Gender Issues

Boys' and Girls' Interests in Physics in Different Contexts: A Finnish Survey

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ABSTRACT

The purpose of this study was to examine gender differences between interests in physics in different contexts. Pupils (*N*=3626, median age 15) were selected by stratified sampling from Finnish comprehensive schools. The survey used 35 interest items: some from the international ROSE* questionnaire and some specifically designed for this study. Items were categorised into six contexts: ideal science, technology in society, technical applications, human being, investigation, and design and technology contexts. Boys were more interested in every context other than the human being context, where boys and girls indicated essentially equal interest. The study indicated that the human being context might offer an approach to design curricula that take into consideration the different interests of boys and girls.

Key words: Gender, physics, context, interest, survey

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1. INTRODUCTION

There is a long tradition in the examination of gender differences when looking at students' interests and attitudes towards science, their study behaviour and achievements. According to modern psychological theories (e.g. Krapp, 2002; Hoffmann, 2002), interest in physics can be seen as a psychological construct that emerges from a student's interaction with (physical) objects and phenomena and explanations of them and with physics as a school subject. Interest can be seen as a medium supporting learning processes and the quality of learning.

Osborne's (2003) 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 are needed. In addition, the numbers of pupils in general who choose science courses in school appears to be decreasing. To solve these problems, different kinds of intervention projects have been launched to increase the number of girls who select science subjects, especially physics (see e.g., Hoffman, 2002). 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. (Osborne, 2003)

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, and difficulty and appreciation of the topic (Simon, 2000; Stokking, 2000; Hoffman, 2002; Trusty, 2002).

Students will study and learn science better if they are interested in it. Typically, students' interest in physics is lower than that in chemistry and biology (Fairbrother, 2000, 16-17). Further, it is often believed that many students are interested in only a few items on the curriculum. Therefore, it is valuable for a teacher to know how to arouse or activate interest. Reeve (2002, pp. 186-187) argued that a teacher can motivate students to study science by arousing the science-oriented interests of the student by choosing phenomena relating to students' interests and life agendas. For that reason, it is valuable learn how science, especially physics and technology, can be designed to be more interesting for pupils, especially girls.

One of the identified predictors for choice of science was an interest in the context where a certain science domain is met. The aim of this study was to identify any significant differences between boys' and girls' interests in studying contexts. Surveying the opinions of pupils, teachers, policy makers, and textbook writers could take into account both boys' and girls' interests, thus pointing the way towards more gender-equal teaching.

2. BACKGROUND OF THE STUDY

Science and Technology at grades 7 – 9 in Finnish Comprehensive School

At about the same time that this research was completed, the National Board of Education in Finland was launching the new Framework Curriculum (2004). Schools are already making school-level solutions based on it. In the new curriculum, themes of physics are expressed traditionally, according to physics domain areas: mechanics, thermodynamics, electricity, light and waves, and modern physics. Further, the new curriculum emphasises research by the following methods: (i) acquisition of scientific knowledge, (ii) understanding of the empirical nature of the natural sciences, and (iii) development of different work or process-related skills, such as measuring and designing an investigation (c.f. Bennett & Kennedy, 2001).

The new curriculum describes technology education as a thematic entity. This means that every subject covers a part of the theme. In physics, the role of technology could be dealt with while studying technical applications (e.g. mechanical or thermal engines), science and technology in society (e.g. energy resources or manufacturing or construction of artefacts in industry), and designing and constructing technical devices for specific purposes (e.g. a telescope or an overhead projector).

Many topics, such as sports, can be integrated to physics education. In biology, areas like anatomy and especially physiology of the human body include contents that can also be applied in physics education. Furthermore, the new curriculum establishes a totally new school subject *health education,* as a multidisciplinary but independent new school subject at the Finnish comprehensive school. Health education, sports and human biology offer a special perspective from which to examine health and biology-related phenomena from the physics point of view (Framework curriculum 2004, 178-180; 197-200; 245-248). This approach is here referred to as the "human being context".

