Designing Effective Field Trips at Zoos and Aquariums

- A Literature Review -

Nicholas J. Meiers
Middlebury College
Middlebury, Vermont

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Introduction

Each year, millions of school children experience field trips to their local zoos, aquariums, nature centers, and museums. The familiar field trip routine has become as much a part of the school experience as desks, blackboards, and recess: chaperones are scheduled, bag lunches are packed, busses are boarded, and the class of students embarks on a day of inspired learning away from the classroom.

In recent years, however, out-of-classroom experiences may be occurring increasingly less frequently in the lives of K-12 students. School district budget reductions and increasing transportation costs, combined with an increased emphasis on standardized-test preparation, have been cited as two reasons for the decreasing number of school field trips across primary and secondary schools (Anderson et al., 2006; Mehta, 2008; Price and Hein, 1991). In recent years, notable institutions around the United States have experienced declines in student group attendance. Chicago's Field Museum reported a 33% decline in past years, and The Natural History Museum of Los Angeles County reported a 28% decline in field trip attendance (Blair, 2008; Mehta, 2008). Preliminary data suggest that field trip attendance has likewise declined at many zoos and aquariums between the years 2005 and 2009 (Meiers, 2010). Zoos and aquariums have faced attendance declines in the past; a similar trend was noted during the 1980s (Price and Hein, 1991).

Field trips are expensive for school districts, and maximizing their educational benefit to students is a complex issue that requires the cooperation of schools and the zoos and aquariums they visit (Orion and Hofstein, 1994; Marshdoyle et al., 1982). As these and other informal learning institutions face a decline in attendance by school groups—a significant segment of their audience—justifying their existence to their sources of funding may become increasingly

difficult (Marshdoyle et. al, 1982; Falk and Dierking, 1992). Young field trip visitors represent the future patrons of informal learning institutions, and early, positive experiences may help facilitate lifelong interest (Marshdoyle et al., 1982). Thus, it is in the best interest of museums, zoos, and aquariums to establish positive working relationships with schools (Phipps, 2010). If field trips are to establish themselves as an integral part of the K-12 landscape, schools and informal learning institutions must work together to ensure that the benefits provided to students by an out-of-the-classroom experience are worth the time and expense that they require.

The belief that school field trips should reinforce the curriculum is increasing in popularity (Melber, 2008). In this paper I will review the literature on field trips, with a particular emphasis on zoos and aquariums. I will examine what students, classroom teachers, and zoos and aquariums should do before, during, and after the field trip so students may receive maximum social and educational benefit from their experience. Clearly there is no single best approach to designing a field trip, but my hope is that this brief review of the literature will serve as a basis for developing an effective strategy and toolbox of materials that K-12 educators might use with students in conjunction with a visit to their local zoo or aquarium.

Note that, because of the similarities between "informal learning institutions" like zoos, aquariums, science centers, museums, observatories, parks, and the like, the examples used throughout this paper will be pulled from a broad spectrum of those institutions. The implication is that many of the findings discussed here can be applied across a diverse range of institutions (Falk and Dierking, 1992).

The State of Field Trips

Orion (1993) suggested that the primary role of field trips in the learning experience is to facilitate a "direct experience with concrete phenomena and materials". Kisiel (2005) proposed

eight distinct motivations for field trips: "to connect with the classroom curriculum, to expose students to new experiences, to foster student interest and motivation, to provide a change in setting or routine, to promote lifelong learning, to provide student enjoyment or reward, and to satisfying school expectations." Field trips are usually designed to satisfy one or more of these motivations. To satisfy school expectations, however, institutions like zoos and aquariums must sometimes shift the emphasis of their field trip programs. For example, as a result of declining attendance in recent years, Chicago's Field Museum has designed field trips that present students with mathematics and other material they might encounter on standardized tests (Blair, 2008). Educators at a Harlem charter kindergarten program justified a "field study" (not "field trip") to a farm on the basis that familiarity with farm animals may provide students with an advantage on their standardized tests when they encounter questions pertaining to livestock. Likewise, students from rural communities have been taken on trips to be exposed to large-city concepts like "sidewalks" and "lawns" with the hope that familiarity with structures not often found in rural environments will increase test performance (Hernandez, 2009).

As these examples suggest, providing students with an opportunity to leave their classroom for the sake of learning in an interactive and novel environment may be happening increasingly less frequently. While many pedagogical best-practice philosophies come and go over time, the call for experiential learning outside the classroom is not a recent phenomenon, as we are reminded by Peter Severinus, the 16th century scientist who many regard as the founder of modern geology:

> "Go my children, burn your books. Buy yourselves stout shoes; get away to the mountains, the deserts, and the deepest recesses of the earth. Mark well the distinction between animals, the differences among plants, the various kinds of

> minerals. In this way, and no other, will one gain true knowledge of things, and of their properties" (Severinus, 1571).

Few educators would question the value of learning through experience, and research has indicated that field trips can be educationally effective from both a cognitive and affective standpoint (Falk, 1983; Koran et al., 1989; Tuckey, 1992; Marshdoyle et al., 1982; Tofield et al., 2003). Field trips may also allow non-English speaking students and students without a particularly strong interest in academics to experience success, and may promote favorable attitudes toward science in students (Ramey-Gassert, 1997; Price and Hein, 1991). A visit to a zoo or aquarium might be enough to spark what will become a lifelong passion for certain students. And, unlike learning in schools, which is often motivated by extrinsic factors such as grades, informal learning institutions like zoos and aquariums may present complex information in more interesting and diverse ways, thus motivating students to learn more through their own intrinsic motivation (Csikszentmihalyi and Hermanson, 1999). Many classroom teachers agree that experiential learning outside of the traditional classroom offers a valuable addition to the student's learning experience, even if the gains made by students are more affective than content-related (Marshdoyle et al., 1982; Melber, 2008).

