AN ABSTRACT OF THE DISSERTATION OF

Bryan M. Rebar for the degree of Doctor of Philosophy in Environmental Sciences presented on September 25, 2009.

Title: Evidence, Explanations, and Recommendations for Teachers' Field Trip Strategies

Abstract approved:

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Larry G. Enochs

Field trips are well recognized by researchers as an educational approach with the potential to complement and enhance classroom science teaching by exposing students to unique activities, resources, and content in informal settings. The following investigation addresses teachers' field trip practices in three related manuscripts:

1. A study examining the details of teachers' pedagogical strategies intended to facilitate connections between students' experiences and the school curricula while visiting an aquarium
2. A study documenting and describing sources of knowledge that teachers draw from when leading field trips to an aquarium
3. A position paper that reviews and summarizes research on effective pedagogical strategies for field trips

Together these three pieces address key questions regarding teachers' practices on field trips: (1) What strategies are teachers employing (and not employing) during self-guided field trips to facilitate learning tied to the class curriculum? (2) What sources of knowledge do teachers utilize when leading field trips? (3) How can teachers be better prepared to lead trips that promote learning? The Oregon Coast Aquarium served as the field trip site for teachers included in this study. The setting suited these questions because the aquarium serves tens of thousands of students on field trips each year but provides no targeted programming for these students as they explore the exhibits. In other words, the teachers who lead field trips assume much of the responsibility for facilitating students' experience. In order to describe and characterize teachers' strategies to link students' experiences to the curriculum, a number of teachers (26) were observed as they led their students' visit to the public spaces of the aquarium. Artifacts, such as worksheets, used during the visit were collected for analysis as well. Subsequently, all

teachers were surveyed regarding their use of the field trip and their sources of knowledge for their practices. A subset of eight teachers were interviewed using guided conversations in order to shed further light on their use of the aquarium field trip and their pedagogical preparation. Data from all sources were organized by repeating ideas relevant to the questions of interest. The resulting evidence was interpreted to support distinct categories of teacher strategies and experience and related claims about these strategies and experiences. Thus, findings reveal that teachers attempt to link the curriculum to the activities, resources, and content encountered on the trip using a variety of connections. However, these curriculum connections are characterized as products of opportunistic situations and reveal limited depth. Evidence further indicates that teachers treat the aquarium visit as a background experience for their students rather than as an opportunity to introduce new concepts or do an activity that is integrated into the curriculum. Nevertheless, teachers included in this study were leading field trips that created countless learning opportunities for their students. Because training specific to field trips is rarely included in preservice programs, teachers were asked about influences on their field trip practice with specific focus on observed strategies. Findings suggest four categories of training experiences that teachers apply to their practice: (1) informal mentoring; (2) past experience trip leading; (3) outdoor education training; (4) traditional education training. Overall findings along with a review of previous research are suggestive of many ways in which efforts to enhance students' learning opportunities may be developed by means of support for teachers. Foremost among recommendations is the idea that field trip pedagogy be integrated into science methods courses required for preservice teachers (the premise for the final manuscript). Furthermore, the findings of this study may serve as a starting point for museums interested in the development of specific support and teacher professional development activities intended to enhance teachers' use of their resources as learning opportunities for their students. Among the implications is the idea that museums and other institutions developing teacher professional development activities might capitalize on teachers' existing sources of knowledge, for example by providing structured support for peer-mentoring and guided reflections related to field trip preparations and skills.

EVIDENCE, EXPLANATIONS, AND RECOMMENDATIONS FOR TEACHERS' FIELD TRIP STRATEGIES

by
Bryan M. Rebar

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

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Bryan M. Rebar, Author

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DEDICATION

This work is dedicated to all the teachers who go above and beyond expectations in order to offer their students quality out-of-school learning experiences. May the findings and recommendations presented here ultimately contribute to enriching the memorable student experiences you work so hard to realize.

EVIDENCE, EXPLANATIONS, AND RECOMMENDATIONS FOR TEACHERS' FIELD TRIP STRATEGIES

CHAPTER I

INTRODUCTION

INTRODUCTION

The idea that field trips help students learn science can be traced back in history for many generations. Although guided outdoor learning activities certainly predate the late 1800s, about this time the nature study movement began to take hold in which students were expected to learn through first-hand experiences inside and outside the classroom (Swan, 1975). In the intervening time between then and the present field trips have become a common practice in education. In fact, it hardly seems necessary to define the term "field trip" because its meaning is typically understood without question among educators, students, and parents and, moreover, the term is almost self explanatory. Yet field trips take many forms, and field trips are usually considered to include more than class trips to a field setting. Common definitions tend to be broad in order to reflect the many uses of out-of-school settings. For example, Victor (1965) asserts that "the field trip should refer to any learning activity that is carried on by the children as a group outside the classroom" (pp.88-89). Implicit but not included in Victor's definition is any mention of a teacher who organizes and guides or facilitates learning activities. Without initiatives by teachers field trips would not occur (Finkelstein, 2005). Thus, for purposes of this investigation, field trips refer to a teacher-led school activity outside the classroom in which students are expected to learn.

Although informal learning institutions (ISIs) such as aquariums often have at least one different interest in field trips than teachers (that of creating repeat visitors) (Storksdieck, 2006), defining field trips broadly to include everything from schoolyard visits to overnight school outings actually makes sense from a learning point of view. The characteristics of learning in the informal settings where field trips take place are distinct from those of the formal classroom setting. In general, field trip learning tends to be more learner-centered and learner-directed, less structured, more open-ended, include more unintended and less directly measurable outcomes, and involve more social intercourse (Hofstein & Rosenfeld, 1996; Ramey-Gassert, Herbert J. Walberg, & Walberg, 1994). Furthermore, learning activity on field trips may be characterized as placing greater emphasis on the learner's identity rather than the topic, allow for participation based on individual abilities rather than universal standards of performance,

foster emotional and intellectual engagement concurrently, and occur where meaning is tied to the context (L. M. W. Martin, 2004).

Using a sociocultural lens further illuminates field trip learning. Because a sociocultural approach to learning accounts for the contextual and social construction of knowledge that often takes place on field trips, this approach has grown the most as a way of understanding how learning occurs in museums (L. J. Rennie & Johnston, 2004) where field trips often take place. In a sociocultural view of learning, interacting teachers and students comprise a community of learners. During field trips especially, these communities can change quickly depending on individuals' participation. Given this understanding, the challenge and the goal of the teacher should be to serve as a resource and facilitator of learning activity by using mediating tools: discourse, prompts, worksheets, and any available resources (such as exhibits) to engage students socially and mentally. A sociocultural approach also calls attention to the learning arrangements in which the teacher presents the visit. For example, are students given individual or group tasks? Are students encouraged to explore and interact with exhibits and each other or are there other foci? Does the teacher help students identify the goal or goals for the visit such that their goals are shared? What mediating tools does the teacher utilize and how?

Underscoring the sociocultural view that highlights the importance of learning facilitators such as teachers are research studies that indicate students' learning opportunities are strongly shaped by the teacher. A number of studies that suggest the influence of the teacher do so by providing evidence of underutilized and missed learning opportunities stemming from the teachers' use (non-use or misuse) of instructional strategies during the field trip (for example, Cox-Petersen, Marsh, Kisiel, & Melber, 2003; Cox-Petersen & Pfaffinger, 1998; Griffin, 2007; Griffin & Symington, 1997; Kisiel, 2006; Wals, 1994). For example, some teachers inappropriately impose formal teaching methods during field trips (Griffin & Symington, 1997) or structure activities too rigorously (Wals, 1994) to maximize learning opportunities. In other cases, teachers have been documented using didactic methods as they lead their students (Kisiel, 2006) or have other educators lead their students (Cox-Petersen et al., 2003) that conflict with science education reform efforts. Teachers have also been documented favoring

managing and observing roles rather than facilitator roles while leading museum field trips thereby initiating fewer interactive activities (Cox-Petersen & Pfaffinger, 1998).

Further museum field trip observations point to the vital role of the teacher. For example, when teachers divide students into small family-like groups accompanied by knowledgeable adults who participate in conversations but allow students to follow their itinerary, students exhibit a high degree of mental engagement (Gilbert & Priest, 1997). Another documented way in which student engagement may be improved on museum field trips involves drawing links to the current curriculum (Gilbert & Priest, 1997). However, when teachers do not communicate expectations for a museum field trip with their students prior to the visit, students show less openness to learning and are less engaged and less impacted by their experience than their more knowledgeable and open-minded teachers (Storksdieck, 2001). The observation that museums are often accepted by visitors as true representations of the world further contributes to the conclusion that teachers need to actively facilitate students' learning on field trips to these sites (Trofanenko, 2006).

Despite the evidence revealing missed learning opportunities, the evidence showing the potential and realized educational effectiveness of field trips is overwhelming (for example, Anderson & Lucas, 1997; Finson & Enochs, 1987; Flexer & Borun, 1984; Orion & Hofstein, 1994; Stronck, 1983; Wolins, Jensen, & Ulzheimer, 1992). As discussed above, one of the keys to realizing these educational benefits involves the teachers' use of strategies that attempt to integrate the school curriculum with students' field trip experiences. Teachers value the curriculum fit of the field trip site highly, but this may reflect their need to justify the field trip to administrators rather than their pedagogical use of a class museum visit (David Anderson & Z. Zhang, 2003). The literature on field trips provides several examples for how a field trip may be carefully integrated into the curriculum (for example, Gilbert & Priest, 1997; Guisasola, Morentin, & Zuza, 2005; Mokros & Wright, 2009; Orion, 1993; Sedzielarz & Robinson, 2007; Wolins et al., 1992). Each of these examples emphasize the importance of introducing connected lessons and activities that occur before, during, and after the field trip.

All of the ideas discussed above were taken into account when proposing and completing the original work that follows. The overall agenda for this investigation is centered on identifying ways in which teachers can and do learn about and utilize field trip strategies for promoting the best possible student learning. Appropriately, the setting chosen for this study is a large aquarium, the Oregon Coast Aquarium (OCA), that serves tens of thousands of students on field trips each year, but provides no targeted programming for these students as they explore the exhibits. As a result, teachers assume a heavy responsible for the learning arrangements for their students. The impact of teachers' learning arrangements is magnified by the physical setting: the Oregon Coast Aquarium is comprised of multiple exhibition areas in various halls found in separate buildings and including indoor and outdoor areas. Included in this study are twenty-six lead teachers representing 71% of the groups in grades 2-12 who visited OCA over a two month period in the fall (the beginning of the school year). Data collection was conducted by passively observing teachers as they led their visits to the aquarium, gathering artifacts such as worksheets used by students, soliciting teachers' responses to an on online post-trip survey, and interviewing a subset of eight teachers following their completion of the survey.

Observations and data collection were informed by the researcher's personal background and experience. As the only researcher collecting and analyzing data, there was no need to reconcile inconsistencies resulting from different researchers' observations. As such, my observations offer the strength of being informed by my considerable previous experiences with field trips. In previous roles as an outdoor educator and science center program director, I have gained rich understandings of the skills and strategies that contribute to engaging teaching in out-of-school settings. In addition, I have worked with hundreds of teachers to schedule and coordinate field trip programs in these roles. As a researcher I have gathered qualitative data both in classroom and outdoor settings, most notably as part of my master's thesis research focusing on students' conceptual learning resulting from a residential environmental education experience. Collectively, my background has prepared me to recognize and capture observations of teachers' use of strategies to present field trips as learning

opportunities for their students. The centrality of the human element in this qualitative investigation is at once a strength and a weakness due to the insights my background allow and perhaps preclude (Patton, 2002). When observational evidence is presented, direct quotes are used wherever possible with sufficient context "to allow the reader to enter into the situation and thoughts of the people represented" (p. 503, Patton, 2002). Moreover, multiple data sources are referenced whenever possible to enhance reliability and to support interpretations.

By examining teacher strategies utilized during the trip (in-trip strategies) chapter two, "Curriculum connecting strategies on teacher-led field trips to an aquarium," attempts to respond to four prevailing messages in the literature as described above: (1) the great potential for learning on field trips; (2) the key role of the teacher in facilitating learning opportunities; (3) the often missed learning opportunities on field trips; and (4) the importance of the teachers' framing and using the field trip itself as an integrated learning experience within the school curriculum. The second article comprised in this work, "Teachers' sources of knowledge for field trips practices" (chapter three), examines influences on teachers' choices of field trip strategies. This second study, therefore, builds on the first study (chapter two) describing teachers' use of curriculum connecting strategies by addressing how teachers learned to use these strategies. Thus, the second study also responds to the prevailing messages in the literature by addressing why teachers facilitate field trips in the ways in which they were observed. The primary audience for these two articles is researchers and museum administrators who pursue study, evaluation, curriculum design, and teacher professional development in out-of-school settings. Finally, the third article comprising this work, entitled "Integrating environmental education field trip pedagogy into science teacher preparation" (chapter four), provides a natural extension of these studies by outlining one method to better support teachers leading field trips. To be more specific, this final article describes how and what strategies to include in a preservice science methods course in order to better prepare teachers for leading pedagogically sound field trips. In part, this final article responds to a finding of the second article: teachers receive little if any training specific to field trips in their preservice programs. The primary target audience for this third

article is administrators, instructors, and curriculum developers involved in secondary preservice science education. A secondary audience is, fittingly, future secondary science teachers and other educators involved in designing and facilitating environmental field trips.

One of the benefits of presenting these three articles as part of a larger body of work is the perspective they jointly offer on the current state of understanding and practice of field trips. Chapter two ("Curriculum connecting strategies") provides a fine grain snapshot of teachers' attempts to facilitate learning that, using a sociocultural approach, might be described as analysis at the level of microgenesis, or moment to moment interactions (Rowe & Wertsch, 2002). Chapter three ("Teachers' sources of knowledge") uses a larger contextual lens to examine teachers' practices in light of their learning and personal development as teachers over time. Thus, chapter three may be described as a study of ontogenesis (compare Vygotsky, 1986). Finally, chapter four ("Field trip pedagogy") provides suggestions for how to promote teachers' learning and personal development in ways that translate into successful field trip strategies for facilitating immediate and short-term learning events. Together these three articles represent three crucial components of a larger research agenda on field trips aimed at bridging research and practice.

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CHAPTER II

CURRICULUM CONNECTING STRATEGIES ON TEACHER-LED FIELD TRIPS TO AN AQUARIUM

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CURRICULUM CONNECTING STRATEGIES ON TEACHER-LED FIELD TRIPS TO AN AQUARIUM

Abstract

Field trips are well recognized as an educational approach with the potential to complement and enhance classroom science teaching. Research over the past several decades has led to a broad understanding of field trip teaching strategies that, when employed, help take advantage of the unique learning opportunities afforded by field trips. Central among all recommended pedagogical strategies is the importance of utilizing the activities, resources, and content to foster learning that complements classroom topics and lessons. Because many teachers lead their own field trips to institutions with educational missions such as aquariums, teachers largely carry the responsibility of facilitating learning opportunities for their students. Although past research has included some descriptions of teachers' field trip leading strategies, there is a need for further detailed observation and analyses of these strategies particularly with respect to attempts to draw connections to the curriculum. In this study, twenty-six teachers leading field trips to the Oregon Coast Aquarium were observed, surveyed, and a subset of eight teachers were interviewed in order to create rich descriptions of the types and the manners in which teachers employ curriculum connecting strategies. Overall analyses reveal that teachers make a variety of curriculum connections during their visit. In most cases, these connections may be characterized as unplanned and opportunistic. Moreover, evidence suggests teachers treat students' experiences as a background experience related to the curriculum rather than as an opportunity to introduce new concepts in an intentional way. The fine details of teachers' curriculum connecting strategies provided by this study provide a logical starting point for specific efforts designed to support and enhance teachers' field trip pedagogy.

Introduction

Aquariums, much like other museums, offer unique opportunities for teachers to engage their students with subject matter relevant to the curriculum. Out-of-school opportunities, such as aquariums, align well with the aims of school science (such as promoting scientific literacy) by providing an ideal setting to enhance student interest in science topics such as marine biology, by providing opportunities for authentic science experiences by means of inquiry and, finally, by fostering improved science learning (Braund & Reiss, 2006a, 2006b). Recently the National Research Council put forth a report that echoes these observations of the alignment between the goals of school science and the capabilities of informal environments specific to science learning. In essence, the report holds that each of the identified strands of science learning identified for K-8 students overlap with the capabilities of informal environments with the added two distinctions that informal environments also are well suited to (1) generate students' excitement, interest, and motivation and (2) to build students' identities as science-competent individuals (National Research Council, 2009).

The notion that out-of-school sites can enhance education is not new; the preeminent educational philosopher John Dewey long ago argued that all genuine education comes through experience (Dewey, 1938). Today the National Science Standards explicitly support extending the science program beyond the walls of the classroom and they praise principals who sponsor field trips (National Research Council, 1996). In Oregon many teachers take advantage of the state's informal science institutions (ISIs); for example, the setting for this study, the Oregon Coast Aquarium (OCA), served over 19,000 students on field trips in the 2005-2006 school year (OCA internal records). Given the recognized potential benefits of field trips and teachers' high use of ISIs such as the Oregon Coast Aquarium—which has an educational mission—as destinations for marine education field trips, one might surmise that most field trips are highly successful in realizing the potential learning benefits of such trips. However, past research suggests otherwise (e.g., Amos & Reiss, 2006; Griffin & Symington, 1997). It has previously been established that facilitating learning opportunities on field trips requires special strategies and skills that are not commonly used in classroom settings

(Cox-Petersen & Pfaffinger, 1998; DeWitt & Osborne, 2007; Griffin, 1994; Rebar & Enochs, In press). Research of field trips has led to many recommendations for strategies to optimize learning for students (DeWitt & Osborne, 2007; Rebar & Enochs, In press). Thus in the following study, these research recommendations serve as a reference point for observed in-trip curriculum connecting strategies (that is, pedagogical strategies intended to promote learning relevant to the curriculum that are used by teachers while leading a trip) used by teachers leading self-guided trips to an aquarium.

Rationale for Field Trips

The rationale for leading field trips as part of the school curriculum is well established from both a theoretical and practical perspective. With regard to the former, Bransford et al. (2005) argue that research on informal learning must be emphasized in conjunction with research on formal learning because learning is learning regardless of the setting. This view contrasts with the body of research on learning that has traditionally explored learning, including characteristics and measures of learning, as independent in these two settings. Similarly, these two types of learning that, by definition, take place in different contexts are viewed independently not just by researchers but by teachers and students as well, leading some students to declare that they are not learning anything in informal settings unless formal procedures and tools, such as the use of worksheets, are applied (Griffin & Symington, 1997). The observation that classroom science tends be abstract, divorced from the real world, involve symbols and numbers and generally lack connections to lived experience (Ramey-Gassert, 1997) supports the conclusion that teachers often separate formal and informal learning as well. It appears that even teachers who lead field trips often separate the two by failing to provide purposeful connections to the curriculum for students (for example, Anderson, Kisiel, & Storksdieck, 2006; Griffin & Symington, 1997). However, the research focus on informal learning has also helped highlight the interpretation of formal learning, particularly in-school learning, as but one context among many in which learning occurs (Bransford et al., 2005). Thus field trips provide an ideal opportunity to bridge the gap between informal and formal learning by highlighting relevant topics and materials in

different settings. These above observation indicate that although field trips are well supported as an appropriate approach to learning, there is a need for more evidence for the ways in which teachers can and do promote connections between field trip experiences and classroom lessons.

Research studies consistently show that students take a positive attitude toward a variety of field trips (for example, Falk & Balling, 1982; Flexer & Borun, 1984; Falk & Dierking, 1997; Pace & Tesi, 2004). Research studies also provide overwhelming evidence that, with the use of appropriate strategies, the potential for guided learning on field trips is great (for example, Anderson & Lucas, 1997; Finson & Enochs, 1987; Flexer & Borun, 1984; Orion & Hofstein, 1994; Stronck, 1983; Wolins, Jensen, & Ulzheimer, 1992). One of the keys to realizing these potential educational benefits involves the teachers' use of strategies that attempt to integrate the school curriculum with students' field trip experiences. The literature on field trips provides several examples for how a field trip may be carefully integrated into the curriculum (for example, Gilbert & Priest, 1997; Guisasola, Morentin, & Zuza, 2005; Mokros & Wright, 2009; Orion, 1993; Sedzielarz & Robinson, 2007; Wolins et al., 1992). Each of these examples emphasize the importance of introducing connected lessons and activities that occur before, during, and after the field trip. Thus, for purposes of this study, the curriculum refers to all the topics and accompanying lessons that each teacher introduces as part of their overall educational mission.

From a theoretical perspective, Braund and Reiss (2006a) identify five potential benefits of out-of-classroom contexts (therefore including field trips): (1) improved conceptual learning; (2) authentic practical work; (3) introduction to "big" science (that is, science using large equipment of done at a big scale not replicable in a lab); (4) improved attitudes; (5) social outcomes such as collaboration and personal responsibility for learning. Teachers refer to similar benefits such as the power of field trips to stimulate interest and motivation in science and develop scientific and social skills (Michie, 1998). Many teachers are quick to recognize the affective value of field trips (for example, Anderson et al., 2006; Mullins, 1998; Stocker, 1996).