Gender and Interest in Science

Traditionally there have been two major points of view from which interest has been approached (e.g., Krapp, 2002). One is interest as a characteristic of a person (*individual interest* or *personal interest*) and the other is interest as a psychological state aroused by specific characteristics of the learning environment (*situational interest*). Personal interest is topic specific, persists over time, and can be subdivided into latent and actualised interest (Schraw & Lehman, 2001). Latent individual interest guides student's cognitive engagement. In addition, latent individual interest can be further subdivided into feeling-related and value-related components. According to Hidi (1990), personal interest develops slowly and tends to have long-lasting effects on a person's knowledge and values. In contrast, situational interest is an emotional state evoked suddenly by something in the immediate environment and may have only a short term effect on an individual's knowledge and values. Situational interest is aroused as a function of interestingness of the context. It is also changeable and partially under the control of teachers (see Schraw et al., 2001). However, personal and situational interests are not dichotomous. Both types of interest concern object interaction. Krapp (2002) has suggested that in certain conditions, situational interest can transform into personal interest. According to him, this ontogenetic transformation is a two-step mental process where *internalisation* and *identification* have a central role.

The last few decades have seen attempts in western countries to increase the number of girls in science, especially physics. In principle, there are two opportunities to design such an intervention: focus on girls or focus on discipline. In the former, the goal is to change girls: their behaviour, attitude, etc. In the latter, the goal is to change teaching and learning, educational policies, and social structures on the basis of research or speculation on students' interest in science (c.f. Biklen and Pollard, 2001).

Despite the huge body of science education research into gender differences, the meaning of gender is very rarely explicated. Traditionally, there are two viewpoints: gender as sexual difference, or gender as cultural construction. These viewpoints have been used to explain why girls' and boys' behaviour, interest, attitude, and achievements differ. The sexual difference explanation relies on biological differences such as brains, genes, etc. The social construction explanation relies on culture; in effect, the (social) environment creates boys and girls.

In recent Anglo-American gender research, *gender as social construction* has been the dominant viewpoint. However, in mathematics and science education research and intervention projects, the implicit perspective has been *gender as a sexual difference* (Biklen and Pollard, 2001; Gilbert, 2001; Gilbert & Calvert, 2003). According to Gilbert and Calvert (2003), that perspective implies that girls and boys are too often assumed to be homogeneous, independent groups. In this view, there is something essentially similar with all girls and something essentially similar with all boys. This viewpoint hides within-group differences. Gilbert and Calvert (2003) argued:

> "Firstly, *all* women do not display equal levels of those characteristics currently defined as being 'feminine' (and, similarly, all men are not equally 'masculine'). Following from this, there is no necessary association between femininity and *actual*, individual women (or masculinity and actual men)"

(Gilbert & Calvert, 2003, p. 863).

They continued that when interventions

"link all girls to 'femininity' and all boys (and science) with 'masculinity' and, consequently, to contribute to the *re*-construction of science as being 'for' man, as something which is unfeminine, and therefore not 'for' women. Consequently, most young women do no see themselves as being capable of science and are not interested in it"

(Gilbert & Calvert, 2003, 865).

The message here is that interventions designed to break stereotypical gender perspectives and increase equality between boys and girls may, paradoxically, create stereotypical views of gender roles, behaviour, achievements, and so on.

Gilbert and Calvert (2003) claimed that too often the approach of researchers, interested in gender influence in science, has been to increase equality between boys and girls by pointing out why girls do not choose science. For us, it seems the gender researchers' goal is to show the masculinity of science, emphasising structures of manpower, etc. Despite the implicit gender concept, the science education researchers' objective is to clarify pupils' interests. The objective seemed to be to find approaches for the future, not to find the mistakes of the past.

Dawson (2000) found that boys are mostly interested in mechanical topics, especially those with a dynamic component, while girls prefer human biology (both anatomy and physiology) and health. There is research-based evidence that boys are still more interested in scientific topics, and in physics their interest has increased. Girls' interest in physics has remained constant from 1980 to 1997, and girls' interest in human biology has waned.