While these advantages to learning at zoos and aquariums may exist, cost-benefit analyses by school administrators often result in field trips being thought of as an "enrichment" experience in the broad scheme of a student's educational experience (Marshdoyle et al., 1982). In light of the current economic and educational climates that often make it necessary to cut programs that are not at the core of the educational experience, despite their benefits, field trips may be conducted less frequently than in the past. As a result, many would argue that students are missing an opportunity to learn together in teams in places with resources, rules, and

opportunities not available in the traditional classroom (Price and Hein, 1991; Connolly et al., 2006).

While budget cuts and standardized testing have contributed to the demise of field trips from K-12 education, they may be only part of the problem. The failure of many field trips and their reputation as an "add-on" to the K-12 curriculum—rather than an integral part of it—rests in both schools and the informal institutions themselves. Some schools are at fault for using field trips to zoos and aquariums as an end-of-the-year "reward" for students, effectively stripping these institutions of their educational reputations and further promoting the notion that they serve a purpose that is primarily one of entertainment. While some studies have reported that classroom teachers believe the field trip experience should be connected to the curriculum (Kisiel, 2005), many classroom teachers have failed to proactively design field trips that take advantage of the resources and opportunities available at informal learning institutions and connect them back to what students are learning in the classroom (Anderson et al., 2006; Davidson et al., 2010). This is not to suggest that classroom teachers don't have a desire to create valuable out-of-classroom experiences. In some cases, a teacher may not feel comfortable creating meaningful curricular links to the zoo or aquarium, but still want to give students the experience. In other instances, teachers are "handed" the field trip date by school administrators. If this date falls near the end of the year, it may be difficult for the teacher to make meaningful curricular connections (Kisiel, 2005).

Early research indicated that many zoos and aquariums did not place sufficient effort into designing programs that supported the curriculum of local schools, nor did they provide teachers with relevant tools to use before and after their visits (Marshdoyle et al., 1982). Recent studies have found that more institutions are providing site-specific resources for use by teachers

(Meiers, 2010; Anderson, 2003), and a majority of classroom educators believe that the primary purpose of field trips is to provide students with an enjoyable opportunity for learning (Marshdoyle et al., 1982). Unfortunately, despite good intentions, many teachers are unable to explain how they expect the field trip will ultimately lead to student learning (Marshdoyle et al., 1982; Kisiel, 2003). Classroom teachers with the intention of connecting the field trip back to the curriculum may not do so in practice (Anderson et al., 2006).

Even when pre-visit planning resources are provided to classroom teachers, teachers may be uncomfortable using them in their own classrooms. There is sometimes a perceived disconnect between the learning goals of classroom teachers and educators at the zoos and aquariums themselves (Meiers, 2010). Teachers may approach field trips with fact-based learning objectives that align more closely with their perceptions of a traditional classroom approach, while zoos and aquariums often place their focus on observation and inquiry (Griffin and Symington, 1997; Price and Hein, 1991; Kisiel, 2007; Mortensen and Smart, 2007). Additionally, field trips may be stressful for classroom teachers from a logistical and organizational perspective (Griffin and Symington, 1997). Teachers may respond to their anxiety over the field trip by creating field trip experiences for their students similar to those that they remember from when they were students themselves (Phipps, 2010). Even experienced classroom teachers may not have the proper training to teach effectively in a zoo or aquarium setting (Kisiel, 2007). To counteract this effect, zoo and aquarium educators must take responsibility for providing teacher training and development in best-practice ways that make clear connections to the classroom and how teachers can take advantage of the resources available at the particular institution (Gutiérrez de White and Jacobson, 1993; Anderson et al., 2006).

Providing support and training for classroom teachers should be a primary objective of the zoo or aquarium. Teachers may not have the background knowledge necessary to design an experience for students that is intriguing while at the same time takes advantage of the unique elements the institution offers (Phipps, 2010). Classroom teachers who believe that informal learning environments are not conductive to facilitating true learning may plan their visits accordingly (Griffin and Symington, 1997; Kisiel, 2003; Tofield et al., 2003). Zoo and aquarium educators must ensure that teachers are aware of the unique opportunities for learning available at their institutions (Kisiel, 2003). The success of the field trip in meeting learning objectives, regardless of what is done by the zoo or aquarium itself, may be mostly dependent upon the ability of the teacher to adequately prepare students and make connections to the curriculum (Davidson et al., 2010). The attitudes of students toward the field trip, and the amount of learning that takes place, will be a direct reflection of the attitude of the teacher and the purpose for which the field trip was conducted (Griffin and Symington, 1997).

Zoos and aquariums should work closely with classroom teachers to understand the purpose of the field trip, so they can better support the teacher's expectations. Zoos and aquariums should take responsibility for providing support materials and training to aid teachers in matching their objectives with the offerings of the institution (Kisiel, 2003; Anderson et al., 2006). When zoos and aquariums do this, they become part of the professional development of the community's classroom teachers. As part of that process, they may be helping classroom teachers become more enthusiastic about science instruction by provide them with new ideas for teaching science in their own classrooms (Bitgood and Benefield, 1989). As teachers become more enthusiastic about science, so will their students (Price and Hein, 1991).