In summary, field trips are strongly supported as an educational strategy because they motivate and engage students and they foster learning connections between formal and informal settings. In light of the previous discussion regarding teachers' less than optimal use of field trips, this an important point due to the unique learning benefits they can offer. Consequently, this study focuses on an educational technique (field trips) that has great potential to enhance learning and thus would benefit from further insights on practice.

Field Trip Leading in Terms of Three Domains

Field trips require considerable preparations and skills which may be considered in terms of three domains: (1) logistics, (2) management, and (3) pedagogy (see Table 2.1). Logistics refers to the preparations and skills required to schedule the field trip, including transportation, permissions, substitute arrangements, chaperone recruitment, and site coordination. Management refers to preparations and skills involved in supervising and guiding students and other adults included in the field trip. Pedagogy refers to the preparations and skills utilized to facilitate a learning experience before, during, and after the trip.

Table 2.1: The three domains of preparation and skills involved in leading field trips with operational definitions.

1. Logistics	**2. Management**	**3. Pedagogy**
Preparations and skills required to schedule the field trip, including transportation, permissions, substitute arrangements, chaperone recruitment, and site coordination	Preparations and skills involved in supervising and guiding students and other adults included in the field trip	Preparations and skills utilized to facilitate a learning experience before, during, and after the trip

Barriers to realizing field trips can easily be classified into one of these three domains (for examples, see Mason, 1980; Michie, 1998; Orion, 1993; Rickinson et al., 2004) and doing so is useful in considering teachers' interactions and roles during field trips. Because participants in this study all led field trips, they have overcome all the logistical barriers, real and perceived, to scheduling this particular field trip to the Oregon

Coast Aquarium. In order to do so, they must have employed some managerial strategies as well. However, pedagogical strategies are not required to overcome barriers to realizing field trips. This insight coupled with the previous research findings revealing a pattern of missed learning opportunities on field trips suggests the need to examine what teachers are doing to facilitate learning while leading field trips. The need for such empirical data has been previously identified by DeWitt and Storksdieck (2008) who state that "an important first step [in supporting better field trip practice] is to be aware of current teacher practice on school field trips, of teacher objectives for these visits, and of contextual factors which can impact how teachers conduct such excursions" (p. 188). Furthermore according to Kisiel (2006), "there has been little study of what kinds of instructional or management strategies teachers use during the museum visit itself" (p.435) with the exception of his study which provides an overview of multiple in-trip strategies.

The notion that each field trip must be framed as an instructional activity integral to the curriculum has been promoted for many decades. For example, Victor (1965) asserted that

> the field trip can be effective as a teaching technique only when it has a purpose. There must be a real reason for taking the field trip. The purpose may be to introduce or arouse interest in a new science unit, to find the answers to questions and problems raised during the unit, or to summarize the highlights and important understandings of the unit. Whatever the purpose, it should be understood by all the children. (p.91)

However, such intentional use of field trips coupled with clear communication about the purpose appears to be quite rare; prior research has found that teachers often do not recognize the degree to which they can and do shape students' learning experiences in such settings and, consequently, students tend to understand a different purpose than students (Griffin & Symington, 1997). Similarly, research on ways to improve science teaching and learning on field trips led Lebak (2006) to conclude that

> the role of classroom teachers are indeed an important factor in their students' participation and learning on field trips. However, the role of the

> classroom teacher must extend from providing pre-planning and post-planning classroom activities to taking a greater role in the teaching and learning of students during the field trip in order for students to connect classroom learning to learning in informal learning centers. (p. 25)

Again, these studies point to the need for further descriptions of teachers' pedagogical strategies employed during field trips (that is, in-trip strategies) with specific attention to strategies that attempt to link classroom lessons with learning experiences that occur on the field trip.

Certainly teachers face constraints on their teaching due to the arrangement of space and available exhibits and resources at the aquarium, but these should not be so prohibitive as to preclude teachers from taking an active role in facilitating learning. Much like other museums and aquaria, the exhibits of the Oregon Coast Aquarium are designed to capture visitors' attention and provide educational opportunities. Csikszentmihalyi (1988) has described individuals' attention as one of the limits to learning. Thus teachers leading field trips to the aquarium are presented with many affordances as well as constraints to teaching within the physical environment. How teachers frame the visit for students can greatly enhance or diminish students' learning opportunities. Museum exhibitions may either introduce problems to be solved or problems to be discovered (Csikszentmihalyi, 1988). The latter, undefined problems, tend to better motivate participants. Rather than allowing the exhibits to provide all the problems and do all the "teaching", teachers can direct students' attention with motivating problems of their own that focus students on content that supports their own student learning goals. In other words, teachers can enhance learning opportunities by guiding students with questions, prompts, tasks, and activities that provide students with choices and allow students to make personal discoveries as they learn. Providing students with choices at various levels, whether they have to do with the sequence of the visit or the organism to be observed in answering questions, is a research recommended strategy for maintaining students' attention on field trips (Gilbert & Priest, 1997; Kisiel, 2003; Orion & Hofstein, 1991b). Similarly, research of museum field trips also points to the value of encouraging small group conversations about the exhibits encountered (Allen, 2002). In practice, it appears that teachers may discourage sustained group

interactions centered on exhibits (Tunnicliffe, 1997) thereby diminishing learning opportunities.

Hence, what we know about field trips is that teachers' pedagogical strategies can greatly impact students' learning. Certainly organization (logistics) and supervision (management) skills contribute to situations that allow for well facilitated learning experiences. Yet, of the three domains of field trip skills, pedagogy is the only one that teachers may completely dismiss and still actualize a field trip. Given this insight along with the findings of previous studies, it is clear that, among teachers who lead trips, there is a need for more evidence regarding the ways in which these teachers employ pedagogical strategies. And in particular, the most relevant focus for data collection is the central theme of all recommended pedagogical strategies: the importance of utilizing the activities, resources, and content to foster learning that complements classroom topics and lessons. Based on this reasoning, the following study focuses on teachers' curriculum connecting strategies.

Guiding Questions

The purpose of this study, which was part of a larger investigation examining teacher field trip practices, is to identify the patterns of pedagogical strategies that teachers use while leading field trips and to describe these strategies in detail. The questions that guided this study are:

1) What strategies are teachers using to facilitate learning tied to the curriculum while leading self-guided visits to an aquarium?

2) How are teachers using these curriculum connecting strategies and to what extent are teachers optimizing learning opportunities tied to the curriculum?

As discussed above, previous evidence indicates teachers underutilize field trip settings as learning environments. Yet the details of teachers' in-trip strategies to promote learning that extends from and connects to classroom topics and lessons require further

description and interpretation. This focus on teachers' use of curriculum connecting strategies addresses the central contribution of school field trips, that is, their potential to engage students with unique and relevant resources through experiences that cannot be replicated in the classroom. Precisely how these resources are presented and how students' experiences are framed determines the educational value of the field trip. In other words, what do teachers do during the trip in attempt to maximize learning opportunities that support the curriculum? Certainly the curriculum used by each teacher who leads field trips to the aquarium varies and, more specifically, their motivations and learning goals vary for this particular field trip. However, regardless of their individual curriculum, motivations, and learning goals teachers must employ strategies to promote relevant and intentional learning situations in order to fully take advantage of the many affordances the aquarium provides. The precise form of these curriculum connecting strategies are the focus of this investigation.

Framework

This study assumes a problem-driven approach in which the questions of interest direct the use of appropriate methods and the lens through which findings are interpreted (Hofstein & Rosenfeld, 1996). As previous discussion makes clear, particularly discussion contained within the above section on the rationale for field trips, the features of informal learning are distinct from formal learning. These features, which include unsequenced events, a real-world context, unintended outcomes, social interactions, nondirected or learner directed foci, and social intercourse (Ramey-Gassert, Herbert J. Walberg, & Walberg, 1994), are particularly compatible with a sociocultural view of learning (compare Rowe & Wertsch, 2002; Vygotsky, 1986). Specifically, a sociocultural approach views social interactions, which take place in a culturally and physically defined context, as learning events. Because the questions of interest focus on teachers' actions and, more specifically, teachers' interactions during field trips, a sociocultural approach is useful to uncovering insights about teachers' practices. For example, a sociocultural view highlights the importance of social interactions in which individuals acknowledge each other's present understandings and attend to them by providing scaffolding that enables another's continued learning. Of interest is if, how,

and to what extent teachers interact to provide scaffolding for their students' learning apropos of the curriculum. Using the sociocultural lens not only points to the need for evidence of teachers' direct interactions with students using language to scaffold learning, but also the teachers' use of tools such as worksheets and other resources including chaperones to further provide scaffolding.

In discussing studies of informal learning, Martin (2004) asserts that

> the advantage of adopting a sociocultural framework is twofold: first, because it assumes the cultural formation of mind it allows us to focus at different levels of learning practices, for example, on transactional moments or on institutional trends. And, because it views learning as a cultural practice and considers the mediation of tool use, language use, participation structures, and social practices, a sociocultural approach allows comparisons of learning activity or learning systems between settings. (p. S76)

These advantages directly benefit this study because it examines transactional moments (teachers facilitating trips), and because these moments are expected to connect learning from the observed setting to the school setting. Teachers may employ mediating tools such as discourse, prompts, tools (for example worksheets), and any available resources (such as exhibits) to engage students socially and mentally in order to promote connected learning. One of the challenges for teachers is the ephemeral nature of participation and participation structures in informal settings. Again, a sociocultural view calls attention to participation and, given the focus of this study, the teachers' learning arrangements for promoting participation.

One school of thought deriving from a sociocultural framework, activity theory, further sheds light on the methods and interpretations of this study. In the Vygotskian tradition, activity theory addresses the relationship between mind and behavior (Minick, 1997). In so doing, Vygotsky's idea of mediation is expanded such that both individual actions and collective activity may be differentiated and explained (Engestrom & Miettinen, 1999). In other words there is a place for interpreting the role of others (i.e., teachers in this discussion) in determining the modes of social activity which characterize the individual and, moreover, the seemingly contradictory activities and actions of the individual may be coherently explained. Thus, activity theory holds that focusing on

goal-oriented action addresses Vygotsky's call for psychological study of an analytic object which is both a unit of mind and a unit of social activity (Minick, 1997). Moreover, in employing activity theory the context is essential in interpreting the activity. According to the theory in which mind and social activity are unified, the context is, therefore, at once the subject's internal goals and motives and the surrounding people, external language, signs, instruments and other mediating artifacts (Nardi, 1996). Applying these ideas to the field trip setting, teachers' and students' interactions within the context of the aquarium exhibitions provide an entry point into interpreting learning, or in the case of this study, learning opportunities.

Although theories of learning do not directly translate into pedagogical practice, activity theory has many implications for teaching. Teachers can define the learning object, support the activity by providing appropriate tools, and help students identify explicit goals. The previous statement perhaps captures the teacher's role so succinctly such that the difficulty in achieving these tasks on field trips merits further attention. The first challenge is that implicit in the teacher's role described above is the notion that, in order to best facilitate learning, she or he must recognize each student's zone of actual performance and proximate development and, moreover, recognize which tools will aid in his or her learning. Another challenge is that of students' interest. Active learning does not begin until a student decides he or she wants to learn and she or he knows what it is he or she wants to know and be able to do (Giest & Lompscher, 2003). Despite these challenges to facilitating learning, particularly when considered in field trip settings, there is overwhelming evidence that student learning can and does often occur, as discussed above. However, research of field trips has produced a litany of recommendations for improving their organization and instruction, the majority of which are complementary (Carroll, 2007; DeWitt & Osborne, 2007; Rebar & Enochs, In press) and find accord with the application of activity theory.

Design

Context of Study

The public spaces of the Oregon Coast Aquarium (OCA) were considered as the context for field trips included in this study, although many of the observed groups included other destinations within their field trip. OCA is a large aquarium open to the public and dedicated to marine education and conservation. OCA welcomes school groups but offers no programming or special staffing for these groups as they visit the many and varied public exhibitions distributed among several halls and buildings including both indoor and outdoor areas. A typical school visit to these public spaces in which students have an opportunity to visit each exhibition lasts approximately two hours. Exhibits primarily consist of aquaria of varying sizes, shapes, and contents along with accompanying interpretive signs. A number of exhibits provide opportunities for hands-on or multi-sensory interactions characteristic of informal settings (see Ramey-Gassert et al., 1994), most notably the touch tank that exhibits tide pool animals. Overall the exhibits and other resources are best suited to engage and stimulate visitors with limited knowledge of the presented topics, similar to most other aquariums (Falk & Adelman, 2003). OCA offers two forms of in-trip support targeting visiting school groups: student worksheets and hands-on classes. Two sets of student worksheets ("grades 2-5" and "grades 6-12") specific to the various exhibits are available to teachers on the OCA Web site. OCA also offers hour long interactive classes taught by OCA staff which take place in a private classroom and must be scheduled by teachers in advance of their visit. While some (eleven) teachers scheduled private classes for their students, all groups included in this study visited the public exhibitions and many of these had their students use the OCA worksheets. Although volunteers are available in certain exhibit areas to answer questions and provide guidance, they do not provide any specific school-targeted instruction or programming. Consequently, the manner in which students are encouraged or permitted to visit the public exhibition areas depends on the leadership of the teacher or teachers facilitating each trip. School groups enter the aquarium just as the

public does. Hence, subsequent discussion of field trips to the aquarium's public areas are referred to as self-guided visits.

Because the guiding questions of this study are aimed at capturing and characterizing a variety of curriculum connecting strategies, no school teachers were excluded on the basis of their students' grade level. Rather, all teachers who scheduled field trips to OCA during a two month period of time toward the beginning of the school year were recruited to join this study. Of the scheduled visiting schools, teachers from 71% of these groups participated in the study including 24 field trips and 26 teachers. Most (88%) participating teachers had previously visited the Oregon Coast Aquarium and nearly three-fourths had previous experience leading a trip to this aquarium. Teachers in this study had an average of nearly fifteen years of teaching experience, but experience ranged from three to thirty years. Additional demographic data are presented in Table 2.2.

Table 2.2: Demographic data for teachers by level of participation.

Experience	**All Participating Teachers (26)**	**Subset of Interviewed Teachers (8)**
Previously Visited OCA	88%	88%
Previously Led OCA Field Trip	73%	88%
Range of Grade Levels Taught	$2^{nd} – 12^{th}$	$3^{rd} – 8^{th}$
Average Years of Teaching Experience Range	14.75 3 – 30	14.25 4 – 29
Hold Teaching Credential	100%	100%

All together, the timing of the study (early part of the school year), the setting (an aquarium far from most population centers), and the demographic data presented in Table 2.2 uniquely position this study to capture experienced and well prepared teachers because, on the whole, these teachers necessarily planned ahead prior to the school year, made arrangements for a far away field trip, and have led previous field trips to the aquarium.

Data Collection

Because this is an exploratory study, it was comprised of a number of components (see Table 2.3) and included several approaches to data collection. Participating teachers were passively observed throughout their visit to the aquarium with particular attention to their interactions with students, chaperones, volunteers and the exhibits. Teaching tools, or artifacts, used by teachers (such as worksheets) were gathered. All participating teachers were invited to respond to an online post-trip survey including questions regarding their field trip preparations, goals, experience, training, and follow-up activities. Questions included both multiple choice responses as well as open-ended response forms and were modeled after the semi-structured format outlined by Bradburn et al. (2004). A subset of eight teachers participated in post-trip interviews in order to shed further light on teachers' practices. These interviews were conducted as a guided conversation (Rubin & Rubin, 1995, 2005). The teachers who participated in interviews were chosen based on availability and interviews were concluded when data gathering reached a saturation point. Transcripts of observations, surveys, and interviews were sorted by relevant data (apropos of the guiding questions) and subsequently coded by repeating ideas (Auerbach & Silverstein, 2003). Using Atlas.ti software, codes were, in turn, examined, modified, and grouped based on common emergent themes. Taken together, the four sources of data provide rich details regarding teachers' use of field trips to support student learning tied to the curriculum. Moreover, the various sources of data allow for triangulation of the evidence thereby adding further validity to conclusions drawn. Whenever quotes are used as evidence, an effort has been made to provide sufficient context such that the interpretations drawn may be evaluated by the reader. Ultimately, findings were organized based on the most salient conclusions, or claims, which could be interpreted given the evidence. As such, the findings are presented under three claims, each with supporting evidence following the claims.

Table 2.3: Components of the study.

Context		**Data Sources**				**Evidence**
Study Site	Participants	Observations	Artifacts	Survey	Interviews	Analysis
·Oregon Coast Aquarium—large, multiple exhibition areas in various halls, separate buildings and outdoor settings open to the public	·71% of teachers leading schools groups in grades 2-12 during a two month time period ·24 field trips and 26 teachers were included in the study	·Teachers' interactions with students, chaperones, volunteers, and exhibits throughout aquarium visit	·Journals and worksheets used by students	·100% of participating teachers responded to post-trip, online survey regarding their preparations, goals, and experience leading trips	·8 teachers participated in post-trip interviews regarding their preparations, goals, strategies, and experience leading trips	·Repeating ideas were uncovered among all of the data sources (shown to the left in orange) and by coding patterns using Atlas.ti software

Findings

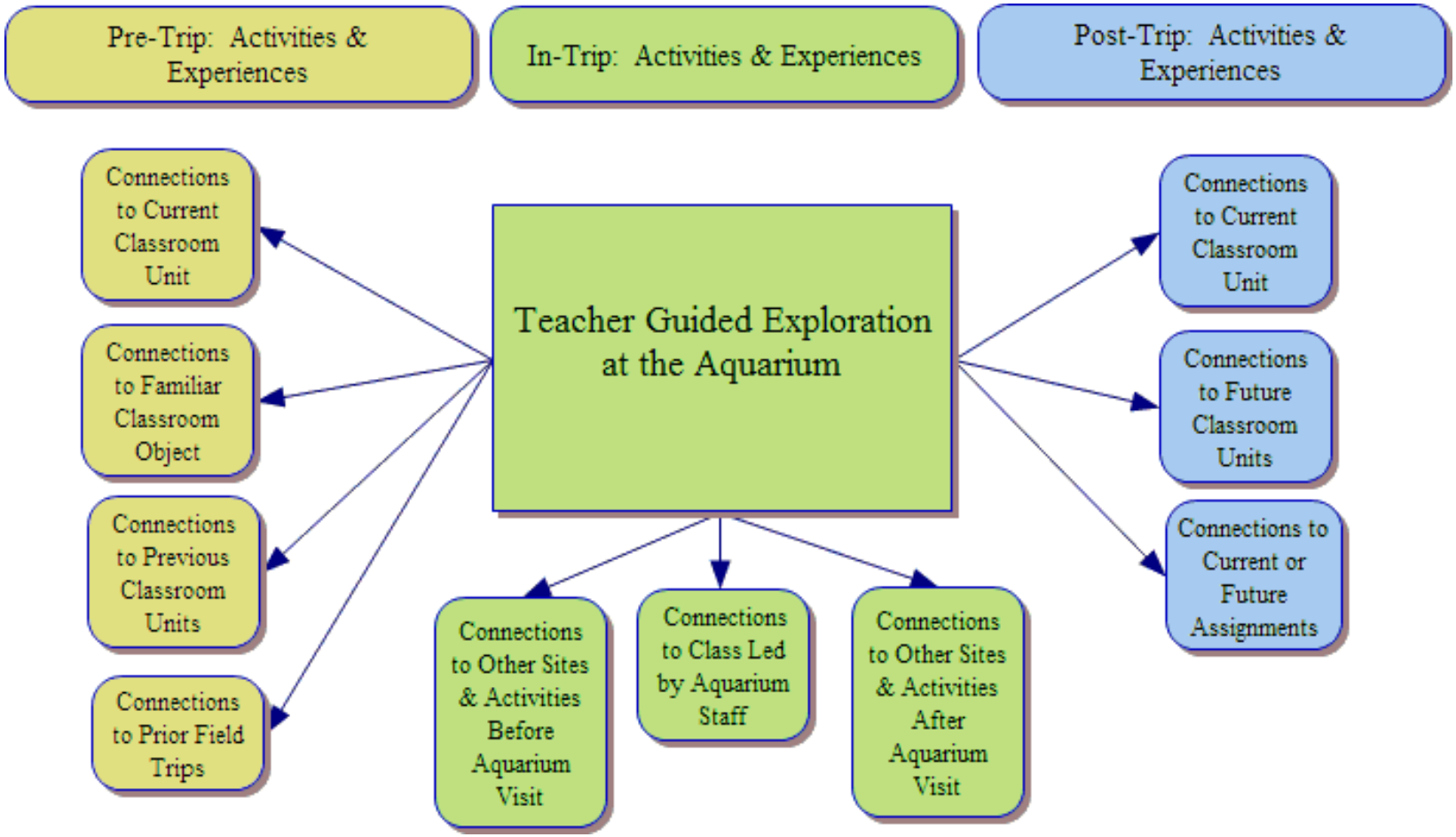
Curriculum connecting strategies were identified and grouped based on the teacher's attempts to relate something encountered in the aquarium with something known or expected to be more familiar to students as a result of past or future class activities, lessons, or topics. In most cases, teachers were observed using verbal connecting strategies. Within the curriculum connecting category, several distinct types of connections emerged as repeating patterns. The identified curriculum connecting strategies used during the aquarium visit are listed in Table 2.4.

