

Is biology boring? Student attitudes toward biology

Pavol Prokop¹, Matej Prokop¹, Sue Dale Tunnicliffe²

¹*Trnava University, Slovakia, and* ²*Institute of Education, London, UK*

The study examines the interests and attitudes of school students toward biology: through their interest in out-of-school activities and their attitude towards lessons as measured by interest, importance and difficulty. Biology lessons were relatively popular with the greatest preference found among students learning zoology. Girls showed significantly greater interest in biology than boys. This difference was highest among grade five (age 10-11) students when learning botany. Girls assessed biology as more important and less difficult than boys. Biology-related hobbies, films and books received greater attention (10-21%) than other activities and were significantly related. However, fifth grade students (both boys and girls) exhibited difficulties in learning botany and interest in biology decreased with age.

Key words: Attitudes; Interest; Biology education; Out-of-school interest

Introduction

Interest, goals, and motivation have been identified as important for learning and academic performance (e.g. Hidi and Harackiewicz, 2000). The development of a positive attitude toward science is one of the most important goals of the curriculum (Koballa and Crawley, 1988; Laforgia, 1988). Students' attitudes toward science and science education have also received attention (Osborne *et al*, 2003).

Science is boring for many students (Ebenezer and Zoller, 1993; Delpech, 2002): difficult, not relevant to the people's lives, more attractive to boys and less interesting to older students (Ramsden, 1998). These conclusions cannot, however, be generalised to all the sciences. There are differences in attitudes toward physical and biological sciences. Physical sciences are receive more negative views than biological sciences (Ramsden, 1998). Boys express more positive attitudes about physical sciences (Schibeci and Riley, 1986; Francis and Greer, 1999), but girls were found to be more interested in biology than boys (Keeves and Kotte, 1992; Jones *et al*, 2000; Barram-Tsabari *et al*, 2006).

Biology is a unique discipline where experiments with living organisms can take place both in the laboratory and in the field. However, increasing use of virtual environments instead of practical investigations in biology has recently been documented (Partridge, 2003; Tranter, 2004). How do students regard biology compared with other subjects? Do boys and girls prefer different topics? Several studies have been concerned with attitudes toward particular disciplines like physics (e.g. Angell *et al*, 2004) or chemistry (e.g. Salta and Tzougraki, 2004) but few studies have focused on students' attitudes toward biology (see Spall *et al*, 2004). Moreover, the majority of investigations were carried out with single-age classes which did not examine possible effects of curriculum progress on students' attitudinal changes.

In this 'cross-age' study, we investigated both students' out-of-school interests in biology and their attitudes toward

biology lessons. Information about students' interests may help teachers to devise strategies to enhance students' interest in biology (Uitto *et al*, 2006). Students' interests in hobbies, the types of films they watch on TV, the books they read and their ideas about careers were also examined. Attitudes toward biology were investigated in three dimensions: interest, difficulty and importance of biology lessons.

Methods

The participants were 941 elementary school students from all grades (1-9) aged 6-15: a similar number of boys (N = 478) and girls (N = 463) from six elementary schools in five Slovak towns. All these students were asked for their favourite school subject so as to ascertain the status of biology in comparison with other subjects. Similarly, students were asked to provide basic information such as gender and grade. The quantity of data obtained varied, as responses were not received for each question from all students. Moreover, only the students (N = 246) in grades 5-9 were included in the analyses of attitudes toward biology lessons. Using the questionnaire was not appropriate for primary students who are early readers.

Students' out-of-school interests toward biology were examined, in a sample of 695 students in grades 1-9, in two different ways. Students of each grade were asked using open-ended questions related to their views on careers. Three multiple-choice questions were derived from previous interviews with students and related to their interests (M Prokop, unpublished data, details available from author).

Secondary school students' attitudes to biology lessons (grades 5-9, N = 246) were investigated using 17 Likert-scaled items on three aspects (interest, importance and difficulty) of biology lessons. The full version of the questionnaire is available at www.zoo.sav.sk/prokop. Most of questions used were modified from Salta and Tzougraki (2004) which assessed attitudes to chemistry among Greece secondary school students. Positive and negative responses were scored from 1 to

5, with negative ones were in reverse order.

