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The Importance of Pupils' Interests and Out-of-School Experiences in Planning Biology Lessons

Anna Uitto, Kalle Juuti, Jari Lavonen, and Veijo Meisalo
University of Helsinki, Finland
anna.uitto@helsinki.fi

Abstract

How to make learning more interesting is a basic challenge for school education. In this Finnish study, the international ROSE questionnaire was used to survey, during spring of 2003, the relationship between interest in biology and out-of-school experiences for 3626 ninth-grade pupils. Interest and experience factors were extracted by using the explorative factor analysis. Out-of-school, nature-related experiences, including watching nature programs on television, reading on nature from books or magazines, or having out-of-doors, nature-related hobbies were the most important factors correlating with interest in various contexts of human biology/health education like health and illness, personal appearance and fitness, human body in extreme conditions and in general biology like zoology, applied biology and genetics, and evolution. Out-of-school experiences in science and technology-related activities, such as using science kits and constructing models, had surprisingly the highest correlation with an interest in basic processes in biology, such as conceptually more abstract phenomena in ecology or cell biology. Design and technology-related experiences, such as using large tools, or experiences in using computers and mobile phones, were the least important factors to correlate with the studied interest contexts. More boys than girls were interested in basic processes of biology, while more girls than boys found human context interesting. When planning biology lessons and field work, it is important to connect pupils' out-of-school, nature-related hobbies and experiences to biology education, because they may represent longer-lasting personal interests. (Most of this paper is a summary of Uitto, Juuti, Lavonen, & Meisalo, 2006)

Interest is Essential for Efficient Learning

How to enhance pupils' interest and motivation to study science has remained a perpetual challenge for school science education. Krapp (2002) and Schiefele (1991) have stated that interest is a central precondition for intrinsic motivation and, according to Sansone, Wiebe, and Morgan (1999), interest is essential to maintain motivation over time. Thus, a critical question for school science education is how interest can be developed and maintained.

Many studies have shown that interest-triggered learning activity leads to a higher degree of deep-level learning (Krapp, 2002). Most researchers differentiate between personal and situational interests (Krapp, Hidi, & Renninger, 1992). Personal interest is understood to develop gradually and affect one's knowledge and values over time, while situational interest appears suddenly as a response to something in the environment and is more emotional in nature (Hidi, 1990). Situational interest is thought to have only short-term impact, whereas personal interest is believed to be more stable. The general view of school education is that pupils' knowledge of a

school subject is acquired in the classroom within varying educational settings organized by the teachers. Moreover, Braund and Reiss (2006) suggest that “school science teaching needs to be complemented by out-of-school science learning that draws on the actual world (e.g., through fieldtrips), the presented world (e.g., in science centres, botanic gardens, zoos, and science museums), and the virtual worlds that are increasingly available through information technologies” (p. 1373). However, very little importance has been attached to children’s out-of-school experiences. Informal learning may occur at home in everyday situations like with friends, watching TV, reading books or magazines, and in various hobbies, as well as in institutions like museums and zoos, and out-of-school activities and experiences may also enhance children’s interest in school subjects.

ROSE Project Surveys Pupils’ Interest in Science

To clarify the role of affective factors of importance to the learning of science and technology by ninth-grade pupils, an international comparative research project, The Relevance of Science Education (ROSE), was organized (Schreiner & Sjøberg, 2004). The Finnish ROSE project was started in 2003 (Lavonen, Juuti, Meisalo, Uitto, & Byman, 2005). Pupils’ interest in biology and their out-of-school experiences were one part of the study (Uitto, Juuti, Lavonen & Meisalo, 2006). The ROSE questionnaire contains 108 statements for pupils’ interests in science education and 61 statements on their out-of-school activities. Eight questions, based on the national curriculum, concerning interest in basic biological processes were also included. For each statement, the pupils were asked to indicate their response by ticking the appropriate box below the topics: “What I want to learn about? How interested are you in learning about the following?” and “My out-of-school experiences. How often have you done this outside school?” The interests were studied using the scale *Not Interested to Interested* and out-of-school activities with the four-point Likert-scale from *Never* to *Often*. The responses of 3626 pupils (49% girls) with median age 15 years were reduced to eight interest-context factors and seven out-of-school experience factors with an explorative factor analysis. Each factor was named according to the loaded items, emphasizing the contents of the factor items (see Tables 1 and 2). A more detailed analysis of the study is described by Uitto, Juuti, Lavonen, & Meisalo (2006).