In summary, a lack of communication between teachers and educators at zoos and

aquariums, along with a general misunderstanding of the other's goals and objectives, may have historically resulted in field trips not executed in ways that maximize their educational value to students. To be effective, field trips should be subjected to the process of "preparation, focus, recapitulation, and review" (Tunnicliffe et al., 1997). The future of field trips can—and should—only be guaranteed only if classroom teachers, in cooperation with informal educators at zoos and aquariums, work to find a way to take advantage of the opportunities provided during informal learning experiences to make them relevant both to the lives of students and the school's academic objectives.

At their best, field trips will provide students with an opportunity to engage in natural, exploratory behavior driven by their curiosity (Birney, 1995; Csikszentmilhalyi and Hermanson, 1999). The ideal field trip should take advantage of the diversity of what an institution has to offer while still grounding itself in solid educational objectives. To do this, the field trip itself—that is, the journey out of the classroom—needs to be viewed as just a small piece of a larger whole. Students must be prepared for the trip, and what they learn must be connected to a larger context, before and after the trip.

First, let us consider what must be done in the days and weeks before the busses are loaded and the lunches are packed.

Preparing for the Visit

Preparation for both students and teachers is important to a successful field trip. Some zoos and aquariums so strongly believe in the importance of teacher orientation that they provide special orientation programs—such as open-houses and field trip planning workshops—which allow classroom teachers to learn what the zoo or aquarium has to offer before visiting with their class (Kim and Snively, 2007; Meiers, 2010). At some institutions, these teacher orientation

sessions are mandatory before bringing a group. Orientation programs may lay the groundwork for future collaborations between teachers and the zoo or aquarium's education staff, which will ultimately make the visit more meaningful to students (Tal and Steiner, 2006). Teachers who are more familiar with the field trip agenda and who feel better equipped to assist the institution's staff report being more satisfied with the field trip experience as a whole (Bitgood, 1989). In recent years, most zoos and aquariums have produced background materials for teachers to assist them in planning the logistics of their visit; these materials may include lesson plans and ideas for linking the field trip back to the school curriculum (Anderson, 2003). Some zoo and aquarium educators report that teachers do not take time to read through the information provided to them, resulting in what they believe to be unnecessary confusion during and prior to the visit. Classroom teachers should attempt to contact the zoo or aquarium's education staff before the visit; zoo and aquarium educators generally view communicating with the teacher prior to their visits to be a good use of time (Meiers, 2010).

Research has suggested that the advanced preparation of students and establishing a link between the field trip and the curriculum are the most influential factors in a field trip being educationally-effective (Davidson et al., 2010; Orion and Hofstein, 1994; Bitgood, 1989). Field trips that are more organized have been shown to result in greater content retention for students (Hurd, 1997). Students will be best-prepared for the field trip when their teachers are informed and prepared, and the learning expectations of students will be high only if teachers expect learning to occur as well (Davidson et al., 2010; Gutiérrez de White and Jacobson, 1993). Classroom teachers report that while they believe pre-visit preparation of students is important, they may have neither the resources nor time necessary to adequately prepare students on their own (Anderson et al., 2006).

There is a psychological basis for the argument that students should receive some type of advanced preparation for field trips. Maslow's "hierarchy of needs" proposes that there are basic physiological and safety needs that must be satisfied before an individual is able to self-actualize and engage in problem solving and creative thinking (Maslov, 1943). Thus, a priority of educators when taking students out of the classroom should be making sure they feel safe within the novel setting. The feeling of security will come about with familiarity and comfort with their surroundings. Often the actual amount of time spent at a zoo or aquarium is limited, so to maximize the value of the time spent at the institution itself, teachers should look for ways to provide orientation to students in the days before the field trip.

The theory of novelty and the way in which it effects knowledge acquisition has been investigated at length in the field trip literature. Alberti and Witryol (1994) define novelty as "the presence of new, unfamiliar, or relatively rare stimuli against a background of familiar events in the child's perceptual history." Thus, the amount of novelty experienced in a particular environment is dependent upon the individual's past experiences and will differ from child to child. Falk (1983) summarized a literature review by Weisler and McCall (1976), which looked at novelty and exploratory behavior in animals. The findings indicated that exploratory behavior in mammals is adaptive and is necessary for survival. In situations where an animal experiences moderate amounts of uncertainty, the desire to explore can be greater than the desire for basic behaviors like eating and drinking. However, in extreme levels of novelty, exploratory behavior can become limited. In humans, children may become frightened, turn inward, and be less receptive to learning in that particular environment. When children experience moderate novelty, they're likely to become stimulated by the new environment and want to learn more about it. The ideal novel environment should encourage exploration, but not distract from the learning

experience (Hurd, 1997).

Novelty is often included as part of the discussion around how to best prepare students for a field trip (Hurd, 1997). In an early study, Falk et al. (1978) proposed that the amount of perceived novelty encountered by students during a field trip might interfere with conceptual learning. In the early study, two groups of students were taken on a field trip to a wooded setting; one group of students lived in wooded areas and the other group of students did not. The results indicated that while both groups of students were able to learn, the students previously familiar with the field trip setting (a wooded area) were more successful in learning new concepts presented during the field trip than students unfamiliar with the setting. Observers noted that the group of students more familiar with the setting behaved more attentively than students who were unfamiliar. Both groups of students were able to learn specifics about the setting itself; the difference was in the amount of content learned from the lesson.

