

INTEGRATING SCIENCE AND ENVIRONMENTAL EDUCATION ON THE URBAN FARM: A TEACHER'S STORY

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Abstract

Although environmental education is an explicit part of the school curriculum, many teachers feel challenged when faced with the task of integrating environmental perspectives into their subject areas and standardized unit-based curriculum. There is a need for practical models of integration that illustrate how environmental education can be melded with traditional educational practices. This study examines that issue. We report on a project that brings together community farmers, secondary school students, and their teacher to explore possible ways of integrating environmental education into science curriculum. Specifically we consider the challenges science teachers face when they attempt to integrate environmental topics into their programs and how they address the challenge of helping students make connections between land-based learning and the curriculum.

Introduction

Today as the number of local and global environmental problems is growing, there is a need for new generations to be environmentally literate. Numerous studies comment on the benefits of environmental education (EE) for students learning, and the development of environmental literacy, sense of place, and responsible attitudes towards the environment. While environmental education has clear support from parents, teachers and communities, the official school curriculum does not value it in the way it does traditional curriculum such as science (Hart, 2003). The tension extends into the classroom where science teachers at all levels feel challenged by the task of integrating environmental perspectives into their programs. They feel unprepared to deal with complex controversial environmental topics, addressing moral issues and values, and engaging students in critical analysis of the society and world. It is evident that more practical models of integration are needed to illustrate how EE can be melded with traditional science curriculum and science education practices. This study examines that issue.

We report on research in a project that brings together community farmers, secondary school students, and their science teacher to explore the value of an intergenerational program for fostering environmental knowing and care. We consider whether and how such a program can assist in integrating environmental education into a school science program. Specifically we ask: what problems and challenges do science teachers face when they attempt to integrate environmental topics into their science programs? How do science teachers deal with the challenges of helping students make connections between land-based learning and the curriculum?

Conceptual Issues

The research we report addresses the problem of how to integrate environmental education into the traditional science curriculum to promote environmental awareness and concern for the planet. A number of authors suggest using an environment-based approach to infuse EE into the classroom practices (see e.g. Lieberman & Hoody, 1998). These authors consider EE as a *curriculum integrator*, an interdisciplinary subject in which deeper learning can occur. But the inherent interdisciplinary nature of EE has left it outside the classrooms of teachers who feel more comfortable working in disciplinary spaces. To address this problem a number of environmental scholars argue for integrating environmental education into science education curriculum, claiming that such integration could be mutually reinforcing and beneficial for both subjects (Dillon & Scott, 2002; Gough, 2002). Gough (2002) suggests that such integration gives EE a “legitimate space in the curriculum” and helps to achieve its objectives and goals that “are very unlikely to be achieved from the margins” (p. 1206). Furthermore, EE can provide science education with novel, interesting and relevant learning contexts, activities and perspectives (Dillon & Scott, 2002; Gough, 2002). These scholars suggest that environmental education can transform science into a more culturally and socially relevant activity, as well as provide students with opportunities to develop novel social and cognitive skills.

However, research shows that teachers do not feel competent in teaching environmental issues, most of which are interdisciplinary in nature and require knowledge of concepts from different subject areas (see e.g. Arrasmith, 1995; Gayford, 2002). Because of contradictory information about most environmental issues, it is difficult for teachers to choose the way to present these issues in the classroom. Further, teachers of science are “usually not well-equipped for understanding pupils’ viewpoints and for handling controversial, conflicting issues in the classroom in a constructive way” (Pozamik, 1995).

Project Design and Research Methodology

The Landed Learning project began three years ago when Education researchers were invited to meet with personnel working at a university-based, urban farm in British Columbia, Canada to discuss ways the farm might build on its educational potential. Following this discussion the researchers met with interested teachers from one secondary school, to discuss ideas on how they might collaborate to integrate a farm-based environmental experience into the grade seven curriculum. As a result, one science teacher, a class of students (different students on each of two consecutive years), and seven community elders with farming and gardening backgrounds volunteered to participate. Each farmer was partnered with three students to form six “farm friend teams.” Between January and June, for the two years the project ran, the students visited the farm to meet and work with their farm friends on thirteen occasions. The teams cultivated the soil, grew plants and discussed different environmental and scientific issues that related to farming and gardening. The students also interviewed their elderly farm companions about farming practices and their history and lives on the land. Over the course of the project, the students maintained journals documenting their farming activities. Small scientific (“controlled”) experiments were planned and carried out. These were also documented in the students’ journals. At the close of the project each June, students gave class presentations using PowerPoint, to visually represent their experiences on the farm, and what they had learned about the environment, planting, farming practices and living with the land, from conducting experiments and working with their farm friends.



