the lesson was designed to fit into past and future curriculum. After observing the sessions I again spoke with teachers and asked them to reflect upon what had occurred in the classroom that day. Specifically, I asked them to describe how what I observed was consistent or inconsistent with their visions, particularly as it related to the informal experience.

Field trip and classroom observations were essential in providing me with additional data sources that helped confirm or challenge the consistency of teachers' visions. They helped me explore how teachers' visions and by extension their informal experiences were situated within their daily classroom work. Additionally, they provided

me access to the numerous ways teachers and informal educators made adjustments to their individual contexts in reaching individual and shared goals.

Focus Group Interviews with Students

A few months after informal learning experiences, I conducted focus group interviews with students in five out of six case study classrooms (scheduling of Group 6 was not possible within research timeframe). I had several goals for these interviews. First I wanted students to explain why they thought their teachers had arranged informal learning experiences. I was interested in finding out how aware students were of their teachers' intentions for them, and if this influenced what they experienced or brought away from the experience. A related purpose was garnering students' impressions of how they felt the informal experience generally fit in with what they did at school. I wanted to know what, if any, connections they were making between these two contexts. Finally, I tried to assess the impact of the formal-informal relationship on students from both their classroom and informal teachers' perspectives. Criteria for determining these impacts came from vision statements and follow-up conversations with formal and informal teachers. For example, many teachers indicated that part of what they hoped students would gain from this experience was increased curiosity. In an effort to assess their curiosity I asked students if there were things about their informal experience that they were still wondering about or had questions about. (see Appendix C).

In this way focus groups provided useful data on the impact of informal experiences on case-study students.

Linking With the Broader Sample

To assess how well findings from the case studies represented the broader base of teacher/student participants in CDM & YNI, I conducted one-time interviews with 36 additional teachers and mailed surveys to every teacher registered to attend a YNI or CDM program during the 1999-2000 academic school year. Although surveys alone might have been sufficient in assessing the reliability of case study findings, I included interviews because of the interpersonal contact and opportunities to follow up on interesting comments. Question development for the interviews and survey were guided by my work with case study teachers and were designed to capture information in four categories: teacher vision, teacher background, vision in practice, and impact on participants (students and teachers).

Surveys

A survey, along with a stamped envelope with return address was mailed to every schoolteacher registered to attend a YNI or CDM program during the 1999-2000 school year. The survey contained both open-ended and selected response questions. Teachers were asked to respond to a total of 16 questions. (see Appendix D.). I mailed the surveys in May 2001 to insure that teachers received the survey before the end of the school year, while optimizing the number who would have already made their trips to CDM or YNI. Although the majority of teachers responded to the survey within the first two months after receiving the mailing, I was still receiving surveys as much as 9 months later. Responding to the mailed survey were 142 (33%) of all YNI registered teacher

participants and 254 (30%) of all CDM registered teacher participants. Some reviewers of this work have voiced concern over the low response rate achieved through my mailed survey. However, research suggests that a 30% to 35% response rate for mailed surveys "covering high- involvement products or socially relevant issues" is typical (http://www.dssresearch.com/library/general/mailresp.asp), and when compared to other types of surveys, for example those dealing with market research or credit card companies, this number is considered high. While this in no way makes up for the data not supplied by the nearly 70% of teachers who did not respond to my survey, it does help to reset expectations. The one-time interviews (discussed below) conducted as part of this research do provide additional insights and confirmatory evidence as to the thinking of the remaining 70% of classroom teacher participants and may go some way in allaying fears that the survey data collected are not representative. Additionally, this return rate does not accurately reflect the total number of possible responses. In the case of CDM an unknown number were lost in the mail.[1] All data were coded and compiled in ACCESS, a computerized relational database (analysis described below).

One-Time Interviews

As part of this research, 19 YNI and 17 CDM teacher participants were interviewed one time Interview subjects were selected as follows: I contacted every fifth teacher from the list of registered teachers to YNI and CDM. Each teacher was given three opportunities to respond to my phone call. If after three attempts they did not return

[1] The post office was able to retrieve some of the damaged/opened letters and return them to me. Additionally, I received a number of the empty return envelopes in the mail. The total number of unused return materials was 62.

my call that individual was no longer considered a viable interview prospect. I continued down the list of teachers until time and willing participants ran out.

All interviews were conducted using a semi structured format, so that, although I used a protocol (see Appendix E) to assure some uniformity in the data collection process, most of my questions were intentionally open-ended to encourage a more idiosyncratic quality to the conversation. This allowed me to discern the significance of the experience from the teachers' perspective. Many of the questions used during the one-time interviews are direct replicates of those used as part of the survey mailed to teacher participants.

Analysis

My analysis employed what Miles and Huberman (1989) termed *progressive problem solving* and is best described as an ongoing reflective process. I continuously worked with and reflected upon the data while they were being collected, identifying patterns and themes, reformulating questions, and generating potential hypotheses, which were checked and refined against ongoing observations and conversations with study participants (Polman, 2000).

All interviews, vision statements, observations, and survey data were transcribed from tapes or handwritten notes to a typed format. Then, using purpose, pedagogy, content, resources, and assessment as my initial codes, I went through and hand-coded my typed notes. These categories were generated empirically during evaluation work for CDM and YNI and represent aspects of teaching practice that visiting teachers claimed

were somehow impacted by, or influenced the informal experience. These dimensions also represent what I consider the basic elements of teaching.

Next I looked for linguistic cues in deciding on categories of comments. Comments were coded as purpose when the language used by the teacher included phrases like *My goals are . . ., What I hope my students will . . ., The reason I do this is . . ..* When a teacher mentioned a particular teaching style or approach the comment or phrase was coded as pedagogy. Examples of items coded as pedagogy might include an expressed preference for using authentic objects, providing activities that access multiple intelligences, or a reliance on text-based resources as a common practice. Similarly, any referent to subject matter, specific curriculum, or factual information related to a certain teaching topic might be coded as content. For instance, a number of classroom teacher participants in CDM mentioned Foresman's Simple Machines curriculum and their desire to provide hands-on science experiences related to levers, pulleys, and forces. In such cases these referents were coded as content.

The texts representing these initial codes were then entered into an ACCESS database and subsequent codes within each of these categories were identified. Through this iterative process I began to develop lists containing similar types of experiences, phrases, or specific words across case-study and interview teachers. This allowed me to understand not only what was alike in teachers' visions and practices but also what differed. For instance, some teachers made comments such as "Most of our students wouldn't get this opportunity otherwise. We know from past experience that this trip will change them and their thinking forever" (Interview AG*). Providing students with*

opportunity/access/exposure to new people and ideas were recurring words and foci noted in the teachers' stated purposes for the educational experiences they provided. Thus, the theme *opportunity, access, exposure* became one critical area for analysis and discussion in thinking about how vision and practice intersect, particularly within the context of formal informal interactions.

In every code or subcode I looked for fit, repetition, and emphasis within each of the teachers' responses. Additionally, I looked for patterns reflected across the data. In particular, I looked for things that tended to cluster for particular teachers or situations.

I was deliberate in sampling for a variety of evidence types, hoping to triangulate the data in testing assertions. As indicated by the data collection processes outlined above, this meant relying on what teachers said (multiple interviews, surveys), observing their teaching within a variety of contexts, examining what materials and resources they employed in their teaching, and assessing how students responded to these teaching episodes in relation to a particular code or theme that emerged. Responses from one-time teacher interview participants and teacher survey data were also invaluable in checking the validity of study findings.

Finally, I checked the accuracy of my interpretations with case study participants to see whether the interpretations I was making matched their experience (Ayers, 1989). Specifically, I asked for and incorporated case-study teacher feedback.

ACCESS relational Database surveys

I received 396 completed surveys from teacher participants to CDM and YNI programs. All teachers' responses to the questionnaire were compiled verbatim in a

Microsoft ACCESS relational database and the content analyzed by further coding/categorizing the responses within each open-ended question type. Similar responses were combined and general category descriptions were developed and compared with those of case study findings. In this way the survey data provided confirmatory evidence or alternative explanations for preliminary findings. Closed-ended questions were simply entered as is and tallied for group totals. The ACCESS database was particularly useful in allowing me to apply descriptive statistics in quantitatively confirming some of the qualitative trends that emerged from the case study data.

The relational database was also valuable in affording me the ability to select specific relationships to analyze, as well as look for unexpected relationships among teacher responses. For example, ACCESS might allow me to see the behaviors or comments within certain question types, as in "What do you hope to gain . . .?" for all teachers with 12 or more years of teaching experience, or across a range of teaching experience, to confirm or learn if total of years teaching was an important indicator for how teachers used or were influenced by the informal learning environment.

Limitations of the Study

This study had two major limitations. They include the role of the researcher and generalizing to the greater population.

Role of Researcher

Throughout this research I have been asked by a number of people if/how my research question and approach might have influenced what teachers did in their classrooms or at the informal setting. That is, did asking to observe classroom activities that represented their visions, and by extension their informal experiences, influence

teachers to think or behave differently than they might have otherwise. The answer to this question is both yes and no. I believe that my interactions with case study teachers almost certainly caused them to think more about their visions of education and how they were or could be manifest in practice. For example, the following is a statement taken from an e-mail I received from one of my case study teachers: "You have been a bad influence on me! All your excellent questions have stirred up some serious cognitive dissonance on my part. The dissonance was always there—you've just stirred it up"(TM, 03/09/00). In some cases, this "dissonance" may have led to new or more fully developed behaviors. But on more than one occasion case study teachers felt unable to enact their visions, or dissatisfied with the way they were doing it, leading me to believe that what I witnessed was illustrative of how these teachers typically think, respond, and behave. Furthermore, by augmenting case study findings with confirming/concurring data from a much broader sample of more than 400 teachers (interview and surveys), I believe that I have accurately represented the connections between visions for education, teaching practice, and effects on students that result from interactions between formal and informal learning environments.

Applicability to the general population

Whether case study, one-time interview, or survey respondent teacher, participants represented a self-selecting population, including those who chose to participate in informal learning experiences and those who were willing to engage in this study. Therefore, the findings presented in this work provide no basis for comparing visions and practices of teachers who either did not participate in this study or chose not

to visit an informal setting. Furthermore, claims made in relation to the visions of informal settings are based only on the statements of four case study teachers, who fulfilled directorship roles at their respective institutions, as well as on institutional mission statements and educational frameworks and codified curricular goals.

As discussed in chapter 2, many informal settings share similar backgrounds and purposes; and facilitators use similar methods in achieving their goals. However, each is distinct on many levels, potentially limiting the applicability of findings across informal settings.

CHAPTER FOUR:

FORMAL AND INFORMAL TEACHERS' VISIONS OF EDUCATION

We who are teachers would have to accommodate ourselves to lives as clerks or functionaries if we did not have in mind a quest for a better state of things for those we teach and for the world we all share. It is simply not enough for us to reproduce the way things are (Greene, 1995)

I cannot stress enough that personal purpose and vision are the starting agenda. It comes from within, it gives meaning to work, and it exists independent of the particular group organization we happen to be in. (Fullan, 1993)

Introduction

Exploring the ideas expressed in the statements above, particularly within the context of formal–informal interactions, was a prominent feature of this work, and one that I will develop in this chapter. Most of the case study teachers reported as a primary justification for involving their students in informal experiences a shared philosophy or vision of what and how science should be taught. These conversations impressed me with their unanimity of feeling and prompted a number of questions about the importance of vision to collaborations between formal and informal environments. What did these visions look like? Exactly what beliefs, purposes, and practices did teachers in each of these settings share, or, perhaps just as important, where did the similarities stop? What did these visions tell us about those who choose to participate in informal learning experiences? What might these visions for education mean in practical terms within the context of informal and formal educational settings? That is, how might vision guide or direct teaching practice? And how might visions provide opportunities for assessing and further developing the quality of informal and formal learning experiences? In this chapter, I address these questions in an effort to clarify the connections between visions

for education, teaching practice, and opportunity to impact students—connections that arise from collaboration between formal and informal learning environments. This chapter focuses only on teachers' visions and their implications for teaching practice. Subsequent chapters address how teacher vision is actually manifested in practice.

The importance of teacher vision has become an established focus of research in recent years. In education, vision has been largely referred to in improvement efforts as an institutional image or statement that describes and guides the goals of a reform (Hammerness, 1999; Loucks-Horsley et al., 1998; Lumpe et al., 2000). A central tenet of this work has been the assumption that "in education or in any field, lasting fundamental change grows out of and is sustained by a compelling vision" (Wilson & Davis, 1994, p. 26). However, a look at the history of school reform reveals that these efforts typically give way over time, often for failing to pay heed to the beliefs of those who are expected to implement change (Cuban, 1995; Fullan, 1993 1995; McLaughlin, 1990). This link between teachers' beliefs and the implementation of reform efforts is well documented (Cornett et al., 1990; Crawley & Salyer, 1995; Czerniak et al., 1999; Haney et al., 1996; Hashweh, 1996; Lumpe et al., 2000; Paul & Volk, 2002; Pedersen & Spivey, 1996) and suggests that outside an institutional understanding of vision there exists a more personal, and perhaps more influential image of education belonging to teachers.

From this more personal vantage point the word *vision* has been used in the educational literature to describe such things as beliefs, hopes, goals (Britzman, 1991; Lortie, 1995), and images of practice (Tabachnick & Zeichner, 1984). Encapsulated in teachers' personal visions is an explanation of what they think is important; it captures their motivations, defines their commitments (Hammerness, 1999), helps to uncover

assumptions and attitudes that support or suppress change (Lester & Onore, 1990), and reveals the moral and emotional aspects of teacher beliefs (Clandinin, 1986; Fullan, 1995; Mullins, 1998,). Researchers of teachers' visions claim that a perspective focusing on the things and ways teachers believe is essential if we are to better understand their actions (Atkin, 2000; Czerniak et al., 1999; Lumpe et al., 2000; Pajares, 1992; Tobin et al., 1994). According to behavioral psychologist Bandura (1997), beliefs are the cornerstone of decision-making. Clusters of beliefs around a particular situation influence attitudes, and attitudes become action agendas that guide decisions and behaviors (Azjen, 1985; Bandura, 1986; Pajares, 1992).

These various claims about links between vision and teaching practice are important to consider in the light of teachers' comments justifying their students' participation in informal learning experiences. If, as I believe, the enduring value of informal experiences is largely determined by how the experience is extended, leveraged, and supported outside the informal setting, then understanding the perspectives and intentions of teacher participants in these programs, and the ways in which they relate to the beliefs, purposes, and practices of those they visit, is imperative.

In *From Knowledge to Narrative*, Roberts (1997) encouraged museums to adopt a "narrative view of education" in assessing the value of informal learning environments for visitors. Roberts claimed, "What and how visitors experience the informal setting has as much to do with who they are as by what the institution is like." She contended that museums may have a far broader impact on peoples' lives than is typically acknowledged, and that to understand the value of these experiences for visitors, informal institutions will have to shift from an evaluation paradigm which traditionally examines

the impact of the informal experience from the institutional perspective, to one of "investigating the visitor experience" (Roberts 1997). This wish to understand and acknowledge the visitor's perspective is increasingly shared by those working in informal learning environments (Doering, 1999; Falk & Dierking, 2000; Leinhardt et al., 2000; Paris, 2000; Pekarik et al., 1999; Winther et al., 2002).

We know that visitors come to museums, parks, and other informal learning environments for a number of purposes and experiences, many of which have now been repeatedly documented and include:

- desire for social interaction (Pekarik et al., 1999; Roberts, 1997; Silverman, 1993)
- opportunities to reminisce, to fantasize, to have an introspective experience (Pekarik, 1999; Silverman, 1993; Walsh in Roberts, 1997)
- search for a restorative experience (Kaplan, 1994)
- educational enrichment or cognitive development (Balling et al., 1993; Kasper, 1999 in Egana, 2001; Pekarik et al., 1999; Simmons, 1996;)

Only recently have we begun to understand how visitors' purposes can be used to guide the way we design, extend, and measure the effect of informal learning environments (Doering, 1999; Kaplan, 1993; Leinhardt et al., 2000; Pekarik et al., 1999; Roberts, 1997).

In the context of this research, teachers' visions ultimately served as both a guide and measure for examining the connections between informal and formal learning environments. Understanding teachers' visions will help in determining what they bring to informal experiences and how the informal experience might be crafted to affect and/or support that. Moreover, visions may provide new insights into program effects, as

well as help identify areas in need of change. Teachers' visions are also made important by the fact that there is little to no research available on the perspectives of those in the formal education world as they relate to those working in informal educational settings, and on how these views influence the learning experiences of children (Egana, 2002; Falk & Dierking, 2000; Mullins, 1998).

Capturing Vision

Using a written classroom vignette as a prompt for discussion, my goal was to capture visions of education espoused by both case study classroom teachers and those working within the informal setting. I assessed vision alignment across the following domains in determining how visions differed or coincided between and within formal and informal institutions: purpose, pedagogy, content, assessment, and view of resources. These dimensions of vision were generated empirically during evaluation work for CDM and YNI, and represent aspects of teaching practice that participating teachers repeatedly claimed were somehow impacted by, or influenced the informal experience. These dimensions also represent what I consider to be the basic elements of teaching. Although all five dimensions were used for coding teachers' vision statements, purpose, pedagogy, and content emerged as most central to the character of teachers' visions and thus received the most attention in what follows.

As intended, the vision prompt was effective at getting at the personal motivations of teachers–less so in capturing institutional visions/purposes for teaching (discussed later). The way teachers mesh their more personal visions with institutional visions and norms for professional practice seems to have implications for optimizing collaborations between formal and informal settings. Overall, study participants seemed comfortable

with the term *vision* in describing their ideals for educational purpose and practice and had little trouble relating their educational images to me. In every case, the visions they described were realistic, thoughtful, and replete with specific examples depicting current or preferred practices. All teachers' vision statements seemed to reflect their personal and often emotional motivations for teaching.

Although our conversations about vision were designed to be open-ended, I was intentional in encouraging teachers to consider the ways in which their visions might be manifest within the five dimensions addressed above. From teachers' comments I developed a list of the types of experiences and outcomes they expected for their students and themselves (see Table 4). It was within these categories that I searched for similarities and differences among teacher responses from both the formal and informal settings. Categories were included only if they represented ideas or themes mentioned by more than one educator. With few exceptions, the visions of the case study classroom teachers and of the informal educators they worked with were similar. The subcategories represented in this table were derived directly from teachers' comments and reflect recurrent language and themes that arose across individual teachers' descriptions of their visions of education.