Since that initial study, a general consensus of the research to follow has been that when students perceive novelty to be high, they become more curious and are more likely to explore and gather information about their new environment (Falk, 1983). The result of increased exploratory behavior is decreased cognitive learning. Conversely, when there is little novelty in the environment, curiosity is low, resulting in a lack of interest in the task at hand and thus low levels of learning (Falk, 1983). A positive correlation has been found between curiosity motivation and intellectual performance, suggesting that the goal should be to provide the proper amount of perceived novelty, which will lead to an appropriate level of curiosity to keep students engaged—yet not distracted— and facilitate an experience to help students meet the desired learning outcomes (Alberti and Witryol, 1994; Anderson and Lucas, 1997; Falk, 1983). Novelty is not a burden, but rather an opportunity to work with students to get to an optimal state of

learning (Falk et al., 1978). Classroom educators can make an experience more novel by choosing an unfamiliar setting, like a zoo or aquarium. The experience can be made less novel—so as not to be overwhelming—by providing students with an orientation to the setting or the instructional material prior to the visit.

The amount of novelty perceived by students may be a factor of the students' ages. Thus, advanced preparation should be done to ensure that the novelty of the site is appropriate for the developmental level of the students (Melber, 2008). Falk and Balling (1982) conducted a study comparing the differences in attitude, behavior, and learning between groups of third and fifth grade students who visited their school forest during their science period and groups of third and fifth graders that took an all-day field trip to a nature center. Students participated in the same activity at both locations. Students in all groups demonstrated cognitive learning, but third grade students who stayed at school showed greater cognitive gains than the third graders at the nature center. The reverse was true for fifth graders; fifth graders at the nature center demonstrated greater cognitive gains than fifth graders in the school forest. The authors attributed the difference in cognitive gains to the novelty of the environment. They proposed that novelty at the nature center was too high for the third grade students, which caused them to interact more with their peers and spend less time participating in the lesson. In contrast, students at the school were able to focus on the lesson because they were more familiar with the site. The older students were motivated to explore the environment at the nature center, suggesting that the amount of perceived novelty stimulated the proper amount of curiosity (Falk and Balling, 1982; Falk and Dierking, 1992).

Once the reality of novelty is accepted, educators can begin to provide students with orientation prior to the field trip that will help bring the novelty to a moderate, optimal level. Pre-

visit preparation can be directed both toward the practical elements of the field trip and toward the conceptual and content elements that students will encounter during their visit. In practical orientation, students are shown the route of travel to the facility, a list of the exhibits they can expect to see once there, the schedule for the day, and other information related to the logistics of the field trip (Balling et al., 1992; Anderson and Lucas, 1997). During content-oriented pre-visit orientation, students are provided with a generalized explanation of the exhibits that they will encounter and the concepts that relate to the visit (Gennaro, 1981). While it might seem common sense to suggest that students should receive pre-visit instruction of some kind, it is not necessarily common practice.

Studies have reported a large amount of variation in the amount of preparation students receive before a field trip, and there is evidence that many classroom teachers have not designed field trips with specific educational objectives in mind. Griffin and Symington (1997) reported that 50% of teachers were unable to explain the purpose of their field trip, and fewer teachers had linked the field trip to their curriculum. Similarly, Tal et al. (2005) found that most teachers could not define the purpose of the visit, and some provided only vague, generic purposes such as “enrichment”. Griffin and Symington (1997) gave examples of cases where students did not receive copies of the field trip worksheets before stepping onto the bus, and were unaware of the exact location of the field trip until the day of the excursion.

The positive effects of orienting students to the practical elements of the field trip and physical nature of the facility itself are not as obvious as providing a content-based orientation to the material, but there is evidence that introducing students to the facility and schedule is worthwhile. A study by Balling et al. (1992) divided fourth grade students into four groups, each of which would receive a different style of orientation prior to visiting Washington D.C.’s

National Zoo. All orientations included a slideshow, worksheet, and poster to be hung in the classroom. One group's orientation was purely cognitive, and emphasized the concepts and animals that students would encounter during their visit. The next group received an orientation on "process skills", which taught them how to better observe animals during their visit. The third group of students received a "practical" orientation, which discussed how they would travel to the zoo, where they would park, what was in the gift shop, what animals were there, what the zoo looked like, and other relevant information. The fourth group received no orientation. Students who received the cognitive and practical orientation demonstrated more learning than the control group which did not receive orientation. However, the highest gain in learning was by the group of students that was oriented to the practical aspects of the visit. The authors concluded that students who possessed realistic expectations about the visit—what they would see and not see, and what they would do and not do—were better able to focus on the field trip, instead of wondering if and when the experience would meet their expectations (Balling et al., 1992).

Anderson and Lucas (1997) conducted a similar study into the effects of orientation to the practical elements of the field trip. In their study, students in a "pre-visit orientation" group received an explanation of the physical features of a science museum three days before their visit, while the "control group" viewed a video about another science museum. The 40-minute presentation attended by the "pre-visit orientation" group was focused on the spatial aspects of the museum (location, floor plan, history) and the logistics of the visit (schedule, arrival procedures). Learning outcomes were measured with a post-test. The first significant finding of the study was that students who had received the pre-visit orientation to the physical/logistical aspects of the museum itself, or had been to the museum before, performed better on the post-test than students who had not been to the museum or did not receive the trip-specific pre-visit

orientation. The second significant finding was that students who had *both* attended the pre-visit orientation and visited the museum prior to the field trip performed the best on the test compared with the other groups (Anderson and Lucas, 1997). The finding that students who had previously visited the museum experienced cognitive gains was important in dispelling the notion that pre-orientation provided to students who have already visited a zoo or aquarium could result in decreased novelty, and thus decreased curiosity, and thus decreased learning outcomes. In this instance, the opposite seemed to be the case.