In both project years two Education faculty members and three graduate students served as the research team. Project activities were documented using video, photographs and field notes. Interviews were conducted with the students and teacher at the beginning, middle and end of the project. Science classes that occurred before and after farm visits were observed and events documented by means of field notes. An interview with each farm friend was conducted near the beginning of the project and a focus group was held at the end. Students' school-based science assignments and journals kept throughout the project also constituted data.

Findings

Previously we have presented findings related to changes in the students' views of the environment, as well as their developing science, farming and environmental knowledge (Peterat *et al.*, 2004; etc.). We found that over the course of the project students' relationship with the environment evolved and became more personal. The majority of students shifted from seeing the environment as an object or a place, to a view characterized by the interconnectedness of humans and environment. The students also developed a greater appreciation of the farming enterprise, gained knowledge of scientific and environmental concepts and learned about caring for and helping plants to grow. Finally, the partnering on the land with community elders helped students change their perceptions of farms and farmers as well as develop a situated understanding of land and its significance in supporting human life.

In both years of the project the teacher, Ellen, began with a strong commitment to integrating the farm-based activities and environmental themes with science lessons. Yet, we noticed that over the duration of the project term the teacher struggled to maintain this course of action. In this paper we present the messages we learned about the challenges the teacher faced as she worked to integrate an environmental project into a standardized science curriculum.

The teacher's goals for the project

By taking her class to the farm, Ellen hoped not only to teach the students science and environmental concepts but also to help them learn about being responsible and "care-full" for something growing and living. In addition, she wanted students to be curious about the living world around them, to ask questions and to learn through doing rather than from a textbook.

I want them when they go out there, not just to go and talk to people but to think of it and to ask themselves questions of why they're there and what are they doing while they're there. And to pay attention to things that they haven't heard before and say 'oh, I didn't know that' and to

indicate to themselves that without being in a classroom with a teacher standing at the front of the classroom, they are learning. Learning things by doing... (Ellen, teacher interview)



Challenges associated with melding environment, farming, and the mandated curriculum

Even though the teacher was fully committed to combining an environment and land-based learning experience with her science curriculum, the integration of the farm experiences and the mandated curriculum presented a challenge for her. Ellen approached this problem by asking students to design and carry out small science experiments in the greenhouse and at the farm. Despite valuing these inquiry-based activities, Ellen found it a struggle to link the experiments to the mandated general science curriculum that included earth science and physical science concepts. The environmental aspect of the program tended to get squeezed and manipulated to make room for standard program requirements. As Ellen pointed out in one of the interviews, *“trying to make it feel as though it’s a natural part of the course... is the perpetual puzzle in terms of integration.”*



The time required to carry out the farming activities competed with time for other science activities, which created a tension in the schedule. The teacher often had to combine several science and farming topics in one lesson, which was difficult for some students.

My only concern there is how it affects them because basically they’re running 2 versions of science. For them it’s not a linear process at all. It’s a paralleling thing and they’re pretty good and switch from one thing to another on the drop of a hat... (Ellen, teacher interview)

While integration of environmental education was an espoused goal for the teacher, we observed that she did not always make explicit connections between the curriculum and the activities of farming project. When we asked, Ellen told us that she wanted the students to make these connections for themselves. Unfortunately this “indirect” approach to integration didn’t work for the students. Many students were unable to make the link between their farm activities and the science curriculum. In their journals these students separated the farming handouts and activity sheets from their science classroom activity handouts. When asked about this, they told us they saw these as distinct and unrelated sets of materials.

Challenges associated with children’s views of “real science” and meeting standards

It appeared that some students did not recognize or acknowledge their farm activities as “real” science. These students viewed science as activity that took place in a classroom or a lab. In their eyes, working in the outdoors on the land, and dealing with the everyday environmental events was *not* real science, nor did it prepare them for their future careers.

I haven’t found [the project] very useful. If I were to actually put a career in farming, I would have studied it in university etc...but I don’t think I’ll plan a career in farming, it’s not that useful. It’s nice to have this knowledge at the back of your mind but a lot of it we already know about it. It’s kind of good enrichment but it’s not a big necessity in your education. I find it more of an enrichment. It’s good to have it but it’s not that necessary. (Student interview, 2003)



Others indicated concern claiming they even felt that they were unprepared for their next year classes because they were involved in farm project tasks rather than chemistry.