In addition to the vision statements gathered from the 10 case study teachers (4 informal and 6 classroom/formal educators), teacher vision was assessed through responses to the mailed survey and one time interviews, as well as through examination of the mission statements and educational frameworks of their schools and informal settings. Throughout the remainder of this chapter, the term *teachers' vision* is inclusive

of formal and informal educators unless otherwise specifically noted. The terms *formal educator* and *classroom teacher* are used interchangeably.

Table 4 *A Comparison of Visions of Case Study Classroom Teachers' and those of Educators Working Within the Informal Setting They Visited*

Vision Alignment	YNI Education Directors	YNI Schools	CDM Education Directors	CDM Schools
Purpose				
Opportunity/access/exposure to new places, ideas, and people	√	√	√	√
Fostering Community Building/Relationships/Group	√	√	√	√
Experiential Learning Cycle, Questioning, life long learning/desire to learn	√	√	√	√
Citizenship	√	√		√
Stewardship/Awareness	√	√	√	
Connecting to a Resource (people and place)	√	√	√	√
Pedagogy				
Student Centered	√	√	√	√
Multiple Ability Groups	√	√	√	√
Real-world/Hands-on/Experiential	√	√	√	√
Thematic Teaching	√	√	√	√
Discovery Learning			√	√
Content				
Emerging from Questions			√	√
Science	√	√	√	√
Interdisciplinary	√	√	√	√
Resources				
Expanded view (people, places, ideas, tools, texts etc.)	√	√	√	√

Vision Alignment	YNI Education Directors	YNI Schools	CDM Education Directors	CDM Schools
Assessment				
Performance Based		√	√	√
Unclear	√	√	√	√

Note. Shaded areas reflect categories and codes from teachers' vision statements that will be covered only indirectly in this document.

Examples from Teachers' Visions

The remainder of this chapter describes the principal foci of teachers' visions within the categories of purpose, pedagogy, and content, and the ways in which these foci might serve as indicators for shared practice between formal and informal settings. Next, the chapter provides an explanation of how career stage or years of teaching affects teacher vision, followed by a summary of key findings and implications for further research. How these visions played out in classroom and informal setting practice is depicted in chapter 5.

Purpose

An area of particular importance, which teachers reported to be the basis of all other actions, was their beliefs about the overarching purpose of schooling. As shown in Table 4, the subcategories (mentioned by study participants) listed under Purpose are suggestive of how teachers in both settings perceived their work, the role of education in society, and its capacity to make a difference in children's lives. Their visions revealed a focus on changing the learning experience for individual children with the broader perspective of how this change, in turn, will influence society. For teachers involved in

this study, the educational purpose on which these subcategories converge was to empower students through lifelong learning and thinking in new ways, and through the development of learning communities that provide access to important ideas and opportunities.

Opportunity, access, and exposure.

Although case study participants came from a variety of institutional contexts, and worked with students representing a range of socioeconomic backgrounds, they expressed similar interests in providing their students with opportunities, access, and exposure, to connect with new surroundings, content, and ways of thinking. Participants gave clear reasons why this should be a primary goal for their educational visions; their reasons were linked to a desire to have their students view themselves and their surroundings with an enhanced sense of the possible:

> BioSITE lets students meet adults who come from other places. They have facilitators from Australia and Japan. The girls can meet adult women who are scientists. They get a variety of experiences that expand their perspectives--even seeing that they live in a city where nature can thrive. If you live in a city you will tend to miss the nature that is coursing through it. (TM, Formal educator)

> All of a sudden because they've gone on these trips and because we have read more and done more they all of a sudden say, "Hey, I could become a movie star, I could work in theaters; hey, I could work in science, I can become one of those people who counts bones. In this area it is very hard for children to come away thinking positively about themselves. They think more about I can't do this than I can do this. So that is a really big goal of mine. To give them hope. That's really important in this area. They need hope that there are possibilities. That they can be a caterpillar turning into the butterfly. (PL, Formal Educator)

> The kids from Beverly Hills have different kinds of deprivations to hurdle. So Beverly Hills kids are getting some exposure here too. Again it's something bigger than you . . . so opportunity, exposure, and a little hardship for a new understanding. (PD, Informal Educator)

> For some it's just the opportunity to be outside. A lot of families don't take advantage of this place even though we're so close. Getting outside, more of an appreciation of the world around them. New awareness that some of that will transfer. Get kids who have never been anywhere out–see it, touch it, do it. (EW, Formal Educator)

Through their comments these teachers showed that they are interested in pushing children to reach beyond the conventional limits placed on them. Their visions revealed a way of thinking that rebuffs conformity in exchange for images of what might be (Greene, 1995). Thus, teachers in both formal and informal educational settings placed a priority on creating occasions for students to develop an expanded appreciation for where and how learning can occur. Additionally, they hoped that students would come to view education as something that can and does happen everywhere, and their surroundings as something that they can influence and that in turn influences them. YNI's core educational theme's sense of place and interconnections reflect this emphasis and form the basis for what counts in environmental education. Paramount to the mission of environmental educators is the notion that students will leave their experience with a better understanding of how important they are in shaping their surroundings, and vice versa. This message is meant to be both empowering and sobering.

The following was taken from YNI's Core Educational Framework:

- Develop a Sense of Place - entails understanding the physical characteristics, human history, and temporal nature of place. Additionally, understanding the value of National Parks and Recreation areas, specifically those that house YNI campuses and their relation to the student's home environment are central to this theme.

- Understand Interconnections - "students learn how physical and cultural aspects of place are interrelated in order to understand their own place and role in their environment."

Further evidence of teachers' priorities came from the larger sample of one-time interviews and surveys. During telephone interviews with classroom teacher participants in CDM and YNI, I asked teachers to explain their motivations for involving their students in informal experiences. Like their case study counterparts, they acknowledged the importance of providing students with opportunities to alter the way they saw themselves and their surroundings.

> Even though we live right here, most don't get the opportunity to go into the outdoors; they don't even know where Puget Sound is. (PM, Interview)

> We are in South Los Angeles, 99% Hispanic, middle-low to low income. Our goal is to get kids out of this environment and exposed to something new. (JW, Interview)

> I teach my students how to day dream . . . part of that [those dreams] comes from having access to new experiences. (KH, Interview)

This sentiment was also repeated in the survey data. In responding to the open-ended prompt, "What do you hope your students will gain from this experience?" approximately one third of all formal teacher participants regarded access, exposure, and opportunities to experience new surroundings, people, and ideas as important benefits of participating in informal experiences (see Table 5).

> Poverty ridden children need to experience the world outside to view the possibilities the world offers. (Survey 229)

> Many of our students have not had the opportunity to visit such a place. This stimulates their thoughts and ideas. (Survey 131)

> Most (kids) do not get to go to places like CDM. It provides experiences and ways to learn outside of a classroom. (Survey 107)

Embedded in all the comments reviewed thus far is the notion that exposure to novel settings, objects, phenomena, and ideas (or alternative/reinforcing ways of thinking about the familiar) stimulates new awareness and possibilities for individual growth. In

informal learning environments objects, places, and phenomenon serve as the text for "institutional stories" but they also provide cues for students' own narratives (Paris, 2000). Thus, the educational purpose of informal and formal educators alike becomes one of inspiring children to consider the wider context in which information is represented and its many possible meanings for them. This belief that successful informal learning environments exist to prompt visitors "to ask and to answer the question what transformation is possible for me here" (Carr, 1993, p. 17) while increasingly shared by the wider informal learning community represents a shift in the way we typically talk about and value educational settings (Roberts, 1997). Viewed in these terms, education as such is expanded beyond a traditional "transmission-absorption model" of learning to one that encourages children to see beyond the particulars of the information encountered and to enter what Greene (1995) called a "kind of imaginative awareness," state of learning "that enables those involved to imagine alternative possibilities for their own becoming and the group's becoming." According to the teachers involved in this study, education in informal and formal settings is not just about sharing information; it's about individuals identifying ways to use these experiences in ways that are significant to them. According to Carr (1991), "critical cognitive experiences in cultural institutions create landmarks, reference points, watershed experiences that become permanent parts of an individual's repertoire of performing data"(pp 19-20). Exploring how children use informal learning environments to transform their knowledge and notions of self can help focus the way we structure such experiences and enrich theories of learning (Kaplan, 1994; Paris, 2000).

Fostering community and sense of place.

Although establishing opportunity and access for individuals through exposure to new places and ideas were highly valued aspects of their visions, teachers recognized that much of this individual growth is contingent upon and fostered through connections with the group. Thus, building relationships and establishing student learning communities were important priorities for many teachers (see Table 5).

Table 5 *Findings Based on the Survey Question. What do you hope your students will gain from this experience (specific content, academically, socially, personally, etc.)?*

Response categories	YNI (Percent)	CDM (Percent)
Discovery/problem-solving/hands-on/questioning	44	30
Science/connection to curriculum	44	38
Opportunity/access/exposure	29	31
Group/relationships/community	47	30
Personal Growth of Students	26	22

Note. Percent for YNI, n = 138; for CDM, n = 253. Total percentage exceeds 100, since teachers often supplied more than one answer per question.

From relationship building to seeking an emotional connection, interactions among students and between students and their teacher were important goals for informal and formal educators. Specifically, formal and informal educators stated that they wanted children to learn in settings where everyone contributes meaningfully. They wanted to construct learning environments where children come to see themselves and each other as important resources. So, for these teachers value was determined as much by experiences with one another as by the physical surroundings with which they interacted.

Building communities of learners seemed to fulfill a number of distinct but reinforcing purposes for teachers, each related to their conceptions of knowledge and how that understanding is produced and subsequently used. First, by providing group

learning experiences teachers sought to offer students a space in which to discover and to develop a shared understanding of what they knew:

> A lot of it is because these kids are LEP (Limited English Proficiency) students so this [the informal experience] gives them language opportunities where they haven't had that before. They can share a same type of thing with a group of kids that can understand what they are trying to talk about and write about, because it's a shared experience now. And when you say, 'Have you ever seen seeds from around the world?' they all can put their hands up now. For the kids that are disadvantaged I find that a real advantage because then it's like a thing they can share together and relive and talk about. That becomes a real good jumping board for them. (PL, Formal educator)

> This experience provides background knowledge to bring to their reading assignments (Survey 106).

Student participation, and by extension membership in a learning community, was seen by some teachers as mediated by access to a shared core of background knowledge (Hirsch, 2002). By balancing inequities in cultural capital through group experiences in informal settings teachers hoped to foster participation among students and enhance opportunities for future learning. This belief is supported by research which suggests that when children have opportunities to explain their learning to others they are more likely to remember the experience and use the information in another setting (Bergin, 1989, in Paris, 2000; Price & Hein, 1991).

Informal and formal teachers complemented this more static view of knowledge with a perspective of knowledge as negotiated. Some of what is shared among students is not just basic content knowledge, but also an appreciation of how different students perceive that content, demonstrate their understanding, and come to view peers and themselves as resources:

> I want to give kids a chance to be seen and to see each other in a new light. You build different relationships in this setting. It's a unique shared experience with your group. (Survey)

> Sense of belonging–whatever the group is that every kid would feel a sense of belonging . . . Kids sitting in groups, setting up interpersonal grouping–gets at an awareness of group and group as resources. . . It's always about the social context of learning and that peers are resources for one another and how you provide access to the exhibit. (JM, Informal educator)
>
> The social thing with the kids can't be neglected. All these cooperatives are doing it together and each perspective is needed, so that can't be neglected. It's a huge part of the experience. (PD, Informal educator)
>
> There definitely is that academic part, and of course, well it's school; it should be academic. But I think it should be so much more and that's what the program has to offer. Making those connections, building groups, working with groups, respect for self as well as for each other. (AT, Interview)
>
> So that's kind of my thing, my goal, what I'm trying to capture is that student connection on another level more than what you can get inside a classroom. When you go outside the classroom. (RT, Formal educator)

It was the opinion of study participants that a successful learning community takes into account and relies on the multiple perspectives represented by the group. Based on this view, the educative role of informal learning environments morphs "from providing authoritative interpretation to facilitating the varied interpretive activities of visitors and encouraging dialogue and negotiation among these different views" (Doering, 1999).

Research on family groups (typically, one or more child visitors accompanied by one or more adults in groups no larger than six) indicates that when experiences were designed to facilitate group interaction, learning and meaning-making actually did result (Borun et al., 1996, 1998). Additionally, when school visits were set up like family groups, children learned more and had better attitudes toward science (Griffin, 1998, in Falk & Dierking, 2000). As reflected in teacher's comments, the sociocultural aspects of the informal learning environment have implications for students learning beyond the

informal environment itself. However, with few exceptions most of the research has focused on group interaction among families; very little has focused on or even considered the sociocultural context of school field trips and the role it plays in children's subsequent learning (Falk, 2000) or their relationships with others (to be explored in the next chapter). Because this appears to be a shared expectation of educators in both settings, understanding the sociocultural dynamic among student participants poses important opportunities for continued collaboration (see Paris, 2000, p. 14, Opportunities for Research).

Experiential learning cycle, questioning, and a desire to learn.

Questioning, exploring, discovering, decision making, problem solving–in short, supporting students in the active creation of personal understanding, were recurring themes in formal and informal teachers' educational purpose for their students. Motivating student interest and curiosity was seen by teachers as a starting point for this agenda. For 44% of YNI teacher participants and 30 % of CDM teacher participants questioning, discovering, and/or explorative experiences were listed as examples of what they hoped their students would gain from a visit to an informal setting. Like Csikszentmyihalyi (1995), formal and informal educators believed that with such inspiration students' question development and a classroom curriculum based on those queries would naturally emerge:

> It [quality learning experience] would look like a kid talking to an adult or another kid, or noticing something and being encouraged by another individual to ask a question. Or it would look like a kid noticing something and being encouraged by another individual to find out the answer to it. It could be anything that gets kids thinking, gets them excited about thinking and makes them want to find out the answer and makes them see how finding out the answer can sometimes be difficult; it can be hard but it's worth looking. And getting the answer can be as simple as asking people who have already studied that and listening to all the

different sides and deciding which makes the most sense to you. (TM, Formal educator)

They need to explore and discover and question for themselves. Each child will discover something different and that leads to something else and so on. I don't have an agenda, I want them to explore and discover. And when they come back, depending on what their interests are, we will build from there. Some like bubbles, others magnets. (KD, Interview)

Teach them how to understand their questions, how to ask more questions, understand how to make sure that they value the question and possibly that there is more than one answer. My ideal teaching situation is if I was teaching science or anything else—I would be able to incorporate all of that into an idea that the kids wanted to learn about. That way you can take the students in any year or any place and they sort of come up with the idea, the theme. (SD, Informal educator)

Student questions were seen by teachers as important indicators of student interest and current understanding as well as the first step in an overall process of knowledge construction. This view seems to coincide with findings from the research literature that demonstrate question asking as a component of thinking skills for learning tasks and as an essential stage in the problem-solving process (Ashmore, Frazer, & Casey, 1979; Dori & Herscovitz, 1999; Shepardson, 1993):

Knowing what the question is and how to get the answer. Knowing what would be the most valuable tools to get the answer, understanding the resources or whatever material you are looking at–then being capable of explaining that material in your own words. I really believe that any kid that can find the answer to any question has learned everything they need to know. But then in addition they need to have the desire to want to find those answers . . . What I would love to do is teach them in a way that makes them want to seek out answers on their own.. (BL, Formal educator)

Where kids are inspired to ask their own questions and in an investigative manner—pulling on multiple sources of information—are able to answer their questions and likely generate new questions. (TM, Formal educator)

What I really want is for kids to make up their own minds. To have some experience engaging in issues. Giving that experience. Exposure grappling with issues so it will become second nature. (PD, Informal educator)

I guess it's the experiential learning cycle. To give experience, and reflection about that experience, and applying that experience over and over again. So my

> general concept of the experiential learning cycle is the experience itself, and then sort of *what, so what, now what. What* is first – what you actually experienced. And then the *so what* is thinking about what did I learn from that experience or what am I taking away from that experience. What did I find out that I didn't realize before? And then the *now what* is applying it to other things that you know – to new experiences or relating it to your life and other experiences. And then coming back to the *what* again and complete the cycle by having a new experience that is informed by the previous experience. (JM, Informal educator)

Knowledge of how to describe problems effectively, procedures useful for making judicious decisions and the search for a particular action from among many possible actions are all outcomes of the questioning process (Dori & Herscovitz, 1999) and were prominent features of effective teaching in participant teachers' visions. In this model, students are expected to move beyond the text book and teacher as sources of knowledge, and schools and informal settings shift from being the ones who know for those who don't know to a mode of joint searching and experimenting (Roberts, 1997). The role of formal and informal educators becomes one of empowering students to look and question for themselves, thus acknowledging more than one way of knowing. Education becomes more about demonstrating understanding and evaluating the meanings students encounter and create, and less about providing specific answers.

Pedagogy

Teacher participants spoke in terms of the persons they hope students will become, particularly when referring to their purpose as educators. Qualities of that end state are embodied in students who are self-motivated learners, problem solvers, appreciative of multiple perspectives, able to work in groups, and aware that there are many opportunities available to them.

The teachers involved in this work have begun to see these qualities as aspects of a whole and to think of the educational expertise and techniques that may foster them as

interrelated. In supporting their visions, teachers believed that how they structure the classroom and their own lessons is at least as powerful as the formal curriculum.

Of all the aspects of teachers' visions targeted for this research, accessing teachers views of pedagogy was most readily achieved through the use of the classroom vignette prompt (see appendix B). Thus, teachers' visions for pedagogy were based almost entirely on the preferences and dislikes they articulated in referring to the classroom vignette, and this is reflected in the quotes selected for this section.

Placing student at center of instruction.

Identifying and placing student interests at the center of instruction were seen as important elements in the preferred pedagogy of teacher participants. As discussed above, not only did teachers view starting from students' questions as an important motivator for learning, their comments also suggest that such an approach is fundamental to the development of more autonomous, self-directed learners.

> My ideal teaching situation if I was teaching science or anything else would be to incorporate all that [vignette activity] into an idea that the kids wanted to learn about. That way you can take the kids in any year or any place and they sort of come up with the idea, the theme. I would put it in their laps. I would say this is your job . . . I'm here to help you but basically you need to come up with what you want to get from this and we'll talk about it and we'll figure it out and try to nail it down, how to do it. (SD, Informal educator)

> I didn't like the classification, name learning in this lesson. That type of data focuses on memorization of facts in a way; which may also be good because maybe I go too far to the inquiry end. I would go beyond the identification focus. There was no way for students to have a question and follow up—hard to see where questions would come up in this format. For example, if the kids notice differences in texture [in the plants] . . . so my job is to provide information and access. Provide materials for asking questions, not all the answers. (PL, Formal educator)

Teachers also seemed to recognize that placing students' ideas at the center of instruction has an impact not only on the curriculum; it also alters the roles that they and

their students possess in the classroom. Although still strategic and essential, the pedagogical visions of teachers in this study advocated for adopting a less directive role for teachers in the teaching/learning process for one that requires students to take on more responsibility for their own learning (content and process). There are payoffs to this approach. For example, we know that children exhibit more curiosity, initiative, and persistence when their inquiries are related to their interests (Renninger, 1992). We also know that students who are given an orientation focusing on their personal agendas do better on more traditional measures of achievement than other groups (Balling et al., 1992, 1995, in Bailey, 2002, Hidi & Harackiewicz, 2000).