Table 2.4: Curriculum connecting strategies observed, organized by connection type.

Curriculum Connecting Strategies	**Connection Type**
Connections to the current classroom unit	Pre-Trip Connection
Connections to familiar classroom objects/artifacts	Pre-Trip Connection
Connections to previous classroom units	Pre-Trip Connection
Connections to prior field trips	Pre-Trip Connection
Connections to other sites and activities before aquarium visit	In-Trip Connection
Connections to in-trip class led by Aquarium staff	In-Trip Connection
Connections to other sites and activities after aquarium visit	In-Trip Connection
Connections to current classroom unit	Post-Trip Connection
Connections to future classroom unit	Post-Trip Connection
Connections to a current or future assignment	Post-Trip Connection

Among the curriculum connecting strategies, strategies may be further grouped based on the class activities and guided experiences to which the connections were drawn: curriculum connecting strategies relate something encountered in the field trip to either pre-trip, in-trip, or post-trip class activities and lessons that took place, or are planned to take place, in the teacher's class. The notion that field trips have three phases including related and relevant pre-, in-, and post-trip activities is not new, hence making its origin difficult to pinpoint. However, the suggestion that these three phases be explicitly applied to any newly proposed models for planning field trips has only recently been voiced (Eshach, 2007). In any case, teachers make connections that clearly reflect this triparted thinking. Figure 2.1 illustrates these teacher-guided curriculum connections between the three field trip phases. Evidence including quotes supporting each of these types of connections is provided in the subsequent passages under the heading Claim #1.

Figure 2.1: Observed in-trip curriculum connecting strategies facilitated by teachers between the three phases of the field trip.



Claim #1: Teachers are making many varied efforts to link the curriculum to the activities, resources, and content encountered on the field trip.

The variety of curriculum connections identified above lends support to Claim #1. Within each of the three types of curriculum connecting strategies, several patterns also emerged.

Pre-Trip Connections

Teachers drew explicit connections to pre-trip activities, lessons, and artifacts in four distinct ways. One way in which teachers were observed making connections was through attempts to link observations to the current classroom unit being taught ("Connections to the current classroom unit"). In the following example the teacher refers to a relevant previsit activity that, as revealed in a follow up interview, the teacher learned from a professional development workshop hosted by the aquarium. The teacher pointed to jellies and said to the gathered students "These are tentacles like arms, look. Remember what you made [referring to a jelly craft model made in class prior to the trip]."

In a second form of pre-trip connections, teachers were also observed making connections to familiar classroom objects ("Connections to familiar classroom objects/artifacts"). While at the touch tank where live abalone are present one teacher remarked to her students "Have you guys seen the abalone on my desk? That's what these are."

In a third pre-trip connection type, teachers also made connections to previous units taught ("Connections to previous classroom units"). At the lobster tank the teacher asked "So what other type of animal did we study last year that has those sort of things?" A subsequent interview with this teacher revealed she was attempting to draw connections for students between crustaceans and a previous unit that focused on insects.

Finally, in a fourth type of pre-trip connection, teachers were observed making connections to prior field trips ("Connections to prior field trips"). For example, at the otter exhibit one teacher made reference to a previous class trip to the zoo: "Here's (an otter), not as big as at the Portland Zoo."

In-Trip Connections

Teachers made three distinct types of curriculum connections that referenced components of school topics introduced or to be introduced at different times. Because the Oregon Coast Aquarium is in a remote location relative to population centers and there are a number of other nearby field trip destinations that cater to school groups, many teachers plan field trips that include multiple sites and activities in one trip and often extend for overnight stays. Therefore, the OCA visit often represents one destination among several others included on an ocean themed field trip. Of the twenty-four field trips observed in this study, eighteen included other destinations and, among those, fifteen were overnight trips. In many cases teachers recognized and drew connections to other activities and sites included in their trip. These connections were made both to recent activities that already took place at another site during the their current trip ("Connections to other sites and activities before aquarium visit") or to planned activities to take place during the current trip ("Connections to other sites and activities after aquarium visit"). As an example of the former, at the estuary overlook one teacher asked "Remember the purple crabs [you saw earlier]? That's what [the blue heron] is looking for." Referring to an upcoming activity, another teacher remarked to a student at the touch tank "Now we'll see these tomorrow. See how they're [feeding]. If you turn over rocks you'll see tons of them."

A total of eleven visiting groups also participated in interactive classroom lessons led by Aquarium staff in addition to their teacher-led explorations of exhibits. These also provided common reference points for teachers to make connections. For example, one teacher directed her students' attention with the question "See those giant green sea anemones? Those are the ones we've touched [in class]."

One striking pattern among all of the in-trip connections is the teachers' use of this strategy to draw attention to recurring animals. In another words, in all cases, teachers used this strategy to draw attention to the point that a certain animal was also seen previously, or should be encountered later during the trip. In some cases, the teacher included more details than simply drawing attention to a recognizable animal. For example, in the quotes above one teacher uses the touch tank to help prepare a student for how to find the animal in the wild. In the quote at the overlook, the teacher uses the sight

of another animal (the blue heron) to place it in the food chain in relation to an animal previously encountered (the purple crab) in the aquarium class. Although this approach begins to address conceptual thinking, such an example was the exception. In most cases, teachers briefly remarked that they were seeing an animal they had seen or would see in the future, as in the following quote: "Hey, there's a limpet (pointing to the interpretive sign). Remember we had one of those on our cards [in class]. Do you see one?"

Post-Trip Connections

Three distinct types of post-trip connections emerged from the data. Teachers drew connections to a current classroom unit ("Connections to current classroom unit"), made reference to future classroom units not yet introduced to students ("Connections to future classroom unit"), or drew connections to upcoming or ongoing assignments ("Connections to a current or future assignment"). In an example of "Connections to current classroom unit", one teacher provided an advance organizer for her class lesson the following day while observing and pointing at animals in the touch tank: "So I haven't shown you guys these called echinoderms. Tomorrow we are going to talk about the classification of animals." In an example of "Connections to current classroom unit", one teacher attempted to take advantage of an opportune moment to prepare one of her students for a future unit on the properties of light: "So Alan, I'm going to ask you to make an observation and remember it for six months. Is the light going relatively straight or curved?" (referring to the rays of the sun shimmering in an aquarium).

"Connections to a current or future assignment" were utilized by teachers in various ways. In two observed field trips, teachers required that students take photos of particular subjects such as tide pool animals or wetland habitats and, in one case, these requirements were listed in a bound journal containing the aquarium's worksheets as well. Another teacher made several verbal references to an assignment requiring students to develop a marine themed board game and suggested that students think about ideas to use as they explore the exhibits. One teacher used one-page worksheets she had prepared by modifying a previsit activity available on the aquarium's website. The worksheet

directed students to gather information about their individually chosen animal which they would later be reporting on in class.

Teachers appear to utilize the first two types of post-trip connections, "Connections to current classroom unit" and "Connections to future classroom unit", in order to serve one or both of the following purposes: (1) they act as background experience with natural phenomena to be studied at a later point; (2) they act as motivators intended to capture students' interest in topics and phenomena to be studied later in the school year. One teacher who arranged to offer his students a behind-the-scenes tour of aquarium operations utilized the post-trip connection as a motivational strategy quite frequently by referring to activities they would do as a class. For example, when gathered by the brine shrimp rearing facilities, he described the shrimp's life cycle and explained that "we will have to do this when we start getting animals in the classroom," meaning that students would need to learn to raise the shrimp to feed other animals. At another point, the same teacher pointed out a shark and said "we'll probably get smaller ones of those and dissect them in class."

Survey Responses

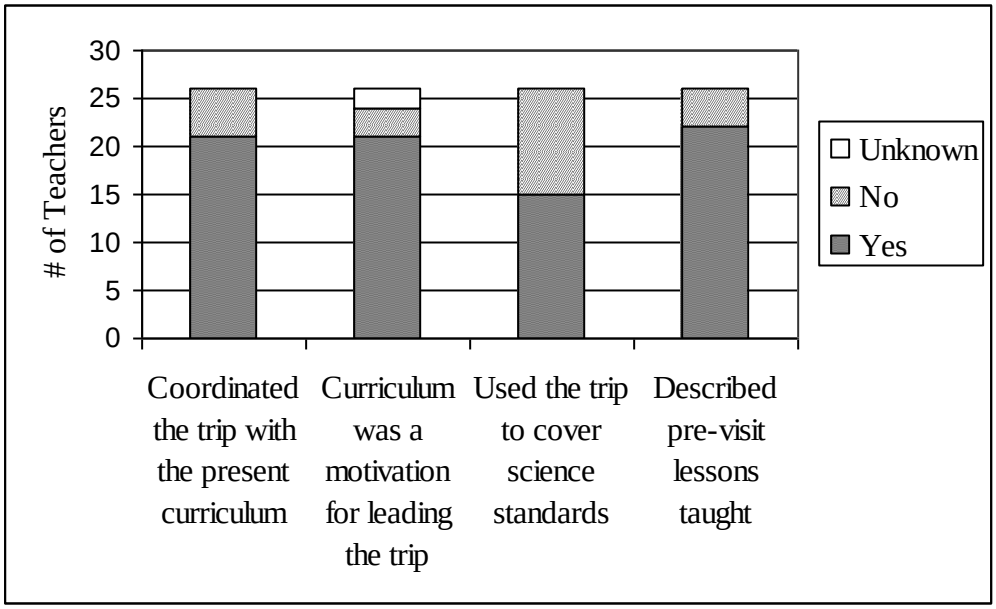
Additional evidence supporting Claim #1 is found among teachers' responses to four questions included on the post-trip survey. These four questions addressed the teachers' use of the trip to support various aspects of the curriculum. These questions are:

1. Did you coordinate this trip with the curriculum you are presently teaching? (21 of 26 said yes.)
2. Which of the following best describe your motivation for leading this trip? Check all that apply. To go to a place where the subject(s) relate to the curriculum. (21 of 24 included this response; 2 did not respond.)
3. Did you use this trip to cover any specific science standards? (15 of 26 said yes.)
4. Did you teach any lessons in preparation for your trip? If yes, please briefly describe them. (22 of 26 provided descriptions. Or, of 24 visiting groups, 23 received related previsit lessons pertaining to ocean science. In the case of one

large school, groups were divided such that non-science teachers included in this study led some of the visits on successive days.)

Figure 2.2 illustrates teachers' responses to the four survey questions that address their use of the field trip to support the curriculum.

Fig. 2.2: Teachers' self-reported use of the curriculum to frame their field trip.



Although each of these questions is similar, each require interpretation due to the different aspects of curriculum connecting strategies that they shed light on (and hence the slight variation in positive responses). For example, the first question directly asks teachers if they aligned the trip with the unit they are teaching at the time of the trip. The fact that 21 of the 26 respondents said yes seems incongruent with responses to the fourth question in which only 22 of 26 teachers described relevant previsit lessons. The one teacher who described previsit lessons but responded that he did not coordinate the trip with the curriculum may not consider the previsit lessons he taught on orienteering, pond study, and invertebrates as truly coordinated curriculum. Descriptions of previsit lessons reveal that three teachers felt the timing of the trip did not ideally match their curriculum even though they responded that the trip was aligned with the curriculum. For example,

one teacher explained: "The curriculum timing for marine invertebrates was way off, so what I did was show two intertidal videos with many annotations, specimen pass-a-rounds, and classroom discussions." In other words, this teacher recognized the importance of preparing students for the trip and thus taught some related lessons, but could not fully take advantage of the trip as hoped such that it aligned with the most relevant curriculum. This sentiment may also explain the one teacher's incongruent responses described above. Conversely, another teacher who responded that she coordinated the trip with the curriculum provided evidence that this was not true for the aquarium visit portion of their trip:

> I reference the trip throughout the rest of the school year. It doesn't coordinate perfectly with our curriculum at the time, but is relevant at different times throughout the school year. For example, we study invertebrates in the spring, and I'm able to review the aquarium info with the kids.

These teacher's comments add further support for the "Connections to future classroom units" strategy previously described and also suggest that this may be a strategy that teachers sometimes use as a second choice to the "Connections to previous classroom unit" and "Connections to current classroom unit" strategies. In other words, some teachers would prefer that the trip were timed to complement current units.

Responses to the second question, which asks if one of your motivations for visiting the aquarium was "to go to a place where the subject(s) relate to the curriculum," reveal that this was a common teacher motivation among many others: 88% of respondents included this motivation. However, it appears this was not the leading motivation for some teachers (although respondents were not asked to rank their motivations). For example, one teacher who described preparing students with two and half weeks of marine biology content surprisingly did not include the curriculum as a motivation for the trip. Her explanation to the first question suggests that this was not an oversight; in response to the question *Did you coordinate this trip with the curriculum you are presently teaching* she reveals "Yes, kind of. We put Marine Biology into our curriculum because of this trip. The remainder of the year is Physical Science." In an

interview this teacher added "We actually add in three weeks of marine biology unit to supplement that field trip rather than the field trip being something that supplements our actual curriculum that we're doing." Thus it appears the curriculum is not driving the trip as a motivation in this case, but the teacher has coordinated the trip with the classroom curriculum. Four other motivations were even more common among respondents' choices: to expose students to new experiences (96%); to provide a memorable learning experience (96%); to foster student interest and motivation for the subject(s) (96%); and to promote lifelong learning (92%). No respondent chose the curriculum as a sole motivation. Therefore, responses to this question indicate that fostering connections between the aquarium and the school curriculum was, at the very least, one motivation among several others.

Responses to the third question offer insight into one specific aspect of curriculum connections, that is, curriculum connections that also support science standards. Although this question was not explored in any depth, the fact that a majority of teachers in this study claim they use the trip to address science standards indicates that most teachers expect science content to be part of students' experience. In a follow up interview one teacher explained that the trip was part of an oceanography unit that naturally addressed standards:

> It's a science unit that you can do that lends itself well to introducing the kids to some state standards and some of the things that are expected, knowledge that's expected of them in science. So one of those things is you need to understand about food chains and food webs work, so that's sort of a no-brainer to bring in stuff that happens in the ocean.

In another interview a different teacher explained that the trip serves as a review for the state standards science test:

> They take their state standards science test in 8th grade. They don't take it in 7th or 6th grade at all. And so really in 8th grade the burden is put on us to review information they've done in 6th and 7th grade. And so it's really helpful to have that field trip really present in their minds because to go back to 6th grade is a long time ago for them. And to be able to review some of that information that we've already done in the 8th grade with that

> marine biology so the ecology, ecosystems, food webs, habitats, niche, all those kinds of vocabulary that come up on that test that they haven't studied since 6th grade.

Previous research has revealed that the curriculum fit is often highly valued by teachers and may be used to help justify the trip but, paradoxically, teachers do not often use outcomes related to the curriculum as measures of success (Anderson et al., 2006). Identifying science standards that a trip addresses may be one way in which teachers justify a trip. In other words, teachers, particularly science teachers, are likely to recognize that "yes" is the "correct" answer to this question regardless of their explicit efforts (or lack thereof) to ensure outcomes related to the standards are achieved. One pattern suggestive of this phenomenon is data showing that among the six sets of teachers included in this study who came from the same school, there were four sets in which at least one teacher responded yes while another answered no. While it is difficult to draw any strong conclusions from these data, it seems likely that some teachers understand that a trip to the aquarium addresses science standards (which are typically written in broad language) whether or not they take any specific efforts to facilitate these or use these to justify the trip. Previous research has indicated that teachers use science standards alignment as a means to justify the trip to administrators (David Anderson & Z Zhang, 2003).

Overall, the survey responses all point to the conclusion that teachers make intentional efforts to utilize students' experiences of visiting the aquarium in order to contribute to students' understandings related to the classroom curriculum.

Interview Evidence

When placed in the context of the other evidence, interviews provide further insight regarding the nature of how teachers make curriculum connections and, moreover, offer insight with respect to the extent to which these connections are carried out. For example, interviews shed light on curriculum connections facilitated by means of assignments ("Connections to current or future assignment"), connections tied to current classroom topics ("Connections to current classroom unit") and connections made

throughout the year back to the trip (an in-class strategy titled "Connecting back to the trip").

Interviews revealed two categories of post-trip assignments: animal reports focusing on specific marine animals, and follow up writing assignments. Four of the eight teachers who were interviewed described some type of assignment in which students were expected to report on some aspects of a particular marine animal's adaptations and life history. Two aspects of these assignments stand out. First, among the four teachers who discussed using this strategy, only one was observed facilitating connections to the assignment both by means of the in-trip activities (which involved observing pre-chosen animals and recording observations and particular animal specific information such as diet, color, and size) and the verbal prompts she used. Second, only one teacher, also the one who was observed facilitating connections, required that students report on an animal that can be found and viewed at the aquarium. This may explain, at least in part, why no evidence of in-trip connections to this strategy were observed among the other teachers. However, there was another teacher who used a unique assignment, that of creating a biological board game, who was observed verbally prompting students to think about ideas for their assignment while exploring the aquarium. However, she had no specific in-trip activities designed to facilitate this idea gathering. Instead, students were expected to complete worksheets borrowed from the aquarium's website. During the interview this teacher revealed that: "I know obviously it's not going to be successful for them to walk around the Aquarium without some kind of focus, but I don't know what that would be yet [aside from using the OCA worksheets]." Evidently, it hadn't occurred to this quite experienced teacher that perhaps an in-trip activity more directly related to idea gathering for the board game assignment would better support her classroom curriculum.

Writing assignments described took several various forms. Two teachers' assignments complemented in-trip journals and were described as reflection pieces. Another was focused on marine animals and took the form of a fictional story including animal facts. In one case, a teacher described an assignment in which students were expected to write a letter to their senator regarding their concerns on the effects of oil spills on marine life and, in particular, otters.

Although no interview questions focused on pre-visit lesson plans, two teachers referred to pre-trip visit lessons in their interviews ("Connections to the current classroom unit"), some of which were related to post-trip assignments. For example, two teachers referred to books they read in class related to sea otters and oil spills. In one case this led to the post-trip letter writing assignment described above while in another case this related to the story writing assignment previously described. Interestingly, the letter writing assignment was not envisioned as a post-trip activity until students' interest in the topic emerged following the trip in a related in-class reading, whereas the story writing assignment was planned prior to the trip. Another interviewee suggested she also would be developing related follow-up activities that she had not planned before the trip.

Connecting Back to the Trip

A strategy that emerged during the course of post-trip interviews is that of referring back to the aquarium trip throughout the year when relevant topics are encountered in the classroom. While this strategy is similar to the previously identified "Connections to future classroom unit" strategy and may be used in a complementary manner, this may be considered a different strategy because it is an in-class rather than an in-trip strategy of connecting. For example, one teacher explained:

> We constantly throughout the school year refer back to the field trip. And we can't take every kid on the field trip which is unfortunate but we're limited numbers wise. But those kids that go on the field trip, they're expected to, when we get to certain topics, to share that information with other students. So it's pretty valuable. It builds not just the kids that are on the field trip but it builds the knowledge base, I think, a lot more because not everybody can go to the coast.

Clearly this teacher views the trip as a source of knowledge that informs students' understandings on curriculum topics that arise throughout the year. Moreover, this teacher suggests that she capitalizes on this knowledge by expecting that students who participated in the trip will teach their peers. Interestingly, in the course of the interview this teacher later revealed:

> [The trip] ties into our curriculum the whole year. Certain spots of the curriculum it ties in better. Like right now we're in genetics so there's not a lot to relate it to because there's more to human genetics than the animal species and plant species genetics. So there's parts of the year it ties in better.

When pressed with the researcher's follow up question "Do you make specific references to the trip?" she replied:

> Oh yes. Constantly. Especially for kids that haven't gone, when we do classification we think about barnacles and crabs, which we had a crab lab at the Hatfield Marine Science Center [another aquarium next door often included in school groups' itineraries] and so we store all that information when it comes time why they're classified the way they are that's when we do our reviews and do our reference from our field trips. Oh, and another lab we did is we did osmosis so we had a plant cell and we added saltwater to it so we were talking about estuaries and adaptations with not just plants, but animals in an estuary area, and that amount of salinity that comes in and goes, that varies.
>
> Researcher: So you made that tie to the estuary that you had visited [visible from an overlook at OCA]?
>
> Right. Actually the kids did it before I did, which was good. But we used it as a reference point too because we had several labs that went along with it.

The striking aspect of this teacher's comments is that in-class connections drawn to the past trip are made throughout the year, albeit in an opportunistic way that relies on students as much as the teacher to identify links. One other teacher also discussed using this in-class strategy of drawing connections to the trip throughout the year. In addition, in-trip observations, as discussed above, as well as several survey responses indicate that some teachers intend to refer to the trip in later units throughout the school year.

Based on the subset of teachers who participated in follow-up interviews, the suggestion is that teachers are making more connections to the aquarium experience than are immediately apparent during their visit. One reason for this conclusion is based on evidence that indicates that some teachers struggle to find ways to facilitate meaningful and explicit connections during the trip. A second reason is that, as evidenced in the

documented case above, teachers may not have specific connections planned at the time of the trip. Finally, a third reason (also supported by survey responses) appears to be teachers' intended use of the aquarium trip as a reference point throughout the year whenever relevant topics arise ("Connecting back to the trip") rather than using the trip to draw attention to particular relevant connections at the time of the trip (which were observed and categorized as either "Connections to current classroom unit" or "Connections to future classroom unit").