Reliability of the attitudes toward biology lessons was calculated using Cronbach's alpha coefficient: only those with Cronbach's alpha value higher than 0.7 were considered as reliable (Nunnally, 1978). Cronbach's alpha for the whole questionnaire was 0.84 while other results Interest ($\alpha = 0.77$), Difficulty ($\alpha = 0.71$) and Importance of biology lessons ($\alpha = 0.77$) showed high internal consistency of data. The high values of reliability coefficients in our study denote that the instruments used for investigation of students' interests are reliable and their usage for further analysis is appropriate. The questionnaires were distributed during the second half of the school year 2003-4 and 2005-6.

Results and discussion

Is biology a favourite lesson?

Biology courses were preferred by 145 (15%) out of 941 responses. Similar results were reported by Sencar and Eryilmaz (2004) for Turkish ninth-grade students. Other science subjects received lower scores. For example, physics was preferred by just 3%, chemistry by 1%, geography 5% and mathematics 14% of 941 pupils. The data for chemistry, physics and geography should be interpreted cautiously, as primary school students have not experienced them.

Preferences for biology were not distributed randomly across grades 1-9 (Pearson Chi-squared test, $\chi^2 = 31.1$, $df = 8$, $P < 0.001$). Biology was the preferred choice in 4th and 6th grades (aged 9-10 and 11-12; 23% and 25% respectively). Conversely, it received lower rates among the youngest and oldest students (4% and 9%) (Figure 1). Sixth grade students are learning zoology which seems most popular. Students in grade 1 and 2 (aged 6-7 and 7-8) found studying 'general biology' least popular. Other details about the biology curriculum in Slovakia are shown in Table 1.

The potential effect of gender on the preferences toward biology lessons was compared, but no difference was found. Similar proportion of boys (72 of 478, 15%) and girls (74 of 463, 16%) cited biology as most popular ($P = 0.7$).

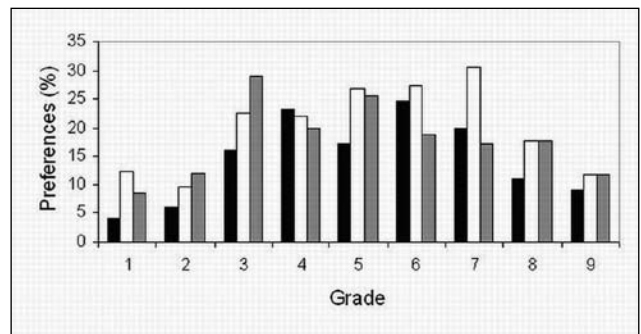


Figure 1. The distribution of preferences for biology lessons (black bars), biology-related hobbies (open bars) and watching natural history TV programmes (grey bars) among students from grades 1-9 in Slovakia.

Analysis of students' interests

Future career choice

Data were obtained from 613 students from grades 1-9. Initially, 68 different jobs were identified, seven of which we considered biology-related (veterinarian, breeder, farmer, medical doctor, biologist, scientist and fisherman). All received low preferences (0.3-4.9%). 'Professional biologist' was cited by only 3 of 613 responses (0.5%), while veterinarian was most frequently chosen in this category (4.9%). We therefore pooled the data of *biology-related* ($N = 68$, 11.1%) and compared them with preferences for *other* jobs ($N = 545$) with choices of workman, policeman, sportsman, etc. The chi-squared test showed no effect of gender or grade on the preference for biology-related careers.