But a pedagogical vision that places the student at the center begs the question, which student (s) and student idea (s)? Consequently, teacher participants also saw access to opportunities for learning for more students as influenced by a pedagogical approach. Specifically, teachers felt that instructional practices involving the use of multiple intelligences, real-world settings, objects, or phenomena, thematic/cross-curricular teaching, and attention to the ways students are grouped were important in their own teaching in meeting this goal, and furthermore, were closely aligned with practices they believed would be encountered in informal learning environments (see Table 6).

Table 6 *Findings Based on the Survey Question: Does this trip align with your own philosophy with regard to pedagogy or how students learn?*

	YNI	CDM
Answered yes	100	95
Hands on teaching	90	90
Engaging w/ authentic objects	86	78
Appeal to multiple intelligences	84	81
Thematic/cross curricular	72	53
Mixed ability groups	76	67

Note Percent for YNI, n =142; for CDM, n = 241

Multiple intelligences.

References to multiple intelligences theory (Gardner, 1993) were common to teachers' pedagogical visions. Based on the premise that "different world versions may be understood to derive from the particular symbolic forms in which one's mind is specialized to deal" (Roberts 1998), teachers relied on multiple intelligences as a means of providing students with greater access to learning and ways of demonstrating knowledge:

> This is probably what I try and do, much of what she has done here, with maybe not as much time to do everything at once. One of the things we do is spread out to meet the different learning styles, because everyone is very diverse. And I tell the kids what I do when I do it. I think it's important for them to understand, well, today we are doing a visual introduction and this is for those of you who are visual learners. The trick is to give something new but in a different way. (RT, Formal educator)

> My philosophy of a project is this: I tell you what I want you to; do it's up to you how you present it to me. You can sing it, you can present it; you can write it; you can PowerPoint; you can do all this stuff, because different kids have different abilities. Richard could not do this project (Hero pyramid) but he can do a PowerPoint presentation. I have kids who are not good at drawing but they are good at writing, so this shows me where it is. (BL, Formal educator)

> I'm sure there are a whole group of thinkers we haven't encouraged in the right way to enable them to make full use of their scientific ability. (TM- Formal educator)

> Students get to experience a lifelong learning experience through use of other intelligences. (Survey 124)

> I have a mixed-up pedagogy so that I can reach more children. The same teaching will not work for everyone so I come at everything from a lot of directions. (KD, Interview)

Of all the "intelligences," opportunities for hands-on or tactile experiences seemed an especially appealing aspect of the informal experience for teachers. Close to one half of all case study teachers and survey/interview respondents indicated that a

hands-on, interactive experience was a principal motivation for participating in an informal learning experience.

> I want to provide hands-on activities, a chance to manipulate objects while learning about them. (Survey 42)

Real world/experiential education.

The ready availability of "authentic" objects, phenomena, or places relevant to the concept under study is what distinguishes informal learning environments from other settings. Thus, students who visit an informal learning environment are not asked to think about Bernoulli's principle in the abstract; they develop understanding in context by experiencing it firsthand. The real world, with tangible aspects of the informal setting, was an essential lure for teachers in support of their pedagogical visions.

As conveyed through their visions, real world settings/experiential education also afford students the space and authority to evaluate their surroundings and the information they experience on their own terms. Creating explanations based on supporting evidence and relating those interpretations to things they already know or may encounter in the future were the markers of a successful teaching and learning episode for teacher participants. Less important was the capacity of students to recite back the teacher's (both formal/informal) version of what students may be experiencing.

> The fact that they are going outside in the "real world" to see flowers and collect. I like the idea of prediction ahead of time. That's all part of the experiential learning cycle—apply former knowledge to a new setting and reflect on what they found and how it relates. (JM, Informal educator)

> What I would love to do is teach them in a way that makes them want to seek out answers on their own so that they can say—not so they don't trust what people are telling them but that they can find ways of verifying that, maybe finding other sources that support that. Howard Zinn says you have to go to the first source. Kids don't have access to first-source materials very often but they can have access to materials that probe those first sources, present them in context and

> explain them. There are different arguments. I mean, we teach science so often as something that *is* because we understand it in a certain way but when you get to the original question of where everything started no one really knows. (TM, Formal educator)

> We do hands-on. Like with habitat we dig on school grounds, record our thoughts; we try to experience real things, use tools, thermometers, make sure of the connections—something that is applicable, something that affects our lives or illustrates that. (SL, Interview)

This kind of valuing of lived experience complicates individual and collective representations of content (Barton, 1998) by making teachers (formal and informal) acknowledge the situated perspective.

Theme-based instruction.

Finally, working under the umbrella of a big idea or theme as a connector for content across disciplines or within a discipline was another aspect of teachers' preferred practice that was privileged as part of their visions.

> It sounds like a cross-disciplinary structure and that the teachers can pursue their subject for a little while. So that sounds great, I like the sound of that. It's giving students a lot of opportunity for doing their own learning. I love that she goes outdoors. It sounds like a lot of different things she covers in just a few days—like, well, the taxonomy that could take a while. I wonder, some people use a theme, use that word as an equivalent to a subject or topic . . . but I want to know what are her messages to this. What is she trying to say about fall wildflowers, OK, so what? So in our structure we are trying to use a theme or statement to help the kid connect all of this. (PD, Informal educator)

> Liked self-paced instruction, noncompetitive grouping, small classroom, lots of resources from texts to tools. The main, I guess the biggest concern with this lesson is that I was never a name girl. And all my natural history classes were such a big struggle and I still look at a bird and I struggle because I know I've learned it, seen it, watched its behavior, and I still am not quite sure of the name right now. I'd like to see this activity not so much focused on learning names but the talent or skill of observations and comparisons and a little of that is in here but not as much as I would do. The first thing I would have done is take them out into the environment and let them not touch anything, just look to see what's out there. And then maybe use hula-hoops or transects and they could study what's out there but get that big picture, and the identification would become a consequence of an activity, not the purpose of the activity (PL, Formal educator)

Content

None of the findings discussed thus far negate the other more familiar factors that bring visitors to museums and make their experiences meaningful. There is no question that many teachers go to informal settings to get specific information and that access to content is an important component of their educational visions and can be an important motivator for their participation in informal experiences (Bailey, 2000; Egana, 2001; Mullins, 1998; Roberts, 1997).

Commitment to School-based Curriculum

As shown in Table 5, when asked in general what they hoped their students would gain from an informal learning experience 44% of YNI teacher participants and 38% of CDM teacher participants stated that they hoped the experience would connect with their school-based curriculum or content. Furthermore, when asked directly if they wanted a specific curricular need met, 62% of YNI teacher participants and 36% of CDM participants said yes: Fifty-nine percent of CDM teachers and 45% of YNI teachers reported that their needs were in the content area of science. For some teacher respondents science needs were attached to state standards, a specific science concept being covered, or curriculum in use at the time:

> Educationally this is really in line with the California Frameworks. Sixth grade is earth science and seventh grade is life science, so it builds on what they are getting in class. (JW, Interview)

> One, I love the outdoors Two, opportunity. Three, excites them about science, and this is in line with the Washington State standards. We study the wetlands, rain forests, tide pools, Native Americans of the Northwest, geography. (PM, Interview)

> What I'm looking for in CDM is the hands-on that aligns with our science. And the permission slip that I sent home said that we are going to the CDM because

> their exhibits align with our science unit. So I'll be looking for evidence of shelters, evidence of simple machines and how heat moves and things like that, and maybe we won't find all of it but we will certainly find certain parts of it and that's fine. (AB, Formal educator)
>
> Many of the activities support one of our science units on motion and energy. (Survey 148)
>
> Culmination to solids, liquids, gases science unit. Introduction to matter (Survey, 110)
>
> Academically I want them to experience Newtonian laws of physics, and lay foundation to understand balance and motion, which is part of first-grade curriculum in my district. (Survey 59)
>
> Culmination of first-grade study of simple machines (Survey 150)

For other teachers, the more general objective of motivating an interest in science or some other content area was the goal.

> . . . to stimulate children's interest in science and social studies (Survey 276)
>
> I come for the hands-on activities to get them interested in science as fun. (Survey102)
>
> We set several areas as must-sees because they tie with different areas of our curriculum. (Survey 111)
>
> This helps our students to develop a good attitude toward learning science and learning in general. (Survey 88)

View of Science as Subject Matter

Conceptions of science and how it should be taught were also embedded in teachers' visions of education with regard to content. A number of researchers have pointed to the connection between teacher-held beliefs regarding subject matter and instructional practice (Atkin, 2000; Helms, 1996; Stodlosky. 1988). With regard to science in particular, Helms (1996) contended that beliefs about science influence what

teachers think warrants attention in the curriculum, pointing to the relationship between what teachers considered special about science and what they did in their classrooms.

In this study, more than half of those teachers who wanted a connection to science referred to the value or importance provided by the hands-on exposure to science that an informal experience would provide, signifying a view of science as a discipline that is perhaps different from other subject areas. The message conveyed through the teachers' emphasis on hands-on science was that of science as something that one does, as subject matter that is best encountered/learned outside the textbook:

> The great thing about science is it can be hands-on. Reading is a big part of social studies. But with science you could give them a problem and they could solve it. (TM, Formal educator)
>
> To provide a loose structured opportunity for my first-grade students to have hands-on experiences with scientific principles (Survey 142)
>
> Explore hands-on science activities. (Survey 146)
>
> Introduce first-graders to hands-on exploration of science ideas and concepts (Survey 266)

Real-world Experiences/Connected Ways of Knowing

A related priority for teachers was the desire to connect classroom learning, particularly in science, to real-world settings or applications:

> Show science as real in our world. Interact creatively with science. (Survey 176)
>
> I think you need a basic foundation for learning in terms of content. But that foundation needs to tie into your practical life for your daily living. I think that is very important. We talk about that all the time. . . . I'd like to think that I have introduced them to some concepts that they will be able to live on later on so that's something they can use in the future. (BL – Formal educator)
>
> The way I thought about environment as if it were a total metaphor for human community and a great venue for teaching people about themselves. Straight science is too narrow. I want to link those two things—ecology and human elements. So environmental education is the explicit focus with the subtext of

> team building, a community of people that care where food comes from, living real lives, and having real relationships. (RO, Informal educator)
>
> Connect children's learning from classroom to real situations outside the class. (Survey 149)
>
> Better understanding of how specific concepts in language, music, and science can be applied in a real-world setting (Survey 132)
>
> That they would be exposed to the idea that many aspects of our lives and culture are related to science. (Survey 64)

Teachers are placing greater emphasis on teaching approaches that relate the science one is studying to specific (local) circumstances (Atkin, 2000; Barton, 1998; Fouhey & Saltmarsh, 1996; Vander Mey & MacDonald, 2001). Undergirding this practice is the belief that work in a real-world situation allows for more "connected ways of knowing" (Fouhey & Saltmarsh, 1996) that personalize and make concrete students' understanding of subject matter that has been traditionally viewed (and experienced) by students as remote and out of touch.

Role of Career Stage: Who is missing from these visions?

I started my analysis by stating that with only few exceptions the visions of education espoused by formal and informal educators were more alike than they were different. I still believe this to be a true statement, but perhaps limited by the type of teacher who chooses to participate in informal learning experiences (or who chose to participate in this study).

Where are the beginning teachers?

The majority of educators who responded to my survey were experienced teachers, with close to or more than half (CDM = 40%, YNI = 54%) reporting that they had been teaching more than 12 years (see Table 7). Although this finding is inconclusive due to

the high number of nonrespondents, it aligns with a survey conducted by the Smithsonian Institute in which 56% of teachers who use Smithsonian in Your Classroom reported that they had been teaching more than 10 years (DiGiacomo et al., 1998).

Table 7 Findings Based on the Survey Questions: How long have you been teaching (circle one)? What grade level do you teach?

	YNI	CDM
0 -2 years	13	22
3-6 years	17	17
6-12 years	17	20
12 + years	54	40

Note. Percent for YNI, n = 138; for CDM, n = 254

However, not only does it appear that veteran teachers are more likely than their less experienced counterparts to participate in informal learning experiences, the visions of beginning teachers who participated in this study also suggest that they may go to informal settings for different reasons and may provide a qualitatively different experience for their students as a result of their participation. In talking about the obstacles of making field trips or creating learning opportunities in the classroom that were informal in nature, beginning teachers who participated in this study referred to the mess, noise, reliance on the text book or text-based resources (dittos), and difficulty in formally grading/testing the experience.

> And in terms of bringing it back with the science it will be just a good reference point and it will be a hands-on activity. And you don't always grade their hands-on activities; those are more for experience than for a grade in my grade book. (AB, Formal educator)

> It's [science and informal learning experience] not on the SAT 9, though, and we are getting that pressure, and although it comes from district, state, and community, our parents are aware of school, individual, grade level, and district scores. (AB, Formal educator)

Further evidence supporting differences between veterans and beginning teachers came from the survey data regarding pedagogy. Of the small percentage (5%, 12

individuals) of teacher participants who said no to the question, "Does this trip align with your own philosophy with regard to pedagogy or how students learn?" (see Table 6) all but two were teachers with 0 to 2 years of teaching experience, indicating a fundamental disconnect in what we might expect to see within veteran and beginning teacher practice.

> I like to do hands-on. But a lot of the time it takes more planning, harder to do because you have to expect some noise and you need to know, you need to know the difference between social noise and learning noise. (AB, Formal educator)

In addition, beginning teachers' reasons for participation were based almost wholly on making a specific curricular link. For the 2-year novice teacher who participated in my case study, the informal learning experience was ultimately used as direct replacement for the Simple Machines science unit at her school site. Although she intended to "get to the Simple Machines text" there never seemed to be time in the schedule to do so. For this teacher, a preference for social studies, combined with what she perceived were the school's priorities for reading and math, took precedence in the curriculum.

Other Characteristics of the Classroom Teacher Participant

Although not directly related to their visions, the particular backgrounds of teacher visitors to informal settings seemed to influence them in taking their students on a field trip (see Table 8).

Table 8 *Finding Based on Response to Survey Question: Did your background or personal interests influence you in making this trip? If yes, please explain.*

	YNI	CDM
Answered yes	77	61
Teaching philosophy	27	37
Childhood informal experience	6	6
Science/EE/Naturalist Background	23	9
Enjoy outdoors	52	0
Previous visit with own family	--	11

Note. Percent for YNI, n = 111; for CDM, n = 156

Although a shared philosophy of how children learn was the predominant background factor teachers listed as an influence on their making a field trip, a number of other factors which have been shown in the literature to influence visitors' museum going and career choices were also important. For example, as illustrated by Florence in Falk and Dierking (2002) and confirmed in other research studies, we know that a range of early childhood experiences seem to be correlated with museum going (including reading, talking, family trips, scouting). Museum attendance is especially influenced by such experiences, as well as by parental modeling (Roberts, 1997). Visits to informal learning environments in turn may be influential in the career choices individuals make later in life. Significant studies include works that have sought to better understand the career choices individuals make. Chawla (1999) interviewed 56 environmental professionals in Kentucky and Norway and found that the most prominent factors impacting environmental action and commitment included the following:

1. Experience in outdoor setting as youth
2. Family values and actions
3. Organization membership (outdoor and environmental groups)
4. Observing and awareness of destructive events or issues (habitat destruction, pollution, radiation)
5. Education (memorable teachers, university classes, hands-on activities)

Chawla's study, based on one- to two-hour interviews, provides personal anecdotes and reflections on the development of environmentally responsible individuals.

Implications

What stood out in teachers' vision statements was a desire to create personal educational experiences for their students. In meeting this goal formal and informal educators will need to structure experiences that support participation in many forms,

such as guidelines for museum visits that encourage and rely on student inquiry, deliberately making connections among various contexts, and acknowledging new ways of knowing by allowing students to share their interests with others (including educators in the informal setting and school). It will mean extending the group dialogue beyond the temporal limits of an informal learning environment.

Summary

The bulleted points below are designed to provide a brief synopsis of key findings or highlights from this chapter.

- Understanding the educative value of the informal learning environment requires an understanding of the reasons why teachers would choose to go and how those reasons influence what is learned. This study used the self-reported visions of formal and informal teachers as a means of creating a portrait or profile of the teacher visitor.
- Visions allow for the identification of what is important to formal and informal educators. This increases the potential for understanding what perceived or actual opportunities exist for relationships between the museum experience and school. The approach used in this study provides the opportunity to assess the quality of informal visits based on vision elements (something that will be explored in the next chapter). It also provides future opportunities to create or plan experiences that meet shared vision components.

- Teachers' visions suggest that educators recognize that the impact of their teaching and/or these experiences may not be immediate, but rather, that they provide a framework of experience children will build on.

CHAPTER FIVE: VISION IN PRACTICE

HOW TEACHERS AND STUDENTS APPROPRIATE INFORMAL LEARNING EXPERIENCES

I want them to carry over what they learned from up there. Part of why the program is so worthwhile is because they focus on the environment. For example, I was with a group that went to the beach to pick up trash. We have a recycling center that we do here (at school) and the kids follow through with that and we talk about waste. I think there has to be follow through on what their major thing is. In fact in March we are going to go to Sanborn Park for one of the studies about trees and this ties into what they do there too. Because it is also one of the programs that teaches kids about the environment (BL – Formal Educator)

We know that classroom teachers work so hard on this trip never mind doing an academic preparation at school – the logistics and the mechanics of making this trip happen is gigantic. Every teacher that organizes these trips my hats off to them. It's brutal. And so it's the preparation and then the follow-up is where the experience can really be accelerated. Again it's all the teacher motivation. It's all up to them and how much they can make room for and look at the environment its relevance to kids today and to their lives in the classroom while they still have to prep for this test and that test and kids have achievement tests they have to take (PD – informal educator)

Introduction

A growing consensus among museum professionals points to limitations in the ways we have traditionally looked for and measured the effectiveness of informal learning environments (Leinhardt et al., 2000; Falk & Dierking, 2000; Perkarik et al., 1998; Paris, 2000; Roberts, 1997). Typically research and evaluation in informal learning environments has relied on behaviorist theory, using stimulus - response or transmission - absorption models to assess in very constrained ways whether individuals have learned (can recall) specific predetermined information from an informal learning experience. The tendency of this approach is to privilege the perspective (short term and curricular) of the informal learning environment while inadvertently discounting or

ignoring the cumulative nature of the learning that many informal educators (Doering, 1999; Falk & Dierking, 2000; Hein, 1998), and the teachers in this study believe is likely.