[The project] takes a lot of time and it’s kind of distracting sometimes because now we have exams and we are kind of behind other classes. We don’t know about chemistry and things. That’s bad because next year we are learning about it and we don’t really have background knowledge, so we will be a bit behind next year. (Student interview, 2004)

The only problem with [the project] is that we miss a lot of work and the other classes know things really well outside of farming so we kind of know less. ... We know more about plants, I mean, we know more than the other classes but the other parts that we’re supposed to be learning about we know less about than the other class. (Student interview, 2003)

The teacher was made aware of these students’ concerns as they would ask her questions about what they needed to know for final exams and whether there would be time to deal with all the school topics

along with their farming. These comments by the children illustrated an unexpected constraint that influenced the teacher's motivation to fully integrate the environmental and science education curricula.

Other pressures and challenges

While not directly related to the teacher's efforts to meld science and environmental education there were administrative and program-related factors associated with the farm initiative that created additional challenges for the teacher. Taken individually these were not serious problems, but they added to the pressures of the meeting the children's' expectations for science and the larger concern of completing the mandated curriculum.

Challenges for the teacher associated with project leadership and Farm Friend interactions

Leadership in the project was made complex by including school, community, farm, and university participants. Attempts to involve the farm friends in integrating farming project and science curriculum created a tension for the teacher that remained unresolved. Ellen openly acknowledged she didn't want to direct the elderly farm-friends as they worked beside her students, but wished that at times they would "do things differently" or "focus more" on certain science or environmental details. On the other hand, most of the farm friends had very little understanding of Ellen's curriculum goals and objectives. As a result, they focused on growing plants rather than on "science" or "environmental" content. This created problems for the teacher while she tried to establish links between school curriculum and the project, as often Ellen's classroom efforts did not find continuation in the farm groups' discussions and activities. As Ellen pointed out,

Running a class of 12 year olds is one thing and running a group of 12 year olds, adults and a whole bunch of researchers is quite another. It is much more difficult... (Ellen, teacher interview)



Creating a space for both project planning and carrying out of activities was also challenging. Little time was available for meetings between the teacher and the farm friends as most project time involved "time on the land." Thus, time needed for developing mutual goals and trust through communication with the participants competed with time needed to carry out the growing projects and science experiments with students.

We seldom talk. Talking to [farm friends] and having them understand what I'm doing is the hardest part of the whole project. ... We proved last year that we can grow things. The problem we still have is the communication lines. (Ellen, teacher interview)

Although these last issues were not directly related to Ellen's attempts to "green" her general science curriculum, we believe that they affected the way the project activities unfolded and how the integration of environmental project and science curriculum was happening. Furthermore, these communication and leadership problems challenged the teacher's confidence in her teaching approaches. Ellen's vision of a fully integrated of farm-environment-science program never was fulfilled. Her students learned science and they learned about growing crops. The children brought plants into the classroom and brought science to the farm - but only a few understood the environmental connections that Ellen had hoped to create. Together these issues and challenges may have influenced Ellen's decision to withdraw from the project and not to continue this kind of integration with her science class in the year to follow.

Conclusions

This case study of one teacher's efforts illustrates some of the complexities of integrating an environmental project into the science curriculum. Although the current science curriculum in British Columbia, Canada, openly supports and encourages environmental education, it does not provide guidance for teachers on how to proceed with EE integration in their lessons. As a result, the decisions on how to teach EE are left to individual teachers. Ellen's story shows how even teachers who embrace the view that environmental education can transform science, struggle when they attempt to translate that view into practice. Among the challenges a science teacher faces are the unit-based structure of the existing curriculum, the tyranny of standardized curriculum and exams, accountability to parents and students, and the view that learning EE is not the same as learning science.

In addition to the hurdles associated with integrating EE into science curriculum there are the challenges associated with designing and carrying out hands-on, place-based environmental education in the non-school-based setting. Such a program of study requires commitments of time, resources and the development of trust among partners, some of whom may not be aware of school schedules and education protocols. This study illustrates that ongoing communication and establishing of mutual goals are key elements in this process. Finally, this research provides empirical evidence that land-based experiential science learning can be meaningful and educationally powerful, but only if teachers provide explicit direction and scaffolding to help students understand the connections between science curriculum, environmental education and their field-based learning experiences.

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