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School's IN for Summer: An Alternative Field Experience for Elementary Science Methods Students

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Abstract

Field experiences are critical to teacher learning and enhance the effectiveness of methods courses; however, when methods courses are offered in the summer, traditional school-based field experiences are not possible. This article describes an alternative campus-based experience created as part of an elementary science methods course. The Summer Kids' Inquiry Program in Science (SKIPS) provided an authentic context in which teachers had the opportunity to plan and instruct science lessons in both whole-class and small-group settings, as well as observe the teaching of their peers. This model allowed us to overcome many challenges to implementing traditional field-based experiences.

School's IN for Summer: An Innovative Field Experience for Elementary Science Methods Students

Over the past several decades, education reforms in the United States have called for an increased emphasis on field experiences in teacher preparation (Committee on Science and Mathematics Teacher Preparation, 2001; Holmes Group, 1990; National Commission for Excellence in Teacher Education, 1985). Research indicates that the effectiveness of education courses is substantially increased when accompanied by field experiences (Weld & French, 2001) and that such practical experiences improve preservice teachers' implementation of instructional strategies and teaching approaches modeled and encouraged in methods courses (Sunal, 1980; Yager, 1996). While instructors of methods courses offered during the school year may utilize field-based experiences at local schools, instructors of summer courses are not able to do so because schools (with the exception of those on year-round calendars) are not in session. Given the importance of field experiences to learning to teach, this poses a significant problem. The purpose of this article is to describe an elementary science methods course offered in the summer in which an alternative field experience was created. We believe our efforts can inform science teacher educators seeking to provide authentic opportunities for learning to teach science to their students, particularly in cases in which courses offered in the summer or early field experiences (those prior to student teaching) are not part of the teacher education program.

Conceptual Framework

Learning to Teach

The importance of teacher knowledge has been emphasized in the *National Science Education Standards* (NRC, 1996). An effective science teacher, as defined by the *Standards*, is knowledgeable in science content, curriculum, learning, teaching, and students. The integration of a teachers' knowledge forms the basis for pedagogical content knowledge (Shulman, 1986), or knowledge of ways to help students understand subject matter. This includes knowledge of how particular subject matter topics, problems, and issues can be organized, represented, adapted to the diverse interests and abilities of learners, and then presented for instruction (Magnussen, Krajcik, & Borko, 1999). The context for learning to teach is an important consideration. Contemporary views of learning, such as situated cognition (Brown, Collins, & Duguid, 1989), recognize knowledge construction as being embedded in the social and cultural context. That is, learning (viewed as a construction and negotiation of meaning) is inextricably linked to the contexts in which it takes place. Within this framework, field experiences become *necessary* for learning to teach; they provide opportunities for learning that cannot be realized within methods courses alone. Indeed, research indicates a potential for students in methods courses to perceive coursework as not being related in meaningful ways to classroom practice (Anderson, 1997).

The Importance of Field Experiences to Learning to Teach

Field experiences are recognized by both researchers and prospective teachers as playing a vital role in teacher education programs (Brimfield & Leonard, 1983, as cited in Potthoff & Kline, 1995). Benefits of field experiences include the following:

- Allowing student teachers to bridge the gap between theory and classroom practice (Krustchinsky & Moore, 1981)
- Socializing prospective teachers for their roles in the classroom (Dueck, Altmann, Haslett, & Latimer, 1984)
- Providing opportunities for prospective teachers to refine basic teaching skills (Henry, 1983)
- Addressing anxieties associated with teaching (Lowery, 2002).

These are critical to students' development as teachers of science in that they provide first-hand opportunities to put into practice what prospective teachers learn in their methods courses (Huinker & Madison, 1997), as well as opportunities to experience success in teaching science to children (Hanuscin, 2004; Moseley, Ramsey, & Ruff, 2004). According to a 1998 survey, however, only 77% of elementary programs provided field experiences (prior to student teaching) to their students (Huling, 1998).

Limitations of Traditional Field Experience Models

Despite their importance, field experiences are not without problems. Abell (2006) identifies three main challenges to the elementary science field experience: (1) logistical and institutional challenges, (2) supervision challenges, and (3) challenges to teacher learning. Logistical challenges focus on establishing a sufficient number and diversity of field experiences for teacher education students, as well as coordinating these programs.