Based on this critique, it may be fair to say that museum educators, researchers and even the public have historically not asked the right questions in ascertaining the full impact of experiences in informal settings. According to Falk & Dierking (2000), "we have searched for inappropriate evidence of learning using flawed methodologies," they contend that a different search image is required to accurately establish the effectiveness of informal learning experiences. This study attempts to narrow the reported gap in current informal learning research: "namely the lack of empirical work investigating what actually is (rather then what ought to be from the informal setting view) happening in classrooms (as a result of informal learning experiences) (Rickinson, M et al.)" by evaluating the effectiveness of informal learning experiences using the expressed goals and behavior of teachers and students as markers of success. It is my hope that the framework provided by informal and formal teachers' visions may bring us closer to being able to more completely document the impact of visits to informal settings by providing insights into their priorities. In other words, I have used teachers' visions as a map that shows where and how to look for the impact of informal learning experiences. The title–Vision in Practice–is meant to indicate the way in which teachers' visits to informal settings and subsequent actions were ultimately useful in supporting their visions for education.

The "transfer of learning" from informal learning experiences to future experiences has been viewed as one of the most valuable components of the informal learning environment (Basile, 2000; Falk & Dierking, 2000; Gass, 1998). But a number

of attributes can influence if, and the extent to which, participants (in this case students and their teachers) will connect experiences encountered in the informal setting to future experiences. For example, we know that teacher intentions for and perception of the field trip experience is an important factor in the overall effectiveness of the visit because the teacher's purpose influences the student's perception and purpose of the visit (Griffin & Symington, 1998; Balling et al., 1980). We also know that the teacher's intentions for fieldtrips may not be oriented toward learning in the traditional sense but rather centered on the experience as an "enrichment activity"; enrichment in this case is thought of pejoratively (Bailey, 2002; Griffin, 1998; Mullins, 1998).

Subsequent experiences, are also contributing factors to what an individual ultimately does or doesn't learn from the informal experience. "It is only as events unfold for the individual after the museum visit that experiences that occurred inside the institution become relevant and useful (Falk & Dierking, p 133 2000)." Understanding the role of teacher vision coupled with how that vision shapes subsequent experiences is the basis of this chapter.

Classroom teachers are often accused of resisting all outside ideas but research shows that most teachers have to transform outside ideas in making them effective in their own classrooms. Pohlman (2000) refers to this transformation of ideas and tools in a particular context as appropriation. I like this term and have "appropriated" it for my own work. What this means is that to be effective teachers must customize "reform ideas" to their particular school contexts and to the individual personalities and needs of their students (Polman, 2000; McLauglin, 1991).

Using their visions as a guide, this chapter attempts to document the ways in which teachers and their students appropriate or transform their informal learning experience within the school context: what elements were taken, what kinds of experiences were generated and what outcomes that led to. Data from a variety of sources were used in making the case for change: teachers' observations and comments, students' comments during focus groups and observations, observations of fieldtrip and classroom activities, and student work in the form of journals, reports, and other curricular assignments.

This chapter follows the format of its predecessor. Each subhead corresponds to a specific aspect of teacher vision; however, data in this chapter address how aspects of vision were manifest in the classroom, either through teacher practice or changes in students. While falling into more general categories - like enhancing personal growth in students- the changes that occurred as a result of the informal experience and subsequent appropriation at the school site happened to individuals and as such are distinct, special, and idiosyncratic. Thus, as this chapter unfolds I try to provide a more nuanced picture by sharing the stories of individuals combined with data from the larger sample. In many instances the examples selected for each aspect of teacher vision may have fit into more than one category. The categories of teacher vision and practice were created out of necessity for analysis sake but seem artificial in a way as each aspect serves as reinforcement for, or an integrated part of the whole vision. Finally, the data are designed to demonstrate what teachers did and how they or their students leveraged, or were changed by the informal learning experience in supporting their visions. Their

inclusion was not designed to advocate for a certain type of behavior or response, rather they provide examples for those in formal and informal education of what is possible.

Purpose in Practice

As indicated in the previous chapter, the educational purpose of teachers' visions was to empower students by creating and/or supporting experiences that inspire life-long learning and thinking in new ways and through the development of learning communities that provide access to important ideas and opportunities for all students.

Opportunity, Access, and Exposure in Practice

As revealed in their visions, teachers believe education will be the consequence of transformative experiences that help children to imagine new possibilities for themselves. Exposure to informal learning environments were considered by teachers as occasions for students to see a different world and thereby see their everyday worlds and its' offerings in a new way. In examining purpose in practice I searched for instances where teachers were creating experiences for and/or students identified opportunities to: develop new awareness and possibilities for individual growth and to use informal learning environments in ways that were personally significant to them.

Janine's story--journey of individual growth

> *As I enter the school I am greeted by Janine. "Hello Miss Barbara, I mean Barbara. Can you believe it? I'm a school representative," she says, pointing to the badge she's wearing on her shirt indicating her new role as a student nominated and elected representative of her classroom and school. With this role comes special rewards and responsibilities: access to the representatives' lounge (a special room with comfortable seating, music, and food), tour guide for visitors, and liaison for the class to school administrators. It was not that the attributes of this position were so remarkable, it was how and who was selected for the position that so pleasantly surprised me. When I last saw Janine, we were both visiting YNI's Olympic Park Institute in Washington State. Janine was there as part of a one-week long class field trip, and I was there as a participant*

observer for this dissertation. We were both newcomers to the class. Janine had recently been "placed" in EW's class. This was her self described last chance as she had already been shifted from class to class within the school; she had the reputation of being a child who was difficult to handle. As is too often the case, Janine's story was one of a broken home, abusive step-father, and a young girl (5th grade) who was being asked to care for even younger siblings. The circumstances of her home life not surprisingly influenced her behavior in school. But EW, Janine's new teacher, also had a reputation; she was considered gifted at "dealing with" the challenging student. Although Janine had just joined EW's classroom the week prior, and despite warnings from her colleagues not to, Janine was encouraged by EW to make the YNI field trip. It was EW's belief that this would be the first step for Janine in becoming a fully integrated member of her classroom community. EW was right. Janine's nervous energy, manic chatter, and inappropriate flirtatiousness was met by EW, the staff at OPI, and EW's students with unwavering patience.[1] *And before long Janine was visibly calmer, more focused on the topics and issues at hand, and filling a meaningful place in the group. A turning point for Janine came when she was asked to share her "expert" knowledge on lichen as part of a "professor hike" activity. She seemed to relish the idea that someone was entrusting her with the responsibility of teaching others. Janine was not content to rely solely on the content printed on the card the instructor had given her. . . she asked questions, and used that information to enhance the scripted piece provided. Throughout the rest of that day and week Janine continued to look for evidence of lichen, noting the different types, locations, and colors as she found them. By the end of the week she was a lichen expert and her fellow students referred to her as such. Other YNI practices (described in more detail later in the chapter) such as, group challenge activities, special group creeds and organizing tropes, and personal notes of inspiration and praise from the YNI instructor (see appendix F for example) combined to support Janine in altering the way she viewed herself and was perceived by her classmates. Why do I share this story of Janine, her teacher, and her fellow classmates? Because it provides one example of how a collaboration with an informal learning environment supported a teacher's vision of creating opportunities for her students to develop a new awareness of themselves and possibilities for individual growth. Janine was dramatically altered by her field experience and her new inclusion in this classroom and her school. As evidenced by her elevated position in, and attitude toward school she had created a new identity for herself that included personal success and achievement as possibilities.*

Janine's transformation was not an isolated case. According to teacher participants, the personal growth of students was a major area of change in students as a result of their informal learning experience (see Table 9).

Table 9 *Findings based on the survey question - Do you notice any changes in your students (academically, behaviorally, personally) as a result of this experience? If yes how do these changes impact your classroom (short/long term)?*

Response categories	**YNI (Percent)**	**CDM (Percent)**
Yes	80	46
Increase interest/exploring in school	19	35
Personal growth (enhanced self esteem, changes in behavior)	22	11
Peer relations (positive treatment of peers, participation/inclusion)	43	14
Retention/enhanced curriculum understanding	19	26
Awareness/appreciation of nature	13	--
Language development	--	10

Note: Percent for YNI, n =138; for CDM, n = 254
Other areas of teacher reported changes in students included: enhanced background knowledge/repertoire for future class work, enhanced peer/teacher relations. Most classroom teachers who responded No to this question did not elaborate, stated that any changes were short term in nature, or (in the case of some CDM respondents) felt change should not be expected from a one hour experience.

Increases in self-esteem, confidence (socially and academically), class-participation as well as improved classroom behavior were all aspects of students' personal growth that teachers reported were affected by the informal experience. For many students this change, as in the case of Janine, had a long-term impact on them and the way the classroom functioned.

> Some students find they are smarter, stronger, and braver then they thought they were (Survey 246)
>
> Self confidence is increased due to the knowledge that they can be responsible for themselves (Survey 346)

> It made a real impression on our students because it allowed them to go outside their normal limits and expand their outlook (Survey 309)
>
> During the field trip some students become more outgoing and that has continued in the classroom (Survey 355)
>
> For my students their world expanded beyond school and family. They discover they can be responsible in public places (Survey 380)
>
> Increased personal self esteem (Survey 87)
>
> Behaviorally one of my students who frequently has difficulty focusing and "acts up" was on his best behavior at the museum. He was stimulated and excited and repeatedly told me that the day of our trip was the best day of his life (Survey 133)
>
> Many students who have low skills in the classroom bloom in this environment – self esteem too. It has a positive effect on the rest of our school year (Survey 147)

Experiential education is defined by what Friere (in Fouhey and Saltmarsh,1996) describes as a process of praxis–reflection and action by individuals on their world in order to transform it. Or put another way " . . . the essence of a museum's public function is to enable the visitor to use museum objects to his own greatest advantage. To call for museum literacy therefore is to call for a theory of instruction focused on teaching visitors how to have personally significant experiences with objects (William Patterson in Roberts 1997 p 70)." For student participants in this study, leveraging the informal experience to their personal advantage and growth also meant making better connections to the traditional elements of school. Teachers shared numerous examples illustrating the improved ways in which students could connect to the processes and content of their classroom curriculum.

> We have an open activity area in our classroom. I think CDM experiences help the children to explore materials in new ways and allows them to create and construct things in new ways (Survey157)

> The children relate new areas of study or review materials based on their experiences and learning at OPI (Survey 231)
>
> . . . able to see how a museum can relate to what they do in school. It adds to school for kids see that learning happens everywhere (Survey 303)
>
> They are more focused in knowing what interests them. I talked with a number of my second graders about what they wanted to be when they grew up (Survey 337)
>
> My science oriented kids tended to explore more of our science station after out visit (Survey 369)
>
> This added to their enthusiasm about school, encouraged creative writing, and challenged them to verbalize their experience (Survey 69)

Roger' story–using the informal experience in personally significant ways

For Roger a student in case study teacher BL's classroom this meant finding a way to bring his Rites of Passage project to fruition. According to BL: "[the school] has a program called the Rites of Passage for the fifth grade to move into the sixth grade. And part of this process they [the students] pick a topic of their choice. One of my boys is doing recycling and how the school can recycle better. One of his biggest peeves is that the school still uses Styrofoam and he has a plan of how to recycle that Styrofoam because it can't be recycled once food is on it so he has this plan of getting hot water and soaking it . . ." Unfortunately, explains BL, Roger was not "making headway with the cafeteria in executing his plan" However, following his field trip to YNI's Headlands campus, where they hold students accountable for the amount of waste they produce in the YNI cafeteria, Roger's ideas had a voice. Now he had a language and an exemplar on which to draw in making his own school based case for recycling. He also had a critical mass of student support – the entire fifth grade that had been on the trip and experienced the plausibility of such an effort. Roger's informal experience held deep personal significance for him. He could immediately apply what he had learned through his YNI experience in the school context.

Roger's story is an example of how a student's interest and attention is determined not by the informal settings inherent appeal but its relevance to their own framework of knowledge and experience (Roberts, 1997); another example of this was found in PL's classroom. Following their visit to the CDM's seeds around the world exhibit and preceding their plants unit, PL's students were observed bringing in packages of seeds or seeds gathered from neighborhood trees to grow or examine on the science

table in PL's classroom. Two girls suggested the class use the seeds to make an -estimate the number of seeds in the can- activity like the one they had seen at the museum. These students also took it upon themselves to provide regular watering for some failing trees that had recently been planted on the school's property. According to PL, the students heightened awareness of the trees could be attributed to both the unit on plants and their recent visit to CDM.

Fostering a sense of community in practice

The two cases presented above point to a view of learning as an opportunity for identity development in relation to one's self, one's peers, and the curriculum. Values and norms concerning community membership are highlighted by this perspective, and were central aspects of teachers' visions. Teacher participants share the conviction that a sense of community is basic to the development of the qualities defining who they hope students will become.

In examining how teachers fostered a sense of community in practice I looked for the following vision elements in their practice: teachers and students developing a shared base of knowledge as a foundation for future learning, enhanced participation and by extension students learning in settings where everyone contributes meaningfully, and finally a community of students (and teacher) who view themselves and each other as important resources.

Teachers viewed group learning experiences to informal settings as a vehicle for students to establish a shared basis of knowledge and the building blocks for future learning. Hands-on group experiences provide the basis for new language to emerge thanks to the shared environment in which students work (Roth & Lawless, 2000)

Teachers recognize and count on this fact and believe that student participation is predicated on access to common experiences that lead to a shared way of talking about them:

> Increased prior knowledge about things so when we talk or write they have a greater repertoire to draw from. (Survey 54).
>
> The children were very verbal about the experience. This is a language delay class so the field trip was a very positive experience. (Survey 342)
>
> It brings a common language and a shared positive experience (Survey 341)
>
> . . .great way to promote oral language skills. As they explained their understanding is solidified (Survey 197)
>
> 75% of my students are ESL. The shared adventures at CDM provide fodder for wonderful follow-up language lessons. (Survey193)
>
> There is so much excitement in talking about their experiences; therefore, they are more willing to write about them. (Survey 306)
>
> Kids bring a lot of language to hands-on science. (Survey 321)
>
> An opportunity to provide additional experiences for my students has long-term value academically as these experiences add to their knowledge base for future activities. (Survey 142)

Roth and Lawless (2000) argue that writing and other formal ways of representing observational and theoretical descriptions should follow opportunities for talking and gesturing science in the presence of the objects and events. As suggested in the comments above, and illustrated through the case below, many of the classroom teachers who participated in this study are using shared experiences in informal settings as a way for students to gain better access to and understanding of the classroom curriculum.

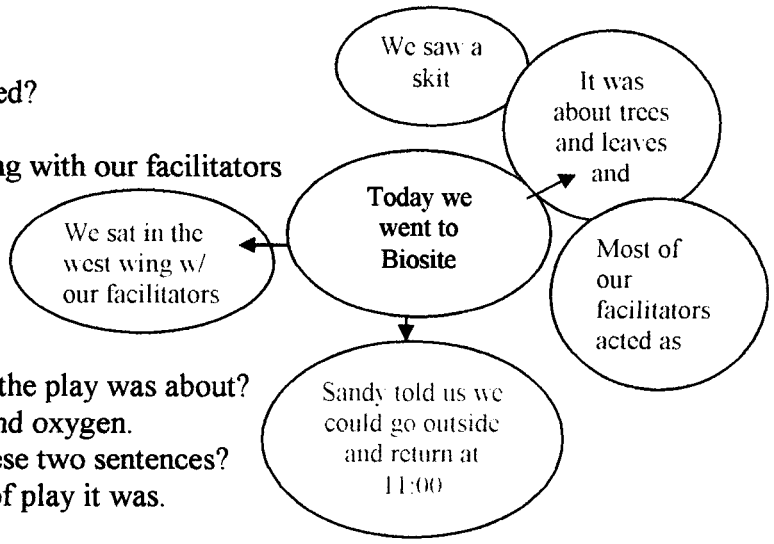
Example of How TM Brings BioSITE Home

As part of a typical and immediate follow-up to his students visit to CDM's BioSITE program, TM has his students create "idea webs". The goals for this activity are to assess the student experience, provide a school based writing component to BioSITE for this ESL class and literacy focused school, and to supply a mechanism through which all of TM's students can build on this shared experience. The following passage describes an observation of TM's classroom following a BioSITE field experience.

> *TM starts the idea web by writing the sentence "Today we went to BioSITE." He encourages a chronological explanation of the day's events by following this sentence with the question:*

TM: What was the first thing we did?

> *What follows is the first of three exchanges of dialogue and the resulting webs that TM and his students constructed following their morning at BioSITE.*



S: We found our facilitators.
TM: What was that room called?
S: West wing
TM: So we sat in the west wing with our facilitators
TM: What happened next?
S: We saw a little play.
S: A skit
S: What's a skit?
S: A skit is a short play.
TM: Anyone remember what the play was about?
S: It was about trees, leaves and oxygen.
TM: Why am I connecting these two sentences?
S: Because it tells what kind of play it was.
TM: Who acted the play?
S: All of our facilitators joined in.
S: Not all, not mine.
TM: Could we say most of our facilitators joined in?
TM: What were they acting as?
S: Parts of a tree.
TM: Where does it connect? Which ideas is this sentence part of?

S: To the skit
TM: What happened after the skit?
S: Sandi told us we could go outside and to enjoy ourselves and come back at 11:00.
TM: What does that idea connect to? So, now we have the makings of a paragraph and we won't write it today but we have done the hard work on it. Does someone want to show how they might organize this in order?

> *After this particular web is completed, TM listens as three students volunteer explanations for how they would string the concepts above into a paragraph. TM records their sentences on the white board so the class has written examples of what a completed paragraph might look like. He continues the follow-up lesson with two more sentence prompts: one designed to solicit more of the student experience, and the other focused on the specific science content students encountered as part of the their year long water quality testing of the Guadalupe river through BioSITE.*

Idea Web # 2
Some students saw a bird feeding its babies in a nest,
Other kids saw some men working on a building and standing on a platform
Students also saw ducks on the river
Some students took photos and other groups tested the river

Idea Web #3 (*all the data referred to above is recorded in student journals prior to leaving CDM so they can read this information directly from their data pages when constructing the idea web)*
We wrote about the rivers height and the rivers condition and much more in our journals
We wrote that the pH was 8.5
We put that the weather was warm and recorded the temperature as 12.5 centigrade.
We said goodbye to our facilitators and walked back to school.