The results of the study indicate that girls were more interested in biology, especially in the context of human biology and health education. Only in the context named *Basic Processes in Biology* did more boys than girls find biological phenomena, such as the functioning of genes, cells, or food webs, interesting. Gender difference was large, for instance, in the interest contexts named *Personal Appearance and Fitness* ($M_{\text{girls}} > M_{\text{boys}}$) and in the out-of-school experiences of *Science and Technology* ($M_{\text{boys}} > M_{\text{girls}}$) and *Home Economy* ($M_{\text{girls}} > M_{\text{boys}}$). This is in accord with the study of Lavonen, Byman, Juuti, Meisalo, & Uitto (2005) that found from the same ROSE data that, in physics contexts, the most interesting things for girls were connected with human being and the less interesting with artefacts and technological processes.

The out-of-school *Nature* experience factor, that includes watching nature programs on TV, reading on nature from books or magazines, and having out-of-doors nature-related hobbies, was the most important experience factor to correlate with the interest-context factors (Uitto, Juuti, Lavonen, & Meisalo, 2006). Even if girls had *Nature*-related activities outside school more often than boys, the correlations between the *Nature* experience factor and most of the interest-context factors seemed to be more evident in boys (Tables 1 and 2). Out-of-school experiences in *Science and Technology*, including science kits and constructing models, had surprisingly the highest correlation with the interest context of *Basic Processes in Biology*, such as interest in phenomena requiring reasoning in ecology or cell biology. However, boys’ and girls’ *Science and*

Technology-related experiences correlated clearly also with the interest context of *Applied Biology*, including interest in more concrete and practical issues in biology, such as interest in plants and animals and how to improve the harvest in gardens and farms. Out-of-school experiences of *Farm Animals* had understandably a relatively high correlation with the interest context of *Applied Biology*. *Design and Technology*-related experiences, such as using tools for gardening or handicraft, or experience in *Computer* and *Mobile Phone*, were the least important factors to correlate with the studied interest contexts. When planning and carrying out classroom and out-of-school lessons in biology, it would be beneficial to take into consideration pupils' out-of-school experiences and interests.

Table 1
Correlation Coefficients (Spearman's Rho) Between Girls' Interest Context Factors and Out-of-School Experience Factors

Experience factors	Interest factors							
	Basic processes in biology	Common health and illness	Personal appearance and fitness	Applied biology	Zoology	Human body in extreme conditions	Sex and reproduction	Genetics and evolution
Science and technology	0.37**	NS	NS	0.26**	0.13**	0.16**	0.06*	0.09**
Nature	0.16**	0.14**	0.10**	0.38**	0.36**	0.24**	0.10**	0.27**
Computer	NS	0.07**	0.05*	NS	0.11**	0.11**	NS	0.07**
Farm animals	0.18**	NS	0.08**	0.35**	0.16**	0.10**	0.12**	NS
Design and technology	0.11**	NS	NS	0.16**	0.11**	0.12**	0.09**	NS
Mobile phone	-0.18**	0.11**	0.08**	NS	0.12**	0.08**	0.09**	NS
Home economy	NS	0.16**	0.15**	0.20**	0.14**	0.13**	0.13**	0.17**

Note. Coefficients ≥ 0.24 are shown in bold. NS = not significant. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Experiences and Interest in Learning Biology

The findings have several implications. First, when planning and implementing lessons in biology or health education, it would be important to remember that pupils' out-of-school experiences, and especially *Nature* experiences, may enhance their interest to study biology. Thus, to increase pupils' motivation and skills to learn biology, it would be profitable to connect pupils' out-of-school nature experiences to school education. If a pupil has, for instance, many *Nature* or *Science and Technology*-related experiences and hobbies, these may also represent his or her longer-lasting personal interest and engagement to learn more about living nature in school. These pupils could perhaps motivate their schoolmates to learn biology or take an interest in nature-related hobbies. Schools could, for example, organize nature clubs where experienced pupils tutor younger pupils during a bird watching trip, visit to a zoo, and the like.