Girls' low interest towards physics led to intervention projects where teaching was designed for girls. Hoffmann (2002) summarised surveys conducted in Germany. She argued that girls respond very sensitively to a change of context. She claimed that girls expressed an interest in natural phenomena and phenomena that could be perceived by the senses, references to mankind, social involvement, and practical applications of theoretical concepts. Other contexts of interest to girls were technical devices with which one often comes into contact, and natural laws that allow the calculation of exact quantities in physics (Häussler & Hoffmann, 2002).

Gilbert and Calvert (2003) argued that these "physics for girls" courses are an easy option, not a real science. Thus, the knowledge and skills learned are not very important, in further progress in scientific fields, such as studies at university. In addition, perceived future relevance is the main predictor for choosing physics in secondary school (Stokking, 2000).

One solution for this problem is to design a curriculum that is based on topics that are relevant for further studies, like medical school, and introduce topics in more interesting contexts.

Research questions

In this research, we focused on interest in physics in different contexts where physical concepts are learned and applied. The contexts were: *ideal context, science and technology in society, technical applications, human being, investigations*, and *technology, design and construction*. These were selected on the basis of the contexts mentioned in the new Framework Curriculum (2004) and earlier research (e.g. Hoffmann, 2002). The research questions for each of these contexts are:

1) How interested are pupils in studying physics in this context?
2) How do boys' and girls' interests to study physics differ in this context?

To answer the research questions, we have analysed students' responses on items of the survey that concern the physics domain in that context. Further, we state a null hypothesis:

There are no differences between boys' and girls' interests in the context.

3. METHOD

Data gathering

We randomly chose 75 schools weighting them by the number of students at Grade 9 level, from the list of Finnish-speaking comprehensive schools in Finland. In each of these schools, about 65 students were asked to answer the survey, which meant about 3 classes from each school. In one school there were only 20 students, in two schools about 30 students, and in two schools about 40 students. The overall effect of this stratified sampling was that students were selected essentially randomly from the whole age cohort across the country. In total, we selected 4954 pupils to participate in the survey, and 3626 pupils answered.

Based on international surveys like PISA and TIMSS (OECD, 2001; Välijärvi *et al.*, 2002.) we know that there are only minor differences between students' achievements in different parts of Finland. Therefore, it is reasonable to discuss national averages. The population of Finland can be classified as quite homogeneous and "mono-cultural" compared with countries with larger populations, several nationalities, and religions. In Finland there is a relatively small number of immigrants.

The questionnaire was sent to the schools on March 27th, 2003, and the headmasters were asked to organise the survey and return completed questionnaires by April 20th, 2003. The national and international purposes of the survey were carefully explained on the cover sheet. One of the purposes outlined was how a new kind of in-service training could be organised by the National Board of Education based on the information acquired by the survey. The letter was signed by the Head of the Department of Teacher Education and the Director of the National Board of Education.

Altogether, 26 reminders (37 % of the selected schools) were sent by May 10th, 2003 to those headmasters who had not returned the survey in time. The purpose of the survey was explained once again, and they were asked to return the completed questionnaires on May 25th 2003. The survey was answered by 3626 students in 61 schools, which corresponds to 73% of pupils in 81% of the selected schools.

Questionnaire

Interest was measured by asking pupils, to rank their liking for school subjects/content areas/contexts, or by Likert-scale items (e.g., *Science is fun, I like to know how radioactivity affects the human body*). The interest instrument ROSEFIN used in this study was prepared to measure students' personal interest in studying physics in certain contexts. It was a Finnish-specific addition to the large ROSE questionnaire (ROSE, 2004; Schreiner & Sjøberg, 2004). The ROSE research project is an international survey which collects data on pupils' experiences, interests, priorities, images and perceptions that are relevant to their learning of science and technology and their attitude towards science subjects (Sjøberg & Schreiner, 2002). We were previously responsible for the Finnish national ROSE survey. For the interest instrument, we chose items from the international questionnaire and designed new items to measure students' interest in the subject contexts. We used a deductive approach (like that used by Burisch, 1984) in constructing new items for the ROSEFIN inventory. In the content validation process, we evaluated the content of the inventory items to ensure that they represented and covered intended context areas. Numerous revisions were made after this evaluation until a consensus about the item contents was obtained. The final inventory included six context areas, with a total of 35 items.