Claim #2: Most of the curriculum connections to which teachers draw attention are unplanned and best described as opportunistic.

As discussed above, each of the in-trip connections, that is connections that the teachers made to other parts of the current field trip, including references to activities before, during, and after the aquarium visit (as represented by the arrows to green boxes in Fig. 1) focused on recognizing animals that either were expected to be or were previously encountered. The evidence for these in-trip connections was primarily based on teachers' remarks to individuals or small groups of students. If teachers had been more intentional about these strategies, one might expect to see greater evidence of planning. For example, written or physical prompts prepared by the teacher might have been used to direct students' attention to differences among habitats or various types of physical and behavioral adaptations, each of which might be related to other aspects of the current trip such as a visit to local tide pools or an aquarium class. The majority of teachers did use worksheets to direct students' attention. However, of 17 groups observed using worksheets, 14 used ones taken directly from the aquarium's website therefore indicating minimal tailoring to suit each teacher's curriculum. Moreover, the aquarium's worksheets make no explicit in-trip connections but rather consist of questions focused on specific exhibits. The only time in which a teacher was observed utilizing an in-trip connection strategy while giving group directions amounted to a single comment directing students to notice differences between OCA and the nearby Hatfield Marine Science Center aquarium also included in their trip. Had teachers made greater

use of group direction times, teachers might have verbally prompted students to make observations and create food chains including previously encountered organisms along with those seen in the aquarium. For the most part, when teachers did make in-trip connections, they took the form of conversational remarks rather than designed instruction. These instances are often referred to as "teachable moments" because the teacher recognizes an opportunity to utilize the setting in order to highlight a particular understanding.

One interview provides further evidence from teachers' perspective regarding the unplanned nature of their connections. When asked about a connection she made between the abalone in the touch tank and the shells in her classroom, one teacher explained "So it's kind of nice when (students) go into the aquarium they not only see them, but touch them as well. I didn't do that intentionally. But I do, I'm sure that's just a natural thing we (teachers) do."

Although connections to assignments ("Connections to a current or future assignment") were evident during several trips, they were, for the most part, loosely structured and in only three trips were the assignments dependent upon observations at the aquarium. In other words, aside from these three exceptions requiring on-site data collection, the observed strategies involving connections drawn to assignments served as supplemental and opportunistic enrichment for students tasked with completing a marine related assignment. In the case of two exceptions the assignment involved collecting photos of various animals or habitats. In practice this resulted in fast-paced scavenger hunts rather than focused observations that leveraged the power of interactions with living organisms. In fact one teacher reported in her survey that the photo assignment was part of "a year-long scavenger hunt through the six kingdoms" in which the photos served as items to be classified. The impact of the photo scavenger hunt assignment was particularly salient when this teachers' small group visited the aviary. The teacher directed her students to find and photograph the puffins and, in less than two minutes, she guided the group on to the next exhibit area. Indeed these photo assignments provide a measure of disconfirming evidence that curriculum connections were unplanned and opportunistic. However, as some of the best examples of planned curriculum connections

they nevertheless illustrate missed opportunities for facilitating deeper curriculum connections while at the aquarium.

In the case of the remaining exception, the on-site portion of the assignment involved each student observing their pre-chosen animal and collecting specific observations as prompted by a worksheet. Again, this represents disconfirming evidence regarding claim #2. However, as previously described, each of the other groups known to have relevant marine animal assignments subsequent to their visit were not observed collecting any sort of data or doing any activities directly linked to their assignments. In fact, none of the other groups' teachers required that their animal be one that they could observe while visiting the aquarium and, moreover, none of these teachers were observed facilitating any sort of connections to the animal assignment. The teacher who had assigned students to create a marine-themed board game hoped that students would gather ideas for their projects and reminded students to think about these ideas while exploring, but had no specific in-trip plan for facilitating connections between the upcoming assignment and the visit.

Strategies used to draw connections to past, current, and future units reveal patterns in which little evidence of forethought or planning on the part of the teacher has taken place. As described above when discussing the strategies "Connecting back to the curriculum" many teachers recognize curriculum ties between the aquarium visit and their classroom topics. However, these ties often arise through informally structured classroom discussion and, as in one case previously described, sometimes depend on students to call attention to relevant links. During the trip teachers seized on opportune moments to highlight distant ties, as in the example in which one teacher asked her student to notice the light in the tank and try to remember it for six months until that topic would be taught. Similarly, while viewing jellies with her students one teacher used the moment to allude to a related future lesson: "These are called sea nettles. We're going to study these things this year, having stinging cells." In another example, when addressing a student one teacher revealed his surprise and excitement to discover that some of the exhibits and accompanying signage related to previous lessons: "Check this out—this is what we've been talking about with invasive species." In a unique example of a connecting strategy involving the application of previous classroom learning, one teacher

prompted her student to recall an estimating technique in order to record the length of his assigned animal (which was not available on the sign): "Remember when we did measurement at school with paperclips? What was 20 paperclips long? Think back to one inch equals one paperclip." Despite the fact that this example involves application skills, it nevertheless represents an opportunistic and unplanned curriculum connection on the part of the teacher. Had the teacher provided students with paper clips or included prompts on the students' worksheets suggesting that students utilize this skill, this could have been considered an intentional connection. The teacher who led a behind-the-scenes tour of the aquarium took advantage of many opportunities to presage future classroom activities such as a shark dissection, setting up aquariums, and raising brine shrimp. However, the only in-trip student activity this teacher planned, aside from the teacher-guided tour, was for students to complete the aquarium provided worksheets while visiting the exhibits open to the public. There was no expectation, for example, that students take notes on the life cycle of the brine shrimp or the tools required and the parameters to be monitored in maintaining an aquarium that were introduced on the special tour.

When asked about follow-up lessons or activities on the post-trip survey, 22 teachers briefly described classroom lessons connecting their aquarium experience to school. Of these responses, seven described lessons or assignments that consisted solely of some type of reflection on the trip. Another eight referred only to generally related topics or assignments with regard to marine content to be covered at some point. Therefore it is not surprising that most teachers were not observed drawing more than opportunistic curriculum connections during their group's visit because it is evident that no integrated lessons were planned by the majority of teachers leading trips.

In summary, the vast majority of the evidence indicates that teachers make few carefully or intentionally planned curriculum connections while leading aquarium visits. Therefore, the connections that teachers were observed facilitating, with few exceptions, represent connections to related curriculum rather than integrated ties to previous, current, or future topics, lessons, and units. In other words, connections drawn by teachers were largely unplanned and resulted as the product of opportunistic moments.

Claim #3: Teachers viewed the aquarium visit as a supplementary background experience for related curriculum presented in class rather than as a lesson with specifically designed and integrated learning opportunities.

Evidence for claim #3 is found in all the data sources: observations, surveys, artifacts, and interviews. For example, in their survey responses, teachers' stated educational goals for the trip tended to be broadly defined and not written in terms of lesson plan objectives. Examples are provided in Table 2.5.

Table 2.5: Sample educational goals for aquarium visit as provided by teachers.

Teacher	Stated Educational Goal
1	"To relate to sea life"
2	"Learn about the oceanic aquatic life"
3	"To learn something new"
4	"Enjoy the experience of discovery"
5	"Complete the aquarium workbook"
6	"To investigate the life on a rocky Pacific shore"
7	"To relate to Life Science"
8	"To view first-hand animal adaptations"
9	"Inspire students to pursue knowledge and stewardship of the oceans"

All indications are that most teachers viewed the trip as an opportunity to provide students with personal experience observing marine life. As described previously, teachers tended to view the trip as a common reference point for shared background knowledge as related topics continued to arise in their classrooms following the trip. This view is captured in one teacher's described educational goal (not included above): "Students are to become familiar with a variety of ocean organisms. This leads to the students doing a research report on the animal of their choice." However, during the visit this teacher did not have any planned activities for her students. She was observed asking a number of questions of students that prompted observations and/or thought, though these questions did not reveal any immediate links to the upcoming report. For example, at several different exhibits this teacher asked students how the animals should be classified. Had classification been prioritized as a learning goal, then this teacher (and others who made reference to upcoming classification lessons) might have used the visit

to require students to complete an assignment in which they were expected to find and identify animals in specific orders or classes, for example.

The teacher who led a behind-the-scenes tour had specific as well as general student goals in mind: "To see some of the job possibilities in the marine sciences and to interact with some of the marine biologists at the aquarium. To also learn about the various animals found off the Oregon coast and what it takes to take care of them in a captive environment." However, this teacher's only in-trip student task was for students to complete the aquarium's worksheets while exploring the exhibits open to the public. Thus it appears that this teacher, much like the others, views this trip as a chance to expose students to topics related to class and not as an opportunity for students to build specific knowledge or skills. Had this teacher treated the trip as an opportunity to present a lesson integral to the goal of learning how to maintain aquariums, he might have expected that students identify the various factors that must be regulated and the tools that must be used to do so. This task could be accomplished using any of a myriad number of approaches ranging from note taking and sketches to photo assignments and interviews with aquarium volunteers. Without such lesson designs, this teacher will certainly have to begin in-class lessons with the most basic principles of marine husbandry even though students might have greater interest in and familiarity with these principles than they would otherwise without the trip.

When teachers used the strategy "Connections to the current classroom unit", these connections were made verbally and with limited supporting activities. For example, when the teacher commented to her students at the touch tank that the class would be studying echinoderms the very next day in the quote cited previously, there was no further evidence that she had designed any activities to prepare her students with additional background. Had she wished to capitalize on students' direct experience with echinoderms and other animals to be discussed in the upcoming lesson on the classification of animals, she might have structured activities in which students actually begin to classify animals during their aquarium visit. Instead, the aquarium visit was treated as a background experience providing students with a common vision of what these animals look and feel like. In the teacher's words, "We did a lesson on vertebrated

and invertebrated and classifying animals into groups. Having seen many of them and touched them in the touch pool helped."

The one teacher who did utilize an in-trip activity to facilitate student learning about animal classification did so by means of a photo assignment previously described. Essentially students were tasked with photographing various animals which they would later classify in the classroom. Thus, as a means of facilitating in-trip learning this strategy appeared to have limited impact. Students found the assigned animals and quickly snapped photos and moved on. There were no further in-trip expectations, for example, that students make a record of their photos with accompanying information about the chosen animals.

In-trip assignments, the majority of which consisted of worksheets, were treated as a means to keep students focused on exhibits. Based on interviews as well as several teachers' in-trip comments, assessment was limited to whether or not students attempted to complete the worksheets, or there was no assessment of in-trip assignments. One teacher commented that worksheets are used "to keep the kids focused on what we are doing" and it's not graded but "kids like the accomplishment" of completing them and it allows the chaperones to help. Other teachers provided evidence that worksheets served to keep students focused on the exhibits. For example, when one teacher saw her students playing with a souvenir machine, she asked "Don't you have some worksheets to do?" As quoted above, another teacher commented in an interview that she did not know how to make the visit successful without students focusing on completing worksheets. She also expressed some dissatisfaction with using worksheets to create a learning experience:

> It kind of makes everything where they just look at the book than they actually look at the Aquarium. At the same time when they wander around and look at the Aquarium it's just like kids in the hallway they tend to—they're more interested in each other than they are in the Aquarium.

Another teacher revealed similar internal conflict in using worksheets. While parent chaperones worked closely with small groups to help them complete the worksheets, the teacher roamed freely and encouraged students to move on to other

exhibits even though they had not completed questions for that exhibit area. Unlike her accompanying chaperones, she made no attempts to engage students with the worksheet questions and in fact commented that she assigned her sixth grade students the aquarium's 2nd-5th grade worksheets rather than the 6th-12th grade worksheets because she thought they would be easier for her students to complete during their two-hour visit. In order to reconcile this conflict between exploration time and focused time with the exhibits one teacher explained that groups choose just certain sections of the worksheets to complete "so that they have time to actually explore and see and talk and see what they have. But we want them to get all the knowledge and so we have them, they have to share, or they have to be like the teacher to the other groups." Thus, the worksheet becomes a tool for a lesson in the classroom but remains distinct from other curricular materials and, similar to other teachers' approaches, the worksheet serves a managerial role of focusing students' attention during the trip. One other group was observed using this strategy of limiting the number of worksheet pages assigned and later allowing students to share their answers.

During an interview another teacher commented that "the aquarium's worksheets are "a way of keeping the kids involved and engaged." Yet another teacher explained that they use the worksheets "Mainly to keep the kids focused on what we were doing while we were at the Aquarium." A different teacher reflected that:

> A big concern of mine when I'm in field trips is giving them something to do like the [worksheets] that we did. That's something that sometimes I struggle with because I want them to enjoy themselves but I also I want them to go away with some new learning or really interested in something. And I feel like giving them something to do, not just walking around, kind of stops them for a second and makes them, gives them really a purpose I guess.

In other words, like many other teachers, this teacher thought of the worksheets primarily as a means to help focus students' attention and not as a tool for delivering a lesson integral to the curriculum.

The photo journal assignments described above also served this role of focusing students' attention on the exhibits. However, when used as one teacher had planned in

the classroom as a means of classifying animals, this assignment shows greater integrating potential between students' in-trip experiences and the school curriculum. Nevertheless, the fact remains that the photo assignment alone facilitates very limited in-trip learning opportunities and serves primarily as a background experience when the classification activity is introduced later. As described earlier, the teacher's assignment involving students observing and recording information about their chosen animal stands out as the key exception to claim #3. Despite this exception, at no time were teachers observed using the aquarium visit as an opportunity to test pre-identified questions or collect data for further analysis as suggested in the research on museum field trips (Guisasola et al., 2005; Mokros & Wright, 2009; Sedzielarz & Robinson, 2007) and as outlined by the National Research Council (2001).

In an interview one teacher essentially dismissed her role as a learning facilitator when asked to compare her roles on the trip and in the classroom:

> I mean I think the biggest thing with me about doing the entire trip that we were gone is just that the overall safety of the kids was my biggest concern the entire time. I knew they were going to learn a bunch. I knew that wouldn't be an issue. But just to be able to keep the eye on the kids, to keep track of everybody even though there were additional chaperones on the trip. When it came down to it their lives were in my hands.

Observations of her interactions during the trip revealed that much of her attention was directed toward guiding, admonishing, and photographing students. She also prompted students to work on completing their worksheets. At one point, when students asked her questions, she redirected them to a volunteer. At another point, she did attempt to facilitate discussion by gathering student and asking them to raise their hands and share the answers they found to various questions. At no time was she observed drawing any implicit or explicit connections to her class curriculum.

Discussion

The primary contribution of this study is the fine-grain level of detail it provides for strategies teachers use to connect students' experiences with classroom lessons while leading a self-guided visit. Figure 2.1 at once illustrates the variety and potential complexity of connections teachers attempted to draw for students (claim #1). Yet examples of how these strategies are enacted reveals, in most cases, their limited depth and unplanned nature (claim #2) despite the fact that the population included in this study likely represents some of the more organized teachers. Teachers often took advantage of "teachable moments" in order to link content to the classroom curriculum while limited evidence suggested pre-planned, integrated curricular links. As a result, in most cases these curriculum connections were limited in scope and promoted minimal student discussion or conceptual thinking. Moreover, most teachers appear to treat their class visit to the aquarium as a related background experience rather than as an opportunity to introduce new concepts in an intentional way (claim #3). This claim supports the conclusions of earlier studies (for example, see Kisiel, 2006), however, the evidence provided to support this conclusion provides new insights regarding the various teachers' use of their students' experience. Specific examples from the various types of curriculum connecting strategies documented here provide a rich resource for developing models that support and expand these strategies. It has previously been suggested by researchers and museum directors that science standards provide a logical starting point for museums to promote curriculum connections (Cox-Petersen et al., 2003; Hofstein, Bybee, & Legro, 1997; Schatz, 2004). This suggestion can be further enhanced by providing teachers with the tools, such as questioning prompts and in-trip activities, that target specific content supported by the museum and specific types of curriculum connecting strategies that teachers already employ. For example, several teachers in this study used the aquarium visit as a background experience for their students in preparation for future assignments on the topic of marine animals while others used the strategy of making "connections to current or future assignments." A written guide and/or professional development workshop provided by the aquarium might outline how students could be prompted to use inquiry skills (a science content standard) to investigate questions related to various

animals' behaviors during their visit. Such guidance might include a list of observable animals, suggestions for how to prepare students with questions for inquiry in advance of the trip, templates for observations and data collection, and suggested tools for observation such as binoculars, magnifying lenses, and stopwatches. In an example in which pre-trip connections may be supported, the teacher strategy of using "connections to familiar classroom objects" might be promoted by loaning teachers artifact boxes in advance of their scheduled class visits. Again, this offering could be supported by written guides and/or workshops that encourage teachers to integrate these objects into the curriculum with prepared lessons rather than treating them simply as familiar items to be acknowledged during the field trip. In-trip connections might be better supported by offering worksheets that include more open-ended question and encourage students to compare various exhibitions. This suggestion finds agreement from previous studies of the use worksheets in museums that conclude medium site specificity, elements of choice, and questions requiring higher level cognition are preferred by school groups and also have greater potential to promote learning (Kisiel, 2003, 2007; Mortensen & Smart, 2007). Furthermore, a choice of worksheets organized by themes might be offered. For example, teachers in this study were observed prompting students to recognize and identify animals in different settings, particularly in preparation to find and identify them in the wild ("connections to other sites and activities after aquarium visit"). Hence, one theme might focus on identification by habitat, thereby expanding on the teacher goal of identification with the introduction of higher order concepts related to habitats and niches. These are but a few examples of how the fine details of teachers' curriculum connecting strategies provided here might prove beneficial in developing greater support for teachers' field trip pedagogy.

Connecting students' in-trip learning experiences to their class learning experiences is essential in the effort to maximize the learning opportunities afforded by a field trip. The types of connections that may be drawn are numerous and likely far exceed those observed and represented in Figure 2.1. In keeping with a sociocultural view on learning, each of those connection types may be facilitated in numerous ways: by means of questions, prompts, tasks, and activities. And each of these connections may be guided by each teacher's curriculum and also their specific learning goals. In other

words, there are no clear limits to the types of connections, the ways in which they may be drawn, or even the concepts they might convey—the possibilities are multitudinous. The teacher strategies described here provide insight regarding (1) the types of curriculum links teachers attempt to convey to their students and (2) the manner in which these are presented and, therefore, provide the basis for efforts to support improved curriculum connecting strategies.

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CHAPTER III

TEACHERS' SOURCES OF KNOWLEDGE FOR FIELD TRIP PRACTICES

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TEACHERS' SOURCES OF KNOWLEDGE FOR FIELD TRIP PRACTICES

Abstract

Teachers draw from many personal and professional experiences when organizing and leading field trips. In order to identify the influences on teachers' field trip practices the following study uses surveys, interviews, artifacts, and observations gathered from teachers who led trips to an aquarium. Findings reveal the types of influence and the impact these influences have on practice. For example, teachers adapt knowledge acquired for use in their field trips from four types of training: (1) informal mentoring; (2) past experience on various trips; (3) various outdoor education training; and (4) traditional classroom education training. Discussion centers on the nature of each of these training types and how teachers acquire and adapt their knowledge. Previous research has shown that while a variety of cognitive and affective learning often results from field trips, there is also a pattern of underutilized resources and missed learning opportunities on trips. This study offers insight regarding strengths and weaknesses of teachers' preparation for leading field trips by documenting how and what skills are learned and applied. Therefore the findings presented here are suggestive of ways in which efforts to formally support and enhance teachers' trip leading skills by means of professional development might build on teachers' existing sources of knowledge.

Introduction

Teachers receive little, if any, formal training specific to leading field trips. Research consistently shows many underutilized and missed learning opportunities on field trips (e.g., Anderson et al., 2006; Cox-Petersen & Pfaffinger, 1998; Griffin & Symington, 1997). However, teachers are creating learning opportunities for students. The cognitive as well as affective learning resulting from field trips has been well documented (e.g., Anderson & Lucas, 1997; Flexer & Borun, 1984; Tuckey, 1992). Any scholarly efforts to support teachers' use of field trips would benefit from an understanding of teachers' existing sources of knowledge regarding their practice. Thus, this study, which is part of a larger investigation on teachers' field trip practices, endeavors to describe, categorize, and represent the leading sources of knowledge that teachers utilize in leading field trips to an institution that affords many learning opportunities but provides limited guidance for how to fully leverage these unique opportunities and integrate them into a designed unit with specific learning goals. Specifically, this study is guided by the question *what are teachers' sources of knowledge for planning and leading a self-guided field trip and how do these sources of knowledge impact their practice?*

This study's guiding question is aimed at uncovering influences shaping teachers' choice of field trip strategies. Unlike most previous studies, this study examines ultimate explanations for teachers' actions rather than simply describing their practices or exploring their immediate explanations for choices. In other words, this study uses a larger contextual lens to examine teacher practices. In terms of a sociocultural view of genetic (or historical) analysis (see Rowe & Wertsch, 2002), this lens might be described as looking at ontogenesis with respect to the relationship between experience and practice, whereas past studies of field trips have primarily focused on microgenesis. Analysis of ontogenesis, as used by the often cited progenitor of sociocultural theories, Lev Vygotsky (compare Vygotsky, 1986), refers to the development of the individual over time whereas analysis of microgenesis refers to short-term learning specific to certain processes (Rowe & Wertsch, 2002). Thus a sociocultural perspective characterizes this study by considering teachers' prior learning and observed interactions

as products of historical, cultural, and social backgrounds. Given this view, understanding teachers' prior experiences is essential to understanding how and why they lead field trips as they do.