> *In a very short time (it took the class approximately 20 minutes to complete this exercise) TM's ESL students have successfully generated the makings for three complete paragraphs. In a class of 20 students I noted that 16 of them participated in the dialogue that led to webs above (not all their contributions were designed for the white board – for example a conversation about the ducks they saw did not make the idea web)*

Although not the most novel appropriation of the informal experience, TM was successful in fulfilling a number of his vision goals through this exercise. By using three prompts designed to allow students to demonstrate three types of knowledge (observational, student experience, content), TM enhances participation for more students (during this exercise eighty percent of TM's students volunteered contributions to the

idea webs that were generated). Furthermore, his approach legitimizes the student experience and gives TM an idea of what his students are taking from their informal visits. Finally, it meets the literacy goals of the school thereby allowing his students to be successful in more traditional ways by creating a setting where everyone has an opportunity to contribute meaningfully.

It is "dialogue and exchange of views that allow each individual to be understood on his or her own terms (Belenky, P 8 in Fouhey)." But talk was only one way that teacher participants in this study engaged students in the exchange of ideas. Drawing and journal exercises often followed opportunities for verbal sharing and were considered valuable because they provide another way for children to express their ideas and findings; they take on the role of talk with regard to assisting children in making meaning of their ideas (Harlen, 1988). According to Elstgeest, these representations may serve as a guide to children's understandings (Elstgeest et al., 1985 in Shepardson & Britsch, 2001).

In the case below, PL acknowledges the student agenda and different ways of knowing by providing opportunities in the ways discussed above that allow students to demonstrate their understanding so that she and her students can build on it together. PL was deliberate in her attempts to know what students had taken from, or wanted to know more about as a result of their informal experiences. In developing this understanding she used a variety of techniques as vehicles for students to express themselves.

Everyone contributes when PL shares power by acknowledging more than one way of knowing

> *PL begins our post field trip interview by describing some of the follow-up activities she has been conducting in her classroom. She explains that because many of her second graders are ESL students she relies on a combination of student drawings, as well as written, and verbal explanations from students in determining what they got from their field*

trip. In one activity she had students interview each other then draw: "Two things that they actually did at the museum, and two things that they learned. So it was a two fold project for them because I was interested in seeing what they picked up versus what I thought they would pick up." In the event that PL can't understand the students' drawings she schedules her own time to interview students. (PL tape records the interviews and also uses them in assessing the language skills of her students by comparing the tapes over the course of the year) "So you can see there are many different things for different kids but there is a theme there. What the majority of kids enjoyed and liked about it – the shakers, the bubbles, the magnets . . . You know if I asked my kids, the ones who love the bubbles – well what makes the bubbles float, why do they rise? - they probably couldn't figure it out but they know that they do so it's sort of like you need to take those interests and pick one of the concepts and things to go back over with them (something PL does by creating activities at the classroom science corner related to students expressed interests. For example, I observed activities in which magnets and rocks were each featured at the science table in the weeks that followed the CDM visit. As discussed later these interests sometimes led to extensive new curricula)." PL couples the insights obtained from student work with what she observed during the field trip itself in assessing the total value (current and potential) of the experience for her students. "And the other thing the like – well (Emilio) figured out that depending on how the bolt was situated on the table, like if it was lying flat he couldn't pull it up as easily with the magnet as if it was standing straight up. So he started trying all the different thicknesses to see which ones, if there were any he could lift up at all. And that was fun to see. More so they fell in love with the seeds on the globe just texturally feeling it and feeling the different shapes and bumps and things. And where as we didn't get that chance to come back and talk about how did it feel – and the other one was they loved the feeling and guessing one where you put your hand inside and guessed how many seeds were there. They love guessing and predicting; now that just shows you a different process going on in their minds. It shows too any number of different things that you know although they may not be picking up total concepts they are involved in all academic areas. They are in writing, they are in listening, they are in math, as well as just the hands-on. So there is a lot more going on even though they may not verbalize what's going on." But PL expects students to know more, and to want more than what <u>she</u> has intended for them from their informal experiences. She legitimizes the student and his view through her assignments and subsequent development of curriculum related to their interests. The relationship between student and teacher in this classroom becomes more horizontal in structure as they share responsibility for what is learned and what will be learned.

Perhaps the most compelling evidence for how the informal experience supported teachers' visions for fostering a community of learners comes from the survey data on student change. In responding to the question, *Do you notice any changes in your students (academically, behaviorally, personally) as a result of this experience?* 43% of YNI teacher participants and 14% of CDM teacher participants indicated that better peer relationships including more positive treatment of peers, enhanced participation by more students and in general more inclusiveness, were ways in which their students had been changed by the experience (See Table 9 for examples of teachers impressions of other ways in which students were changed).

> The biggest impact is just that they can learn from each other (Survey 354)
>
> Their common experience seems to break down walls between kids (Survey 217)
>
> Our students responded how they had to share with others from other classes in order to experience all the opportunities at the museum. They are more tolerant of each other and their individual needs; they are willing to help as well as to receive help (Survey 312)
>
> Experiences like this bond students together creating a caring community of learners (Survey 184)
>
> " . . . they respect each other and accept each others differences (Survey 241)
>
> We had deaf kids who were real reclusive didn't participate at school. On the trip they opened up, became leaders of groups. My kids have treated them much different even still. This experience has changed their lives at school (PM, Interview)
>
> I noticed they have more to say because of this experience. More students get involved; They have more questions and are more interested in what happens in the classroom (Survey)
>
> Classes became more caring and helpful towards each other and more cohesive unit (Survey 72)

> More tolerance for fellow classmates, work better to achieve common goals. Students come back to visit from years past and continue to say that they use some of their skills. (Survey 266)
>
> *From a focus group student responding to the question, "How was this experience like school?"* It shows you how to treat people the same way you'd like to be treated (FG from TM's class).

The student interactions these classroom teachers describe are in fact essential to the success of the YNI curriculum and a desired outcome for staff. As a central focus for instruction, YNI's core educational theme--*Sense of Place*--moves beyond an understanding of one's place in the physical environment to include a sense of comfort and contribution in one's social/academic groupings as well.

Establishing a community of learners in the field

> *This observation describes the second day of a five-day residential environmental education program in the Marin Headlands, and it was clear, despite having spent only one day with these children, that the field instructor had already made an impact on them. Their enthusiasm was unfettered as these children tumbled, skipped, and leap-frogged over one another to form their opening circle. Their individual voices like their bodies just moments before were difficult to keep track of but the general direction was clear - - toward the instructor – and the tone was merry. The instructor allowed herself to enjoy the cacophonic chatter for a moment, and then with a simple chant - - "YO, YO, YO" – she made their disparate voices and purposes unite, as the children responded in unison "WHAT'S UP?"*
>
> *The Instructor's YO, YO, YO was a recognized signal to the group that it was time to move on and that she needed their attention. The group's response WHAT'S UP, sounded proof that they understood this cue and were ready to go. This ritual like the forming of a discussion circle to begin and end activities was part of a large repertoire of organizing tropes designed to support group norms for behavior. But these rituals went beyond simply creating codes of conduct for safety and efficient group management. The language and behaviors the instructor employed were special. These children as did I felt like they were part of their own new community; one that was unique, one that they had taken a special part in developing.*

It was the little things the instructor did as part of her hidden curriculum to establish a community of learners that pervaded every activity and the consciousness of these children. For example, they began the morning by creating a recipe for a "sweet week". Each child contributed suggestions for behaviors, activities, and mindsets that would enhance the group's chances of learning and of having a positive experience. They were encouraged to carefully pen their suggestions onto parchment paper. Once all the items were added, the paper was placed into a silk box; the box was secured with its ivory latch and given to one child in the group for safekeeping. This treasure would eventually make its way through the group by the end of the week.

The condition of the box, having been in countless fifth grade backpacks in numerous outdoor setting is a testament to the seriousness with which these children viewed this exercise and its' content. With these activities, ritual circles and behaviors the instructor had set these children up to succeed at maximizing the potential for the group and their experience.

Once past our morning greetings, the students were ready to begin their activities. Today's agenda included a group challenge, visit to the fishbowl, pond activity, and a "solo-sit" on the beach. We were all made aware of this plan via the "mind map" a no reading required, 12 x 8 visual arts display depicting each planned activity in primary colors. The theme of the day is always situated in the middle; this day's theme was "Everything's Connected".

Our first activity is the group challenge. Today's challenge is formally known as "Ants on a log". To start the challenge we form a line on top of a log – all fourteen of us. To complete the challenge we need to reverse the order of the line. The catch! No one can step off the log–not even a toe touch- as we change positions. However, in planning their approach, the group can step off the log as often as they like.

The challenge begins falteringly. The instructor is deliberate in her attempts to foster communication among group members. She reminds them throughout their initial sputtering efforts to complete the challenge that they have unlimited time to strategize. She encourages them to give each other an opportunity to ask questions or add ideas to the list of suggestions for resolving the challenge. After several failed attempts, a determined calm befalls the group; soon fresh ideas and conversation volley across the circle in a natural cadence that demonstrates this group's new comfort in working together. They no longer look to the instructor, their teacher, or me for certain insights as they work; instead they are intently attentive as any and all members of their group share ideas.

The instructor's conscious and considered demonstration of equitable behavior sends the implicit message that this is a community of learners where all opinions have value. The organizational structure of this community, like the log we stand on is horizontal such that no one person's knowledge has more worth then any other person's knowledge. The instructor's behavior is a deliberate inclusion of her self in an attempt to meld fourteen individuals into a cohesive unit who appreciate the contributions of their peers. As the group explains at the end of this activity, to be successful requires patience, good communication skills, a sense of humor, and the equal participation of all group members.

Like YNI's programs, the museum experience is designed to enhance social interaction and participation among visitors to the setting in creating a community of learners. Many exhibits are constructed such that they only "work" if operated by more then one individual. In addition there is typically more then one way to perceive of and successfully experience an exhibit.

While observing a visit to the CDM, I watched as AB's students negotiated the "proper way" to move the oscillating bridge so that the strand of lights along the side of the exhibit would light up. For some of the students electrifying the lights was secondary to making the bridge move. In any case the group of 6-8 students had to decide together how to manipulate the bridge's hinged platform as one third grade body was not heavy enough to do the job. Some of the students argued that they should run as a group over the top of the bridge, others advocated for a more see-saw type option whereby some stood at the peak and jumped while those on the end stepped off the bridge. The students that wanted to run across the bridge reasoned that their action would be better for lighting the bridge "because it makes it (the bridge) move more". In the end both methods were attempted.

Regardless of how the students ultimately used the exhibit, or whether or not the students understood what was necessary to produce an electrical current, the experience was successful in fostering greater participation and perspective sharing as dialogue and reasoning among students had to occur in order for the bridge to move at all.

Experiential Learning Cycle, Questioning, and Desire to Learn in Practice

In implementing their visions, teachers set as their aim promoting learning in the broadest sense by strengthening children's inquisitiveness, their motivation, and their ingenuity as they develop and assess their own (and others) interpretations of the world around them. In so doing they hope to support a more autonomous, self directed (life long) learner.

Because teachers placed a premium on learning from and building on students' interests as a part of their visions, some of what I looked for in their appropriations of the informal experience was if, and the extent to which, these settings inspired questions and how teachers leveraged those inquiries in their own practice.

To ascertain what questions were triggered by the informal experience, I directed the following questions toward the approximately 135 students who were part of the focus group interview days I conducted in five case study classrooms: *Are there things you saw or did that you still have questions about? Are there things you still wonder about?*

The kinds of questions students came up with fell into three main categories; those involving the mechanics of a specific exhibit, those related to the teachers' or the informal settings' curricular agenda and those related to a new content area (see Table 10)

Table 10 – *Examples of student responses to the focus group questions - Are there things you still wonder about? - and the topic areas they tended to represent.*

Exhibit Mechanics	Teacher /Informal Agenda	New Content Area
• How does the zoetrope work? • How does placing your hand on the sensor results in hearing your heart beat? • How do the bees find the hive at the museum?	• How do plants breathe? • How do seeds eat? • Are all plants green? • Where do seeds come from originally? • How do we clean polluted water? • What is inside a fish? • How is "dirty" water good for some animals (crayfish) and not others?	• How are algae different from plants? • Where does the river start? • What kinds of things can we make with seeds? • Does the tidepool area look different in different seasons? • How are decisions made about Indian fishing rights?

On average, four unique areas for content development or exploration were identified per focus group classroom.

Despite being an expressly hoped for and often leveraged outcome for their informal experiences and the teaching they hoped to impart, some teachers expressed uncertainty in dealing with the implications of working from students' questions.

Questions Lead to Autonomy in TM's Classroom

> *" . . .it does open up so many other interests and ideas. It starts like a crack in the ice then spider webs across the surface and at some point we have to get off the ice or we will be drowning in all this extra material (TM, formal educator)*
>
> *For this teacher meshing students' interest with required aspects of the school based curriculum seemed a formidable and sometimes unwieldy task. TM reconciled his desire to honor students inquires with the need to address his compulsory curriculum by giving students the space and authority to pursue questions on their own. He did this by allowing students one half hour each day to investigate a question of interest that pertained to their BioSITE trip. For many students their investigations proceed with little direct input from TM although he does take an informal inventory of the types of things students are tracking. I found out about one of his students' inquiries indirectly when I spotted a library book on pond algae sitting on her desk. When I asked this student about the book she explained that she had become interested in algae when she noticed a*

"bloom" in a quiet section of the creek during a recent visit to BioSITE. This student decided to make algae the focus of her in-class inquiries. Like her teacher, she also meshed her desire to question with the demands of the formal curriculum by making this book her next installment of "The Accelerated Reader Program"[2] Although relying primarily on text based resources to solve the majority of their inquiries, the students in TM's class are meeting the goals of his vision by demonstrating the desire, and self-direction required of a lifelong learner.

TM is not alone in responding to the potential rooted in student curiosity. Of those who answered YES to the question –*Has this experience changed you or your teaching in any way?* 18% of YNI teacher participants and 20% of CDM teacher participants claimed that they had changed the way they approached content in their classes (Table 15). For the majority of respondents in this category change came in the form of a greater willingness to build from or give voice to students' questions.

For EW's classroom this meant additional time "in the field" exploring the beginnings of a local creek restoration project designed to bring back a salmon run. Her students' curiosity about salmon, their habitat, and lifecycle were peaked during an evening program at OPI in which the issue of Native American fishing rights was the topic of discussion. Empathetic to the rights of these indigenous people, and just as concerned over diminishing stocks of salmon (and the reasons behind their decrease) EW's students began to ask questions about the salmon in their own community roughly 2 – 3 hours away on another part of the sound. Meeting the challenge posed by their curiosity EW arranged for the citizen activist spearheading the restoration project to take the students on a walk (the creek and adjacent beach were within a half mile walk from the school) to view the site and talk about the challenges involved in bringing the salmon back. I came back to participate in this additional field experience. As our leader (a school neighbor and concerned citizen) described the difficulties and potential of the project, for at least one student this local issue became an opportunity. By the time the day had concluded he had devised a plan to survey all the neighbors within walking distance of the creek to assess their knowledge of the project and explain the ways in which they could be an asset to its success.

Mitchell, in Hidi & Harackiewicz (2000), noted that though teachers have no influence over the individual interest's that students bring to class they can influence the development of such interests by creating appropriate settings which foster them. The experiences in the informal setting combined with teacher endorsements and support through subsequent experiences resulted in an overall increase in students' interest and exploring behavior in school (See Table 9 for percentage who noted change in students).

> They become more curious learners who now how to connect their learning (Survey 222)
>
> It was a reminder I think that learning is something they do for themselves (Survey 352)
>
> . . . they have more excitement, curiosity, questions . . . which in turn stimulates conversations and thinking skills (Survey 275)
>
> Yes, students are changed. They are more self-directed, articulate, and deeper Socratic seminars (Survey 387)
>
> Increased motivation and satisfaction with whole experience of being in school. (Survey 75)
>
> They continue to ask if they can touch things, observe more, also more familiar with their geographic locations (Survey 350)
>
> This is very stimulating for the kids. They are puzzled by what they see, fascinated by what they discover and always come back wanting to know more (Survey 62)

For case study teacher PL, students' questions about her unit on plants, combined with her class visit to the CDM to see, among other things, the Seeds Around the World Exhibit led to a half-year long and summer school curriculum based on students growing interest and enhanced understanding of plants. Initially begun as a question about if and why all plants are green, students questions carried them deeper into content (then even their teacher had intended) to learn more about special types of plants, specifically marine

algae. PL supported her students interest in algae by inviting a guest speaker to come to her classroom and share examples and information about marine algae. For this particular group of ESL students for many whom summer school became mandatory, this curriculum continued throughout the summer months and led to the creation of "alga dioramas" that PL later brought to a CDM teacher advisory meeting to "show-off". During this advisory meeting PL attributed her students visit to the CDM for their increased interest and now highly developed understanding plants. For her, the ability to leverage student interest into a curriculum that lasted half the school year and the summer and left her students feeling inspired and connected was priceless. By capitalizing on the "situational interests" (Bergin 1999, Hidi & Harackiewicz 2000) of their students PL and EW were able to enhance students' engagement within science and increase motivation for academics.

Content in Practice

Case study teacher RT probably best conveyed the importance of content to teachers' visions when he said, "and well it's school it should be academic . . ." This opinion was shared by approximately 40% of CDM and YNI survey participants who said they hoped the experience would connect with their school based curriculum (see Table 5). There is no doubt that schools are held accountable for and should be responsible to students in insuring that they learn rigorous academic content specific to the major disciplines. This responsibility to content was not lost on teacher visitors to informal settings

Commitment to the school based curriculum in practice

For an overwhelming majority of teacher visitors (survey, interviews, and 4 out of 6 case study teachers) to YNI and CDM, commitment to the school based curriculum was a primary focus of their activities in preparing for and following-up the informal experience (see Tables 11 & 12). As indicated in the previous chapter, access to science content was of particular importance to teacher participants and occupied the majority of what teachers did to prepare for the trip, while their follow-up tended more to the language arts and social studies curriculum.