As a result of the studies mentioned above and others similar to them, some have suggested that orienting students to the practical elements of the trip is the most important form of pre-visit orientation (Connolly et al., 2006). It seems counter-intuitive to many educators that students who learn about gift shop offerings and parking arrangements prior to their field trip may end up learning more about zoo animals than students who were given a pre-visit orientation specific to animals. A recent survey of zoo and aquarium educators found that a full 25% of those surveyed did not believe that this practical style of orientation would be a good use of time for students (Meiers, 2010). Once zoos and aquariums are aware of the benefits of practical orientation, they will be more likely to share them with classroom teachers. Until then, the importance of practical orientation will remain buried in the primary literature.

Just as physical pre-orientation was shown to improve student learning, work has been done to show that pre-exposing students to material that they will encounter on the field trip may help students gain more from their experience. There are two approaches to exposing students to material prior to their visit (Gennard, 1981). Using an "overview" approach, students are presented with the key concepts, terms, and principles that they are likely to encounter on their field trip. Using an "advance organizer" approach, students are provided with more complex

details specific to the upcoming field trip. Gennaro (1981) conducted a study in which students received pre-visit instruction consisting of a blend of "overview" and "advance organizer" materials. Half of the groups received pre-visit instruction that covered material associated with an upcoming field trip, while the other half received material not related to the field trip. The results indicated that the group that received the trip-specific orientation performed better on the post-test than the group receiving the unrelated pre-visit orientation (Gennaro, 1981). With this information in mind, it seems the best pre-visit orientation may be one which balances the practical and conceptual elements of the upcoming field trip.

There has been research conducted into the interaction between the novelty of the setting and the novelty of the instructional material, and how much learning results. A study conducted with children and rats found that both groups learned best when either new material was presented in a familiar environment or familiar material was presented in a novel environment (Lubow et al., 1976). In the field trip context, these results suggest that care must be taken to balance the novelty of material and with the novelty of setting. Multiple visits may be necessary to take advantage of this phenomenon; during the early visits to a novel site students can be provided with more familiar material, and during the following visits—when the novelty of the site has somewhat worn off—students can be given novel material.

In addition to preparing students for the practical and content-related aspects of their visit, Orion and Hofstein (1994) suggested that students should be psychologically-prepared for the experience. Students whose previous field trips have been recreational in nature may not be prepared for a trip that is learning-based. Repeated exposure to learning field trips, as well pre-visit orientation into the practical and content elements of the field trip should help students develop expectations of what is expected of them during the experience (Orion and Hofstein,

1994).

Finally, classroom teachers should provide students with an opportunity to take an active role in the pre-visit preparation. Students may benefit from taking time in advance of the visit to develop their own questions, which will help them guide their experience when they arrive at the zoo or aquarium (Connolly et al., 2006). Students should be encouraged to develop open-ended questions (instead of "fact finding questions") that require comparisons between exhibits or animals and will likely have more than one correct answer.

During the Visit

After considering the ways in which students and teachers can prepare in advance for their visit to the zoo or aquarium, classroom teachers need to determine how students will spend their valuable (and often limited) time during the visit. Time at a zoo or aquarium can be used most effectively when it alternates physical activities with stationary periods (Price and Hein, 1991). The experience should take advantage of the zoo and aquarium's resources and avoid lectures and presentations that could be conducted just as easily in the classroom (Price and Hein, 1991; Bitgood, 1989). The field trip should be student-centered and promote social interaction between the students, the teacher, and the zoo and aquarium staff (Tal and Morag, 2007). A few hours is rarely enough time for meaningful learning gains, and repeat visits to a site are likely to benefit children of all ages (Price and Hein, 1991; Bitgood, 1989; Falk, 1983).

Research has shown that both self-guided tours and guided tours by the institution's staff can result in student learning. Students participating in tours guided by zoo and aquarium staff may learn more facts, but students part of a less-structured program led by teachers or chaperones might enjoy the experience more (Bitgood, 1989). A combination of guided and self-guided touring might be the most valuable use of time (Bitgood, 1989). When zoo and aquarium

staff are not familiar with a teacher's goals for the visit, they may present programs that are not engaging to students (Kisiel, 2005). Students in one study noted that the least enjoyable part of the experience was listening to education staff "go on and on" about topics that were not interesting (Davidson et al., 2010). Guided programs may be heavy in technical terminology that is poorly explained (Tal and Morag, 2007). The best way to ensure that students are having an experience consistent with their previous knowledge and experience is for the classroom teacher to be actively involved with guided programs (Tal and Morag, 2007). Research has found that the presence of the teacher is important in improving student focus during guided programs as well (Tal and Steiner, 2006). Unfortunately, it is not unusual for teachers to disengage during the guided programs and converse with the group's chaperones (Tal et al., 2005).

When students are not partaking in a program guided by the zoo or aquarium's education staff, the classroom teacher is responsible for orchestrating the day's activities. Classroom teachers face several challenges in attempting to provide guidance for their classes during field trips. First, classroom teachers may be unfamiliar with the institution's offerings. They often do not have the background knowledge necessary to create a link between the styles of learning that the zoo or aquarium provides and what the students are learning in the classroom. For example, while zoos and aquariums are designed to provide visitors with free-choice learning opportunities in an unstructured environment, the teacher may not be prepared to take advantage of these elements. Learning stations, interactive displays, and live animals are not a part of the typical classroom experience and teachers may be unaware how they can best weave them into the curriculum (Griffin and Symington, 1997). The second problem encountered during a teacher-led visit is that students are typically broken into groups led by parent chaperones as a way of keeping the group organized (Parsons and Muhs, 1994). While this approach is necessary

and mandated by most zoos and aquariums in the form of a student-chaperone ratio, the result is that the control of students becomes decentralized. In order to ensure that all students have a somewhat consistent experience, teachers provide worksheets for their students to guide their activity (Kisiel, 2007).