Most often, supervision of field experiences is carried out by cooperating teachers (Colgate, 1991) rather than faculty. This can lead to a disconnection between coursework and the practicum experience (Beck & Kosnik, 2002; Zeichner, 1990, 1996). Supervision efforts may be directed toward students who are having difficulty in the field (Morris & Curtis, 1983 as cited in Potthoff & Kline, 1995) or toward making a minimum number of contacts to evaluate performance for a grade (Borko & Mayfield, 1995; Goodlad, 1990, 1994), rather than toward supporting development of pedagogical content knowledge.

The first two challenges may contribute to the third—barriers to teacher learning. Without sufficient diversity and number of experiences, as well as appropriate support and supervision, teachers may not benefit fully from field experiences. Even when the first two challenges are addressed, however, there remain barriers to teacher learning. If teachers have never experienced reform-based science instruction themselves, it is difficult for them to re-create it accurately in their own classroom (Kelly, 2000). Many prospective teachers have experienced years of passive, lecture-driven science during their own K-12 education and enter their methods courses with a vision of themselves as science teachers that is closely related to their experiences as science learners (Abell & Bryan, 1997). Thus, they have expectations to teach science the way they were taught in their own classes (Kelly, 2000), an expectation that can directly oppose new perspectives on teaching science offered by the methods course. It is important, then, that field experiences provide opportunities for reform-based science teaching practices.

Establishing field experiences that provide this optimum environment, however, proves difficult. For example, results from the 1993 and 2000 National Surveys of Science and Mathematics Education (Smith, Banilower, McMahon, & Weiss, 2002) suggest there has been little change in science instruction in the nation as a whole since the publication of the *Standards* (NRC, 1996). Abell (2006) describes this as the "ultimate paradox"—while our goal is for prospective teachers "to observe, create, and enact reform-minded practice in real elementary classrooms. . . . the desirable kinds of classrooms in which students should serve their apprenticeships quite often do not exist" (p. 77). Field experiences then, despite their intent, may undermine the efforts of methods instructors (Abell, 2006) and fail to provide the necessary link between theory and practice (Ohana, 2004).

Alternatives to Traditional Field Experience Models

How are teacher educators responding to this problem? Several programs have utilized traditional school-based contexts in alternative ways to enable prospective teachers to engage in teaching science. Moseley et al. (2004) utilized a "Science Buddies" system in which prospective teachers were paired with elementary students to carry out investigations over a six-week period. The culminating event was a presentation to students' families, teachers, and the community. Hanuscin (2004) implemented science "workshop" sessions at local elementary schools. During these sessions, elementary teachers and their students visited the schools' science labs and participated in hands-on activities as they rotated through stations, facilitated by the university students. McDonald (1997) used "Family Science Night" programs at local schools to provide preservice teachers opportunities to observe children learning science, learn about science teaching strategies and techniques, and learn about parents and families. Others have utilized contexts *outside* of schools, such as science museums and nature centers, to develop preservice teachers' science knowledge, pedagogical knowledge, and confidence in teaching (Cox-Petersen & Pfaffinger, 1998; Jung & Tonso, 2006; Kelly, 2000).

Each of these programs provides evidence of the potential for alternative field experiences to contribute to the learning of prospective teachers, while overcoming challenges to traditional field experiences. We argue, however, that each of these falls short of providing a context reflective of the whole-class science instruction for which teachers will be responsible in their future positions. Given our personal encounters with students who are skeptical that strategies utilized with small groups can "work" with an entire class, we were concerned with the transfer of learning and designing an alternative field experience that would address this issue.

Design of Course and Alternative Field Experience Model

Advance Methods of Teaching Elementary Science is a three-credit graduate-level course offered in a four-week intensive session each summer by the Department of Curriculum & Instruction. Students in the course (hereafter referred to as teachers) typically include those seeking post-baccalaureate certification—individuals who have not previously taught—as well as experienced teachers seeking advanced degrees. The instructor of the course (first author) and a doctoral student (second author), who was completing a teacher education internship in the course, developed a syllabus focused on three central questions:

1. How do elementary-age learners make sense of science? What do elementary teachers need to do to facilitate sense-making in their science classrooms?
2. How can science learning be assessed? How can assessment be used to guide instruction?
3. What resources to support elementary science learning exist? How should instructional materials be designed and implemented to reflect what we know about best practices in science education?