The question of interest explicitly examines the role of personal experience, which points toward the need for evidence of tool usage, particularly language usage, derived from these experiences. Clearly, this is an historical approach that considers learning as a result of interactions. Ultimately, the teachers' social interactions with students and others involved in the field trip are taken as evidence of previous learning. These social interactions are understood to facilitate learning to various degrees because, according a sociocultural view, specifically a Neo-Vygotskian interpretation (for example, DiPardo & Potter, 2003; Karpov, 2003), learning is situated in context, socially mediated, and evident via activity.

Previous Research: Evidence Relating Experience and Practice

Research relating teacher behaviors and past teacher experiences is minimal, although sociocultural, social cognitive and constructivist theories are built on the premise that experience directly influences cognition and, thus, behavior. Evidence of a relationship between teachers' past experiences and field trip leading behaviors has begun to surface in recent studies. For example, based on teacher interviews, Preusch (2006) asserts that years of teaching experience associate positively with the teacher's ability to relate environmental science lessons in the field to the curriculum. In a detailed study exploring various perspectives on field trips through observations and interviews, Mullins (1998) found that novice teachers tended not to recognize or refer to the affective value of field trips while experienced teachers often focused on this quality. It follows, therefore, that experience leading field trips adds to teachers' understanding of the types of learning that field trips support. In order to facilitate this experience, Mullins describes how novice teachers must adopt a student's role on field trips before they can make the transition to a veteran guide. The observation that novice teachers do not immediately recognize the nature of learning that field trips support suggests potential differences in practice based on years of teaching experience. In a study documenting

teachers' lack of involvement in planning and facilitating museum field trips in Israel, Tal, Bamberger, and Morag (2005) note that only teachers who had led previous field trips to the field trip site were involved in choosing and connecting trip activities with the classroom activities. The authors go on to hypothesize "only experienced teachers in museum and other informal settings might apply a learner-centered approach as they are aware of various learning styles in the outdoors" (R. Tal et al., 2005, p. 932). Michie (1998) found that past experience with successful field trips, primarily as a teacher but also as a student, increased teachers' willingness to lead field trips. This is suggestive that teachers may also lead trips as they recall being led. Based on his observations, surveys, and interviews of teachers, Kisiel (2003; 2005b; 2007) has similarly and repeatedly speculated that teachers' experiences as students serve as a model for how they enact field trips with additional influences stemming from their more recent experiences as a trip leader. Griffin and Symington's (1997) research-based conclusion that teachers inappropriately attempt to impose formal classroom techniques to informal settings suggests that teachers often lack appropriate experience to draw from, but do rely on past experiences related to their classroom training. When teachers have relevant outdoor experience from personal or professional activities or previous coursework involving field trips, these teachers are more likely to lead field trips (Spence, 1991). Similarly, Tal (2001; 2004) has shown that pre-service teachers who experience an organized approach to leading a field trip and are also prompted to reflect deeply on the experience are more likely to lead field trips and, when they are heavily involved in leading the trip, student cognitive, affective, and social learning is more substantial. Further supporting evidence provided by Orion (1993) demonstrates that teachers, particularly teachers with no history of leading geological field trips, involved in an extensive in-service program designed to plan and implement geology field trips are more likely to continue leading field trips after the program. In a specific example of practice, Kisiel (2006) observed that some teachers had difficulty managing time on a museum field trip and this caused these teachers to rush. By rushing, they changed their strategies by becoming more directed and interpretive. Kisiel speculates that these teachers' lack of experience at this museum explains their practice; in other words, had the teachers previously visited the museum, they may have drawn on that experience in leading the trip. Thus, the research is

suggestive of many possible links between teachers' past experiences and teachers' pedagogical field trip practices, but to date no study has addressed this question directly. The following types of experiences have been suggested as influences on practice: (1) years of teaching experience; (2) familiarity with the field trip site; (3) choice of classroom pedagogy, and associated influences such as teacher training; (4) outdoor experience, as a professional or hobbyist; (5) professional development in the field; (6) childhood experiences on field trips; (7) past experiences as a teacher trip leader.

Design

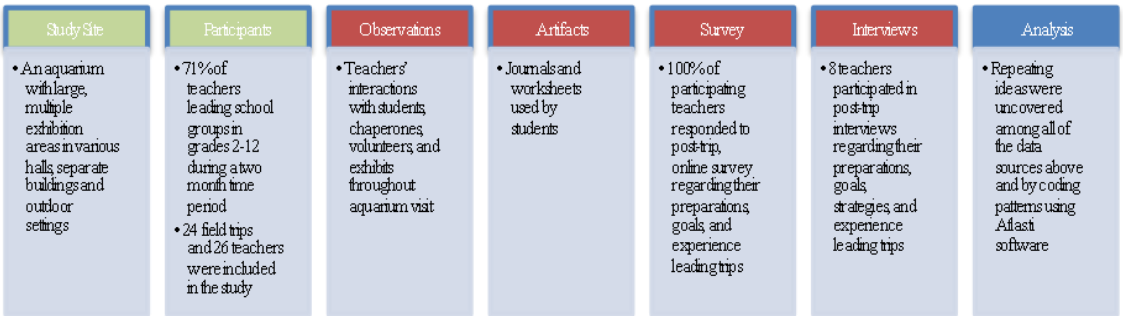
Context of Study

The Oregon Coast Aquarium (OCA) served as the field trip site. OCA is comprised of many varied exhibit areas distributed in various halls among two separate buildings plus broadly spaced outdoor exhibit areas. Although OCA staff offer educational programs in classroom settings that were utilized by some visiting groups included in the study, self-guided visits are the norm for school groups interested in exploring the exhibit areas open to the public. Volunteers are stationed throughout the exhibit areas but they do not provide any formal or school-targeted programs. In other words, volunteers assume the same roles they do with students on field trips as they do with the public which is to say they answer questions and offer brief explanations about exhibits. Thus, the teacher has a high degree of responsibility with regard to the educational strategies employed while visiting the exhibits. There are many opportunities for interactive and hands-on engagement of the sort that distinguish informal settings as unique opportunities for learning (Ramey-Gassert et al., 1994). All teachers planning school field trips to the aquarium over the course of a two month period early in the school year were recruited to join the study. A total of 24 separate field trips and 26 teachers were observed over this period representing 71% of the school groups attending at this time. School groups ranged in grade level from 2nd to 12th grade.

Data Collection

An overview of each of the components of this study, including data sources, is provided in Table 3.1. Data sources utilized in this study include interviews, surveys, observations, and artifacts. During their self-guided visits teachers were observed with particular attention to their interactions with students, chaperones, volunteers and the exhibits. Whenever possible, any teaching tools, or artifacts, such as worksheets used by teachers were gathered. Following their visit, participating teachers were invited to respond to an online survey regarding their experiences leading field trips. Questions addressing teachers' sources of knowledge for field trips included open-ended response forms and were modeled after after the semi-structured format outlined by Bradburn et al. (2004). The literature informed the construction of several questions pertaining to particular influences on teachers' choices of field trip pedagogy. Eight teachers were selected for post-trip phone interviews based on availability. Interviews concluded when relevant data reached saturation. The interviews were loosely structured as guided conversations (Rubin & Rubin, 1995, 2005) and specific observations served as talking points regarding individual teachers' practices and their origins. Transcripts of observations and interviews along with responses to surveys were reduced to relevant data as defined by the guiding question. Subsequent analyses involved coding by repeating ideas (Auerbach & Silverstein, 2003). Atlas.ti software was employed to organize and quickly compile and compare the resulting evidence under each code. Multiple sources of data allowed for triangulation whereby evidence from each data source could be, in many cases, further validated by other data sources. When evidence is presented to support interpretations and conclusions, an attempt has been made to provide sufficient context using quotes and descriptions such that the reader may determine the validity of the assertions.

Table 3.1: Components of the study.



As the only researcher, I drew on my considerable previous experiences as an environmental educator and science center program director serving school field trips in order to guide my observations and lines of inquiry during interviews. I also drew on my previous experience as a researcher gathering observational data during field trips. Consequently, this study is at once benefitted and limited by my personal understandings of teachers' field trip practices

Analyses & Findings

Survey Responses

Insight regarding teachers' sources of knowledge about field trip pedagogy was provided by a variety of evidence. Several survey questions asked teachers to reflect on influences on their practice. Interviews with a subset of teachers allowed these teachers to offer further insight regarding their influences and sources of knowledge. Moreover, observations of the individual teachers who participated in interviews allowed for specific questioning regarding particular field trip strategies and their origins.

Survey questions regarding teachers' sources of knowledge may be categorized into two groups: questions that attempt to elicit general experiences that may influence teachers' choices of strategies and questions that address specific experiences pertinent to the observed trip. General questions allow participants to identify personally meaningful influences while specific questions provide baseline data for comparison. The first

general question was *Have you received any training or mentoring for how to conduct field trips? If yes, please describe.*

A number of teachers described various forms of training they have received including several of the teachers who answered no, but went on to provide details. These descriptions were grouped into three distinct categories (although one response falls into two categories): (1) informal mentoring; (2) past experience trip leading; (3) outdoor education training. Of the twenty-six participants, five teachers described an experience in which they learned informally on-the-job from more experienced teachers. An additional five teachers referred to their past experience leading school field trips as a source of training, in one case describing this experience as "trial and error." Three teachers described some form of structured outdoor education training they received, either through a graduate program or through job training for an outdoor education program, or both (see Table 3.2).

Table 3.2: Types of field trip training described by teachers with example quotes.

Training Type	**Example Quote**
Informal Mentoring	"I came under [a] veteran teacher when I started teaching 6th grade five years ago. [He] had led these trips for years and was a great resource/guide for my first 1-2 years."
Past Experience Trip Leading	"I have been involved in school field trips for 23 years and have taken students not only locally but all over the world."
Outdoor Education Training	"I have a Master's degree in Outdoor Education. I have worked with Outdoor Schools [and other programs for many years]."

The second question analyzed on the survey was *Do you have any past experiences (jobs, hobbies, coursework, etc.) that have helped you plan for field trips? Please describe.* This second question elicited a greater variety of responses which can be grouped into six categories, some of which overlap with the categories identified among the previous responses. Among the twenty-six respondents, only three provided no further response than "no." The remaining responses can be grouped into one or more of the six categories shown in Table 3.3.

Table 3.3: Types of helpful field trip planning experiences described by teachers with each code's description (criteria) and example supporting quotes.

Experience Type	**Description of Code**	**Example Quote**
Past Experience Trip Leading	Refers to past experience leading school field trips as a source of training (12); Synonymous with training type category identified above	"Past field trip experiences definitely play a role in the way I plan now. Past frustrations can be some of the greatest learning tools."
Personal Outdoor Experience	Refers to descriptions of free-choice outdoor activities (4)	"I have spent a great deal of time fishing, clamming on the coast, and hiking in the coastal forest."
In-Service Professional Development	Refers to workshops that included field experiences (2)	"I have taken workshops that included field experiences, the most powerful ones are my model for what I want to offer my students."
Outdoor Education Leader Experience	Refers to work with students in the outdoors in a capacity outside that of a teacher leading a field trip (5); Shares many qualities of the "outdoor education training" category described above	"I am involved with youth work and have planned trips, retreats, mission trips, outings."
Coaching Experience	Describes experience leading athletes on trips that applies to leading school field trips (2)	"I have coached volleyball long before I was a teacher and have taken groups of kids on buses and to away games."
Museum Work Experience	Describes previous work as a museum employee as helpful background (2)	"I used to work at an aquarium as a husbandry manager."

Notably, of the six identified types of relevant experiences referenced by teachers in response to this question regarding relevant experience, only two pertain to experience gleaned under the auspices of a teacher role. Among these two, conspicuously absent is pre-service training or coursework. The other four types of experience represent learning that occurred outside the realm of a school teacher role. The final three categories share the common feature of representing work experience assumed outside the role of a formal school teacher. In addition to the above categorized responses, two unique responses suggest further potential categories (that could not be established without additional evidence confirming a recurring pattern). One teacher referred to work experience as a

field biologist, another type of non-school teaching experience, while another teacher referenced his experience as a child on school field trips as a helpful influence.

The third question analyzed asked *Are there any other factors that influence the way you lead a field trip?* Six categories were identified among responses to this third question (see Table 3.4). Many of the responses to this third question address situational factors that affect teachers' choices for how to organize and lead field trips rather than underlying influences that represent sources of knowledge for how to go about designing and leading a field trip. For example, of the twenty-four respondents, twelve referred only to variables (that is, situational factors) that influence their field trips. These responses were categorized into one or more of the first four factors listed. The final two categories that were identified represent more personal and underlying influences.

Table 3.4: Additional factors that influence teachers' field trips, as identified by teachers, with a description and a representative quote for each.

Factor	**Description**	**Example Quote**
Size and Composition of the Class	Comments suggest that the teacher designs each trip to accommodate the particular students in the class based on factors such as interest level, class size, special needs, or behavior issues	"The number, age, and type of students in my classes influences which trips we take and how involved each trip's activities are…in the past with larger, more diverse classes and/or special needs students I have eliminated the lab at the aquarium and…aquarium touring time."
Coordination With Other Teachers	Indicates at least one other teacher helps design these teachers' trip and, therefore, the design does not entirely reflect one teacher's choices	"The other 5th grade teacher and I work very closely together in our plans and every aspect of the trip."
Chaperone Participation	Who and how many chaperones were recruited for field trips affected the way the teacher leads field trips	"Being well prepared and communicating early with parents, so they can be talking and teaching their kids at home, and possibly come to help guide and teach students on the trip."
Time Constraints	Suggest they might lead field trips differently given more time	"We don't have a lot of time to actually look at the exhibits, only about an hour and 15 minutes."
Past Experience Trip Leading	Refer to experience leading previous school field trips as factors that shaped their	"At the beginning of my teaching career I tried to always have my students take clipboards and have questions to

	current practices; Responses contain the same elements as the synonymous category identified and described in the previous two questions	answer and/or notes to take. I have learned with 3rd graders that is not always the best way. They have a really hard time trying to hang on to stuff and hold things and write. What is really best for them is hands on experiences. When we get back they can answer questions and read and take notes."
General Goals for the Trip	Refer to any general goals ranging from safety to fun to reinforcing beliefs about creation as factors shaping practice	"I want my students to get the most from it both academically and emotionally/socially."

Responses to this question are instructive in that they call attention to the point that individual teacher practices with respect to field trips may vary simply based on situational factors. In other words, how a teacher leads a trip may be influenced largely by the challenges of the moment. However, whatever situational challenges a teacher faces in designing a field trip, that teacher makes choices that shape the learning opportunities afforded by the trip. Therefore, even though the same teacher might make different choices given different situations, that teacher's choices nevertheless reflect past experiences and the resulting knowledge he or she has developed regarding effective teaching strategies. Notably, one of the above situational factors, that of coordination with other teachers, not only represents a variable that perhaps limits an individual teacher's choice of practices on a given trip, but also represents an influence and source of knowledge for future choices—an insight that interview responses reaffirm.

Interview Responses

Interview responses provide richer and more insightful descriptions of individual teachers' relevant training, relevant experience, and factors influencing field trips identified in the analyses of survey responses. During interviews, teachers discussed many forms of training, both informal and formal, that they drew upon when enacting their own field trips. These various types of training were coded using the names and descriptors shown in Table 3.5.

Table 3.5: Categories of formal and informal training referenced by teachers as sources of knowledge influencing their own trip leading each with an example supporting quote.

Training Code	**Description**	**Example Quote**
Collaboration	Teacher refers to collaborating field trips with other teachers.	"We [the 5th grade teachers] work very strongly as a team [to plan field trips]."
Mentor	Teacher provides evidence that he or she acts as a mentor to another teacher or student teacher with regard to field trip leading.	"I was kind of talking through the planning with [my student teacher] every step of the way. So she would kind of know what is encompassed in it all."
Mentee	Teacher provides evidence that he or she uses knowledge or skills learned from one or more teacher-mentor regarding how to lead field trips.	"I always watched how [my former teaching partner] dealt with parents…I've watched the expectations that she would establish for them and model for them on how we expect them to work with kids and the behaviors we wanted and try to impart learning to the parents this year."
Trial & Error	Teacher discusses trying strategies on field trips and then making changes on future field trips.	"When I came and started teaching most of it was just working with the team and figuring out what we needed to do…At the end we always reflect and write down notes to keep track so that we know what needs to be done, what we wanted changed, and how we want it adjusted."
Related Trip Experience	Teacher discusses any of a variety of experiences involving participating in group trips that serve as a reference for his or her own field trip leading.	"I used to go on as many field trips as I was available for [as a parent chaperone]. It would just be so loud and it would be so unenjoyable to be on the bus with the kids that now that I'm in charge and I'm in control, I have much higher expectations."
Environ-mental Education	Teacher describes a formal training experience involving environmental education.	"I was on staff at Outdoor School…You really get practiced with moving groups around and being able to get the attention of large groups and you know there's just a lot of stuff like that that practice came into it."
Professional Development	Teacher refers to teacher professional development that she or he used in leading the trip.	"[At the marine science workshop] I just learned a lot more about animals, different categories of them, and where to find them and how to interest kids in them. We did some art activities that we still do that came from that. There are definitely parts of [their] curriculum that we have included in

Training Code	Description	Example Quote
		ours. We've got a booklet that our kids go through that we've put together. And I've added some things from the Aquarium, particularly regarding food chains and food webs and that sort of thing and some stuff on plankton. And I have their stuff readily available. I look at it all the time."
Education Applied	Teacher provides evidence that they have applied educational training (a theory or approach, e.g.) for use in leading field trips. Or teacher refers to impact of trip using educational jargon.	"You can have the kids study, read, whatever about the different animals, but to actually have them go—and this is what the integrated thematic instruction was encouraging, was that it's brain compatible. They need to get their senses involved with it. They really need to be there for it to really take root inside of them. It's a sensory thing."
Other	Teacher provides evidence for prior field trip training that provides preparation for something other than the pedagogical components of the trip.	"So to be able to have that experience [leading overseas adventure trips] at least budgetwise, has just been really helpful at least to be able to do the Newport trip. And I think like anybody, the more practice you get at any type of thing, the more confident you feel at it and the more successful you are at actually leading the activity."

These above training codes identified using interview responses provide a finer grain by which to categorize teachers' training for field trips. In other words, most of the training codes identified from interview responses provide more specific examples of the training types identified from survey responses. Table 3.6 shows how the training codes relate to the previously identified types of training.

Table 3.6: Categories of training described by participants organized by the three training types identified from survey responses.

I. Informal Mentoring	II. Past Experience Trip Leading	III. Outdoor Education Training
Collaboration	Trial & Error	Environmental Education
Mentee	Related Trip Experience	Professional Development
Mentor	Other	Other

Subsequent analyses provide examples and rich descriptions of how each category of training listed above is discussed by participant teachers. Additional support is provided by observational evidence of the application and/or experience of these training categories, as in the case of informal mentoring, during field trips to the aquarium.

I. Informal Mentoring

Six of the eight teachers interviewed referred to learning about how to lead field trips from a more experienced teacher while serving as a teacher or student teacher, thereby suggesting this is a quite common source of knowledge that may be underrepresented by survey responses. One teacher described her informal on-the-job training during her first year teaching:

> When I first started teaching, there was a wonderful woman who I basically adopted her as my mentor because at that time you didn't have anybody. And the first field trip that she kind of led me through in how to do them, a little bit how to do them, was to the pumpkin patch. . .The excitement of the kids was just amazing. They were totally into it. They were highly motivated. We didn't even do that much with the darn pumpkins when we brought them back. That's the weird thing is that in this day and age now, I would have done a million things with those pumpkins, right down to weighing them, measuring them, going to a store to buy the stuff to make characters, you know, that kind of stuff. But that was the first field trip that I ever took kids and it was sort of under her umbrella of showing me how to do it.

In the above passage, this now veteran teacher sheds light on the rather undefined but self-evident relationships assumed by a novice and experienced teacher in which the experienced teacher introduces the novice to trip leading by modeling and, perhaps at times, specifically discussing her actions. This teacher's final remarks make it clear that, upon reflection, her informal training was incomplete in terms of pedagogy. The teacher also alludes to two recurring patterns among mentor-mentee relationships: (1) mentors establish a benchmark as to what constitutes success on a trip and (2) mentors tend to focus on logistics and management as the key to leading successful field trips. Subsequent analyses provide further support for these patterns particularly with the

inclusion of observational evidence of mentoring occurring during field trips. Similar analyses address the additional training categories. Yet additional analyses center on other teacher-identified influential experiences. Ultimately all of these analyses lead to a composite picture for teachers' sources of field trip leading knowledge.