Hobbies

Biology-related activities (animal rearing, plants' cultivation and fishing) came third in the most preferred choices, acquiring 20.9% of all preferences (145 of 695) a similar rate to computer-related activities (22.3%). However, sport-related activities were preferred much more (41%). Preferences for biology-related activities were not influenced by gender ($P = 0.1$), but the effect of the age was significant ($\chi^2 = 22.1$, $df = 8$, $P < 0.01$). Preferences for biology-related activities

Table 1. A summary of the biology curriculum used in Slovakian elementary schools

Grade (age)	Branch	Main topics
1 (6-7)	General	Plants and animals in each season, basic aspects of plant morphology, health care
2 (7-8)	General	Economically important and field plants and animals, human diseases and health, basic observations and morphology of honey bees
3 (8-9)	General	Biotic and abiotic factors of environment, human health and anatomy, animals, plants, fungi
4 (9-10)	General	The importance of solar radiation, water, air and earth in life of plants and animals, morphological and anatomical adaptations of plants and animals on environment, biodiversity and protection of living organisms.
5 (10-11)	Botany	Nature, bacteria, plant morphology and physiology, fungi, economic importance and protection of plants
6 (11-12)	Zoology	Invertebrates, vertebrates, anatomy and morphology of animals, distribution, importance and protection of animals in Slovakia
7 (12-13)	Human biology	Man as a part of nature, human anatomy, health and lifestyle
8 (13-14)	Mineralogy and geology	Abiotic parts of nature, structure of Earth, minerals and rocks, geological processes, geological structures of Slovakia, identification, importance and protection of abiotic nature
9 (14-15)	General biology and ecology	Life processes of organisms, ABC of ecology, life environment of organisms including humans

were similar to those for the biology as a favourite subject (Figure 1).

Do the students watch nature programmes on TV?

Out of 12 different film categories, natural history programmes were favoured by 127 of 694, responses (18.3%) compared with comedies (20.2 %), action (13.4) and stories (14.1). Other types received less than 10% of preferences. Preferences for natural history programmes were significantly affected by the grade ($\chi^2 = 16.65$, $df=8$, $P < 0.05$). A lower preference was found among younger students (grade 1 and 2, age 6-7 and 7-8) and the eldest (grade 9, age 14-15 and 16) students (Figure 1). The effect of gender was not significant.

Reading natural history books

Similarly, natural history books were the second most preferred books from 10 categories (125 of 693, 18%). Fiction (24%) came top. Other categories received less than 10% of preferences. Neither grade nor gender affected the reading of natural history books.

Relationships between future career, hobbies, watching TV and reading books

We used binomial scores (preferred or not) from each of the items in calculating a Spearman rank correlation coefficient: this examines relationships between variables to establish if the data obtained from these four questions were related. All variables significantly correlated with each other (all P 's < 0.01) with correlation coefficients range 0.1-0.295. This suggests that there is a significant expression of the student's interest in each of the measured variables. Greatest correlation was found between watching natural history films and reading natural history books. Evaluation of each of these categories showed that elementary school students in Slovakia have relatively positive attitudes towards biology in general, because their leisure activities were closely related to biology.

Future careers in biology receive relatively little attention in comparison with other jobs, or the other categories of hobbies, books and TV programmes. Very few students were interested in professional biology. We believe that this phenomenon could be improved by greater publicity about biology careers in biology/science lessons. Gibson and Chase (2002) reported that students who experienced hands-on activities in a Summer Science Exploration Program showed higher interest in science careers than students from a control group. Similarly, Prokop *et al* (2007) showed that field trips guided

by biologists positively influenced participants' attitudes toward future careers in biology.

Attitudes towards biology lessons

The mean scores of secondary students (grade 5-9, $N = 246$) for the three aspects (interest, difficulty and importance) are greater than 3.0 (Figure 2). This suggests that biology lessons are interesting, not difficult, but still important (positive attitudes). As we have shown above, significant differences exist in preferences for biology lessons with respect to students' age. We therefore used factorial ANOVAs with the grade, preferences to biology lessons (preferred or not) and sex as factors and means of three attitude dimensions as the dependent variable for comparison.

Interest

Interest was influenced by all three factors. Girls showed higher interest in biology than boys ($P < 0.05$). Students who noted biology as their favourite subject regarded biology as more interesting than other students ($P < 0.01$). Sixth grade students (age 11-12) scored highest and grade 8 (age 13-14) students lowest regarding interest in biology ($P < 0.01$). Interestingly, significant two-way interaction between gender and grade showed that fifth grade girls (age 10-11) (learning botany) gave higher scores than boys from the same grade ($P < 0.05$).