Second, it would be important to regularly organize well-planned, outdoor biology education because fieldwork, with its small-scale studies and observations, offers an experiential and contextual way to learn about, for instance, ecosystems. Learning at zoos, botanical gardens, or science parks may enhance pupils' interest in learning more about biology. In general, pupils are

usually able to remember out-of-school learning experiences better than the more conventional classroom lessons. Actual and situational interest may be the first step in the development of more consistent personal interest in biology, or science in general. Third, boys and girls may be interested in different content and contexts of biology, with girls being, on average, more interested in human-related contexts. At least some technologically-oriented boys could become more interested in human biology or health education if, during the lesson, they are allowed to use appropriate instruments to measure things like blood pressure, lung volume, and heart pulse or to count steps.

Table 2
Correlation Coefficients (Spearman's Rho) Between Boys' Interest Context Factors and Out-of-School Experience Factors

Experience factors	Interest factors							
	Basic processes in biology	Common health and illness	Personal appearance and fitness	Applied biology	Zoology	Human body in extreme conditions	Sex and reproduction	Genetics and evolution
Science and technology	0.36**	0.07**	0.21**	0.33**	0.16**	0.16**	0.13**	0.17**
Nature	0.31**	0.27**	0.26**	0.39**	0.39**	0.33**	0.16**	0.30**
Computer	0.05*	0.10**	NS	-0.09**	0.12**	0.21**	0.07**	0.07**
Farm animals	0.23**	0.06**	0.28**	0.44**	0.10**	NS	0.11**	0.10**
Design and technology	0.12**	0.07**	NS	0.10**	0.13**	0.17**	0.14**	NS
Mobile phone	-0.07**	0.09**	-0.08**	-0.13**	0.11**	0.16**	0.08**	NS
Home economy	0.15**	0.19**	0.19**	0.22**	0.21**	0.23**	0.16**	0.18**

Note. Coefficients ≥ 0.24 are shown in bold. NS = not significant. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Curricular Goals and Out-of-School Biology Education

Out-of-school education needs careful planning, along with prior and subsequent work at school and consideration of the curricular goals. Many of the interest contexts appearing in the study belong to the Finnish core curriculum for comprehensive biology education, such as species kingdom, basics of ecology, human biology, evolution, genetics, and applied biology, as well as health and environmental education. For instance, pupils learn the characteristics of Finnish ecosystems and conduct a small-scale study of one ecosystem during the seventh and ninth grades. Thus, skills to plan, perform, and evaluate out-of-school education are important for the biology teacher.

As a new, temporary, written objective, making a herbarium is also mentioned in the Finnish core curriculum. In the context of outdoor ecology education, the use of information technology may have many new possibilities, such as saving authentic information on plants and biotopes using digital cameras or portable phones when studying ecosystems. The whole field excursion can be recorded as a later reminder of what kind of observations and small experiments were made. Thus, the use of information technology in field education may surprisingly also motivate keen computer users to find a way to observe nature out-of-doors.

From School to Real Life

Motivating nature experiences would be important especially for pupils who miss such experiences in their free time. Out-of-school excursions may encourage pupils to engage in various nature activities and hobbies in their free time. Moreover, pupils' positive nature experiences and values are suggested to relate with positive attitudes towards responsible environmental behavior (Uitto, Juuti, Lavonen, & Meisalo, 2004). Some pupils were interested in applied biology. Visits to farmhouses, gardens, or food industry facilities may therefore be interesting in helping to learn where and why biological knowledge and skills are needed in real life, such as in various professions. With human biology and health education being interesting topics for pupils, health rehabilitation institutions and first aid centers may be good places to visit and learn to appreciate the work of people within the health care sector. At one's best, classroom education, out-of-school education, and informal learning complement each other.

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Readers' Forum

Inquiry (Continued)

The discussion regarding the meaning and use of the term inquiry is intriguing. I would like to react to and enlarge on some of Peter Eastwell's questions and concerns. Most personal curiosities, if investigated, are guided by past experiences, interpretations, and beliefs of the person who is curious. Hence Peter is correct insisting that there is really no unguided inquiry. To me the important thing is that students be encouraged by teachers and others to pose their own