Unfortunately, worksheets often become a focal point of the field trip and prevent students from asking their own questions and making their own observations (Price and Hein, 1991). One study reported that a large number of teachers viewed completion of the worksheets as the ultimate goal of field trips (Griffin and Symington, 1997). Some worksheets disregard the exhibits completely, focusing only on the exhibit signage (Griffin, 1999 in Kisiel, 2003), effectively eliminating the exhibit from the experience entirely. The literature has emphasized the need to better understand how worksheets can be designed to facilitate learning experiences in a way that does not suppress the curiosity of students. Kisiel (2003) suggested that successful worksheets have a connection to post-visit activities, focus on the exhibits (not the labels), use diverse styles of questioning, allow students to interact with each other, and are clear and easy to understand. Mortensen and Smart (2007) provided a model for a free-choice worksheet based on constructionist learning theories. The worksheet emphasized an interaction between students and their environment, resulting in an experience that can be given meaning after becoming assimilated into the students' existing knowledge. The authors suggest, among other things, that a well-designed free-choice worksheet should capture the curiosity of the learner, be age- and developmentally-appropriate, allow for free-choice of exhibits to explore, be available prior to the visit, connect to the curriculum, and allow additional time for exploration. Mortensen and Smart (2007) noted that worksheets fitting their model increased the diversity and number of curriculum-related conversations amongst students while viewing exhibits.

Properly-designed worksheets are an important consideration, since there no greater waste of out-of-classroom time than turning a potentially engaging experience into a mundane act of labor, stripping students of the opportunity to observe freely and formulate their own questions (Potter, 2006; Price and Hein, 1991). Researchers at the Monterey Bay Aquarium observed that students with worksheets interacted less with peers while viewing exhibits, spent less time looking at individual exhibits, and did not spend significantly more time at the aquarium when compared to students without worksheets (Parsons and Muhs, 1994). Not surprisingly, students have reported that worksheets are boring and limit the amount of freedom they have in choosing which exhibits to view (Griffin and Symington, 1997). Researchers have noticed that students spend their valuable museum time copying from the worksheets of their peers to avoid having to visit the exhibits to record the information on their own (Griffin and Symington, 1997; Connolly et al., 2006). The goal of properly-designed worksheets should be to give students enough freedom to allow them to explore areas of interest while still having enough structure to ensure that student exploration leads to content goals being met (Melber, 2008).

The problem with using worksheets in zoos and aquariums rests not in the worksheet itself, but the way in which the worksheet design sometimes limits the students' experience. Worksheets may be necessary to make the zoo or aquarium less confusing, guide students in looking at exhibits more closely, and ensure each small group of students has a similar experience (Kisel, 2003; Anderson, 2003). In multiple studies, students reported that they did not believe they were actually learning unless they were completing worksheets or learning facts—an indication of the perceived connection between "learning" and traditional school activities (Davidson et al., 2010; Griffin and Symington, 1997; Kisiel, 2003). A suitable goal is to create

worksheets that will flow along with—not against—the desire of students to explore the zoo or aquarium's unique elements. As part of an inquiry-based field trip, worksheets can provide the framework within which students make observations that will help them draw conclusions to larger questions (Anderson, 2003; Connolly et al., 2006). At a zoo or aquarium, worksheets can assist students in thinking in biological terms (Anderson, 2003). Some have argued that the field trip experience needs to be grounded in structured opportunities for observation, discussion and reflection so students will make conceptual gains in their understanding, instead of purely affective gains (Tunicliffe et al., 1997). Worksheets can provide this structure.

As long as worksheets are designed properly, they can be effective at helping students get more out of their zoo or aquarium experience. However, it unclear what "proper design" looks like because different educators have differing preferences. In a recent study, Kisiel (2007) found differences in opinions over whether the worksheet should be more "survey oriented" or "concept oriented" in its approach. The "survey oriented" approach emphasized a direct style of questioning that required students to read the interpretive signage from a broad range of exhibits across the museum, while the "concept-oriented" used questions that allowed students to come up with answers that were broader in nature, leading toward particular concepts rather than simply copying trivia from exhibit signage. Kisiel provided teachers with the two styles of worksheets and asked which they would prefer to use with elementary or middle school groups during a visit to a natural history museum. 70% of teachers responded that they would prefer the survey-oriented approach for both elementary and middle school groups because they felt it promoted higher-level thinking, covered the museum in a broader sense, and would keep students occupied for a longer duration of time. They felt that the concept-oriented approach was too "simplistic," "broad," and "minimalistic". On the contrary, proponents of the concept-

oriented approach felt that style of questioning looked more interesting for students to complete, and felt the survey-oriented worksheet included too much "fact gathering" and emphasized finding "answers on the plaques" (Kisiel, 2007). In evaluating the worksheets, teachers paid more attention to task density—how many exhibits students needed to visit and how many questions they needed to answer—than the cognitive level of the questions, further supporting the notion that classroom teachers may associate busyness with learning.