Each item was measured with a Likert-type scale, with categories ranging from *not interested* to *very interested*. A Likert scale with five response categories has a neutral middle point. Sjøberg and Schreiner (2002) claim that based on their previous experiences, it is too easy to choose the middle point, so the data lack direction. The ROSE survey, and therefore the present research, used only four response categories in order to force a choice from respondents.

Operationalisation of the contexts

Context is defined here as "a situation or background where curricular content is related". In the questionnaire, pupils were asked to state: "How interested are you in learning about the following?" Below, the context questions and the related Cronbach's Alphas are reported in order to estimate the internal consistency of the sum variable. Items in the questionnaire were sorted by content (except those items common with ROSE, which have been marked with an asterisk). Thus, there were items concerning mechanics, or some other common topic, one after another. In the following bulleted lists, items are sorted by context.

We followed three guidelines while designing items for the interest instrument for the survey questionnaire, choosing as many items as possible from the original ROSE questionnaire in order to avoid expanding the number of items. The guidelines were:

1) Items were designed so that in each context there were enough items of each content area. The contexts were chosen on the basis of earlier research findings, which observed the integrating themes (e.g. technology and health/human biology).
2) The physics content of every item is relevant to topics of the new national curriculum, thus each item concerns one of mechanics, thermodynamics, electricity and magnetism, light and waves, or modern physics (radiation).

3) Based on our experience in science teaching, we ensured that the difficulty level of every item was not too high to be taught at school level.

Ideal context

- Forces acting between the planets and the sun, and motion caused by those forces
- Linear and circular motion caused by forces
- Warming and cooling, and solid/liquid/gas phase transformations
- Light and sound as wave phenomena, and reflection and refraction of waves
- Electric and magnetic forces and phenomena (motion and balance) caused by those forces
- Electrical circuit, how it works and what kind of components there are
- Atoms and molecules*

Cronbach's Alpha of the context was 0.88

Science and technology in society context

- The use of satellites for communication and other purposes.*
- Traffic safety (acceleration and braking)
- How energy can be saved or used in a more effective way*
- How different musical instruments produce different sounds*
- How to use and repair everyday electrical and mechanical equipment*
- How electricity has affected the development of our society*
- How X-rays, ultrasound, etc. are used in medicine*

Cronbach's Alpha of the context was 0.78

Technical applications context

- How to find my way and navigate by stars.*
- Forces acting in bridges, and building and planning of structures
- How petrol and diesel engines work*
- Optical instruments and how they work*
- How cassette tapes, CDs and DVDs store and play music*
- How a nuclear power plant functions*

Cronbach's Alpha of the context was 0.79.

Human being context

- Forces acting in muscles when using them in sports
- Heart, blood pressure, and blood flow
- How radiation from solariums and the sun might affect the skin*
- Influence of electric shock / electricity on muscles and the body

- How radioactivity affects the human body*

Cronbach's Alpha of the context was 0.70.

Investigation context

- Studying linear and circular motion and how they are caused by different forces
- Measuring temperature and studying heat phenomena
- Studying light and sound phenomena
- Measuring voltage and electric current
- Measuring the radioactivity of a radioactive sample

Cronbach's Alpha of the context was 0.80.

Technology, design, and constructing context

- Making a mechanical toy, like a balancing object
- Constructing a warming or cooling machine
- Constructing an optical device like a camera or a telescope
- Constructing an apparatus working with electric current
- Constructing a radiation detector

Cronbach's Alpha of the context was 0.79.

4. RESULTS

In addition to content, in order to learn about context, we generated a sum variable as a measure of interest in a context. The sum variable was the mean of a respondent's context items scores. Thus, the sum variable score is a measure of respondents' interest in studying physics in the context. Figures 1 – 6 show the total distributions of sum variable scores in the contexts. 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 4. While examining the figures, it should be noted that contexts were operationalised by different numbers of questions.