Though this was not a content course, we chose to focus on a single science topic through which to enhance teachers' knowledge of students, curriculum, and pedagogy. Prior to the session, teachers were asked to rank a list of elementary science units according to their confidence in their knowledge of the content. The list was comprised of physical science units, given that physical science tends to be elementary teachers' weakest content (Atwater, Gardener, & Kight, 1991). The topic about which teachers felt *least* confident teaching—sound—was selected in order to help build their understanding of this content and how to teach it.

In addition to teachers' *knowledge*, we recognized the importance of teachers' *beliefs* in learning to teach science. According to Abell and Bryan (1997), "Learning to teach science involves clarifying, confronting, and expanding ideas, beliefs, and values about science teaching and learning" (p. 164). That is, teachers' practice might be affected through affecting their beliefs. We also acknowledged, however, that changes in teachers' beliefs may come about *through* practice (Loucks-Horsley, Hewson, Love, & Stiles, 1998). For example, Hancock and Gallard (2004) described field experiences as both reinforcing and challenging preservice teachers' beliefs about teaching and learning science. Thus, we felt teaching experiences would be critical for impacting our students' knowledge and beliefs about elementary science teaching; however, because the course is held during the summer session, a traditional school-based field experience was not possible. As a result, we sought an alternative model.

In creating our program, we were concerned with providing an experience reflective of teachers' future classroom context and responsibilities. Specifically, we wanted to provide opportunities for teachers to design and implement lessons of their own creation, provide instruction to an entire class of students, and develop strategies for managing materials for hands-on instruction within a whole-class context. To accomplish this, we invited elementary students to our campus for a week-long program, the Summer Kids Inquiry Program in Science (SKIPS). Below, we describe the design of this program and our initial implementation.

Summer Kids Inquiry Program in Science

Publicity and Recruitment

SKIPS was planned for the last week of the four-week session and was scheduled from 9:00 AM until 12:00 PM, Monday through Thursday. In the district within which the university is located, approximately 30 minutes is allotted for science instruction at grades K-5 each day. Thus, our program provided roughly the equivalent of five weeks of science instruction in the elementary classroom. Intermediate elementary grade students (entering grades 3-5) were targeted for enrollment based on the conceptual difficulty of the content selected.

Beginning the first day of class, teachers enrolled in the course (eight this particular session) were engaged in publicizing the program and recruiting elementary students. A website and brochure advertising the program were created to provide information about the nature of the program, topic, schedule, location, and registration. A $25 registration fee was assessed to cover the cost of materials. Teachers distributed brochures to places parents might be likely to visit, such as the public library, local coffee shops, recreation centers, and movie theaters. This campaign proved successful, in that we were able to recruit 26 elementary-age students. The group had an equal number of males and females and was evenly distributed by age (8-11). Approximately 25% were non-white. Thus, we feel our enrollment represented a diverse classroom of elementary students, such as what might be found in public schools in the area.

Planning

From the first day onward, what teachers learned in the university course was directed toward answering the three central questions we identified and applying these ideas to the design and implementation of SKIPS. The following five components were included in the course:

1. An analysis of elementary science curriculum materials
2. Discussion of science education literature written by both practitioners and researchers
3. Review of video cases of elementary science teaching
4. Development of a lesson sequence
5. Reflective analysis of teaching

Though components 4 and 5 specifically pertained to SKIPS, each of the other components informed our efforts. For example, the elementary curriculum modules teachers reviewed and analyzed focused on the topic of sound. Readings were related to student misconceptions, pedagogical innovations, and assessment strategies applicable to planning and facilitating SKIPS. Videocases provided models of effective elementary science instruction, elicited problems of practice, and raised awareness of elementary students' thinking in science.

One of the first tasks for the class was deciding upon the goals of the program. Through discussion and consensus, goals were created for four areas: (1) content knowledge, (2) inquiry skills, (3) attitudes toward science, and (4) understandings about the nature of science. The conceptual goals, which served as the basis for selecting and sequencing the learning activities and dividing up the teaching tasks among the class, included the following:

- Sound is caused by vibration.
- Sound travels through a medium.
- Sound has different properties such as pitch, volume, and timbre.
- Organisms have distinct structures for producing and detecting sound.

