Chapter 28
Outdoor Science in Teacher Education

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ABSTRACT

This chapter is an account of the development of prospective teachers' competence to conduct outdoor science education. At the Department of Science and Mathematics Education, the students participate in outdoor education courses. They also plan, manage, and evaluate outdoor lessons designed as assignments in science education, participation in school practice, and summer courses. Many student teachers evaluate and analyse the pedagogical aspects of outdoor science when they carry out research projects in schools for their graduation thesis work. In order to understand the activity of science teaching and learning outdoors, a qualitative study was conducted. It was based on interviews with teacher educators and included studies of students' examination papers. A Cultural Historical Activity Theory (CHAT) lens was applied to the study. The theoretical framework helped to identify the prospective teachers' abilities and skills to design, implement, and evaluate tasks related to the professional competence of delivering outdoor science activities.

INTRODUCTION

Teaching and learning outdoors has a long educational history. Traditionally, the main forms of such outdoor activities are associated with fieldwork and outdoor educational visits, particularly in relation to the biological and geo-sciences (Dillon et al., 2006). The potential of natural settings and open air environments for science teaching has been actively explored by researchers and teacher educators around the world. For a review of the literature see Dillon et al. (2006) and Tilling and Dillon (2007). Some educators have even expressed the conviction that "the future of school science lies outdoors" (Slingsby, 2006, p. 51). However, while there is a broad agreement that field studies are a laudable and form a necessary part of science education, Tilling and Dillon (2007) suggest that there is a decline in outdoor educational activities. Science studies in many schools and teacher education institutions are almost exclusively limited to indoor activities.

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The situation can be partly explained by science teachers' low interest in organising outdoor lessons. This came as a consequence of their poorly developed pedagogical competence to conduct educational work outside the classroom. The situation is likely to become even worse if teacher education does not prepare prospective teachers for such work, as is often the case. Traditionally, science teachers are trained to teach in the classroom, in the computer room or in the laboratory. It is logical to assume that transfer of teaching from indoors to outdoors activities can be a problem. These issues need further investigation. What can be learned from teacher education institutions that systematically try to develop outdoor teaching competence?

In order for the reader to understand the findings presented in this chapter, we need to say some words about the current situation with regard to science teacher education. The situation at our university reflects the dynamics of the situation at national and global level. Over the last decade experienced science teacher educators have noticed a decrease in the preparedness, interest and motivation to study science by the students enrolling on the courses for prospective primary and secondary school teachers. This lack of interest has led to a reduction in the breadth and depth of content and methods of science given in teacher education. When students are offered elective courses in science they tend to avoid choosing them. However, outdoor education courses go against this trend. They still attract many applicants in spite of the heavy weight of science. The department has a long tradition of training prospective teachers in outdoor pedagogy. Outdoor studies are conducted in different forms and on different occasions, such as science course assignments, school practice, diploma work projects, activities with school children visiting the university campus, and on master degree courses. Usually, outdoor educational experiences receive very positive participant evaluations. Student teachers learn to recognize learning opportunities in the world around them. They learn to discover science as a means to explain natural phenomena while being in the natural environment.

Teachers' ability to teach constitutes the core of their professional competence. In this study we began by conceptualizing teacher competence. We used a definition developed by Döhrmann, Kaiser and Blömeke (2012) in a Teacher Education and Development Study in Mathematics (TEDS-M). Then we expanded on their project. They suggested that professional competence includes cognitive as well as affective-motivational aspects. Cognitive abilities are founded on a combination of subject knowledge and pedagogical knowledge. Affective-motivational characteristics include professional beliefs, motivation and meta-cognitive abilities such as self-regulation. We felt that practical ability or embodied knowledge of practical outdoor experiences should be added to the classification offered by Döhrmann, et al. (2012) particularly for a description of science teachers' professional competence. In order to illustrate this contention, we would like to ask the reader to consider the case of boarding a canoe for a study trip on a lake. Motivation and theoretical knowledge are important, but the practical experience of keeping balance when stepping into the canoe will be decisive for initiating this activity without getting wet. Practical ability is usually meaningful and of course strongly context-bound.

This chapter aims to explore some aspects of prospective science teachers' professional competence that could with advantage be developed in an outdoor context. The role of context in science education is increasingly attracting the attention of researchers. This is reflected in recent academic publications (Lee, Wu, Tsai, 2013; Hansson, 2015). Nonetheless, the use of an outdoor context for training prospective science teachers remains an area with potential for further educational research and development of pedagogical practice.

Situated outdoor science teaching can be investigated with advantage through the theoretical lens of Cultural Historical Activity Theory (CHAT). This theoretical approach has been found to be productive

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