Another teacher described learning trip leading skills as a student teacher. In her case, the teacher for whom she served as a student teacher worked closely with several other teachers to create an integrated curriculum including field trips. Evidently she had not previously thought of this experience with these teachers as a form of training; when referred to her survey response stating that she had received no training or mentoring, she corrected herself:

> I hadn't even really thought about that I had been on the field trips. And I did go on the field trips with them, so I guess I answered that incorrectly. In thinking about it in my training to be an educator in college there was no training or anything. I didn't receive any specific training there.

Interestingly, when asked directly about the influence of her experience as a student teacher on how she leads field trips, her response focused solely on how organized her informal mentor teachers were. Indirectly she later revealed further evidence regarding the influence of her student teacher experience by discussing her fastidious organization for taking field trips in collaboration with another teacher.

> It's trial and error when it comes to field trips. And from my experience a lot of people don't take kids on field trips any more just because it's so much work. There's a lot of work. And even being as organized as I am and having another teacher that works with me, we do things together, it's still a lot of work. We're staying until 5:30 or so the day before getting it all set up in order to go on the trip. It still takes more time than preparing for an activity in the class.

Thus, for this particular teacher, the most salient influences of an informal mentoring relationship pertain to how she organizes and collaborates in preparation for field trips. This observation finds further support from her response to a question about the biggest obstacles to leading trips:

> It's a lot of extra effort and time to organize it. You know there's a lot of extra paperwork. You have to get your OK through the office. Then you have to get the bus okayed. Then you have to order the lunches. Then you

> have to make groups. Then you have to get the chaperones. Then you have to call the chaperones and make sure they're coming. Then you have to do lesson plans because if you're not here all day, I have classes with 6th and 8th graders, you have do lesson plans for them. Make sure those classes are covered. Organize subs for people, especially in middle school. Organize subs for people that are going that still have classes here, so it's a lot of stuff. There's a lot to it. Especially when you're in high school, middle school because you still have to have all your lessons done for your other classes as well.

Again, the emphasis is on preparing and being organized. Here this teacher makes specific reference to lesson planning for the classroom but notably absent is any mention of lesson planning for the field trip itself. Due to the unique challenges posed by creating structured learning opportunities in such an informal environment as an aquarium, this might seem surprising. However, observation of this teacher's trip revealed that the only pre-planned in-trip activity for students consisted of completing worksheets provided by the aquarium. Students were organized into small chaperone- or teacher-led groups for exploration of the exhibits and, when it was time to gather as a large group, the teacher used a whistle to get students' attention. When asked about how she saw her role in the trip, she replied

> I feel like my role for the whole group is that we get to where we're going to go, and everybody is safe, they have a good time, and they learn something. And so we do that by making sure that we do all our head counts. Now I don't talk with the chaperones as much as my team teacher. She talks more with the chaperones and stuff, individually. I talk to them, the whole group together before we go and tell them about the grading policy because this is the first trip with these group of parents. And my role, I just try and coordinate everything. And I also count on my other teachers to do the headcounts, you've got food, you take care of this, just to delegate and make sure everything is taken care of and done. And also to make sure everyone knows what's expected of them. I'd say that's my basic role for the whole group. When I'm with my small group, you know it's pretty much the same thing. To make sure they follow the rules. We do go over the rules quite a bit with the whole group before we go also. To make sure we follow the rules, that we're welcome back when we come, that nobody gets in the position that they're not allowed to go on the next field trip, to make sure they learn. And I remind them this is about learning. Learning is always more valuable than learning in the classroom, really. That's my opinion, but a lot of people might dispute that. It's a learning experience. That everybody's safe and have a good time.

Although she clearly recognizes the trip as having a learning goal, her efforts focus on organization and management. Even in her communication with chaperones, there appears to be more emphasis placed on supervision than on learning facilitation. Learning, it seems, is something that is assumed to happen if all the logistics and management are properly arranged.

A relatively new teacher with four years teaching experience provided insight regarding the process in which she was being informally mentored to lead her students to the aquarium. Because this was her first year teaching fifth grade and she had never visited the aquarium she explained that last year's fifth grade teacher prepared and trained her. In fact,

> She lined up the entire trip. We start planning the trip in January. So she was already starting to plan the trip. So when I came in and started teaching fifth grade, the trip was already set up for me. So what I meant by that, in January when I have to start planning it [for next year], she is going mentor me…So I basically just got to go on the trip [this year]. So as far as the mentoring role that she took on for me, was basically she had planned the trip out for me, she kind of gave me a play by play, what to do and when, how much allotted time should be for the different activities, and did the itinerary for us, but unfortunately she wasn't able to go this year…but it went fine.

Again there is an emphasis on the logistics, in this case regarding time allotted for various parts of the trip. This teacher's comments further suggest that her informal mentor has taught her that once the trip is planned, all that the leader must do is follow the schedule. As a practice, new teachers, such as this one, inheriting traditional field trips and learning about how to organize them from their predecessor(s) appears to be a recurring pattern; in fact, four of the six interviewees who described receiving some form of informal mentoring also described inheriting the aquarium field trip as part of the existing curriculum.

One veteran teacher with twenty-six years teaching experience shed light on the mentoring experience from multiple perspectives: first, as a mentee serving as a parent-chaperone on the aquarium trip, then as a new teacher learning from a peer teaching partner, and finally as a veteran teacher mentoring both a new teaching partner and a

student teacher. Already serving as a new teacher of a different grade, this teacher describes learning about trip leading from the teachers while accompanying his child on the traditional aquarium field trip:

> I watched how those people ran it…When I went as a parent, [my future long-time teaching partner at the time] had a different teaching partner and so I watched both of them. So I kind of knew how they ran things. I took from that and used what I saw. I had to incorporate that in [my trip leading].

Note this teacher's focus on how things are run on the trip rather than how lessons are facilitated. When he began working with this teaching partner he explained that he continued to learn from her as the two collaborated:

> I always watched how she dealt with parents…She was always a good listener. So I've tried to do more of that this year [now that she retired] and just be available for them. Also I've watched the expectations that she would establish for them and model for them on how we expect them to work with kids and the behaviors we wanted and try to impart learning to the parents this year.

As he gained experience, he began to share his knowledge of field trip leading.

> As a result of this particular field trip when I came back I wrote a recipe for successful field trips for [our school] and I included three components…It started out with tips for students, tips for parents, tips for teachers. So there were three areas and they were bulleted with various things…So I wrote this thing and gave it to the principal and he tweaked a couple of items or made a couple of suggestions. And the staff looked it over at a staff meeting and we just went over it line by line. People just reworded things they didn't like, and I just let them have it. I didn't care. Now it's been printed up and put in our school directory.

The guide he describes writing was a response to various behavior concerns that had arisen in previous field trips. Thus the knowledge he shared had to do with management strategies.

When he received a new teaching partner, he said she learned from him much as he had learned from his previous teaching partner: "This person I had last year [as a teaching partner]…was brand new. She was just experiencing [the aquarium trip] for the

first time. She's a first year teacher. She was just absorbing." When asked if he was specifically trying to show her anything, he responded,

> mostly just how the whole thing sort of goes…She was just seeing how the whole operation went. And I pretty much ran it. The advantage I had in doing that is that I had a student teacher also who did unbelievable amounts of work getting ready for it. And that took a lot of load off of me just prepping things. I'd tell her what we needed to have done getting things ready for it, and she did a lot of that.

The mentoring role he describes himself taking is quite similar to the one he saw his mentors assume. While he absolutely agreed that he took a mentoring role for both his new teaching partner and his student teacher, his active mentoring appears to take two primary formats: first, modeling how to organize and manage the trip and, second, assigning organization tasks. This conclusion is further supported by observations taken during the aquarium visit that revealed only brief interactions between the teacher and his student teacher. Neither was assigned to a student group and both wandered independently. At one point the teacher asked his mentee if she thought a particular group of students should move on to other exhibits. At another point he somewhat playfully remarked that she should keep an eye on a certain group of three students who were enjoying a crawl-through tank because "they're trouble." The remainder of his interactions with his student teacher were indirect; if any additional mentoring occurred during the aquarium visit it was in the form of modeling as the teacher managed chaperones with suggestions and interacted with students by prompting observations, sharing information, taking photos, and guiding groups to new exhibits. It is clear that at each step of the learning process about field trips, including roles as a participant chaperone, a novice teacher, a collaborating teacher, and a mentor teacher this teacher continually focuses on trip leading skills that pertain to logistics and management with little reference to pedagogical skills. His comments also suggest that, in his view, a good trip is a smooth trip with few mismanaged logistics or behavioral issues.

Another veteran teacher who was accompanied by a student teacher thought of herself as a mentor. When asked, "did you see this field trip as an opportunity for [your student teacher] to learn about field trip leading?" she responded:

> Yes! I told her that I would have leaped at the chance to do something like this being an intern in a classroom. Because I was kind of talking through the planning with her every step of the way. So she would kind of know what is encompassed in it all.

When asked about specific efforts to guide her, she added:

> Well, she helped me actually with the different details. She helped me with things like making the nametags. She actually helped me to keep myself organized. There's all these different pieces of paper you have to have with you to make sure you're all on track. So she was very aware every step of the way. She was a wonderful assistant.
>
> Researcher: You probably consider that as part of the learning experience as well, keeping track of all the organization?
>
> Yeah. Right down to what snacks are we providing for the kids. Those are the nuts and bolts.

During their observed trip, this teacher worked closely with her student teacher together leading a small group of students through the exhibits. Both focused on interacting with their students by prompting observations. In only one instance was the teacher observed directly mentoring her student teacher by taking a moment to explain that she could buy a certain prop for her classroom that related to one of the exhibits about crabs. Although this teacher's educational use of the field trip differed somewhat from the previous teacher described in that she had each student assigned to research a specific animal using questions on a worksheet for a follow up classroom report, her role as a mentor appears quite similar. Prior to the trip she mentored her student teacher by describing and delegating organizational tasks and during the trip her primary form of mentoring occurred by means of modeling. Although it is unclear if and what sort of debriefing occurs between the mentor teachers and their mentees following the trip, all the evidence taken from teachers' own descriptions of roles and observations in the field indicate that mentor teachers construe a successful trip as one that is well organized logistically and managed smoothly. In-trip teaching strategies receive little emphasis by mentor teachers and are conveyed almost exclusively by means of modeling.

II. Past Experience Trip Leading

From the interviews a more detailed picture of how past experiences participating in and leading various types of trips have contributed to teachers' approach to field trips emerges. For example, three teachers described how they have simply tried certain practices and afterward reflected on them and made changes on future field trips ("trial & error" training). Although the exact nature of these changes was not always clear, the types of changes teachers appear to focus on have to do with addressing logistics and/or behavior issues. In one case a teacher described the problems involved with using parent drivers and, as a consequence, the resulting change to hiring buses.

Six teachers also discussed a variety of other trip experiences that they draw from when leading school field trips. These include serving as a mission trip leader, a coach, an adventure trip leader, a wildlife biologist, and as a student participant on childhood field trips. When asked about how these experiences influenced the way they lead field trips, teachers' answers either referred to organizational preparation or to the type of experiences they want their students to have. For example, the former mission trip leader explained

> you have to look at the type of sponsors or chaperones you have to take, what you need to do for meals, what you need for transportation, what kind of permission slips you have, how you communicate to the parents, what your itinerary is. Actually, there's not a lot of difference [between planning a mission trip and a school trip].

The teacher with adventure leading experience explained

> You do everything, everything from the budget to reservations…you're responsible for creating this whole thing. So to be able to have that experience, at least budgetwise, has just been really helpful, at least to be able to do the [aquarium] trip. And I think like anybody, the more practice you get [at] any type of thing, the more confident you feel at it and the more successful you are at actually leading the activity.

By contrast, the two teachers who referred to their childhood experiences as students on field trips described how their memories influence their choice of activities for students. In one case, the teacher referred to going on this very same coast trip with the same school as a fifth grader. Although the aquarium did not exist when she was a

student, she said she did not want her students to miss out on the sorts of fun, non-educational activities she recalled, such as playing on the beach and visiting the wax museum. In other words, her childhood experience directly influenced her choice of activities, albeit not for the aquarium portion of the trip. In the other case of a teacher drawing on her childhood memories, she explained that her school field trips involved a lot of standing in line to see things. Her intention was to avoid leading this sort of trip. Therefore, her childhood experience also impacted her choice of activities but, rather than attempting to replicate her experience for her students, she attempted to change and improve it. Observation of her group's visit revealed that she actively prompted observations and interactions with the exhibits and, as an indication of her priorities for her students, interrupted her students who were reading a sign and attempting to complete a worksheet question in order to redirect their attention to a live octopus that had come into view.

III. Outdoor Education Training

Two teachers referred to formal training they had received to teach outdoor lessons during interviews. One teacher described her experience working at an outdoor school for visiting school groups. She explained that this training helped prepare her with questioning strategies that she was observed using while leading a visit to the aquarium. "The whole point of Outdoor School is to get kids to ask and be curious about stuff…And so that's how I was originally taught how to teach." This teacher also explained that "You really get practiced with moving groups around and being able to get the attention of large groups and you know there's just a lot of stuff like that that practice came into it." Her training for outdoor school also influenced how she prepared chaperones to assist during the aquarium visit.

> My overall role is as a facilitator and a manager, and to empower the parents to be able to play a role as mentors and as teachers and as advisors and as guides…And so teaching them how to not just to be a parent but also to be a teacher and to be an effective teacher, and for kids beyond just your kids. And so my biggest role is—particularly in the aquarium is where I feel it comes out—is really being able to empower those parents to feel like they're successful in managing and successful in teaching and

> can use me as a resource, but that they don't need me to manage the kids that they're working with…. [At pre-trip chaperone meetings] a lot of [what we share] is knowledge. So [chaperones] know more than the kids do…. So we go over just logistic stuff so you know basic stuff like where you'll be sleeping at night. Or here's your general map to the aquarium…. We do brainstorming for group management.

Although it is clear that this teacher expects parent chaperones to teach as well as manage students, her comments suggest that her primary preparation for these chaperones involves introducing the trip logistics and appropriate management techniques (which she herself learned in her role as an outdoor educator). While her outdoor educator training appears to have influenced her in-trip use of strategies that prompt observations and provoke thought (for example, she was observed asking students how an otter would sleep in the ocean), her preparation did not lead her to plan any organized in-trip activities for her students that integrated classroom lessons with learning opportunities at the aquarium. Instead, her students were expected to complete the worksheet provided by the aquarium despite her recognition that "some of [the questions] guide [students] toward thinking but [for] a lot of them…they could look through a book and find the same answers." Hence, although her training as an outdoor educator included logistical, managerial, and pedagogical components, the logistics and management skills appear to have the most influence on her practice.

Three teachers referred to in-service teacher professional development they had received as influence on their field trip practice. In the case of one teacher, her experience participating in an ocean science workshop helped her ensure that "all of my kids, whether they were going or not, had a better ocean and estuary knowledge than we'd done before," although it is not clear this preparation translated into any in-trip pedagogy. In the case of another teacher, she explained that she borrowed the general approach of using logbooks, or worksheets, for students to which she was first introduced through a teacher support program. Finally, a third teacher described multiple impacts of a marine science teacher workshop in which he participated:

> It was near to working with this curriculum and I wanted to be a little more in the know about certain things. So I felt that was something I needed to benefit myself as an educator. And you know I just learned a lot

> more about animals, different categories of them, and where to find them and how to interest kids in them. We did some art activities that we still do that came from that. I think it was more for personal growth than anything.

While observing jellies with several students this teacher made a reference to the art activity (which the class had done prior to the trip) in an apparent attempt to help his students make connections between the classroom curriculum and the exhibits. Later in the interview this teacher also explained that the workshop introduced him to specific destinations that he now includes in their multi-day coast trip as a result. There was little evidence, however, that his training experience influenced his practices during the visit. And although the workshop built his confidence with the content, his in-trip use of such knowledge was limited to occasional comments such as "[that urchin] is in the same family as sea stars."

IV. Education Applied

During interviews at some point five teachers discussed their trip using educational terminology. In some cases it is clear that the teachers' educational training drives their practices while in other cases it appears their training provides a lens by which teachers interpret the impact of the trip. In one case of the latter, a teacher described how field trips cause students to experience disequilibrium.

> Any time a group of people experiences disequilibrium and then find equilibrium back together as a whole, it tends strengthen the group as a whole rather than as an individual. So what we end up seeing is more compassion and more understanding and just a better relationship between the students in general having gone through an experience like that than if they had just gone and seen each other, you know, every day for five hours a day and then they go home.

As a result of this educational reasoning, the teacher explained that the trip was intentionally planned at the beginning of the year in order to promote "bonding that happens with the students." In a case of the former, one teacher explained how her experience using an instructional approach known as integrated thematic instruction (ITI)

has compelled her to reflect on her teaching practices large and small, in other words, both in terms of her use of field trips and the specific strategies used during field trips. With regard to the use of field trips, she remarked

> The efficacy of the field trip has led me to want to find more meaning in the field trip, which causes me to continue to want to do the field trip. So the ITI was a jump start into thinking [about] leading their experiences outside my four walls as a classroom…. Also the fact that I'm dealing with kids who are concrete learners. Think about Piaget. They're concrete learners until they're about ten. So concrete means you have to have the thing there itself. And that's how you get meaning is from the real thing. When I first started realizing that there was so much power in the field trip is what caused me as a practitioner to go into seeking more ways that I could explore and expand the use of the field trip as a medium for the kids' learning.

Clearly this teacher has applied her training in educational theories and approaches toward the use of field trips in ways that attempt to leverage their learning potential according to these understandings. With regard to specific applications of her training, she explained

> I think that as the teacher it's necessary to make the bridge between what's happening there on the field trip and what's happening in the classroom…. [By using ITI it] is easy to hook into the new learning if you can go back to what they've already learned. That was my strategy, was trying to build relevancy for the new learning.

During her trip she was observed facilitating numerous curriculum connections by means of posing questions that asked students to compare observations with previously studied topics and a student assignment requiring each student to research a specific animal's natural history which they would later share in class.

In another example of a teacher applying her educational training to practice during a trip, one teacher was observed instructing students who had been running to go back and walk. Earlier in the visit she was observed witnessing another teacher use this technique and remarking that it was a good idea. When asked about her use of this practice, she explained that

> It's called positive behavior support and it's a way to reinforce the action or the behaviors that we want to see…. So you have them redo what you want them to do. It's an opportunity for learning…. It comes from the administration…[and] that's something you learn during your mentor teaching.

From these examples, it is evident that educational training not specific to field trips sometimes plays a role in teachers' choices to use field trips and the their choice of strategies during those trips inclusive of managerial and pedagogical approaches. Consequently, education training may be posited as a fourth category of prior training teachers utilize when planning and leading field trips (for categories 1-3, see Table 3.6). The observation that education training sometimes influences teachers' field trip practices in clearly traceable ways is not surprising considering the parallels between classroom appropriate strategies and field trip appropriate strategies previously described (see Rebar & Enochs, In press).

Conclusion

Field trips are common educational practices despite the fact that it is rare for teachers to receive formal training regarding how to plan and lead a field trip. Not surprisingly, research of field trips has consistently revealed a pattern of missed learning opportunities. These missed opportunities must be, at least in part, attributed to this lack of structured training. However, studies of field trips have also documented many benefits of field trips that cannot be achieved in a classroom setting alone (e.g., Anderson et al., 2006; Flexer & Borun, 1984; L. Rennie & McClafferty, 1995; Tuckey, 1992). Therefore, it is evident that teachers are enjoying some degree of success with their use of field trips by using practices that were, by and large, not a product of formal training specific to field trip pedagogy. Consequently, any efforts aimed at supporting and enhancing teachers' success as field trip leaders would benefit from an understanding of the sources of knowledge that teachers draw from when preparing and leading field trips. This study begins to uncover these sources of knowledge and points the way toward future models of professional development designed to enhance teachers' field trip practices by leveraging existing teacher influences. For example, as discussed above, one

of the leading influences on teachers' field trip practices is informal mentorship by a peer teacher. A future model of professional development might initiate a program that takes advantage of the existing relationships documented in this study in order to introduce and spread best practices for field trip leading. Although considerable evidence is presented here that illustrates the influence of teachers' previous relevant training and experiences stemming from (1) informal peer mentoring, (2) prior trip experiences, (3) outdoor education training, and (4) traditional education training, the most salient impact of these sources of knowledge is on teachers' preparation for the logistics and management of field trips. In other words, when teachers draw on these sources of knowledge, they most often focus on logistics and management skills. Logistics and management strategies are essential to realizing field trips. Moreover, logistics and management strategies may be employed in ways that complement and enhance pedagogical strategies. Thus the importance of recognizing and further supporting teachers' development and use of these skills should be apparent. However, applying appropriate pedagogical strategies are essential to facilitating intended and relevant learning outcomes.