Working in pairs, teachers planned instruction so that each day of the program was focused on a single conceptual goal, while goals for inquiry skills, attitudes toward science, and understanding the nature of science were embedded throughout the week. Instructional plans were informed by course readings (see, for example, Abell, Anderson, & Chezem, 2000), videocases of elementary science teaching (Abell & Cennamo, 2004), and review of elementary curriculum materials for teaching sound, such as STC and FOSS. Each pair presented their lesson sequence for peer review and made revisions to promote a seamless progression of activities and building of concepts throughout the week.

Implementation

When students arrived on the first day, they met in small groups of three to four, each led by one of the teachers. Small-group time at the beginning of each day (15-20 minutes) was utilized to build rapport, discuss students' ideas about the concepts, and share students' science notebook entries. Following small-group time, the pair of teachers responsible for that days' instruction introduced the learning activities, and each led his or her respective lessons. During this time, the other teachers facilitated activities with small groups and/or observed their peers' teaching. Thus, while each teacher was responsible for leading whole-class instruction for three hours, instructional opportunities were also embedded throughout the week in terms of small-group interaction. For example, some lead teachers structured activities as centers, which enabled teachers to facilitate or reteach an activity multiple times with different groups of students.

Feedback and Reflection

Research indicates that prospective teachers will develop as professionals if they engage in appropriate reflection on their experiences (McIntyre et al., 1996; Russell & Munby, 1992). Debriefing of the day's activities was carried out in two separate forums; the first involved each teacher and his or her small group of students and took place at the end of the session. During this time, students provided teachers with feedback on what they found interesting, what they learned, and what still confused them about the day's activities. The second debriefing involved only the teachers and took place after the students were dismissed. This was an opportunity for teachers to reflect on their instruction, receive feedback from peers, and make adjustments to instructional plans in light of students' prior knowledge and the progression of their ideas resulting from the day's activities. Additionally, it provided an opportunity to consider how their ideas and strategies might be implemented in their own future classrooms. As a third form of feedback, the course instructor observed and provided individualized written feedback to teachers in relation to their personal goals for teaching science, which were set at the start of the course. The final assignment prompted students to synthesize their learning from the feedback they received and reflect on their progress in meeting their goals and answering the central questions on which the course was focused. As one teacher commented, "The 'practicum' of teaching science camp was invaluable, and the reflective final assignment allowed me to process the experience."

Discussion

We feel SKIPS allowed us to overcome many of the logistical and supervisory challenges, as well as barriers to teacher learning faced in implementing elementary science field experiences (Abell, 2006), whether through traditional or alternative models. First, logistical challenges, such as securing classroom sites and cooperating teachers, scheduling campus visits, and collaborating with informal science programs, were not impeding factors in this model because SKIPS took place during regularly scheduled class meetings within our campus science classroom. Furthermore, integration of SKIPS into the course eliminated the logistical challenges that could be posed for students had the program been scheduled outside of class time (e.g., in the evening) or off-campus. Given we had several teachers who had a significant commute to attend the course (> one hour), this would have been particularly problematic for their participation. Though the structure of the program created *new* logistical challenges—such as recruiting elementary students—we view these as surmountable obstacles, particularly because publicity was handled cooperatively by the teachers, not solely by the course instructor. The collection of fees did require some additional support, however, and we are grateful to our administrative staff for processing registration fees and ordering materials.

We believe supervisory challenges common to traditional field experiences were effectively addressed through our model because the course instructor was able to both instruct *and* supervise the teachers, assisting them in building strong connections between theory and practice. Often, this was carried out in an individualized manner. Because teachers had different levels of experience and background in teaching, the course instructor asked them to set goals for their teaching so that individualized feedback could be provided in relation to these goals. For example, prospective teachers (those who had not yet taught) chose to focus on developing questioning skills or using particular instructional strategies; whereas, experienced teachers selected promoting student explanation and argumentation or teaching about the nature of science as their goals. The instructor provided ongoing feedback to teachers throughout the week as she observed them teaching and interacting with the elementary students. Such periods of sustained and intensive observation would not have been possible within a traditional model, in which teachers would be distributed across different classrooms and/or campuses for their field experiences.

A third type of challenge identified by Abell (2006) relates to teacher learning. We feel our model provides a meaningful learning experience for teachers. As one commented, "SKIPS was one of the most exciting and productive learning experiences I have had." In part, this is because teachers had autonomy to establish a classroom environment reflective of their own vision for inquiry-based instruction. Because we *created* our classroom for this field experience, teachers did not have to struggle with the tensions between their desire to enact reform-based practices and the more didactic style of a cooperating teacher. Instead, they were able to confront and clarify their knowledge and beliefs about teaching through reflection on their own practice.