Table 11 – *Findings based on the survey question: Do you or your students do anything special to prepare for this experience? Yes No - if yes, please explain?*

	YNI	CDM
Yes	89	48
Content/curriculum	76	69
Field trip behavior/expectations	10	15
Parks curriculum	18	--
Group building	11	--

Note. Percent for YNI n = 138, CDM n = 254. *Content areas used for preparations: YNI - Science 71% (science content in decreasing order geology, ecology, life sciences), Social Studies 15%, Interdisciplinary 7%, Language arts 3% . For CDM Science comprised 59% of the preparations teachers did.*

Table 12 – *Findings based on the survey question: Do you or your students do anything special to follow-up for this experience? Yes No - if yes, please explain?*

	YNI	CDM
Yes	84	72
Content/curriculum	71	80
School/public share of information	10	15
Stewardship	18	--

Note. Percent YNI n = 138 , CDM n =254 *Content areas used for follow- YNI 62% Language arts and social studies, 41% science, CDM 68% in language arts*

For some classroom teachers the informal experience was used in augmenting a variety of existing formal curricula as well as fulfilling the curricular goals represented by more general content areas (see Table 13). In other cases the informal experience

became the fulcrum on which the school-based curriculum turned. Perhaps the most thorough example for how a teacher used her YNI experience throughout her entire curriculum is found in Appendix G. Entitled the Yosemite Project Curriculum, Appendix G shows how one teacher identified ways to connect the YNI trip to her school and district standards for all the content areas (Reading/Language Arts, Math, Social Studies, Health, Physical Education and visual arts) something informal learning environments may be particularly well suited for because of the interdisciplinary nature of the content they feature. Additionally it provides examples for intended pre-assessments, lessons for implementation, possible activities for the YNI experience itself, and final assessments. The lesson plan entitled "You Fix Yosemite Valley" is included in appendix G as an example of a project based activity students completed as a follow-up to their experience.

Table 13 *Examples of curricula or topics teachers indicated using as of preparation or follow-up to their informal learning experience. Only responses that were mentioned five or more times were included*

Commitment to School Based Curricula		
	Yosemite National Institutes	Children's Discovery Museum
Formal Curricula	Project Wild Audubon Adventures Project Learning Tree FOSS Land Forms California Salmon Project	FOSS Motion and Balance Simple Machines San Jose Mercury News (Seeds) California Frameworks – • Past and Present • Community • California History
General Topic Areas	Ocean Life Water quality Creek monitoring Life cycles Habitats/biomes Parks research Continental drift theory Native American studies /Miwok California History –John Muir	Light & Color Bubble physics Sound Water cycle Music Writing

While much of how the informal experiences was appropriated in supporting content was short term in nature and included projects such as: having students create their own museum; making pattern, dictation, or ABC books based on their visit; hosting invention days as part of a *Simple Machines* curriculum, or creating a bulletin board for a local shopping center focused on environmental concerns, at least 15 % of all teachers explicitly indicated that they commit to long-term (two-weeks to one year) programs connected to the informal experience. Not included in this number are comments made by teachers referring to project based work, which by its very nature might also be considered long-term, or teachers who said they had committed to community service projects.

> We go prior to studying a four week unit on six simple machines and other hands-on activities in the classroom. (Survey 168)

> We spend a lot of time considering our role in that ecology, heightening awareness. We talk about the economics of it looking at things from the loggers and the owls' perspective. They look at speeches UPS law school put together for a senate hearing – then they held their own hearings representing loggers, millworkers, and the environmental view. We take young people who will be our leaders and broaden their perspective beyond (Bellvue). We do a whaling commission simulation where they create speeches and "speak in front of the IWC. This is the culmination of a two month study of the McCaw culture. (OK, Interview)

For some classroom teachers the visit to the informal setting seemed to meet more school wide or institutional objectives as well. For example in BL's school, the YNI experience built on the school's extensive recycling program and focus on citizenship with a particular emphasis on one's responsibility to the environment. YNI as an experience was presented to students as a rich reward and culminating activity for their elementary school days. Although only the school's fifth graders attend YNI, the entire school (K-5)

participates in a walkathon to provide the necessary funds for the trip. They participate knowing that in the future the student body will support them in making this trip. Fifth-grade students write letters to fourth graders describing their experiences, and every bulletin board in the school (as well as that of the local shopping center), both before and after the experience, advertised the merits of the YNI fieldtrip. The shopping center bulletin board I saw served as a public platform for students environmental messages. It contained stories about what students did on their trip along with please for environmentally friendly consumer practices and reminders to reduce, reuse, and recycle.

Another example involves a fourth grade teacher, RG (Interview, CDM), and his teacher colleagues from the second and third grades who work to spiral the curriculum across grade levels. All three grades deliberately visit CDM each year but focus their preparation, follow-up, and informal setting experience on different content strands important to the particular grade level they are teaching. The take-away of this example is that even though the students from this school are visiting the same setting year after year they are not making the same trip. There are continued and expanded benefits to each repeat visit as their students attach meaning to new content each year.

Role of the teacher agenda

The good news for teachers who have connected their informal experiences in the ways described above is that research findings (and common sense) suggest that children remember most when their teachers link visits to the school curriculum by embellishing the unit with a visit to an informal setting (Bailey 2002). However there is another view, that of the student. Falk and Dierking (2000) describe a body of research that assessed what students believe they will be doing on field trips. Having fun, visits to the gift shop,

going on a bus trip, as well as hinting at the school / informal learning environment agenda were all listed as pieces of students' expectations. Balling et al (1980) believe that "the outcome of any field trip will be affected by the interplay between these two sets of anticipations and the actual field trip." We know that students' attitudes tend to mirror teachers' attitudes (Griffin 1998, Griffin and Symington 1997) thus, outwardly expressing those expectations may be important to the overall effectiveness of the informal experience and its subsequent appropriation by students. In a study designed to investigate how manipulating the student agenda through pre-trip orientations would affect children's learning and behavior Balling et al (1980) report that children who received an orientation showed significantly more learning (content, observational skills, and knowledge of the setting) then the corresponding comparison group (no orientation).

Among focus group students from cases study classrooms, student awareness of the teachers' purpose for field trip was high; 94% of students could state – almost verbatim what their teachers' content goals were for their informal experience. In each case study classroom some form of pre-trip orientation took place. Reassuringly, even the simplest orientation resulted in students' clear understanding of the terrain to be covered during their informal center visit. For example, case study teacher AB provided field trip chaperones with a photocopied page (Appendix H) from her students' *Simple Machines* text and asked that they go over the picture with their group prior to entering the museum. Students subsequently used the page as a hide & seek game to locate simple machines in the exhibits they were interacting with. During my observation of this field trip I watched as AB's students pointed out pulleys (on both the Bubble exhibit and lift a bowling ball exhibit), gears (grinders from seeds around the world and the crank washing

machine), ramps, and levers (Rube Goldberg type exhibit) to their parent chaperones. For the parent chaperones this was definitely an eye-opener as many of them had failed to see the simple machines until the students pointed them out. Several weeks later when I asked AB's students why they thought they had gone to the museum 92 % said they were there to learn about simple machines.

> To learn about simple machines like pulleys, and levers, and stuff like that (Focus group interview)

All of AB's students also mentioned that they thought they were going to have fun.

Understanding the teachers' agenda did not preclude students from making their own connections to unintended subject matter for the trip. Although most students reported that the experience reminded them most of science, many students claimed the experience reminded them of more than one content area (Table 14).

Table 14 *What subject matter students claimed they felt the informal experience represented Students often attributed the experience to more then one subject matter category.*

Subject Matter Connections	
Science	47 students
Social Studies	37 students
Math	19 students
Language Arts	32 students
Art	17 students

> You know the thing upstairs where you had those little pipes where you make stuff that reminded me of shelters from our social studies book (Focus group interview)

> The math like when you have to estimate the beans or seeds in the tube (Focus Group Interview)

> Where the town was where there was a map with the roads that you could look at with the magnifying glass and see where you live and where our school is that reminds me of social studies (Focus Group Interview)

> It reminds me of choice time – it's whenever you have free time you can go back there (points to corner of room) and play games and its sort of like the museum (Focus Group interview)

According to YNI and CDM teachers, enhanced retention and connections to content was another way in which their students were changed (Table 9).

> Students see and understand simple machines in real life. Students look for levers and motors in objects they see around us (Survey 292)

> Could relate action of each machine because they were able to experience it (Survey165)

> It begins the process of linking learning outside the classroom, sparks some kids to get more deeply into content (Survey 155)

Pedagogy in Practice

For the overwhelming majority of teacher participants (survey, interview and case study) in this study, instructional practices involving the use of multiple intelligences, real-world settings objects or phenomena, thematic/cross curricular teaching and attention to the ways students are grouped were considered important in their own teaching and were practices they believed would be encountered in informal settings (Table 6). But despite describing a shared philosophy about what and how to teach with the informal setting, the majority of teacher participants say they were changed by their informal setting experience (see Table 15). For those who reported being changed, 48% of all YNI study participants and 55% of all CDM study participants indicated that their teaching was somehow affected by what they had experienced. More than half (CDM and YNI) reported pedagogical change came in the form of more hands on, discovery based, experimental/science based teaching, and project based teaching.

Table 15 *Findings based on the survey question: Has this experience changed you or your teaching in anyway? Yes No if yes to what extent (please circle one) not at all, somewhat, to a great extent. In what way?*

	YNI	CDM
Yes	67	44
Pedagogy	48	55
Reinforces/motivates existing practice	10	38
Curriculum/content	18	20
New Understanding of Students	47	30

In addition, even though the majority of survey respondents claimed to take more then three field trips per year, their level of confidence in making these trips seemed to increase.

> "I am more relaxed about taking my children out for the day. In our own little community to see what's happening." (Survey 72)

Excursions with their students within the environs surrounding the school, like EW's trip to the creek restoration site and later to view constellations in the nighttime sky from her backyard, seemed to dominate the new field trips teachers were observed or reported making. This greater willingness to take their students out of the classroom meant more time in the local community and in most cases more instruction in science. For example, CDM teacher participant KD (interview) told me that she makes approximately 24 field trips per year, most of which take place within walking distance of the school.

For AB (case study teacher) the school's playground offered a surprising chance for more science instruction. You may remember AB was unable to find time in her literacy and math focused classroom to get to the Simple Machines science text that served as the catalyst for her CDM field trip. Nonetheless, AB described how the

school's orange tree and her trip to CDM gave her courage to follow a student led inquiry:

> The school custodian was picking up the oranges that had fallen on the ground when one of my students asked if she could have them. I told her she could eat one but that we weren't going to have all those oranges in the classroom. Of course once one student had an orange they all wanted one. . . I'm not even sure how it came about, but one of the kids asked if bigger oranges had more sections than smaller oranges. I had no idea so we decided to find out by doing a little experiment right there on the spot. It worked out really great. The kids did everything themselves. They made the predictions, separated the oranges by size, it was great. (AB, Formal educator)

For some teachers visiting an informal setting was a novel experience, either because they were visiting for the first time or visiting in a new capacity as a teacher. In most cases, teachers who were first time visitors to the informal site were attending with a grade level colleague who had convinced them to come along as a means of offsetting transportation costs (the number one teacher reported challenge to organizing field trips). For these teachers change came in the form of new awareness that possibilities to visit an informal setting exist for them, as was the case for fourth grade teacher, SC (interview).

During my pre-trip interview with SC it was apparent that she had been conscripted by a teacher colleague to make the trip and was apprehensive about going. She indicated that because this was an environmental education trip and she was "*not a science person*" that she didn't expect to "*do much with the kids*" once they returned to school. However, when I interviewed SC just two days into her five day YNI field trip she was brimming over with ideas not only for how she planned to use what she and her students were learning at YNI this year, but what she hoped to do to prepare her students for the next year's experience. When I asked SC what caused her to change her feelings

about the trip she explained that she had found a lot of interdisciplinary content she could easily build on in her school curriculum. She also confessed that she was *"better at this kind of science then [she] thought [she] would be . . .especially the pond life"* .

Lack of awareness was the root cause of SC's initial nervousness about taking her YNI field trip. Just one exposure to an informal setting had elevated SC's appreciation for the kinds of teaching and learning opportunities that exist for her and her students in informal learning environments.

Finally a greater awareness of their students, the teaching or interactions their students encounter during their fieldtrip, and how that affects what they learn was another way teachers felt they (and their teaching) were changed. One teacher (interview BP) indicated that she would definitely structure classroom activities differently based on her students' behaviors while interacting with exhibits at CDM. She noted the first floor exhibits seemed more "open-ended" and elicited a different response from her students then the more "structured", institutionally driven *Seeds around the World* exhibit space. While conceding that both types of experiences had value, she felt that she: *"needed more first floor activities in her classroom. The kids just got something totally different from them. More explorative, they stayed with it longer (Interview BP)."*

The ability to observe their students in a learning environment where they were not the person in charge seemed not only to offer teachers better insights into their students but gave them an opportunity to self-reflect or ponder alternatives to their own teaching in a safe haven. Teachers could watch and assess how their students might respond to any number of experiences or ideas. In this way informal experiences provide

powerful incentive for teacher participants to move toward and/or maintain preferences in teaching practice (see Table 15).

> I learned that learning really takes place in the reflection of the experience and I try to incorporate that into my classroom practice (Survey 98)

More about teacher change

Although the examples presented throughout this chapter were selected to show how teachers were enacting their visions of education, they are also representative of how teachers and students were changed by their participation in informal learning experiences. The specifics of how people are changed are highly personal and unique And ranged in character from not at all to highly evolved.

Overall, the evidence supports the premise that informal learning experiences facilitate some degree of change or learning in most participants; albeit not always the learning one might predict or intend. Thus the issue that remains for collaborations between educators in formal, informal settings may be one of scalability, primarily in terms of quality. Namely, what factors or conditions are necessary to bring about the kinds of changes we want for the greatest number of individuals? I think the answer to this question can be found in teachers visions and is the focus of the next and final chapter.

Summary

As in the chapter four, the bulleted points below are designed to provide a brief synopsis of key findings or highlights from this chapter.

- Personal growth of students is a major area of change in students. Increases in self-esteem, fieldtrip and classroom participation, and improved classroom behavior were noted and improved the way the classroom functioned.

- Students are connecting personally with the content they experience in informal settings. Through this change they appear more able to connect to traditional elements of school as a result of their informal experiences.
- Teachers are using shared experiences in informal settings as a way for students to gain better access to and understanding of classroom curriculum allowing more students to be successful.
- Teachers are changing their approach to content by building new curriculum based on students' interests and questions raised during visits to informal settings.
- Pedagogical changes in the form of more hands-on, discovery and project based teaching was reported by and observed of teacher participants, resulting in an overall increase in science instruction.

CHAPTER SIX: CONCLUSIONS

Everybody leaves with a sense of wonder about the world and themselves.
(ROSS, Informal Educator)

Most science educators in informal settings have forged collaborations with schools. Recent statistics suggest that school groups may account for a quarter to half of all visitors to science museums; for environmental education providers, the numbers are even higher. As teachers more frequently turn toward informal settings for assistance in educating students, the leaders in these settings increasingly ask if and how their programs are effective.

This study began as an effort to understand the impact of informal learning environments on schools by developing a picture of why and how teachers and their students were leveraging their informal experiences. It differed from most other attempts to assess the value of informal learning environments because it used the visitors' (in this case teachers, and to a lesser extent their students) perspectives and goals as a starting point in defining the value and potential of visits to informal science settings. My desire to begin by understanding classroom teachers' visions of education and how those visions aligned with visions of educators in informal settings stemmed from the belief that without some correspondence in goals and practice there would be no incentive for classroom teachers to build on informal experiences back at the school site. Since much of what visitors ultimately take away from an informal setting is influenced by subsequent experience, the ways teachers' appropriate informal learning to practice is critical.

I discovered that central to informal and formal teachers' visions was a view of education as empowerment. I explored such goals as empowering students to conceive of

themselves and their worlds differently, empowering students by sharing responsibility for what and how they learn, and empowering students by creating learning environments where everyone can contribute meaningfully. A related goal of teachers was to create very personal educational experiences for their students.

Implicit in the visions teachers shared with me were conditions for educational change. For instance, if we want students to retain, understand and use ideas, information, and skills we must give them ample opportunity to make sense of those ideas by involving them in complex learning situations. Starting from students' interests, we need to structure differentiated opportunities for them to construct understanding by connecting what they know, to what they want to know. This is not to say that certain basic content shouldn't be addressed or assessed; but it does mean that the ways students have and create access to content may be varied with individuals. In meeting these goals educators in both classroom and informal settings will need to create experiences that encourage students to make personal connections across the learning environments they experience.

While these recommendations seem straight forward a number of barriers impede their ready implementation in today's classrooms, take as one example the trend for accountability and standardized testing currently sweeping the nation. Over the past ten years nearly every state in the United States has introduced a set of accountability standards often accompanied by mandatory tests of student achievement. In some states monetary rewards are given to high performing schools while sanctions face those working in low performing schools. With such stakes attached to the results of mandatory testing the effect of accountability legislation has been to create greater uniformity in

school programs and in what students experience as teachers tailor curricula and instructional practice to prepare their students for state tests. In some instances student preparation for state testing is mandatory and consumes a large portion of the teaching day. Related to this pressure is the perception of teachers that they already have too much to cover in their curriculum. For one case study teacher, her district's emphasis on reading and math achievement consumed a large portion of her teaching day. The particular reading program the school/district purchased was very prescriptive. It demanded that a set amount of time and mode of instruction be applied to reading each day. The teacher explained that between the demand for specific reading and math curricula, and mandatory API test preparation, much of her teaching day was consumed, leaving little time for her to pursue her self-described thematic, multidisciplinary, and open approach to teaching.

For informal science settings the effect of the accountability trend is to push informal learning experiences further back on the classroom teacher's instructional priority list. Many informal settings have responded to the increased pressures teachers may feel to prepare their students for statewide assessments by advertising the ways their programs are linked to the standards. Through a process known as "back-mapping" the informal science center generates a list of its offerings and connects them to a corresponding list of tested standards. Visit almost any informal center website and you will find a section dedicated to their state or districts standards However, the potential loss of school group visitors and the revenue they bring is only part of the total cost and concern to informal learning environments that the accountability movement brings. Government agencies and not-for-profit organizations are increasingly using "standards"

as a guide for their grant making decisions. As a result, those working in informal science settings may feel forced to shift attention away from the practices and content they know best to focus (perhaps too narrowly) on areas that are "fundable". Presently an overwhelming majority of museums report substantial reliance on school curricula or standards in shaping their educational programming. While on the surface this approach to programming appears innocuous enough it may lead to the same uniformity or narrowing of experience that the critics of standards based assessments fear for schools.

Yet another barrier to enacting the conditions for educational change espoused in teachers' visions is overcoming the ritual conditions of classrooms. Despite decades of educational reform school classrooms remain relatively unchanged. Walk into most American classrooms and you will find curricular goals related to the accumulation of facts and skills outside a meaningful context, teachers at the center of instruction, and a primary dependency on textbooks as a source of content, evidence that little has changed. Removing these hurdles and the others discussed above will require altering the expectations of policy makers, teacher educators, teachers, parents and students.