To examine the null hypothesis, we used a two-tailed t test at $p < 0.05$. As an additional check, we tested the power of the difference using Cohen's d. The d shows a meaningful effect at $d < 0.2$, small effect at $0.2 \leq d < 0.5$, moderate effect at $0.5 \leq d < 0.8$, and large effect at $d \geq 0.8$ (Cohen, 1977). For this study, where we were looking for any effects, power should be higher than $d \geq 0.2$ to be meaningful.

Table 1 provides a summary of the main results. The data showed that boys were most interested in the technological application context and girls were most interested in the human being context. According to the *t*-test, gender means were significantly different on every context sum variable score. In the *d*-test for power, the effect was greater than 0.2 on every context sum variable score except the human being context. Thus, we do not reject the null hypothesis comparing boys' and girls' sum variable score means in the human being context.

Consequently, we can answer the second research question: "How do boys' and girls' interests to study physics differ in each context?" In the technology application context, there was a large difference between boys' and girls' group means. In the ideal and the STS contexts there were moderate differences. In the investigation and the design and technology contexts there were small but significant effect sizes. The human being context was the only one with no meaningful effect size in the difference between the group means.

Table 1. Boys' and girls' group means, standard deviations, t-test values, and effect sizes (Cohen's d*) of the context sum variable.*

Context	Girls		Boys			
	M_g	$S.D._g$	M_b	$S.D._b$	t	d
Ideal	1.72	0.61	2.20	0.69	-21.0^{***}	-0.78^{c}
STS	2.02	0.56	2.33	0.62	-14.9^{***}	-0.55^{c}
Technical applications	1.87	0.57	2.40	0.67	-26.4^{***}	-0.99^{d}
Human being	2.24	0.65	2.20	0.62	2.0^{*}	0.07^{a}
Investigation	1.97	0.65	2.15	0.67	-8.0^{***}	-0.28^{b}
Design and technology	1.86	0.62	2.17	0.70	-13.9^{***}	-0.50^{b}

Note. * Significance level $p < 0.05$ *** Significance level $p < 0.001$

a) no effect, b) small effect, c) moderate effect, d) large effect

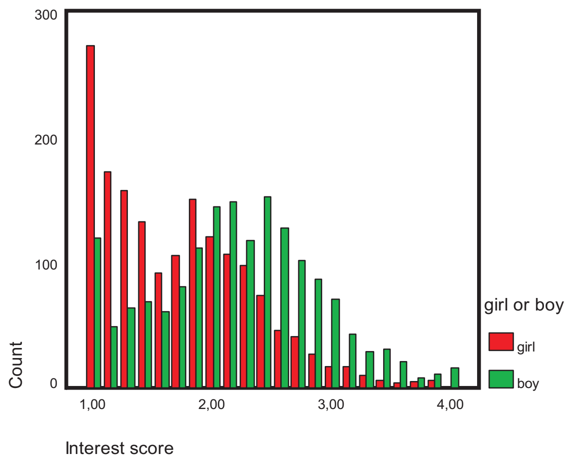

Figure 1. Distribution of sum variable scores measuring pupils' interest in the ideal context.

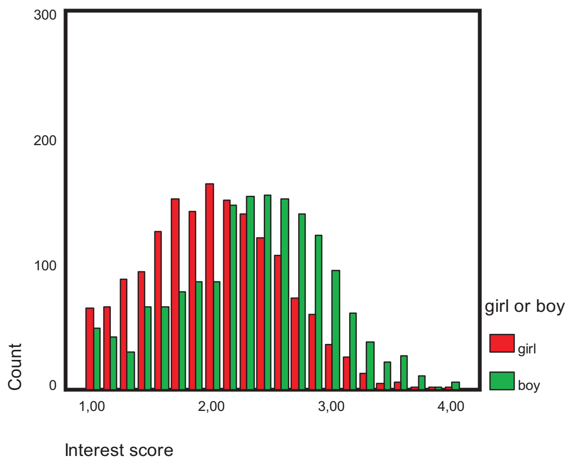

Figure 2. Distribution of sum variable scores measuring pupils' interest in the science and technology in society context.