One of our greatest concerns in designing our program was providing an authentic experience reflective of the classroom environment in which the teachers would normally teach and the responsibilities they would have in that context. Course evaluation comments overwhelmingly indicate that we achieved this goal. As one teacher wrote, "Relating what we learned to teaching live students gave it an authenticity." The opportunity to create and implement lessons of their own design was a significant aspect of the program—and one that may not have been possible in a traditional field experience. While this opportunity was provided in other alternative models, it was done so in the context of informal science education settings (Cox-Petersen & Pfaffinger, 1998; Jung & Tonso, 2006; Kelly, 2000), and with small groups of students (Hanuscin, 2004; McDonald, 1997; Moseley et al., 2004). An advantage of our program design was the ability for teachers to enact whole-class science instruction, similar to their teaching context during the school year.

Furthermore, this alternative model involved teachers in resolving problems of practice as colleagues. Student evaluations indicate that the teachers found the "discussion and debate over planning and instruction" invaluable. Even within a single week, teachers' progress in addressing these problems was evident. For example, on the first day, we encountered a student whose behavior was disruptive and antisocial. He refused to participate in the activities and often interrupted both students and teachers during discussions, making comments about unrelated topics. Some teachers initially dismissed this problem, stating the belief that it was not able to be resolved in the context of one week but could be if they were in their own classroom and had several weeks to address it. By reflecting on how the student responded differently to different instructors, they recognized patterns that led to changes in how they responded to this students' behavior. Within two days, teachers witnessed a complete turnaround in their interactions with the child—as well as this child's interactions with other students—a change that they could contribute to their own practice. In this manner, we believe SKIPS' structure provided a supportive environment in which teachers could work together to enact change in their practice and authentic experience in questioning, behavior management, and the daily logistics of teaching (Moseley et al., 2004).

Recommendations

Though we feel SKIPS offers an advantage over other alternative models by providing an environment that more closely resembles the classroom settings in which our students would teach, there are also limitations of our model that must be acknowledged. While classroom teachers are expected to provide formal evaluations in the form of grades, in a summer program such as ours, this is not a part of teachers' responsibilities. As such, some of the teachers in the course viewed the purposes of the program in a different light—evident in the importance (or lack thereof) they placed on assessment. One teacher in particular questioned the need for assessment, stressing the informal nature of the program as a "summer camp." Reflecting on our implementation of SKIPS, we realize that assessment was primarily informal and formative in nature. Thus, it did not provide teachers with appropriate models of how they might implement formal or summative assessment in their own classrooms. In order to address this in future semesters, we plan to implement a case study approach, in which each of the teachers would be responsible for developing a "case" surrounding a specific student's conceptual development during the program through evidence from both formative and summative assessment. In addition, while the presence of multiple instructors offers a rich opportunity for teachers to learn from observing each other's practice, it also poses significant logistical challenges if roles are not clearly defined. We were fortunate to have a manageable course enrollment of eight participants, which enabled teachers to take on the roles of teacher, small-group leader, and observer at various times during the program. Implementing this model in the context of larger enrollment will require some readjustment to our current structure, such as operating multiple camps concurrently.

Conclusion

Given the importance of field experiences to learning to teach, it is critical that teachers enrolled in science methods coursework simultaneously have an opportunity to implement what they are learning and develop their skills for teaching science to elementary learners. As discussed in this article, traditional school-based field experiences may be difficult to implement and offer less-than-desirable conditions for supporting reform-based practices advocated in the methods courses. In some cases, they simply may not be available. While some instructors have turned to alternative models, many of which are held in partnership with informal science education programs and organizations, these alternative models may not provide a context reflective of the classroom settings in which teachers will be expected to teach. We believe that SKIPS approximates teachers' future classroom settings in that it allows students to design and implement their own lessons as well as manage materials for hands-on science within a whole-class context. We have reason to believe that this experience can positively impact teachers' future instruction. As one teacher commented, "I learned a great deal that can be used in my classroom." The degree to which teachers' experiences in the course and working with SKIPS translates into their classroom practice, however, should be explored in future implementation in order to evaluate the potential of this model to facilitate the development of teachers' pedagogical content knowledge for elementary science.

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