Because the participants in this study all led field trips, they have overcome all the barriers (for examples, see Mason, 1980; Michie, 1998; Orion, 1993; Rickinson et al., 2004), real and perceived, to realizing this particular field trip to the Oregon Coast Aquarium. In order to do so, they must have employed logistical and managerial strategies. However, pedagogical strategies are not required to overcome barriers to realizing field trips. This observation may in part explain why teachers focus more on logistics and managements strategies in their discussion pertaining to mentoring.

Findings present minimal evidence for teachers' use of reflective practices with regard to field trip pedagogy. Not coincidentally, the teacher who provided the greatest evidence for ongoing personal reflection on her field trip pedagogy also drew numerous connections to the curriculum for her students and tasked students with a pre-planned activity tied to class lessons. The potential of guided reflection to improve teachers' in-trip pedagogy is suggested by the following interview exchange in which the researcher questioned the teacher about her strategy to revisit exhibits with her students. Specifically, during the visit the teacher's small group of students was observed racing

ahead through a series of three tunnel-like aquaria in order to see the sharks in the final exhibit. Afterward, the teacher gathered her students in the lobby to discuss their answers to the questions on their worksheets. In her words,

> after we sat down and read the questions, there were some questions that were like "huh, I wonder what they were doing and did anyone notice?" And they didn't because they were so excited to be there and get through there. So when we went back—a good strategy would have been to read the questions before we went through it. But with the group I had, a lot of seventh graders, they're just so excited to get in there and look at it, that they wouldn't even think about what's in those questions. But after they got through the excitement of getting in there and getting through it and we looked at the questions and they thought about it, and they weren't really sure about the answers. And then we went back again, then they knew the answers. Then they had looked to see what it was they were supposed to be looking for. Just how the animals moved in the water. The sharks move constantly, but the rockfish just hang out in one spot. So what's going on there?

At the end of the interview the researcher commented that this revisit strategy finds considerable support in the research because it pertains to the idea of novelty in which students become hyperstimulated by new surroundings and unable to focus (see Falk & Balling, 1982; Orion & Hofstein, 1991a). Therefore, the researcher, explained it makes sense to allow students to first explore and become acquainted with their surroundings before asking them to focus on questions. In response, the teacher replied "I think I'll tell my staff from now on that, you know, let them go through, get to the other side. Talk about some of the—look at some of the questions, then go through it again. Because it's the most exciting part to the kids. Why not do it twice?"

Thus, upon a guided reflection, the teacher was able to gain greater recognition of an effective, research supported pedagogical strategy and, moreover, came to the conclusion that she should share this knowledge. Meanwhile, the researcher was prompted to consider possibilities for ways in which the exhibits might be redesigned such that it would better capture students' attention upon the first visit. This idea resulted when the teacher explained that, in previous years, an interactive antique diving mask had been on display toward the beginning of the tunnels and this had kept students from racing to the last exhibit with the sharks.

The above exchange illustrates the potential for teachers to draw on their existing knowledge with intentional guidance. Such an exchange takes the form of a cogenerative dialogue applied to field trips (see Lebak, 2006) and may serve as a particularly rich format for structured professional development involving museums and teachers. Such cogenerative dialogues allow teachers to draw from their existing knowledge and experiences, reflect on their strategies, share their insights, and also learn from new research-based insights. Additional models of professional development might benefit from formalizing mentor-mentee relationships in order to further facilitate intentional reflection on pedagogical as well as managerial and organizational aspects of enacting field trips. This study also supports the conclusion that teachers would benefit from the inclusion of field trip pedagogy in pre-service training (Rebar & Enochs, In press), and further indicates that preparing future teachers with ways to approach mentor teachers in order to discuss field trip strategies would be advantageous. Employing a constructivist and historical approach to preparing teachers for field trips has the potential to build on teachers' demonstrated efficacy and previously acquired skills. Moreover, further applying a sociocultural lens to interpreting activity such as the students' reaction to the tunnel can help clarify how the operational structure of actions was interrupted due to the particularly unfamiliar conditions. As a consequence the operation of visiting an exhibit area became an action, thereby interfering with students ability to focus on the teacher's intended action of answering the worksheet questions. Thus it is evident that the power of employing this approach is two-fold: it enables facilitators to focus conversations with teachers on existing skills and strategies while simultaneously allowing for purposeful interpretation of appropriate actions and goals. In other words, this study is suggestive of ways in which teachers may be empowered to build on and restructure their existing field trip pedagogy with the introduction of learning theory and field trip research findings in a supportive format. Despite the limited formal preparations teachers receive specific to field trips, teachers have many sources of knowledge that contribute to their field trip practices and, therefore, these should be recognized and utilized in new and continuing efforts to enhance field trip practices.

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CHAPTER IV

INTEGRATING ENVIRONMENTAL EDUCATION FIELD TRIP PEDAGOGY INTO SCIENCE TEACHER PREPARATION

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INTEGRATING ENVIRONMENTAL EDUCATION FIELD TRIP PEDAGOGY INTO SCIENCE TEACHER PREPARATION

Abstract

Field trips are commonly used methods for teaching about the environment and their potential educational benefits are well documented. However, teachers receive minimal preservice training for how to make use of field trips in order to enhance environmental education (EE) and improve pedagogy in general. A review of the research on field trips reveals that many learning opportunities are missed. However, this same line of research also leads to a wealth of recommended strategies for optimizing learning on field trips. A summary of these recommendations is provided along with suggestions for how they might be integrated into a science methods course targeting preservice teachers. We make the case that including field trip pedagogy in existing science methods courses may be accomplished without restructuring course objectives and without displacing other important material to be covered. In fact, we assert that introducing field trip strategies in science methods courses will serve many existing course and program goals while simultaneously leading to improved EE instruction at both the secondary and university levels.

"Go my Sons, buy stout shoes, climb the mountains,
search the valleys, the deserts, the sea shores,
and the deep recesses of the earth ... for in this way
and no other will you arrive at a knowledge of nature
and the properties of things" P. Severinus (1571)

Few teacher education programs prepare preservice teachers to lead effective and meaningful field trips (Griffin, 2007). Yet, there is substantial research on the preparation and delivery of field trips that may be used to enhance environmental learning and awareness in ways not replicable in the secondary school classroom. Rather than acting as an additional expectation, incorporating field trip pedagogy into preservice programs provides a means to accomplish most, if not all, of the existing goals common among exemplary programs while simultaneously enhancing the preparation of teachers. For example, field trips may be used to address science content standards and, when infused into a preservice program, provide an opportunity for preservice teachers to lead themed and inquiry-based lessons. Carefully framed, such a field trip focus in preservice programs might include all the characteristics of excellent science teacher preparation programs as outlined by the National Science Teachers Association (2004). This idea to integrate environmental education (EE) into science methods courses has been suggested previously by Heimlich et al. (2004) as a means to overcome the barriers posed by the many requirements that must be addressed in preservice teacher preparation. Specifically, we suggest introducing field trip pedagogy as a means to support EE. While recognizing that EE is sometimes treated as a methodology and at other times treated as something to be taught (Swan, 1975), we assert that preparing teachers with the strategies to facilitate and optimize their students' personal experiences is essential to ensuring that quality education about, in, and for the environment takes place in formal education. Field trips, we believe, provide the ideal shared student experience for teaching and learning with our environments as advocated by McInnis (1975b). Continuing with her argument for this sort of contextual approach McInnis (1975a) declares "rather than being one more egg for the overcrowded curriculum basket, environmental education provides a more adequate basket for the existing curriculum" (p. 51). Field trips naturally form a large part of the basket while teaching strategies are eggs already included in preservice methods courses. By using field trips as a centerpiece for science methods, teaching skills may be enhanced and developed more completely.

In the following chapter we describe the key teacher strategies for facilitating field trips and suggest how they may be integrated into science teacher preservice programs at the middle and high school levels. Including field trip pedagogy in such

programs is a significant step in addressing the goals of EE as put forth in the landmark Tblisi Declaration (UNESCO/UNEP, 1978). In this chapter, discussion begins with the characteristics that define a field trip. Next discussion centers on the research evidence, learning theory, and rationale supporting the inclusion of field trips in science education. Subsequently, research-based field trip strategies are introduced. Finally, discussion concludes with ideas regarding how these recommended strategies for leading EE field trips might be infused into a science methods course.

What Is a Field Trip?

To teachers, the term "field trip" often connotes a major undertaking involving extra time and effort. Generally, all indications, such as museum attendance records, suggest that the number of field trips teachers lead declines with age level such that, by the time students are in high school it is likely they will not experience educational field trips. Our extensive experience working both as teachers and with teachers suggests there may be several factors contributing to this decline: (1) additional challenges in logistics posed by secondary schools' multi-course multi-teacher typical school day; (2) pressures placed on teachers to cover the required curriculum (which, in all but the rarest of cases, does not explicitly or inherently support field trips); (3) students' increased involvement in other conflicting after school activities such as sports, clubs, and jobs; and (4) the (inappropriate) assumption that field trips are educationally most effective for students at an earlier developmental stage.

We take a cosmopolitan view on field trips that should help assuage teachers who fear or would rather avoid grand endeavors with their students. Put simply, we define field trips as any educational activity that teachers guide or direct in a setting outside the classroom. Given this view, there is reason to believe that every teacher has the minimal resources needed to lead field trips. A field trip might be as close as a short walk to the schoolyard. As such, none of the factors mentioned above pose realistic barriers to planning and realizing field trips. This is an important point to bear in mind as we discuss why field trips are needed, how they may simultaneously enhance EE and science education efforts and, moreover, why and how they might be supported as a method within preservice science programs.

Why Are Field Trips Necessary?

There are many well justified reasons for including field trips in the curriculum, and they derive from research of student learning on field trips, learning theories, and the underlying principles behind formal education. Field trips have recently been recommended as a way to teach science and conduct inquiry (National Research Council, 1996; 2001). However, the notion that out-of-school sites can enhance education is not new. In 1917, Twiss asserted in a book on science teaching that "in spite of all the difficulties, therefore, it ought, in any school, to be possible to have in every subject some field observation in which a considerable portion of the class can participate" (p. 145). Concurring with Twiss's view, the preeminent educational philosopher John Dewey argued that all genuine education comes through experience (Dewey, 1938). Today, field trips of all type are common practice, at least at the primary level. However, in practice, teachers often fail to maximize learning opportunities afforded by exhibits, models, live specimens, natural settings, experts, and other resources not accessible in their classrooms. This failure may be attributed in part to the general absence of proper teacher professional development for such events.

The potential contributions of field trips to students' achievements are well documented. Eshach (2007) summarizes the research literature by concluding that "children enjoy going on scientific fieldtrips. They are aware that they are expected to learn from the trip, and that it should not only be a 'fun day', but rather a day where they enjoyably learn science" (p. 177). In a meta-study reviewing the research on outdoor learning, Rickinson et al. (2004) conclude that "substantial evidence exists to indicate that well-taught and effectively followed up [outdoor lessons] offer learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom" (p.24). Rickinson et al. further add that "there is substantial research evidence to suggest that outdoor adventure programmes can impact positively on young people's: (1) attitudes, beliefs and self-perception—examples of outcomes include independence, confidence, self-esteem, locus of control, self-efficacy, personal effectiveness, and coping strategies; (2) interpersonal and social skills—such as social affectiveness, communication skills, group cohesion and teamwork" (p.32). The rationale for utilizing field trips is supported by Braund and Reiss (2006a) who maintain

that when science is introduced in an out-of-school real-world context it is more "authentic" and may be recognized by students as having more relevance.

From a theoretical perspective on learning, the sociocultural school of thought most closely associated with Vygotsky (1986) draws attention to the importance of social interactions and, specifically, to the significance of peers or teachers enabling students to grasp new and more complex ideas by means of facilitated experiences. Field trips, which, by definition change the setting from a formal to an informal context, are particularly well suited to such interactions because they better allow for social behaviors characteristic of everyday learning experiences outside of school time. As a result, field trips not only provide for valuable social learning opportunities, they do so in a way that helps students connect their school learning to their everyday life learning. The North American Association for Environmental Education (NAAEE) EE guidelines explicitly support this outcome of connecting learning with the real world as one of the stated essential underpinnings (Simmons et al., 2004).

In accordance, research studies consistently reveal that students show a positive attitude toward all types of field trips (e.g., Falk & Balling, 1982; Flexer & Borun, 1984; Falk & Dierking, 1997; Pace & Tesi, 2004). Students' positive attitude toward field trips contrasts with their increasingly negative attitude toward school science as a factor of age (Braund & Reiss, 2006a) and therefore leads to the suggestion that students might be engaged in school science when it is purposefully and intricately linked with out-of-school science activities (Braund & Reiss, 2006b) such as field trips. Including field trips in the science curriculum may improve students' attitudes toward science because doing so compels teachers to vary their teaching strategies. A variety of strategies has been shown to increase the efficacy of teaching and therefore has been used to argue for the inclusion of more informal science learning experiences, especially field trips (Hofstein & Rosenfeld, 1996). Finally, research studies have demonstrated how to build successful field trip models that actively involve students in environmental learning (e.g., see Enochs & Kean, 1999; Orion, 1993). In these models, field experiences are intentionally linked to school science, again addressing the issue of poor student engagement in science. It is worth noting that in his model, Orion (1993) discusses how field trips provide hands-on experiences that, drawing on a Piagetian view, facilitate the transition

from concrete to more abstract levels of cognition. In summary, the rationale for using environmental field trips to support school science is well founded.

What Strategies Do Science Teachers Need to Learn?

Familiar Strategies Applied to Field Trips

Although most research and theory points to the overriding message that field trips have enormous potential to enhance school science, and specifically EE, many studies reveal numerous missed learning opportunities on field trips. For example, when organizing field trips, teachers do not often plan how to monitor the effectiveness of their students' experiences or how to build on these experiences (Amos & Reiss, 2006). Griffin and Symington (1997) have shown that teachers often fail to identify or clearly communicate their instructional goals for the trip to their students and, moreover, that teachers often fail to recognize the extent of their influence on the teaching strategies and the content of field trips. In other words, many teachers do not recognize field trip settings as appropriate environments for planning and facilitating organized lessons centered on specific learning objectives.

In many ways, a number of research supported strategies for enhancing field trip learning parallel strategies identified as best practices in the classroom. For example, research suggests teachers should first determine the learning objectives, then develop appropriate activities for the trip (L. Rennie & McClafferty, 1995). For teacher educators this means demonstrating how the curriculum can be used to guide field trips rather than showing how the curriculum fit (that is, the trip's relevance to class topics) may be used to justify the experience; in practice the latter is the norm (Anderson et al., 2006). Often the destination drives the activity and teachers tend to view trips as general enrichment (e.g., see Gottfried, 1980; Griffin & Symington, 1997). Ideally, planned field trip activities, similar to classroom activities, should align with learning objectives, connect to the curriculum (Finson & Enochs, 1987; Guisasola et al., 2005; Wolins et al., 1992) and support science standards (Cox-Petersen et al., 2003) and EE guidelines. Moreover, the same methods of inquiry used to teach classroom science may be applied to out-of-the-classroom settings (National Research Council, 2001). Studies of field trips

consistently reveal a pattern in which teachers frequently do not approach, frame, and facilitate field trips as an integral part of the curriculum (for example, Anderson et al., 2006). Within the context of preservice programs, simply introducing the use of field trips as learning events that can be utilized to support classroom teaching would begin to address these missed opportunities. When compared with the preparation required for normal classroom lessons, field trips require considerably more time, effort, and expense. Therefore, it is imperative that teachers are provided training based on the use of research-supported teaching strategies for field trips.

Strategies for Out-of-the-Classroom Challenges

Additional, perhaps less familiar, recommended strategies have been identified to help teachers prepare for the common challenges (unique when compared with classroom challenges) posed by the informal settings where field trips take place. These strategies and the associated specialized knowledge for facilitating learning contrast with formal teaching strategies (Cox-Petersen & Pfaffinger, 1998; Griffin, 1994). Studies consistently support the conclusion that these strategies and this knowledge are not common or instinctual among the majority of teachers who lead field trips. Thus, the unique challenges for teachers that field trips present may be used to organize the research recommended strategies that should be included in a preservice program. These challenges are (1) students' overstimulation caused by new surroundings on field trips (and the chaos that often results); (2) limited time available to take advantage of unique opportunities, (3) difficulty in creating a suitable learning tool such as a worksheet; (4) unknown nature of new settings that leads to surprises; and (5) preparation and management of additional adult chaperones (see Table 4.1). The following passages briefly describe these challenges and some of the research-recommended strategies for handling them.

The challenge of students' overstimulation is really a factor of novelty. In other words, when a field trip setting contains too many new stimuli, students are unable to focus sufficiently to engage in meaningful learning. This problem may be addressed in several manners. Foremost, it is essential for teachers to recognize the developmental level (Taylor, Morris, & Cordeau-Young, 1997) and assess the experience of their

students in order to plan an appropriately stimulating trip. The goal should be to introduce moderate amounts of novelty such that students are neither disinterested due to the familiarity of the setting and/or activities nor overstimulated due to the novelty of the experience, but rather optimally engaged and focused (Falk, 1983; Falk & Balling, 1982). Teachers may reduce novelty by orienting their students to the trip ahead of time by concentrating on three domains: cognitive (students' relevant knowledge level), geographic (students' familiarity with the setting), and psychological (students' "mental readiness for a field trip") (Orion, 1993). Another strategy to reduce novelty (thereby enhancing students' ability to learn) is to repeat visits to the same site. Such a strategy often poses logistical and financial challenges, but is certainly possible for schoolyard field trips. A repeat visit strategy is presented by the National Research Council (2001) as a model way to use inquiry methods in which students are guided to conduct an investigation of water quality at a nearby pond over the course of several months. First students become familiar with the site. Then, in the classroom, students work on developing an investigative question and tools needed to conduct their project. Students return regularly to the site to gather data that they eventually compile into a final report. Field trips and classwork complement each other such that students continue to be stimulated, but not overwhelmed or bored, both in the field and in the classroom.

A wealth of opportunities and limited time to explore them leads some teachers to attempt to squeeze every possible experience into a trip by exposing students to as many places, exhibits, people and/or presentations as possible in a tightly structured schedule. However, research suggests that students will retain more when field trips focus on resources, activities, and content that is closely tied to the curriculum (Finson & Enochs, 1987; Guisasola et al., 2005; Wolins et al., 1992), fewer new items are introduced (Barnard, Loomis, & Cross, 1980), and students are allowed time to explore in small independent groups (Cox-Petersen & Pfaffinger, 1998). The goal on field trips should be to take advantage of the unique resources not available in the classroom. Therefore, activities and tasks that can be completed in the classroom should not be imposed on students while in the field. One way to extend a field experience is to use Web resources, particularly when the field trip site supports its own Web site (Cox-Petersen & Melber,

2001). Notably, this same recommendation to use a destination's Web site with students is also a suitable strategy to reduce novelty when used as an advance (pre-trip) organizer.

In keeping with the notion that field trips should highlight unique resources, it is vital that teachers choose or develop appropriate strategies for engaging and focusing students. Too often on field trips, teachers impose formal classroom structures that do not suit or optimally take advantage of the setting (Griffin & Symington, 1997). While acknowledging that there are a variety of teacher motivations for leading a field trip—several categories of motivations have been identified (see Kisiel, 2005a)—there are, nonetheless, certain guidelines that should inform the teacher's selection of teaching strategies in all cases:

(1) Research clearly points to the benefits of valuing students' interests and choices with respect to where the trip takes place or to which exhibit or organism an individual focuses on in order to answer a question or complete a project (Gilbert & Priest, 1997; Kisiel, 2003; Mullins, 1998; Orion & Hofstein, 1991b).

(2) Social interactions should be encouraged especially during assigned tasks or activities (Hofstein & Rosenfeld, 1996; Watson, Aubusson, Steel, & Griffin, 2002).

(3) Prompts or questions, be they verbal, written, or otherwise, should target responses that promote conceptual learning and require interaction with unique resources (Kisiel, 2003, 2007; Mortensen & Smart, 2007).

Providing choices allows students to draw from their intrinsic motivation to make discoveries and learn. Promoting social behaviors allows for many varied forms of learning, including peer-to-peer learning talk, sharing activities, cooperative manipulations, observing others engage in learning activities, peer-to-peer teaching, and creative play (Watson et al., 2002). Assignments and tasks that require students to read considerable text, for example, rather than focusing on observations and interactions with their surroundings on a field trip fail to offer a truly unique experience that cannot be replicated in the classroom using books or other texts. Therefore, teachers' use of prompts that require student interactions with each field trip site's unique resources are key to capitalizing on the learning potential presented by out-of-school settings.

