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Teaching Science in the Field. ERIC Digest.

How frequently do students study the natural world "outside?" Teaching science in the field provides unique opportunities to investigate the natural world of students' everyday lives. As in the classroom, lessons designed to foster "meaningful learning," provide "hands-on activities" and promote student "inquiry" can be effectively implemented in the world's largest laboratories, the natural and built environments of the outdoors. Many studies indicate that well-designed, field-based instructional strategies promote cognitive learning and other outcomes worthy of greater attention (Lisowski & Disinger, 1987).

A variety of settings and locales can be used for science investigations in the field, ranging from schoolyard investigations within the time frame of a single class period (Russell, 1984) to residential (boarding) programs involving overnight stays. Stoodt (1995) explains the use of "hands-on" science in the schoolyard and backyard, and offers tips for getting started with few resources. Studying the principles of physics in amusement parks (Reno & Speers, 1995) and using "Computer Physics on the Playground" (Taylor, Hutson, Krawiec, Ebert, & Rubeinstein, 1995) are good examples of field experiences strongly related to student experiences and interests.

USING URBAN ENVIRONMENTS

Valuable field experiences are not limited to "natural" areas; urban environments can be rich sources of field experiences. Peters (1995) described an eco-social studies approach which examines the issues, conflicts, and problems in relationships between humans and their natural environment. Use of a physics "trail" has also been described for outside the classroom (Foster, 1989). Nearby areas can be developed for ecology studies (Hale, 1985; Schneider, 1984), and many sites can be studied effectively "as is," such as vacant lots, trees, and the school playground (Ferbert, 1979; Hollweg, 1988). Vogl and Vogl (1985) focus elementary students' attention with leading questions and then present a site survey of the urban environment, including the soil, plants, and animals typical of city areas. Shaffer and Fielder (1987) include the materials of which the streets and buildings are constructed, and study the city as a system.

A VARIETY OF EXPERIENCES

Many different types of field experiences have been described, including development of environmental study areas (Buetler, 1993; Johns & Liske, 1992; Trust, 1991), development of nature trails (Zeph, 1985), extended field studies (Muller, 1983; Rigby, 1986), and activities for students with physical handicaps at outdoor education centers (James, 1982; Peterson & Sullivan, 1982). Formal evaluation of programs (Brody, 1984; Hamm, 1985) has also been described. Papers presented at the International Symposium on Fieldwork in the Sciences (ISFIS) address such topics as: interdisciplinary approaches, preschool education, the role of fieldwork in environmental education, nature excursions, computer applications, reference collections, teacher training, project descriptions, and implementation of fieldwork (van Trommel, 1990).

SUBJECT INTEGRATION

Continued calls for integration of subject matter strengthen arguments for teaching science in the field since the interrelationships of formal knowledge are evident within thematic instruction (Cook & Martinello, 1994). Both elementary and middle school teachers have used thematic instruction and student collaboration with success (Nelson & Frederick, 1994; Piazza, Scott, & Carver, 1994). Suggestions for the implementation of environmental studies (Disinger, 1986; Greig, Pike, & Selby, 1989; Hungerford & Volk, 1984) also indicate the applicability of environmental education in high school settings. But there are also barriers (Mason, 1980; Samuel, 1993).

High school science classes have traditionally retained a disciplinary focus, yet the recommendations of "Science for All Americans" (Rutherford & Ahlgren, 1990) suggest that a concerted effort to be inclusive of the interests and abilities of all learners is long overdue. Changes in curricular design--elements of which are often found within field-based inquiry--are also recommended in the "National Standards for Science Education" (NRC, 1996). "Parts courses--parts of the cell, parts of the microscope, parts of the leaf, parts of the brain, parts of whatever--neither do justice to the nature of biology nor do they benefit the student" (Ost & Yager, 1993). Rather than focusing on nomenclature and college preparation, the construction of curricula that promote depth of understanding, and less coverage or breadth, would enable investigation of themes that include the natural world, in natural settings.

OVERCOMING GENDER BIAS

The important contributions of science in solving social problems, which are rooted in real-world observations, has been described as an influential factor in the decision-making of girls who elect to study science (Harding, 1985). Specific steps can be taken to remove gender bias and to include the thinking of scientists with diverse backgrounds, overtly directed toward retaining the interest of women in pursuing science-related careers. For example, undertaking investigations that are global in scope and use more interactive methods, increasing the time spent in the observation, and involving women in the construction and manipulation of equipment are recommended to maintain the participation of women in the scientific enterprise. Use of more cooperative learning strategies and both quantitative and qualitative data collection methods, accompanied by the development of hypotheses that are relational and multi-causal rather than consistently employing strictly-controlled, reductionist studies are also recommended (Rosser, 1993).

PLANNING FOR SUCCESS

Ideas for the development of management skills, planning opportunities, and curriculum development (Bain, 1979; Disinger, 1984; Fischer, 1984; and Lavine, 1985) have been offered. Tips have also been offered regarding useful teaching strategies, available community study units, and steps for arranging and leading field trips, including sample forms for parental permissions and transportation requests, (Lee County School District, 1988).

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INTERNET RESOURCES

-The GLOBE Project

http://www.globe.gov

Worldwide network of schools collaborating with scientists to collect data. Uses the Internet to facilitate collaboration.

-Acorn Naturalists Search Page

http://www.acorn-group.com/search.htm

Source of books on field experiences.

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