

Kari M. Sormunen, Vladimir A. Tarasov, and
Sergey R. Bogdanov (Eds.)

**Mathematics and Science Education in the
North-East of Europe: History, Traditions
& Contemporary Issues**

Proceedings of the Sixth Inter-Karelian Conference
Sortavala, Russia
11-14 September, 2003

Host of the conference:
**North — Ladoga branch of
Karelian State Pedagogical University**

Publisher of the proceedings:
**Department of Applied Education
University of Joensuu**

This conference was supported by:
Russian Humanitarian Scientific Foundation (project 03-06-00425 r/C),
Government of the Republic of Karelia (contract № 37-03, 15 April 2003),
**University of Joensuu, and
Karelian State Pedagogical University**

OUTDOOR PHYSICS PROJECT: TOWARDS CREATIVE LEARNING AND TEACHING

O.Popov*, S.Bogdanov**, A.Kjurshunov**, I.Tevel**

**Department of Mathematics, Technology and Science Education, Umea University,*

***Physics Department, Karelian State Pedagogical University*

Introduction

This paper presents a project run in cooperation between physics educators at the Department of Mathematics, Technology and Science Education in Umea University, Sweden and at the faculty of Physics and Mathematics in Karelian State Pedagogical University, Russia. Ideas of the project are illustrated from the data presented on our common website <http://www.aks.dem.ru/outdoors/index.htm>.

The aim of this project is to make the study of physics in Russian and Swedish teacher education more interesting by developing a combination of outdoor activities and ICT technology.

Research background

Developing science courses, in particular in physics, which are more attractive to students and improve the quality of learning outcomes, is a challenge that faces teacher educators in all

countries. Our previous research shows that many students perceive physics mainly as applied mathematics with limited connection to everyday life (Popov, Zackrisson and Olofsson, 2000). Following modern pedagogical/didactic trends, science educators have developed for example the following strategies:

- locating physics problems in a richer context which resembles some features of real-life situations,
- creating collaborative forms in carrying out laboratory assignments,
- developing different computer applications that facilitate concept understanding, etc

These efforts have led generally to a higher quality of physics learning outcome.

However, one important resource for physics education still seems relatively unexplored: physics activities in 'nature' (i.e. in the open air, in the forest, by the lake, etc). Materials related to this topic are poorly represented in the Internet, and there are few publications in science education journals about physics activities concerning nature.

In Sweden and Russia teachers have the important advantage in using nature as educational resource. Swedes and Russians have a unique advantage in having rightful access to the countryside. In Sweden these rights are granted by the "Allemansrätten" (literally: everyman's right), which gives every person free access to nature regardless of land ownership. In Russia this is assured by the state ownership of the land. Whereas in most of the Western countries daily access to 'the outside' for school children and university students is restricted by regulations concerning trespass on private land or security reasons.

Some remarks on the history of Swedish —Russian cooperation

Productive network cooperation between the Department of Mathematics, Science and Technology Education (MaTNv) in Faculty of Teacher Education in Umeu University and Karelian State Pedagogical University (KSPU) has been taking place during three years with support of New Visby program. During this time we learned about structure, traditions and work culture in teacher education in the two universities, through teacher exchanges, workshops and conferences. Comparative studies on student teachers communication skills in science we conducted and results presented in international conferences.

One of the key points of the research was the focus on the role of social and cultural contexts in teaching, studying and learning science. We assume that in order to help students

acquire new knowledge, interests and values, teachers need to depart from existing cultural traditions and context.

Evidence also indicates that addressing the socio-cultural context in organising learning situations in science classes is also justified on affective and motivational grounds. Students are more likely to respond positively to science when it is presented in contexts which are familiar and meaningful to them (Lave, Wenger, 1991). Motivation to study science is likely to be higher where learners can connect a problem discussed in the classroom with the praxis of their everyday lives (Scott and Driver, 1998). Thus, constructing physics teaching based on the outdoor activities and supported by ICT is likely to have a positive effect on science teacher education.

The overview of general tendencies and areas of common interest

Teacher education systems in Sweden and Russia currently experience substantial changes. In Russia, there is focus on making teacher training more flexible, dynamic, and accessible for students. During 90-s some new approaches and key principles, based on the ideas of developing education and continuous training, were worked out. As the result, the new Federal Program of modernization of education was approved by the Government in 2002. In particular the necessity of individual educational trajectory of every learner is now one of the main development vectors with the ideas of openness, accessibility, effectiveness as cornerstones. Within this framework the problems of overcoming of the lack of academic mobility of the teachers and establishing teachers' distant cooperation via network are of special interest for Karelia, with a lot of rural schools. During last years the issues of such networking become one of the prior activities of the research groups in KSPU (with Sortavala and Petrozavodsk districts as the piloting territories).

The similar processes and tendencies are observed in Swedish education system. One of the important features of current changes is introduction of research in teacher education. Umea University is one of the leaders in putting forward new pedagogical trends in Sweden. Over a number of years, Umea University has developed a profile for outdoor pedagogy and experience-based education. Outdoor courses run by the Department of Mathematics, Technology and Science Education have high attendance rates and are attract good student evaluations, but their content includes mainly biology, ecology and general pedagogical skills development.

A survey study conducted in Umea (supported by the Visby programme grant in 2001) shows that most Swedish student teachers have an interest in open-air activities and have had broad experiences of nature (Popov, 2002). This needs to be better exploited in the interests of science education.

Case based teaching

During the first stage of the project the framework of the outdoor modules was worked out (pilot version is presented at the site www.aks.dem.ru/outdoors/index.htm). This framework includes the bank of the "physics cases" - the list of natural objects and physical phenomena with suggestions how to use them in physics activities outdoors. The list of cases includes some pedagogical content knowledge "hints" for each object. The object "birch" is presented below as an illustration of such case.

Case birch: Birch as the object of and the tool for physics learning and teaching

This case starts with the table presented below. Each cell of the table is available in more detailed version. For example, the list of hints for the cell M3 looks like:

- Measuring the length of the shadows of the stick and the tree.
Using a mirror.
Comparing with the human's height (statistically).
Checking the statement "the thicker - the higher".