

## Students' Reasons to Choose or to Reject Physics

Kalle Juuti, Jari Lavonen, Anna Uitto, Reijo Byman, Veijo Meisalo  
University of Helsinki, Department Applied Sciences of Education  
kalle.juuti@helsinki.fi

### Abstract

*In this paper, possible differences between female and male students' reasons to choose or reject physics in Finnish upper secondary schools are studied. According our national survey (N=2934) pupils argue that future relevance is the most important reason to choose or reject physics. Overall, boys' and girls reasoning differed only little.*

### Introduction

There is a long tradition in the research of gender differences when looking at students' interests and attitudes towards science, their study behaviour and achievements. Interest in physics can be seen as a psychological construct that emerges from student's interaction with physical objects and with physics as a school subject [1, 2]. Interest can be seen as a medium supporting learning processes and the quality of learning. Moreover, interest is a content-specific concept as well as a directive force, and it consists of two kind of valences: feeling-related and value-related valences. Feeling-related of valences are feelings that are associated with a topic or an object, for instance feelings of enjoyment and involvement. Value-related valences refer to the attribution of personal significance to an object [1].

Osborne's [3] comprehensive literature survey shows that one of the main motivators for gender-related research in science education is the fact that there are few girls in technical and science-related occupations, but more qualified personnel is needed. Physics in the upper secondary school is a kind of „gate keeper“ for technology and medical studies. To solve these problems, different kinds of intervention projects have been launched to increase the number of girls who select science subjects, especially physics [2]. Increasing the number of girls in science (and technology) has been seen as a solution to ensure productivity and the economic future of nations. This has been considered an international problem, at least in western countries. Equal opportunity legislation has provided an additional reason to increase female participation. Thus, increasing the number of people in non-traditional occupations (e.g. girls in technology and boys in nurturing jobs such as nursing) has been seen as a way to develop a more equal society [3].

In addition to gender, research has identified other predictors for the choice of science, such as future relevance (future studies or occupation), interest in the

contents of science subjects (domains of science), interest in a context (e.g., science in society or technology) where certain science domain is met, interest in an activity type of students or method of studying subject or teaching methods used, achievement, influence of media and family, and difficulty and appreciation of the topic [2, 4, 5, 6].

In order to increase the number of pupils choosing physics in the upper secondary school, it is important to know their feelings toward physics and how they value different reasons to reject or choose physics studies.

The research questions for each of these reasons to reject or choose physics are:

- 1) How important upper secondary school students view the reason to reject or choose physics?
- 2) How do boys' and girls' opinions of importance differ in this respect?

To answer the research questions, we have analysed upper secondary school students' responses to items of the survey that concern the reasons to reject or choose physics to study.

### 1 Method and results

To answer the research questions, we chose schools weighting them by the number of students at grade 2 level (age 17), from the list of Finnish-speaking upper secondary schools in Finland. The survey was answered by 2934 students.

Students evaluated *rejected physics*' or *chosen physics*' Likert-type statements according to their choices. Students were asked to answer questions for rejecters' or for choosers' items. Items were five-scaled from *not important reason* to *very important reason*. Altogether, there were 16 items probing choosing and 19 items probing rejecting physics.

Below, there are few examples of *rejection* and *choosing* items.

- My future studies do not require physics knowledge
- I am not talented in physics
- No one of my friends chooses
- I am talented in physics
- The attitude of my sister or brother is positive towards choosing physics

We generated a sum variable as a measure of importance of reason Before summing up the variables we tested the internal consistency of each sum variable. The

alpha coefficients were on acceptable level ranging from .69 to .96. Sum variables for reasons to reject physics were: R1 *no future relevance*; R2 *no competence*; R3 *negative message from family and friends*; R4 *negative message from media, teacher and career counseling*; and R5 *physics is too technical*. Sum variables for reasons to choose physics were: C1 *future relevance*; C2 *competence*; C3 *positive message from family and friends*; C4 *positive message from media, teacher and career counseling*; C5 *interest and importance*

The sum variable was the mean of a respondent's reason items scores. If a respondent stated *not interested* for every item, he or she gave the sum variable score 1, and if a respondent stated *very interested* in every item, he or she gave the sum variable score 5. Thus, the sum variable score is a measure of respondents' evaluation of the importance of the reason.

Table 1 shows the sum variable scores for *rejected physics* and table 2 shows the sum variable scores for *chose physics*. Further, gender differences were analysed with Student's *t*-test and Cohen's *d* for effect size.

**Table 1. Evaluations of the reasons to reject physics**

Reason to reject	Mean of importance	
	Boys	Girls
No future relevance	3.1*	3.4 <sup>a</sup>
No competence	3.1*	3.4 <sup>a</sup>
Physics too technical	2.3	2.3
Media, teacher, counselling	2.1*	1.8 <sup>a</sup>
Family and friends	1.7*	1.2 <sup>b</sup>

\* According to *t*-test statistically significant difference  $p < 0.05$ .

<sup>a</sup>) Cohen's  $d > 0.2$ . <sup>b</sup>) Cohen's  $d > 0.5$ .

**Table 2 Evaluation of the reasons to choose physics**

Reason to choose	Mean of importance	
	Boys	Girls
Future relevance	3.5	3.5
Interest and importance	3.4	3.3
Competence	2.9*	2.6 <sup>a</sup>
Media, teacher, counselling	2.0*	1.8
Family and friends	1.9*	1.8

\* According to *t*-test statistically significant difference  $p < 0.05$ .

<sup>a</sup>) Cohen's  $d > 0.2$ .

Even if there were statistically gender differences in several reasons; the effect sizes were quite low. In reasoning why to reject, there was a moderate effect in gender difference in *family and friends* reason and small effect was gender difference in *no future relevance*; *no competence*; and *media, teacher and counseling*. Reasons

to choose, boys and girls evaluated rather equally. There was a small gender difference only in *competence* reason.

## 2 Conclusions

Pupils' evaluated future relevance to be the most important reason to reject or choose physics in the upper secondary school. Analyzing gender differences, the difference between choosers and rejecters, in rejecters group there were more gender differences. This result offers an important message for instructors developing teaching to keep relevance in mind. Fancy contexts may increase situational interest [7, 8], but there is a risk that this fancy physics appears to be irrelevant from the point of view of further studies. On the other hand, offering pupils a wide variety of experiences of physics in different contexts, they possible see the relevance of physics in several areas of their living and possible occupations. The unimportance of teachers, media, and family raise a question to consider: how aware, in fact, pupils are of factors influencing their choices. Further, if students are aimed to choose more physics in secondary school, informing them about future relevance may influence their choices positively.

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