The results of this study are significant because they present an inconsistency in how teachers feel depth and breadth should be managed during the field trip. Kisiel proposes that it is the responsibility of informal educators at institutions like zoos and aquariums to help classroom teachers realize that giving students choice and control over their experience can lead to students meeting learning objectives. For example, some teachers have found success asking students to keep a "question book" in which they record questions they would like to investigate when they return to the classroom (Connolly et al., 2006). Students will be most likely to ask questions that have some connection to their past experiences, highlighting again the importance of pre-visit preparation. Others have suggested that students be divided into "expedition groups," with the goal of gathering information and bringing observations from the field back to the classroom (Connolly et al., 2006).

Whether worksheets are used during a field trip or not, the field trip should be designed to promote social interaction amongst students. Classroom teachers and educators at informal learning institutions walk a thin line between developing a field trip learning experience that will be enlightening enough to not "kill student interest, debase the child, [or] stymie natural curiosity", but not so unstructured that it will result in students "running amok" around the institution during their visit (Potter, 2006; Parsons and Muhs, 1994). It is often

misunderstandings about how to best reach this balance between "education" and "entertainment" that leaves students with an experience that is either too heavily weighted toward one direction or the other. Some research suggests that students should be given an opportunity to work in teams and solve problems as a group (Price and Hein, 1991; Mortensen and Smart, 2007). Students have been shown to prefer gathering information themselves and sharing their findings with peers over listening to presentations conducted by staff (Griffin and Symington, 1997; Birney, 1986 in Falk and Dierking, 1992). Prompted to comment on how he would organize a field trip, one student responded, "I think it would be better working like a group because then, like a group could go around at their own speed, check everything out, and if one person doesn't understand it, the other people can help him out if they understand it better" (Griffin and Symington, 1997).

Of course, just as is the case in the classroom, peer-peer interactions during field trips have the potential to either promote or impede learning. A study involving elementary students found a positive relationship between the occurrence of student-student interactions and the number of student-exhibit interactions, suggesting that students interact more with the exhibit as they interact more with each other (Tuckey, 1992). The same study reported that students in pair groups spent more time at exhibits than students who were alone or part of larger groups. While *quality* of time spent at exhibits is more important than *quantity* of time, quality conversation will be more likely to occur when students are viewing the exhibits. Depending on the structure of the visit, many zoo and aquariums may not have enough staff or volunteers to support smaller groups of students, and thus groups tour *en masse*, possibly with negative effects on the educational experience (Price and Hein, 1991).

The social element of the experience is important to students, and may be the only part of

the field trip they remember fifteen or twenty years later (Davidson et al., 2010; Falk and Dierking, 1992). In a survey of 36 zoo and aquarium educators, only one reported that the social component of the visit was important to students, suggesting that educators at zoos and aquariums may not be considering this important element when planning their programs (Meiers, 2010). If educators are able to make this social element an important part of the exploratory process during the field trip, student learning may become more spontaneous because students are able to interact with peers and the zoo or aquarium in a way that is interesting to them (Csikszentmihalyi and Hermanson, 1999).

The content of zoo exhibit conversations was the focus of a study investigating how students on field trips interact with the exhibits and their companions. Tunnicliffe et al. (1997) compared the conversations of family groups visiting a zoo to the conversation of student groups (pre-school through age 12) visiting the same institution. The results indicated that school and family groups conversed amongst themselves in a similar fashion; their conversations were centered on observing animals, naming them, and connecting them to their own past experiences. Compared with the family groups, affective and emotive comments were higher in school groups. The similarities between verbal communication in school and family groups suggested that school group leaders may view the zoo visit in the same terms as families; with the primary objective being social (Tunnicliffe et al., 1997). This might be explained by the fact that most student groups are led by a chaperone who is the parent of one of the students in the group. In one study, nearly 70% of parents reported that their main reason for chaperoning was to spend time with their children (Parsons and Muhs, 1994). Thus, the experience of students in a chaperon-led group may be similar to that of a family group visiting zoo or aquarium, and some chaperones will promote better learning experiences than others (Kisiel, 2003; Parsons and Muhs,

1994). Likewise, in designing the field trip, classroom teachers may place more emphasis on affective criteria than specific learning objectives (Anderson et al., 2006). The authors argue that this "information poor, experience rich" dialogue is not acceptable for school groups, where students should be encouraged to converse using appropriate scientific terms (Tunnicliffe et al., 1997). Appropriately-designed worksheets encouraging interaction between students will provide student groups with an opportunity to think and talk using the appropriate terminology, while not limiting the experience to a scavenger hunt of exhibit signage.

In a separate analysis, Tunnicliffe (1998) recorded and analyzed over 1,200 conversations of boy and girl students visiting zoos to investigate potential differences between the content of boys' and girls' conversations. The results from the zoo indicated that the content of boy and girl conversations were similar, but boys were more likely to name specimens while girls were more likely to discuss their own observations and personal connections to the animal featured in the exhibit. The results are relevant to zoo and aquarium educators, as well as classroom educators, looking to help students overcome their gender-specific biases. Chaperones can also be coached in ways to help both boys and girls consider elements of the exhibits that may not first occur to them.