But imagine a public school context where parents, administrators, community based organizations, including informal science settings, work together on a regular basis to develop and enact an educational philosophy designed to meet the specific needs and interests of students and their teachers. Now enter the 5th grade classroom of this school where the artist in residence from a local museum facilitates small group discussions focused on the influence of art on popular culture using prints of important art as his prompt. Imagine the 8th grade classroom where students engage in an ongoing email exchange with marine mammalogists from a major aquarium and state university to

discuss current research that addresses questions the students in this classroom raised during a recent field trip to an elephant seal rookery. Next sit down with the parent of a 2nd grade student at this school who explains why she is not concerned with the schools mediocre performance on the recent statewide achievement test, claiming she knows more about what her child knows and can do then the test reflects because she is frequently a guest in her daughter's classroom (a requirement for all parents at the school) and witnesses her progress first hand. This parent continues by describing the schools' emphasis on process and problem solving in the lower grades, something she notes is not assessed by the state test. Finally, she reports that by the 8th grade the students from this school are testing "off the charts" and are going to the best high schools in the district. This school, this educational community exists and was one I visited as part of my research.

The belief of the 4th grade teacher I had initially come to observe from this school, along with the other case study teachers who shared their visions with me, was that by connecting their academic content to the lived experiences of students, they increase the chances that all children will derive meaning from their studies. Given that the goal of formal and informal educators is to root a broadly focused curriculum in the day-to-day lives of a community of children, then abundant opportunities exist for meaningful collaboration between formal and informal learning environments.

Demographic and technological changes are redefining our conceptions of educational institutions. The dominant learning environments of tomorrow may well look more like the informal settings of today than traditional classrooms. To serve the national goal of science literacy for everyone, education leaders will need to think beyond current

constraints to understand what types of learning environments and approaches engage the greatest number of learners.

Most educators think of education reform as a product of change among teachers, schools, districts and universities. That is, even though informal learning environments are widely credited with providing participants with the inspiration to think about or learn science differently research on how to do school reform still comes from and focuses primarily on the school context.

To change this perception those working in informal learning environments need to demonstrate and focus on the educational value of what they offer. Part of the value informal learning environments provide is their capacity to excite and engage students in learning. What is missing from formal schooling are experiences that incite and maintain students' and teachers' interests. Implicit in these findings is the wealth of opportunities that lie at the intersection of formal and informal learning.

Examining underlying participatory structures, motivation to learn, development of interest and modes of leadership that are part of, or stem from informal pedagogies can inform the design of learning experiences in schools and other places. Providers of informal education experiences need to develop and communicate connections between school learning goals and informal programs. This does not mean simply creating a checklist of the "standards". Informal settings should work with the educators who participate in their programs to reframe the educational value of the informal learning experience; this study represents an attempt to do just that.

For successful collaborations in science education, program leaders in both settings must commit to studying learning in and beyond the informal learning

environment. In developing a clearer picture of learning, informal educators must force a balance between informal learning environments as distributors of knowledge and shared discovery and knowledge creation. Establishing the balance may come from asking questions like, what is done to ensure that knowledge is constructed in the mind of the learner? How is the informal program and learning space designed to help students make personal connections?

The two informal settings I worked with placed a premium on being perceived by their visitors as a relevant part of their home communities, a goal of many informal settings. The value of making connections to the visitors school and home community is three fold: they (i) build on students' existing frame of reference, (ii) foster students' thinking about and connection to their school environment, and (iii) relate to communities so students are more capable of exploring issues, decision making, and responsible behaviors in their home context. I have presented a number of cases throughout this study that demonstrate how students are making these connections. But it is not enough to think connections will be made at the school site because students had a good experience. Connections can be common if informal settings collaborate with teachers and work to develop, understand and enhance the many ways students make meaning of their informal experiences within their home and formal school context.

My hope is that we begin to conceive of and develop the role of informal learning in public school environments with as much intention towards design as informal environments. An expanded notion that learning can occur anywhere suggests that the space and institutions around schools could be enhanced and used for programs. Conceiving of the school and surrounding community as an informal learning

environment and designing it to support and reinforce educational goals could be a way to maximize its learning value. I find great value in considering the curriculum embedded in the school and surrounding environments and drawing out the informal learning opportunities to complement the formal ones.

Harnessing the power and potential of informal settings is dependent on crafting real partnerships between schools and informal learning environments by recognizing that success for both is in large part mutually dependent. Student success requires a genuine effort directed toward identifying and generating experiences (in both settings) that build on the shared goals of formal and informal educators. It means expanding traditional notions of learning and the settings that foster it.

APPENDICIES
Appendix A

Table of (Modern) History of Museum/Outdoor Education

Catalysts/Causes/Concerns	Innovations
1860's-1870's Science Museum of London –viewed as an important focal point in Britain for those who were battling to persuade the government to devote more attention and money to education in science and technology. Belief that Britain's survival depended on its ability to produce sufficiently scientifically minded people.	South Kensington Museum became a focal point –its apparatus displayed and lectures given to provide the man on the street with a new view of science –focus on current progress
1874 – Royal Commission was formed to "enquire into the state of scientific instruction" – museums were included as part of the study. Work in museums had government support and educational purpose. Mixed into education was an opportunity to display national pride in glorifying Great Britain's technology. (Hudson 1987)	
1880's through the turn of the century Increasing urbanization/industrialization – in Europe and in U.S.. Growing separation between man and nature. Concern for the moral, spiritual, well-being of the citizenry	U.S.- advent of the camping movement – Gunnery school, Round Hill school. Mostly private, mostly geared toward men. Curriculum focused on frontier skills and values – maintain American heritage. While educational, camping was not an integral part of the "school" curriculum. Not a vehicle for teaching science, but rather a means of preserving frontier ideals—preserving the character and democratic ideals essential to an American way of life Museum of Natural History (Britain) makes shift away from museum as storehouse/curiosity cabinet- -more explicit attention to educative purpose. Less emphasis on the scholarly visitor- museum a place for all people. Every specimen should have a purpose, that purpose should be made known through informational labeling.
1910-1920's – Germany - Interest again in sustaining a qualified work force to match needs for enhanced technology. The Deutsches Museum was a real innovation – it was essentially a technical school! Land donated by Munich, government and industry funding(supplies, experts)	Deutsches Museum – goal to develop a museum A museum that illustrates the development of science and technology – demonstrate how programs in these fields influence the character and quality of life of people. Visitors or guides could activate models. **Mandatory attendance of every school child over the age of ten in Munich- 1/yr!** Under the guidance of either a teacher or museum staff. Guided tours for adults conducted by engineers. Special fund created which allowed factory workers/older students to spend 4 days in museum and write reports on their experience
1926- New York museum taskforce visits Europe in search of inspiration. " [From summary of findings] The first different impression that one obtains in visiting the industrial museum is that exhibits move. The second most	1930 – New York Museum of Science and Industry - called the "Museum of Motion" was a direct output of the taskforce

remarkable thing about these exhibits (industrial museums in Europe] is that visitors there handle the exhibits. Handling points to the basic departure of new from old. There has been a radical change in educational approach. Those in charge today realize that knowledge is doing – the profoundest pedagogical principle ever enunciated (Danilov 1982)	1933 – Museum of Science and Industry in Chicago – founded by Julius Rosenwald in 1933, a decade after a family visit to the Deutsche Museum when Rosenwald's eight year old son was completely taken by the exhibits found in the German Museum. Chicago's museum was created " for the entertainment and instruction of the people" "What the museum presents today . . . something which reveals the principle of letting operating mechanisms teach the facts of science, engineering and industry in the only way in which they can be taught vividly and interestingly . . . There is nothing so dramatically instructive as action (Danilov 1982)."
1937 – Palais de la Decouverte started by scientists Funded wholly by ministry of education. The purpose of this institution was solely educational – to make as many citizens aware of the principles and applications of science	Palais de la Decouverte (note purposely not called a museum – start of a trend). University students demonstrate science experiments to visitors explaining them in a language which is intelligible to people with no specialized knowledge of the field.
1930-70's Major period of development for Environmental education. This was the age of splitting atoms, above ground testing of nuclear bombs, and Rachel Carson's silent spring. Environmental legislation (Nixon) Clean Air, water and environmental protection acts	1951 – School Forests in 32 states 1951 Outdoor Education Association Established 1950 –60's – we see a move away from the camping stereotype to programs a curricula more closely identified with schools. The term camping is replaced with outdoor school, school in the woods teaching manuals and guidebooks and special training for teachers begin to appear.
1965 Elementary and Secondary Education Act – specifically Title I and III Triggered by 1965 legislation Elementary and Secondary Act. Particularly Titles I & III make funds directly available to schools but call for activities pioneered by informal science centers. Title I was geared toward poor children Title III called for the creation of summer camping and outdoor ed. facilities. Creativity in Education 5 million dollars spent on 89 projects involving outdoor education between	1966 The Deperatment of Education hosts a conference of museum directors at the Smithsonian. Purpose of conference – 1.survey present relations between museums and

	education. 2.Explore methods of involving museums more directly and more fruitfully in educational process at all levels. 3. Formulate proposals for research and development relating to museums and education. Change focus from primarily open education where museum goers come to self-educate to more formal programs of education designed to meet specific needs of schools. Legislation triggered a 55.8% increase in education al services at Schenectady museum (without increase in budget, staff, or exhibition area Museum of Science -Boston – 100,000 children served under new Mass school visit program sponsored by Mass State dept of education
Oppenheimer attends Smithsonian Conference on museum education - -is inspired to open his own facility- following a visit to Europe, he models Exploratorium after the Palais De la Decouverte in France	Am. Museum of Natural History 3x as many formal classes in planetarium Major increase in the diversity of programming at this time.
1967- Project need (National Environmental Education Department	R.Grove of Arts and Humanities Program Office of Education – "Within the past 8 months the new education legislation began to have considerable impact on he museum world. It urges closer rapprochment of museums and schools. Both are experiencing a slight discomfort" 1966 – Journal of Environmenatl Education established 1967 Fernbank Outdoor program established as part of the City school system of Atlanta it is funded though money provided under ESEA and NDEA. All Atlanta schools participate in science education through Fernbank 1968 – Exploratorium
1970 – Public Law 91-516 - Environmental Education Act calls for an office of environmental education within the department of education.	

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Appendix B

Classroom Vignette for Vision Prompt

What I am hoping to achieve through this activity is an understanding of your ideal for what science education might look like – that is your vision of science education. Knowing that describing a vision of science education in the abstract is difficult I've provided vignette(s) of science teaching and learning in classrooms that I hope will serve as a prompt in thinking about/ discussing your own vision of science education, and the practices/ resources you employ in teaching science. It is not my goal to have you judge the teaching described in the portrait(s) -- I'm sure you will find both things you like and dislike -- but rather use the portrait(s) to identify areas that resonate with you in describing an ideal scenario – or constraints to that ideal – for creating optimal science learning experiences for you and your students.

Children are sitting at desks arranged in-groups of 3 –4. Textbooks line the book shelves and it appears as though there are enough materials for each student. In this class a quick count reveals 21 students are present today.

The teacher Ms. Kari, told me that in this school science is integrated with social studies, history and geography. Teachers are free to set up schedules for instruction allowing for thematic teaching over a longer period of time.

This is a grade four classroom. Children are not grouped by ability. Classrooms are basically non-competitive environments where the individual is encouraged to do his or her best. (Say something about group norms)

Ms. Kari begins almost every year with a unit on the change of seasons from summer to fall. This year the concentration will be on fall wild flowers. Together with the two other teachers who have fourth grade classes, she has planned to use 5 class session to take them out into nature to observe the late flowers of summer, to make a collection of the flowers they find, and to systematically name the flowers. How many different flowers would they find this year? How many names would they manage to learn?

Ms. Kari introduced the unit on Fall Flowers by telling her students everything they would be doing in the next two weeks. She wrote the activities on the board and allowed students to ask questions.

For today's project students were to work in pairs. Each pair was to collect as many different plants as possible from the field immediately adjacent to the school. Students were asked to predict how many different flowers they might find before beginning their field work.

The class was organized to leave the classroom and walk to the field site where they had worked before on a different project. At once the working pairs began to collect flowers

and count. After 30 minutes outside, pairs returned to the classroom to start their second science session.

The next hour was filled with anticipation as pairs began counting their specimens. Soon the entire class was involved in finding out how many different flowers they had found. Thirty different plants were found in the field site. No one had predicted they would find so many different types of plants.

The remainder of the time was spent naming three plants with the help of reference books. There were not enough books for each pair so some worked in larger groups while others waited for books to become available Though Ms. Kari knows the names of most of the plants, she did not give out names freely to those who asked. The point of the exercise was to be comfortable using reference books as a means of identifying a plant name.

Students began drawing pictures of their plant collections in their science workbooks with the names written underneath. The plants were placed in water until the next session. One hour was used the following day to look at the plates with the help of a magnifying glass. Work continued on drawing the plants in the workbooks and finding out more about them from the reference books.

On the third day students were asked to choose a plant to draw in their workbook. They were asked to draw the root, stem, leaves and flowers. Ms. Kari used the board to talk about the plant parts and the functions of each. A discussion of the food chain followed and how plants play an important role as primary producers. Kari also passed along interesting about what different plants have be used for in the past. Students were asked to complete a homework assignment from their textbook that connected their fieldwork to information about plants and food chains.

Ms. Kari used the final session as a form of assessment to find out how many different plant names the children actually learned. Pairs were asked to return to the field and pick one specimen of every plant they could name. They brought the plants back to the classroom, sorted them and then wrote the names under the plants. In the end, if they were in doubt, they were able to use the reference books.

Appendix C

Student Focus Group Interview

1. Why do you think you your teacher took you on this fieldtrip? Is this important?
2. Can you tell me something you remembered about your trip to YNI/CDM?
3. What did you like most about this fieldtrip?
4. Are there things you saw or did that you still have questions about? Are there things you still wonder about?
5. Did this trip remind you of anything you do or talk about at school or at home? How is this experience different from anything you do at school or at home?
6. What subject– math, science, art, social studies, language arts - was this most like? In what ways is it like that subject?
7. Have you thought about this trip since you got back? If so, in what ways have you thought about your trip?

Appendix D

Survey Questions

1. What was/is your motivation for making this trip to YNI? Have you ever visited or participated in a YNI program before? Please circle - yes no

2. What do you hope your students will gain from this experience? (specific content, academically, socially, personally etc.)

3. Was there a specific curriculum need you hoped the YNI visit would meet? YES NO. If yes, what was it and to what extent did the visit meet your needs?

Curriculum need _____
Extent met need (please circle): Not at all Somewhat Hit the mark!

4.Do you or your students do anything special to prepare for this experience? YES NO
If yes, please explain (curriculum/projects, skills, community activities etc.)_____

5.Do you bring special materials with you on the trip (journals, scavenger hunt, etc.)?

6.Do you or your students do anything special to follow-up this experience? If yes, please explain (see #4 above)

7. Do you notice any changes in your students (academically, behaviorally, personally) as a result of this experience? If yes, how do these changes impact your classroom (short/long term)?

8. Has this experience changed you or your teaching in anyway? YES NO If yes,

To what extent (please circle one) not at all somewhat to a great extent

In what way_____

9. Does this trip align with your own philosophy with regard to pedagogy or how students learn? YES NO If yes please circle any /all that apply

   Hands on teaching/learning appeal to multiple intelligences mixed ability groups

   Engaging with authentic objects thematic/ cross curricular other _____

10. What words or phrases best describe this experience?

11. Did your own background or personal interests influence you making this trip? YES NO
If yes, please explain

12. How many other field trips do you take each year? 1- 2 2-4 more than 4
    Where did you go and how do you decide?

13. Please list the three biggest challenges in taking this trip (include school based and field trip site challenges)?

14. What would make it easier for you to support this experience?

15. How long have you been teaching (circle one)? What grade level do you teach? ____

0-3yrs 3-6yrs 6-12yrs more then 12 yrs

16. Are you taking this trip alone, with grade level colleagues, mixed grade level, other (circle one)?

If you would be willing to participate in a focus group or workshop dedicated to thinking about and creating classroom support materials for teachers who visit YNI, please include your name, school, the grade level you teach, and time of year you would like a meeting like this to be held (spring, summer, fall, winter).

Appendix E

One-time Interview Questionnaire

1. What are your motivations for taking this trip?
2. Are there specific things you hope your students will gain from this experience?
3. Do you expect the field trip content/pedagogy to relate to other things/subjects you are doing in your classroom?
4. Did you/ are your doing anything to prepare for you trip? If so what kinds of things are you doing?
5. What types of lessons are most effective with your students?
6. Do your or your students do anything special to follow-up this experience? If yes, please explain
7. Did you notice any changes in your students (academically, behaviorally, personally) as a result of this experience? If yes, how do these changes impact your classroom (short/long term)?
8. Has this experience changed you or your teaching in anyway?
9. What words or phrases best describe this experience?
10. Did your own background or personal interests influence you making this trip? If yes, please explain
11. How long have you been teaching? What grade level do you teach?