With respect to limiting and mitigating unwanted surprises on field trips, the research points to several effective strategies. The destination should reflect the pre-identified purpose or learning goals for the trip rather than choosing goals to suit a predetermined setting (L. Rennie & McClafferty, 1995). This is a subtle but consequential point. Many schools continue traditional field trips long after the original guiding purpose and relevant curriculum ceases to be in place. Such cases are not ideal for optimizing learning opportunities and can lead to unintended situations (often because teachers do not take full ownership of the trip). Once a clear purpose and learning goals have been identified, the next step is to consider the agenda of potential destinations (Kisiel, 2005a) should the site have one. The site's agenda should support the teacher's agenda; if it does not, students may be introduced to unrelated content at best or, at worst, students may be subjected to inappropriate propaganda. A site's agenda may be considered on several levels. It is worth learning about the site's mission as well as their methods and programming. Organizations likely to have their own agendas, such as museums, interpretive programs, and managed natural areas, tend to have easily accessible online mission statements thereby allowing teachers to screen them for significant conflicts. But even when there is agreement, on-site educators may favor lectures rather than interactive activities and, moreover, may highlight specific topics or concepts that do not support the teacher's goals. Thus, the importance of communication and collaboration between teachers and other educators who may be involved is indispensable (R. Tal et al., 2005). Ideally, teachers should visit field trip sites ahead of time in order to avoid these undesired surprises. Previsits allows teachers to plan and coordinate for safety, logistics, expectations, and learning activities (Anderson et al., 2006; Cox-Petersen & Melber, 2001; S. S. Martin & Seevers, 2003). In practice, much of this planning may take place using all other tools available: Web sites, brochures, email and phone conversations with the site's staff, etc.

The informal context of field trips often requires the assistance of additional adults. Managing and preparing these chaperones is a new task that few teachers perform in their classrooms. Consequently, teachers may not recognize the extent to which they should prepare chaperones in order to best ensure learning while on the trip. Without such guidance, chaperones may struggle with their role. Therefore it is as equally

important that the chaperones understand the goals for the trip as the students. Moreover, the teacher needs to communicate an understanding of students' current ideas, thinking, values, and learning needs with chaperones (Schauble et al., 2002). Teachers can make use of chaperones' individual skills by encouraging them to facilitate learning in their own ways (Sedzielarz, 2003). By organizing students into small groups with chaperone leaders, teachers can promote family-type interactions among students and adults thereby encouraging informal learning conversations. Such an approach has been suggested as ideal for promoting learning in informal settings (Griffin & Symington, 1997; Parsons & Muhs, 1994). Chaperones should be prepared to ask questions that require students to explore their surroundings (Watson et al., 2002); this may be accomplished by providing chaperones with a list of questions or a bag of prompts (Cox-Petersen et al., 2003). Finally, teachers must encourage chaperones to model the sort of interactions they expect students assume (Griffin & Symington, 1997).

Table 4.1: Common field trip challenges that require the use of strategies as recommended in the research.

Challenge	Recommended Strategies
Chaos/Over-stimulation	• Use pre-visit lessons specifically related to the site's topics. • Plan trips that introduce moderate novelty; use pre-trip orientation to reduce the novelty of new settings. • Prepare for novelty: cognitively, geographically, psychologically.
Limited Time	• Link the content to the curriculum to improve students' retention. • Use the site's Web site to plan logistics and extend lessons in the classroom. • Incorporate science standards in lesson planning. • Limit the stimuli, such as number of exhibits visited, to improve learning. • Allow time for small group exploration.
Teaching Tools (such as tasks, worksheets, or prompts)	• Consider students' input, interests, and abilities in planning your trip. • Give students choice in exploring. • Allow for some less structured time. • If you use worksheets, emphasize concepts rather than a broad survey of the content, and preference questions that prompt students to interact with resources and allow some degree of choice in response. • Encourage social interactions, even while using worksheets.
Surprises	• Determine the trip's purpose first, then plan the setting. • If you choose a museum destination, consider how it supports your agenda. • Visit the field trip site ahead of time and coordinate with staff on safety, logistics, expectations and learning.
Chaperones	• Recognize and support multiple roles of chaperones and encourage chaperones to use new approaches to facilitating learning. • Encourage chaperones to promote conversations among students (because most of students' talk in learning settings is learning talk), and ask questions that require students to explore available resources. • Encourage chaperones to interact with students in a family-like way in small groups. • Consider providing chaperones with a list of questions and a bag of props they can use to focus students' attention and inquiry. • Model interest in exhibits. • Prepare chaperones with an understanding of students' current ideas, thinking, values, and learning needs.

Assessment

Research-based recommendations for assessment of field trips are limited. However, given that learning in field trip settings differs from usual classroom learning, it follows that appropriate assessment would, similarly, differ. As discussed earlier, research on the use of worksheets indicates that text-based, fact-focused assignments do not suit informal settings (Kisiel, 2003, 2007). Because interactions are the ideal goal of field trips, Parsons (1999) suggests evaluating the learning process as well as the product; this might be accomplished by using conversations as evidence of learning. Depending on the purpose of the field trip, many varied outcomes might be considered for assessment, and many of these may be gathered after the trip has concluded and students have returned to the classroom. Clearly, assessments should not interfere with students' opportunities to interact with their surroundings while on a trip; if anything, in-trip assessments should be designed to enhance these interactions. One such method that can achieve this goal is the requirement that students create a photo journal documenting their observations (perhaps including specific expectations). Carefully planned, such an assignment has the potential to focus students' attention on details of interest and relevance to the trip's purpose and, moreover, might be employed to facilitate connections once students return to the classroom. An additional application of principles discussed earlier would be the use of group assessments rather than individual evaluations. Since field trip learning should be social, it follows that assessments of this learning would, most appropriately, involve peers working together. Therefore, group projects, presentations, or reports, for example, seem to align well with this type of learning experience. Open-ended, alternative measures of learning such as free-writing, drawings, and paired interviews in response to simple prompts have been demonstrated as effective means to capture students' conceptual growth resulting from outdoor field trips (Rebar, 2008). In summary, as with all assessment, measures should reinforce and reflect the nature of the learning expected.

Integrating Field Trips into Preservice Programs

Why Science Methods?

Colleges and universities need to make field trip planning and methods an integral part of their preservice programs. Introducing field trip pedagogy in science methods courses should result in both more and better field trips led by science teachers. This claim is supported in part by research revealing that teachers cited a lack of preservice preparation for planning, enacting, and evaluating student learning in the field as major reasons for not taking field trips (Mason, 1980). Additional benefits of including field trip training in science methods courses may be drawn from the results of a study in which 715 institutions were surveyed regarding preservice EE. In her study McKeown-Ice (2000) found that when EE was included in teacher preparation, it was primarily included in science education, although institutions generally rated their delivery of EE instruction methods as only adequate (32%) to poor (33%). In other words, institutions that have integrated EE to some degree have found its best fit is in science education and they recognize the need to improve these programs. Integrating EE field trip pedagogy in science methods would accomplish this. McKeown-Ice also found that most students specializing in EE (and not necessarily preparing for classroom certification) received their teaching methods in science methods courses. It is likely that many of these specialized EE students will pursue careers in which they are involved in coordinating and facilitating field trips in roles other than that of the classroom teacher. McKeown-Ice concluded that even those teacher education programs including EE were not adequately preparing preservice teachers to effectively teach about the environment (including the use of field trips). Clearly, preservice programs in science education are well positioned to fill this niche of better serving environmental educators while simultaneously better preparing all preservice science teachers for EE with the inclusion of field trip pedagogy as an integral part of their curriculum because, as discussed earlier, field trips are ideal for introducing EE and field trip leading skills are essential to leading learning-focused trips.

Representative Science Methods Course Objectives

The overall goal of a science methods course should be to increase student competence and confidence in teaching science. The objectives of the course should be designed to develop students' knowledge of science teaching and learning. Such objectives of a representative science methods course provide numerous opportunities to introduce research-based field trip pedagogy (see Table 4.2). When considering ways to include more field trip connections in science methods courses, we encourage teacher educators to begin by examining their science methods course objectives and aligning field trip practices as appropriate. Table 4.2 illustrates this using representative objectives typical of a science methods course. Subsequent steps of infusing field trip pedagogy should flow from each course's objectives. Naturally, the ways in which field trip pedagogy may best be introduced within a preservice program will depend on each program's existing structure. Regardless of the format, we hold that many opportunities exist for the seamless infusion of field trip pedagogy within these programs when examined closely. Including field trips in the preservice curriculum, we believe, will enrich existing course preparations.

Table 4.2: Example science methods course objectives and corresponding field trip connections.

Representative Science Methods Course Objectives	**Field Trip Connections**
Discuss the research relevant to science teaching and its significance to preservice science teachers.	Provide field trip related articles as discussion topics. Reflect on theories, approaches, strategies that support field trip pedagogy.
Plan science curriculum including the development of lesson plans which include instructional objectives/outcomes.	Develop lesson and unit plans that include pre-trip, in-trip, and post-trip lessons. The site should be selected based on the identified objectives and outcomes.
Plan science curriculum including the development of appropriate assessments and assessment procedures for diverse learners.	Develop pre-trip activities that introduce concepts to be addressed and orient students to the trip site. Develop authentic assessments for pre-trip, in-trip, and post-trip lessons that promote students' social and environmental interactions.
Construct and utilize plans for lessons involving science inquiry skills and/or generating science content through use of inquiry skills.	Design lessons that encourage students to ask testable questions, make observations and collect data in the field, draw conclusions, and present results.
Develop more favorable attitudes toward the teaching of science in addition to interests in science, which may carry over to future personal leisure time activities.	Engage preservice teachers by modeling interactive strategies that support field trips. Encourage preservice teachers to develop creative unit plans that include field trips.

How can field trip preparation be integrated into a science methods course?

The purpose of science methods courses is to prepare teachers to create learning environments for their students. Thus, preparing teachers to lead field trips centers on this same goal that has always guided science preservice programs. Preparing teachers for field trips requires many broad skills and strategies that are already integral to science methods courses. For example, from a broader perspective, approaches such as inquiry, project-based learning, and varying strategies in order to appeal to multiple learning styles are common inclusions in methods courses. Field trips and the identified strategies for optimizing learning discussed above are well suited to support each of these approaches. What better way to promote these approaches than to model their use within a science methods course by means of sample lessons from a unit including one or more field trips? One of the challenges is that organizing and leading out-of-the-classroom activities also requires additional skills, both managerial and pedagogical. How can these be infused into a methods course that already is limited by time and the topics that must be covered? Table 4.3 provides a representative model for how a science methods course might be restructured with the integration of field trips using a schoolyard garden trip as an example within a unit on botany and soil science.

Table 4.3 Representative outline for a science methods course modeling a unit plan that includes field trip pedagogy.

Sample Unit Plan: Soil Science and Field Trip to the Schoolyard Garden	
Pre-Trip	1. Model a pre-trip lesson to a botanic garden or vegetable garden (for example, an investigation of soil and how it affects plant growth). Include pre-trip preparation by designating groups that work together to do a class activity and develop their own testable question. 2. Model pre-trip logistics preparation by orienting students to the field trip destination by using the site's Web site. Share a letter of invitation to parents including expectations (the time and in-trip responsibilities including teaching/group facilitation duties). 3. Brainstorm with preservice teachers other lessons they could do as a pre-trip lesson as part of the unit. 4. Assign preservice teachers to develop one of the lessons that were brainstormed as a pre-trip lesson.
In-Trip	1. Role-play a field trip to the campus garden. Give "students" data tables with prompts to record observations. "Chaperones" help lead small "student" groups using cue cards with additional

	questions and a bag with tools for conducting the inquiry. "Students" investigate their question by planting seeds under appropriate conditions to address their group's question (if the site will be revisited), or collecting soils from various locations for further investigation in the classroom/laboratory. 2. Reflect on the field trip as a class (stepping out of assumed roles). Consider what would you do differently as a teacher? What did you notice about being a chaperone or student?
Post-Trip	1. Model a post-trip lesson plan in which students analyze their data and prepare poster presentations as a form of authentic assessment. 2. Reflect as a class on pre-, in-, and post-trip lessons and the overall unit. 3. Assignment: (1) Preservice teachers design a post-trip lesson plan that fits with the overall unit. (2) Preservice teachers write a reflection on the overall experience and how they might use this type (or another) field trip.

Many science methods courses include a culminating assignment in which students are expected to design a unit plan including sample lessons. Thus, a logical extension of the outlined activities in Table 4.3 would be a unit plan assignment that requires preservice teachers to develop their own unit including one or more field trips. Sample lesson plans might be required for pre-, in-, and post-trip portions of the unit. Preservice teachers might be further expected to present a teaching demonstration that is taken from one of their component lesson plans. Within their teaching demonstrations, regardless of whether they choose a pre-, in-, or post-trip lesson, they must draw on some of the field trip strategies introduced in the course. Using such a course structure, science methods instructors may accomplish each of their course objectives while also preparing preservice teachers to introduce EE by means of field trips.

Summary

Field trips are commonly used educational methods for teaching about the environment, yet teachers receive minimal, if any, preservice preparation for planning and leading trips. Not surprisingly, important missed learning opportunities on field trips are well documented in the research as a consequence. This line of research has also led to a wealth of recommended practices that would enhance field trips. In the preceding discussion we have summarized these key recommendations and made the case that their

inclusion in preservice courses, particularly science methods courses, would naturally integrate into the existing framework of such courses. Field trips provide an opportunity to apply many of the methods introduced in teacher training programs. However, in practice teachers often struggle to take full advantage of field trips because, although recommended field trip strategies share similarities with classroom strategies and they both support broader approaches such as inquiry, the informal context of outside-the-classroom settings requires different strategies and knowledge. By preparing aspiring teachers with these specialized field trip strategies and knowledge in their initial teacher training coursework, we believe the quality of both university and secondary instruction will see improvements.

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CHAPTER V

CONCLUSION

CONCLUSION

The articles presented here represent three vital components necessary for bridging research and practice with respect to field trips. Speaking broadly, these three components are: (1) detailed evidence about ways in which teachers currently utilize field trip visits to a museum as part of their curriculum; (2) evidence regarding the source of teachers' field trip leading skills; (3) a model for one way in which research-based recommendations for field trip pedagogy may be introduced to teachers. Furthermore, the research components of this study (chapters two and three) may serve as a starting point for the development and application of theory-driven professional development models. Expanded discussion of the preceding assertion must necessarily be prefaced by a summary of the key contributions of each of these articles.

Chapter two, "curriculum connecting strategies", offers new insights on the details of strategies used by teachers to promote student learning experiences tied to school lessons while visiting an aquarium. The value of connecting students' field trip experiences with the curriculum is well established (for example, Gilbert & Priest, 1997; Orion, 1993; Wolins et al., 1992). Although it also has been well documented that teachers often do a poor job of integrating field trips with the curriculum (for example, Tal & Morag, 2007), there has been little focus on the exact ways in which a sampling of presumably well organized and experienced teachers utilize the actual site visit as a relevant learning experience. Certainly the museum visit is but one of three phases of the field trip (considering related pre-, in-, and post-trip class meetings) in which the content and resources made available and interactions made possible by the museum might be utilized by teachers to introduce related concepts and ideas, and a number of other studies have explored the impact of pre- and post-visit lessons (for example, Anderson, Lucas, Ginns, & Dierking, 2000; Falk & Balling, 1982; Finson & Enochs, 1987; Gennaro, 1981). But taking advantage of the unique resources and potential experiences afforded by a museum visit is essential to ensuring the educational effectiveness of the field trip. And, in many cases, the way in which these resources and experiences are introduced on museum field trips, or any field trip, may be heavily dependent on the teachers' choices of strategies, as in the case of this study. Hence, what this study provides is descriptions

of specific curriculum connecting strategies that teachers employ. This study builds directly on previous investigations describing the range of in-trip teacher strategies employed (Griffin & Symington, 1997; Kisiel, 2006), instructional strategies used by museum educators (Cox-Petersen et al., 2003; Tal, Bamberger, & Morag, 2005; Tal & Morag, 2007), in-trip teacher roles assumed (Cox-Petersen & Pfaffinger, 1998), teachers' use of worksheets on museum visits (Kisiel, 2003, 2007; Mortensen & Smart, 2007) and case studies of master teachers' field trip strategies (Lucas, 2000; Wolins et al., 1992). Each of the types of curriculum connecting strategies described here might serve to inform attempts to support teachers' use of deeper and more intentional curriculum connections. Previous study has shown that teachers are interested in activities and suggestions for ways to connect their curriculum to museum visits (Phillips, Finkelstein, & Wever-Frerichs, 2007).

Chapter three ("Teachers' sources of knowledge") offers insight regarding a relatively unexplored topic, that is, how teachers learn to lead field trips. Previous studies have touched on this topic, initiated some speculation about it, and some previous teacher experiences have been identified as predictors of teachers' likelihood to lead field trips (for example, Michie, 1998; Spence, 1991; Tal, 2001; 2004). However, this study stands out because it directly addresses teachers' sources of field trip leading knowledge along with corresponding observations describing individual teachers' practices. The theoretical importance of this study is the broad, historical lens (i.e., sociocultural lens) it applies to a field dominated by studies of immediate and short-term impacts coupled with proximate explanations. Thus, positioning this study along side the previously described study presented in chapter two further illustrates its value, not only due to its contrast as a different approach but, due to the fact that evidence presented in both articles originates from the same investigation. Put simply, the interactions and patterns of strategies described in chapter two reflect the teachers' sources of knowledge described in chapter three. Thus it becomes more apparent how the historical approach complements the prevailing approaches exploring immediate interactions.

The practical importance of the findings presented in chapter three is the opportunity presented to design support structures that take advantage of and build on teachers' existing sources of knowledge. For example, outdoor education training

emerged as one useful source of knowledge for teachers who led field trips in this study. Yet only a select number of teachers have some type of outdoor education training from which to draw. Hence, professional development efforts would be well advised to explore ways in which they might draw from outdoor education to improve field trip training. Such a model might also utilize teachers who have this background such that they become actively involved in sharing their knowledge. This suggestion touches on another important insight: teachers provided minimal evidence that they reflect deeply on their pedagogical field trip practices. Therefore, professional development models that acknowledge and attempt to utilize teachers' existing sources of knowledge would benefit from designs that promote guided reflection regarding these practices.

Chapter four ("field trip pedagogy") provides an outline for one way in which research-recommended strategies for leading field trips may be introduced to preservice science teachers. It should be noted that the contribution of this article is the organization of precisely what strategies should be introduced and the suggestions for how to do so. Previous arguments for including environmental education training, of which field trip training is a part, in preservice teacher preparation have been voiced (Heimlich, Braus, Olivolo, McKeown-Ice, & Barringer-Smith, 2004; McKeown, 2000). Chapter four, it should be further noted, truly only represents one of several implications for better supporting and preparing teachers that may be drawn from the research presented here.

Returning to the assertion that the research findings of this investigation may be used as a foundation for the development of theory-driven professional development models, the most logical starting point for such an endeavor is teachers' existing skills and knowledge, as described. In particular, the findings relating teachers' pronounced use of informal mentoring to teach and learn about the skills required to lead field trips indicates existing communities of practice (see Lave & Wenger, 1991) including novice and expert teachers are in place. Therefore, a professional development model that utilizes communities of practice as a theoretical framework may be able to leverage these relationships in order to enhance field trip practices. Research suggests that communities of practice cannot be easily designed (Wenger, 1998). Hence the finding that communities of practice supporting field trip training exist and appear to be quite common is of great value as a means to encourage and support improved field trip

preparation. Although findings presented here only reveal new teachers learning from more experienced teachers, there is evidence to suggest that student teachers can teach their master teachers as well when the student teachers are prepared with research-based field trip strategies much as outlined in chapter four (Olson, Cox-Petersen, & McComas, 2001). Thus it appears that there exists a grand opportunity to develop a model for field trip preparation guided by a community of practice approach and involving institutions offering teacher preparation, in-service teachers, and museums. Such a model might include the science preservice preparation program and adopt the ideas discussed above. Certainly various collaborative efforts among such partners have previously been established (for example, Robertson, 2007), but the suggestion to involve these parties using the described framework seems likely to contribute to new and fruitful outcomes. There is potential, for example, to organize both formal and informal activities in which teachers are prompted and guided to share their knowledge by means of conversations, demonstrations, videos and many other formats. As discussed earlier, insights from research must be introduced throughout these activities. In addition, findings regarding teachers' current use of curriculum connecting strategies (presented in Chapter II) might serve as a guide for the introduction of content, strategies, and materials that support and enhance teachers' use of the museum.

The potential for the success of such a model also finds support from a study of teachers' interests with respect to museums: Finkelstein (2005) found that, among other wishes, teachers want museums to be places that help teachers improve their pedagogical skills. By participating in the proposed model for professional development, museums can fill this wish by focusing on field trip strategies. In the past, the teacher professional development offered by informal science institutions such as aquariums has generally not included field trip strategies (R. Tal et al., 2005) or introduced related curriculum materials (Phillips et al., 2007). The opportunities for museums to expand their professional development offerings may also prove to have added benefits for the museums using this model. Teachers and educational researchers representing university partners may help offer suggestions that improve the presentation and content of exhibits if open conversations are promoted, as suggested by the concluding example of chapter four. Moreover, should such a model prove to attract or impact teachers who avoid field

trips due to perceived barriers such as a lack of proper skills and curricular materials, then museums might also increase their attendance.

Initiating a new model for professional development, as outlined here, opens the doors to many new potential studies. Aside from the most obvious question, how would such a model impact teachers' practices, proposed studies might ask in what ways are teachers' existing sources of knowledge best accessed and shared? Furthermore, can support for informal mentoring alone improve field trip practices and, if so, what does that support look like? Clearly the challenges posed by documenting, interpreting, and supporting teachers' use of field trip sites, such as aquariums, as learning environments also provide many opportunities for continued research and accompanying professional development.

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