

Integrating Environmental Education Field Trip Pedagogy into Science Teacher Preparation

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*“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.

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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 the students are in high school it is very likely that they will not experience educational field trips. Our extensive experience working both as teachers and with teachers suggests that there may be several factors contributing to this decline: (1) additional challenges in logistics posed by secondary schools' multicourse 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 types 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 field trips. 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 metastudy 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 and Balling 1982; Flexer and Borun 1984; Falk and Dierking 1997; Pace and Tesi 2004). Students' positive attitude toward field trips contrasts with their increasingly negative attitude toward school science as a factor of age (Braund and 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 and 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 and 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 and 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 and 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 the best practices in the classroom. For example, research suggests that teachers should first determine the learning objectives, and then develop appropriate activities for the trip (Rennie and 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 and Symington 1997). Ideally, planned field trip activities, similar to classroom activities, should align with learning objectives, connect to the curriculum (Finson and 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 and 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 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 ways. Foremost, it is essential for teachers to recognize the developmental level (Taylor et al. 1997) and assess the experience of their students 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 and 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 and Enochs 1987; Guisasola et al. 2005; Wolins et al. 1992), fewer new items are introduced (Barnard et al. 1980), and students are allowed time to explore in small independent groups (Cox-Petersen and 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 and 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 (pretrip) organizer.

Table 1 Common field trip challenges that require the use of strategies as recommended in the research

Challenge	Recommended strategies
Chaos/Overstimulation	<ul style="list-style-type: none"> • Use previsit lessons specifically related to the site’s topics. • Plan trips that introduce moderate novelty; use pretrip orientation to reduce the novelty of new settings. • Prepare for novelty: cognitively, geographically, psychologically.
Limited time	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Recognize and support multiple roles of chaperones and encourage chaperones to use new approaches to facilitate 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 the 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 draw students’ attention and inquiry. • Model interest in exhibits. • Prepare chaperones with an understanding of students’ current ideas, thinking, values, and learning needs.

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 and 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 2005) – 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 and Priest 1997; Kisiel 2003; Mullins 1998; Orion and Hofstein 1991).
2. Social interactions should be encouraged especially during assigned tasks or activities (Hofstein and Rosenfeld 1996; Watson et al. 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).

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 preidentified purpose or learning goals for the trip rather than choosing goals to suit a predetermined setting (Rennie and 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 2005) 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 that are 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 (Tal et al. 2005). Ideally, teachers should visit field trip sites ahead of time to avoid these undesired surprises. Previsits allow teachers to plan and coordinate for safety, logistics, expectations, and learning activities (Anderson et al. 2006; Cox-Petersen and Melber 2001; Martin and 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 and Symington 1997; Parsons and 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 and Symington 1997).

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). If 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 that 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 quite 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 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 2 illustrates this

Table 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 that include instructional objectives/outcomes.	Develop lesson and unit plans that include pre-, in-, and posttrip 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 pretrip activities that introduce concepts to be addressed and orient students to the trip site. Develop authentic assessments for pre-, in-, and posttrip 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.

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 the existing course preparations.

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 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.

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 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 posttrip 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 posttrip 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.

Table 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

Pretrip	<ol style="list-style-type: none"> 1. <i>Model</i> a pretrip lesson to a botanic garden or vegetable garden (for example, an investigation of soil and how it affects plant growth). Include pretrip preparation by designating groups that work together to do a class activity and develop their own testable question. 2. <i>Model pretrip logistics preparation</i> 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. <i>Brainstorm</i> with preservice teachers other lessons they could do as a pretrip lesson as part of the unit. 4. <i>Assign</i> preservice teachers to develop one of the lessons that were brainstormed as a pretrip lesson.
In-trip	<ol style="list-style-type: none"> 1. <i>Role-play</i> 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. <i>Reflect</i> 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?
Posttrip	<ol style="list-style-type: none"> 1. <i>Model</i> a posttrip lesson plan in which students analyze their data and prepare poster presentations as a form of authentic assessment. 2. <i>Reflect</i> as a class on pre-, in-, and posttrip lessons and the overall unit. 3. <i>Assignment</i>: (1) Preservice teachers design a posttrip 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.

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 that the quality of both university and secondary instruction will see improvements.

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