Appendix F

YOSEMITE PROJECT CURRICULUM

Reading/Language Arts Standards	Diagnostic	Lessons	Yosemite	Assessments
Reading				
▫ Reads for critical analysis	Cloze test	John Muir: 2 readings "Silent Spring in Yosemite"	topographic maps	Geology Test
▫ Reads for understanding	Oral reading	Yosemite Myths		
▫ Reads for information	Habits of Mind	Bears article Safety article		rubric
Writes (and revises)				
▫ for a purpose	rubric use	eyewitness account	Journal	published
▫ to develop voice		Myth of Half Dome		Rubric
▫ with rich variety of patterns				
Listening/speaking				
▫ Listen, comprehend/evaluate	Casual presentation	NEWS, Myers-Briggs and other learning style		Rubric
▫ Speaks for a variety of purposes		Activities	Spider Caves Directions	
		Socratic Seminar *Yosemite*, M. Sanborn		
Mathematics Standards (used with problem-solving applications)				
Proportional reasoning	Indirect measurement Pythagorean Theorem	"Yosemite Math" "		
Patterns and functions	graphing slope	"		
Computation/estimation	formulas/endangered species)	"	ranger discussions	
Algebra	simple equations	"		

Mathematics cont'd.	Diagnostic	Lessons	Yosemite	Assessments
Statistics	air/water pollution			
Measurement	population figures	Yosemite Math Finding the epicenter Richter Scale	coordinates/ordinals	Did not get lost
Social Studies				
Globe/Mapping	Legend/Scale Park map	coordinate system Contours, topography topographic profiling	trail-blazing	locating destination
Timelines/Graphs/Primary sources Land bridge/Ice Age/ Evolution		Geology of Yosemite Horses/ Little Ice Age	Use vocabulary/ ranger talks	
Conflict btwn. Govt./settlers/natives		Human history of Yosemite		graphic organizer
Imperialism		Story of Miwoks/soldiers		
Features of Constitution		Development of National Parks system States rights Vs Federal Government		test
Current Yosemite Valley Implementation Plan		democratic process :public hearings etc.		panel presentations
Science Standards				
Scale and structure		earthquakes plate tectonics Measuring latitude	explain structures	use dynamic vocabulary
Environment		biodiversity Fluvial system	ranger discussion	
Cycles	Geologic cycle	Rock Cycle		

Health	Diagnostic	Lessons	Yosemite	Assessments
Emotional needs	group work ability Learning styles	NEWS activity etc. hiking Values Clarification:	solitude	backpack trip
Skin		Protection	post-hiking skin condition	
Safety		hiking: food, water first aid Walking down grades	hiking, carrying packs rock climbing	correct pack procedure
Physical Education				
Growth and Motor Development				
Accept differences in motor performance Body type advantages Recognize differences in strength between sexes	group hikes	promenade Mori Point pace stride	backpacking	Safe return with a positive attitude
Exercise Physiology				
Cope with above normal stress Pulse rate Cardiovascular efficiency Explain sweating purpose Develop an "I can" attitude towards physical activity Regular exercise prevents heart attack Warm-up exercises	group hikes	heart/pulse muscles, tendons, ligaments cardiovascular system		log for muscle strength, Muscle endurance, flexibility, and cardiovascular endurance
Food choices/physical fitness	food pyramid	diet log "How fit am I?"		BMI

Physical Education cont'd.	Diagnostic	Lessons	Yosemite	Assessments
Psychosocial Development				
Effective team player Sex-integrated classes Direct small group of peers Display self-discipline Offer assistance when needed Rearrange equipment to create a greater challenge Compete with others to improve Performance			Institute activities	Yosemite Institute determines if the class is fit enough to backpack

Visual Arts	Diagnostic	Lessons	Yosemite	Assessments
Aesthetic Perception: Imaginative ways to perceive things in nature			backpacking watercolors	
Creative expression				project poster
Art Heritage	Internet use	American art history:: Thomas Cole/Moran Ansel Adams Mythical symbols to Illustrate myths	photography	project

1998 Yosemite Final Project: How is Life Changing?	Use 6 lessons and your Yosemite Experience to answer the Essential Question	Rubric
1999 Panel Presentations by Different representative/concerned groups: Which Plan is the best for the Valley?		Panel

Appendix G

Assignment F
Creative Project

Simulation Game: You Fix Yosemite Valley!

Premise: One of the best ways for students to start using critical thinking skills and practical application of curricula is by doing authentic work. The National Park Service is developing their Vision for the 21st Century: A General Implementation Plan for Yosemite. At the same time, my students will be spending a week with Yosemite Institute and will have firsthand knowledge of the problems and potential of the Yosemite Valley. Using a simulation game can help students develop those critical thinking skills and communicate their ideas to the NPS at a time when interest and concern are heightened.

Objective:: Students have an opportunity to learn about the variety of cultural influences on the valley and help decide the future plans for restoration/mitigation/limitation of the park environment

Preliminary Work:

1. Students spend time before their visit preparing for hiking and writing eyewitness accounts.
2. Students will receive some instruction from Yosemite Institute on the ecology management, mitigation and restoration processes going on.
3. Students will examine the four alternate plans for Yosemite Valley

Class research:

4. Students will return to school and study the various components of the complex issue.

Final Product:

5. The various representative interest groups will caucus and design possible plans.
6. Culminating activity will be restoration/preservation presentations by interest groups before a panel of "government officials".
7. Results will be passed along to NPS at Yosemite

Simulation Game Plan

Step One:

Students choose to be a member of one of the eight teams. There will be 2 or 3 students per team.

Step Two:

Each team receives a folder containing the following materials:

- ❑ Group Recording Sheet
- ❑ The 4 alternate plans and support material on the VIP
- ❑ A packet of material researching their affiliation group
- ❑ Daily Log Sheet for each member
- ❑ Timeline for project
- ❑ Description of what and how to use a CAUCUS
- ❑ Information Sheet for Pre-Panel Presentation
- ❑ Information sheet for Final Presentation to Panel

Step Three:

Following directions on the Group Record sheet each group will divide the work and spend one week collecting, sifting and thinking about their information.

Step Four:

Group will decide which alternate plan they will support and/or modify to meet their group's needs. They will have one week to prepare an oral presentation on their choice and to caucus with any other group(s).

Appendix G

Group Recording Sheet

Names of group members

_____
_____
_____

Affiliated Group

_____

Individual responsibilities:

Name	Job responsibility
_____	Internet research
_____	Map study
_____	Graphic design
_____	Writing final plan
_____	Speaker before the panel
_____	Materials
_____	Troubleshooter
_____	Folder holder
_____	Phone Master

Group responsibilities:

- ☐ Reading all the information and taking notes or dividing the reading, taking notes and teaching each other the information.
- ☐ Group must agree on which plan to present
- ☐ Group must agree with Final Presentation Plan

We caucused with these other groups:

_____
_____

Appendix G

My Daily Log Sheet

Name _____

Group _____

Date	Comments: what I did, how it went, questions, problems etc.

Appendix G

Date	Comments: what I did, how it went, questions, problems etc.

What's A Caucus
And
Why Do We Need It?

1. A caucus is a meeting between 2 or more groups for the purpose of forming a unified team to get a project approved.

2. Your group may have a great idea for the Valley floor, but you might be able to get the Panel to agree if you have a few more groups to go along with you. Appearing before the Panel with more than one other group gives you more power to get your plan approved.

What Do We Do If We Decide
To Have a Caucus ?

3. You need to send out a member of your team as a representative to other groups and see if anyone else's plan is similar or fits in with your plan. If you can find other groups who are interested in your plan or merging 2 or 3 plans, you will have a meeting together (that meeting is called a caucus),

Appendix G

Information for Final Presentation to Panel

1. Each group (or groups) will make a presentation to the panel that is not longer than 10 minutes.

2. The order of presentation will be done by lottery.

3. The Panel will ask questions at the end of each presentation.

4. Speakers should dress appropriately.

5. After the last presentation, the Panel will adjourn to a separate room and decide which plan to approve.

6. Panel will announce their decision to the class.

7. Reception is immediately after announcement.

Appendix G

Project Timeline

Week One	Experience the Yosemite Valley Floor
Week Two	Examine the 4 alternate plans for Yosemite Valley and choose group affiliation. Group will organize using the Record Sheet and start research.
Week Three	Groups will study own group's position and agree on new plan or one of the 4 alternates. Plan and produce any visuals etc. to go along with presentation map.
Week Four	Groups practice and prepare presentations to Yosemite Valley Implementation Plan *Panel

* Panel will consist of parents, principal, community member and several seventh graders.

Reception following Panel's Final Choice

Week Five	Groups will write final draft of proposals to send to NPS and Yosemite Institute leaders.

Alternative #1

The "No Action" Alternative

Under this alternative, projects would be undertaken in a piecemeal manner. Although a few elements of the other alternatives might still be implemented through this approach, changes would not move forward in a coordinated, comprehensive and integrated fashion, which is necessary to fully realize the goals of the General Management Plan.

Questions about this alternative:

Alternative #2

The Proposed Action

- Approximately 147 acres would be restored to natural conditions, 82 acres redesigned and 59 acres developed in the east end of Yosemite Valley
- An orientation/transfer facility would be constructed near Taft Toe at the Valley's west end, in a location which would be out of major scenic viewing areas. The creation of interim parking would be dependent upon establishment of a regional transportation system. If parking is created, it would be removed as a regional transportation system is developed.
- Day-use parking areas in the east end of the valley would be removed.
- Miles of new, safer and restored biking and hiking trails would be created.
- Sections of the roads through Stoneman, Ahwahnee and Cook's meadows would be removed and meadows restored.
- Three bridges would be removed to restore the natural flow of the Merced River.
- National Park Service and concessionaire headquarters and other non-essential buildings would be relocated out of the Valley.
- Lower and Upper River campgrounds would be relocated to less environmentally sensitive areas of the Valley.

Questions about this alternative:

Alternative #3

- An orientation/transfer facility and a parking structure would be located near Pohono Quarry (the creation of such a structure would be dependent upon the establishment of a regional transportation system). If built, the parking structure would be visible from major scenic viewing points in the Valley. The structures under consideration for Pohono Quarry would be permanent and more expensive than the parking area at Taft Toe.
- Approximately 143 acres would be restored to their natural condition, 93 acres redesigned and 57 acres developed in the east end of Yosemite Valley.
- Day-use parking areas in the east end of the Valley would be removed.
- Two bridges would be removed to restore the natural flow of the Merced River.
- Lower and Upper Campgrounds would be relocated to less environmentally sensitive areas of the Valley.

Questions about this alternative:

Alternative #4

- Approximately 118 acres would be restored to natural conditions, 95 acres redesigned and 36 acres developed in the east end of the Yosemite Valley.
- Roads and day-use parking areas would be retained and consolidated, with a minor expansion to accommodate day-use vehicles which must be parked for the duration of a visitor's stay.
- Three bridges would be modified to restore the natural flow of the Merced River.

Questions about this alternative:

Appendix G

Common Features of the Three Action Alternatives

- Reclaimed land would be restored to a natural state, although the acreage of restored land differs between the alternatives.
- Visitors would use a shuttle bus system to travel within the Valley.
- Overnight visitors would park their vehicles for the duration of their stay in the Valley.
- The Village Store would be redesigned to serve as a Visitor Center and provide a hub for the shuttle system.
- Visitor amenities, museums and amphitheaters would be located near the redesigned Village Store. A grocery store would be located at Curry Village.
- Many facilities would be relocated. Park headquarters would be moved out of Yosemite Valley and the existing building converted into a natural history museum. Other National Park Service facilities, the headquarters for the concessionaire, and some concession employee housing units would be moved outside the Valley. Houses along the edge of the Ahwahnee Meadow would be removed.
- Improved traffic patterns, which vary with each alternative.
- A day-use vehicle reservation system would be implemented to alleviate congestion and avoid the need to close the Park during periods of heavy visitation (the reservation system is being developed separately from the draft VIP)

- Note: VIP means Valley Implementation Plan

Information Sheet for Pre-Panel Presentation

Group Affiliation _____

Group Members _____

_____

Group Speakers _____

Materials needed for presentation:

- ❑ Map showing your plan for the Valley
- ❑ Speech notes
- ❑ Support materials to strengthen case

Chart other groups' plans and see if you would like to caucus with them.

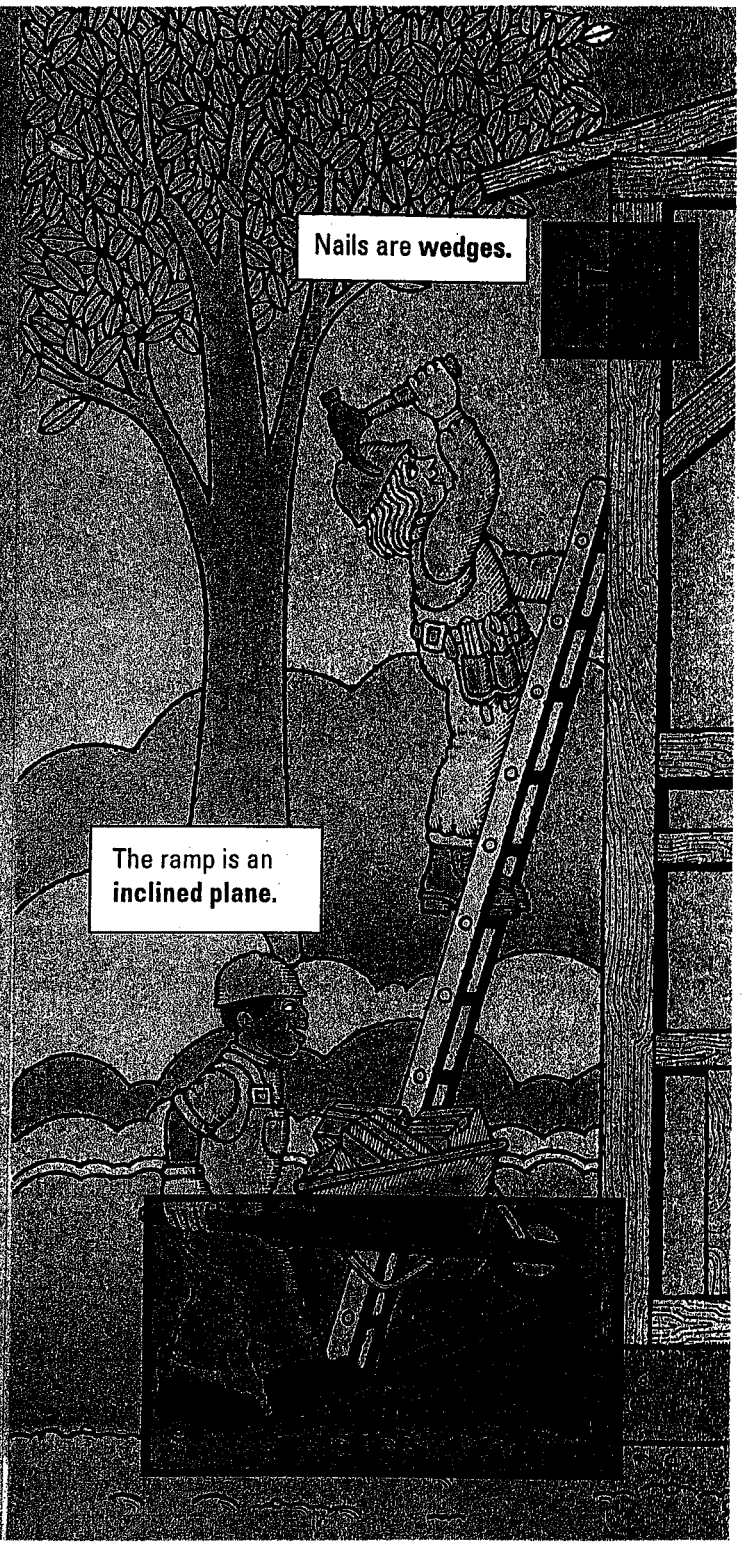
Group Affliliation	Proposed Plan

Prepare Final Presentation for Panel

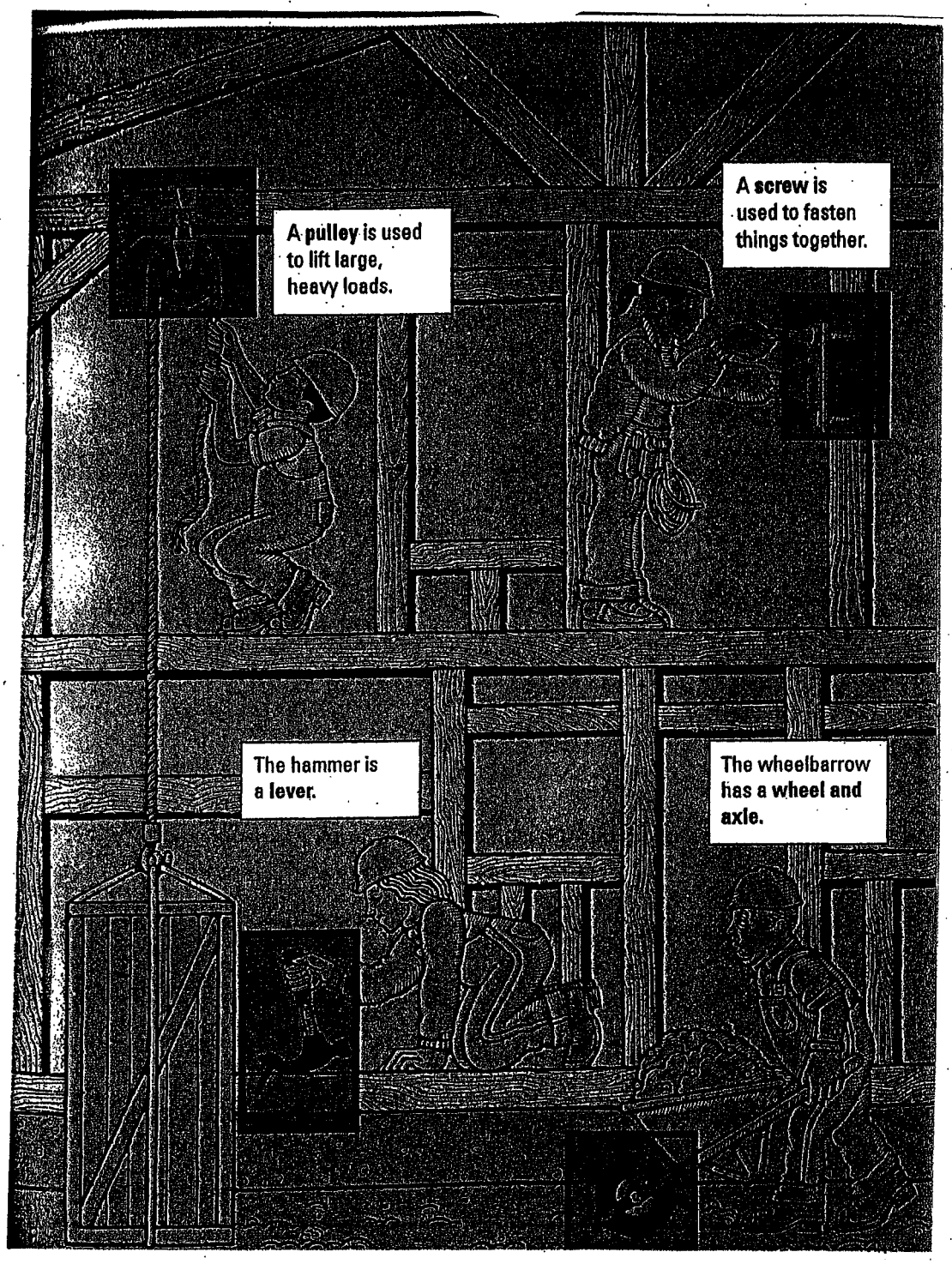
Simple Machines

How are simple machines helpful in building a house?

Many tools are used to build a house. The six tools being used in the picture all use energy to do work. These tools are **simple machines**—machines with few or no moving parts. The wheelbarrow makes pushing heavy loads easy because its wheels are fastened together by an axle. Notice that the ramp is slanted so that the wheelbarrow moves up it easily. Nails are used to hold parts of the house together; sometimes screws are used instead. Why might a screw hold some things together better than a nail?



Appendix H


A pulley is used to lift large, heavy loads.
A screw is used to fasten things together.
The hammer is a lever.
The wheelbarrow has a wheel and axle.

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