Understanding what is important to the youngest children during field trips is difficult because of the discrepancies between what they say and what they actually experienced. In an effort to better understand the field trip experience through the eyes of children ages 3 to 12, DeMarie (2001) provided a group of children with disposable cameras during a field trip to the Columbus Zoo and asked them to, "take pictures so the other children would know what the trip was like." Approximately 88% of the photographs taken by children ages 9-12 contained animals. During interviews, those children often connected their reason for taking a photograph to

information they had learned previously in school or books. Some children worked together as a group to photograph the greatest variety of animals. Children ages 6-8 featured animals in 85% of their photographs, and took photographs both unfamiliar and familiar animals. Both of these older groups of children reported taking pictures of what they thought other children would enjoy. Children between the ages of 3-5 included animals in only 56% of their photographs. The younger children were more likely to take photographs of animals that were familiar to them, like goats, chipmunks, and squirrels. They photographed people, signage, sidewalk cracks, and parts of animals up close. The author noted that while the oldest group of children was able to understand concepts like extinction and the two oldest groups retained new information and built upon their previous knowledge, pre-school children remembered and noticed elements of their visit with which they were familiar.

The implication is that the amount of perceived novelty may need to be manipulated as students progress through grade levels. DeMarie (2001) suggested that, for preschool-aged children, a walk around the block might have an educational value equal to a trip to the zoo, without the logistical challenges. The zoo experience may be overwhelming for the youngest students, but a simple walk around the block gives the children an opportunity to have an experience that is more closely connected with the context of their everyday lives. As result, DeMarie (2001) proposed that multiple visits to a site like a zoo or aquarium may be necessary if young children are to learn concepts that are not a part of their ordinary experiences. Falk (1983) similarly concluded that children ages 10-12 were receptive to day-long field trips to places like zoos and aquariums, but younger children may require shorter, repeat visits; an initial visit to gain familiarity with the site and then follow-up visits to focus on the material (Falk, 1983).

As mentioned previously, pre-visit orientation to the physical nature of the visit may

improve student learning because it allows students to arrive with realistic expectations of what the experience will and will not entail. The agendas of students may be different than that of the teacher, and different from that of the institution. Anderson et al. (2008) identified three "competing agendas" associated with the field trip experience: the agendas of content, mission, and time. The authors hypothesize that when students and institutions have competing content agendas, there is a difference between what material students would like emphasized and what the institution wants to emphasize. For example, a student viewing a lion exhibit at the zoo may want to talk about her own cat at home, while the zoo educator might be interested in discussing the grassland biome. Similarly, "mission" was identified as a competing agenda. If a particular visit is designed to study grassland biomes and a student is interested in penguins, he may not be interested in the exhibits being discussed and attempt to seek out other exhibits. Third, Anderson et al. discuss the competing agenda of "time". A student interested in penguins may want to spend more time at the exhibit than the visit allows. Repeat visits are one way—albeit not always practical—to deal with the time agenda. Classroom teachers must determine what their goals for the trip are and how those goals may or may not match with the agendas of their students. By doing so, they will be able to develop students' expectations appropriately.

Considering different agendas is a reasonable ending point for a discussion on how to best manage the student experience during field trips. Successful field trips simultaneously shape and cater to the student agenda. Likewise, the museum agenda and the classroom agenda should be linked. Educators at zoos and aquariums must help classroom teachers consider how they might plan their experiences to take advantage of the unique elements of the zoo or aquarium. By giving their students more choice in how they spend their time, creating links back to the classroom curriculum, and designing the experience in a way which promotes social interaction

between students, classroom teachers can make the field trip experience more meaningful to students. The result is a win-win-win situation for students, teachers, and the zoos and aquariums.

Post-Visit

Upon returning to the classroom, students should be given the opportunity to present the observations they gathered during the visit through a class newsletter or similar medium (Connolly et al., 2006). Doing this after the visit takes advantage of the excitement and memories from the experience while they are still clear in the students' minds. Classroom teachers may also allow students to ask questions pertaining to the trip, and use these questions to assess what students have learned (Price and Hein, 1991).

Despite intentions to discuss the field trip once back in the classroom, in many cases this follow-up discussion does not take place (Griffin and Symington, 1997). Even when teachers report offering follow-up activities after a field trip, students may not recognize them as an extension of the field trip unless the connections are closely-linked and explicit (Anderson et al., 2006). Classroom teachers serious about using the field trip as a learning experience must provide students with an opportunity to build upon what they have learned following the trip; students are unlikely to remember the content of the experience if it is not linked to future learning (Davidson et al., 2010).

Historically, the effectiveness of post-visit activities on student learning has not been examined in the literature (Bitgood, 1989). The first study to examine the effects of post-visit activities on student learning was conducted by Anderson and colleagues in 2000. As might be expected, their work suggested that post-visit activities had a positive influence on learning gains. However, they also determined that post-visit activities should be designed to, "detect and respond to alternative conceptions that may be produced or strengthened during [the field trip]."

In other words, it is the responsibility of classroom teachers to use post-visit activities to ensure that what student learned—or believe they learned—was indeed accurate. Clearly more study is needed in this area to determine what types of follow-up activities are most useful in taking advantage of what was learned during the field trip.

Conclusion

A wealth of research has been conducted examining the ways in which field trips can be planned, prepared for, and facilitated to best support student learning. The challenge is for educators at zoos and aquariums to work cooperatively with classroom teachers to educate them on how they might augment their curriculums by taking advantage of the resources zoos and aquariums have available. This will require time, effort, and a shift in the way we perceive the role of the field trip in the K-12 experience. Zoos and aquariums should lead the way by taking responsibility for providing classroom teachers with professional development opportunities and ensuring that they are offering programs and resources that meet the needs of the teachers in their community. Classroom teachers, in turn, should be willing to take advantage of the opportunities for learning that zoos and aquariums offer.

The research presents all stakeholders—teachers, administrators, students, zoos and aquariums—with a call to action. It's time we heed that call.

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