Difficulty

Boys considered biology lessons more difficult than girls ($P < 0.05$) but students who gave biology as their favourite lessons ($P < 0.001$) thought it easy. Fifth grade (age 10-11) students thought biology more difficult than older students ($P < 0.05$). There were no differences in the mean scores between students in grades 6-9. Reported difficulties of fifth grade students may be explained by students' difficulties in learning plant physiology (Anderson *et al*, 1990; Özay and Öztas, 2003). Alternatively, in this grade students experience various new school subjects (e.g. history, geography) and new teachers. This switch from primary education (grades 1-4) to secondary (grades 5-9) is difficult for many students (Catsambis, 1995). Gibson and Chase (2002) showed similar effects as students lost interest in science when they moved from middle to high school. Also, it is possible that interaction between both two factors explains learning difficulties in this grade.

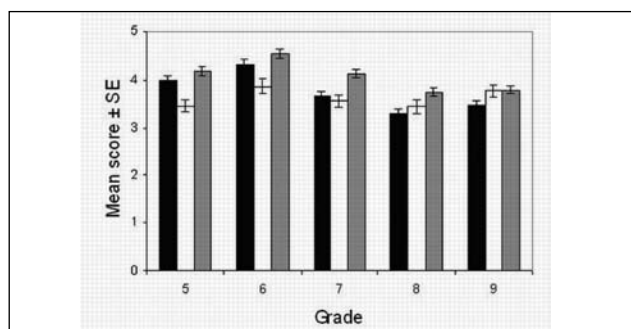
Importance

The mean score for the importance of biology lessons was significantly higher in girls than in boys ($P < 0.001$), but the effect of biology as a favourite lesson was not detectable ($P = 0.2$). Interestingly, 5-7 grade students considered biology as more important than other students ($P < 0.001$, Figure 2).

Conclusion

In general, girls had more positive attitudes towards biology, especially when learning botany. Gender differences were found in all three aspects explored. Interest toward biology decreased in older students. Moreover, significant differences in attitudes between students reporting biology as their favourite subject indicate that such simple categorisation can be used in further studies. Non-linear distribution of attitudes can be explained as the effect of a different curriculum in

Figure 2. Mean score and standard errors (SE) of students' attitudes toward biology measured according to three aspects: Interest (black bars), Difficulty (open bars) and Importance of biology (grey bars). Mean scores above the mean value of 3.0 indicate that attitudes were rather positive for all three.



each grade. However, other possible explanations such as effects of different educational methods or interaction of biology with other courses used in each grade cannot be dismissed.

Girls' preferences for botany support earlier findings by Hong *et al* (1998), but we failed to find girls' preferences for human biology and boys' preferences for earth sciences (Dawson, 2000). Interestingly, while science is generally more difficult to understand for girls (Jones *et al*, 2000; Osborne *et al*, 2003) boys in our study reported that biology is significantly more difficult for them.

Educational implications

Several educational implications from the present study arise:

- biology has been considered less attractive to younger and older students. Thus, ways that increase students' interest should be focused preferentially on these students
- greater attention should be given to the teaching of botany because it causes difficulties for a majority of grade five students. Also, a more in-depth study of curricula and biology textbooks is needed to identify the origins of problems in this grade and age group
- biology and science in general are not considered attractive careers. More programmes allowing personal contact with biologists (perhaps through non-formal learning) may render biology more attractive
- further research is needed to identify why boys are less interested in biology than girls. We propose that boys should be engaged for example in practical work and fieldwork which may make biology more interesting to them.

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Pavol Prokop (corresponding author) is a university lecturer in the Department of Biology, Faculty of Education, Trnava University, Priemyselná 4, PO Box 9, SK - 918 43, Trnava, Slovakia, and is a researcher at the Institute of Zoology, Slovak Academy of Sciences, Dúbravská cesta 9, SK - 845 06 Bratislava, Slovakia. Email: Pavol.Prokop@savba.sk. Matej Prokop is PhD student in the Department of Biology, Faculty of Education, Trnava University. Sue Dale Tunnicliffe is a researcher and tutor for the BEd programme at the Institute of Education, University of London, UK.