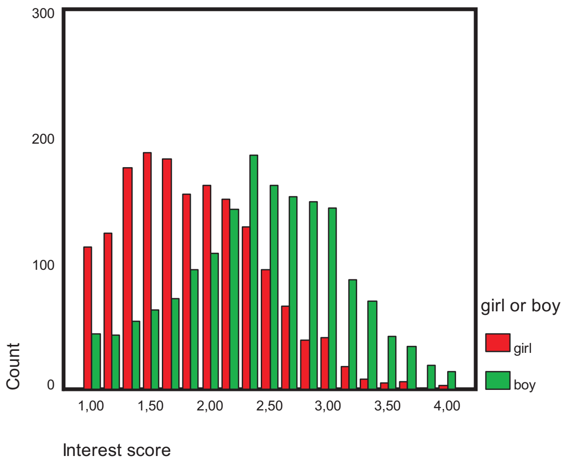

Figure 3. Distribution of sum variable scores measuring pupils' interest in the technological applications context.

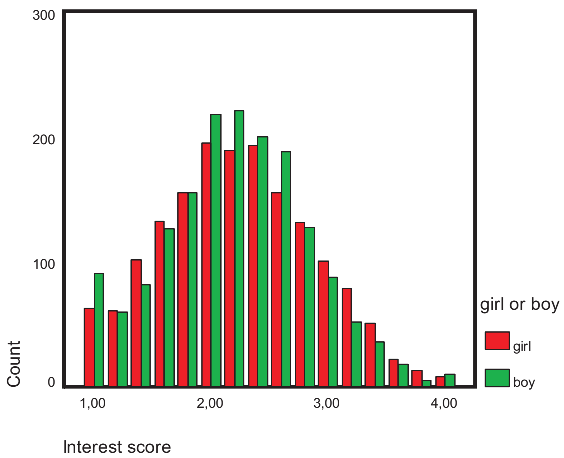

Figure 4. Distribution of sum variable scores measuring pupils' interest in the human being context.

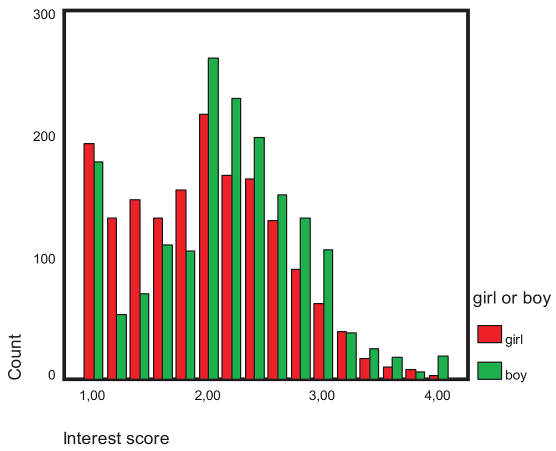

Figure 5. Distribution of sum variable scores measuring pupils' interest in the investigation context.

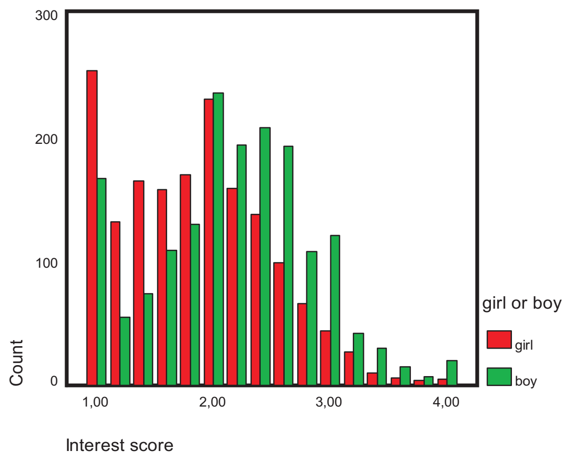

Figure 6. Distribution of sum variable scores measuring pupils' interest in the science and technology in society context.

4. DISCUSSION AND CONCLUSIONS

The main results of this research showed that between boys' and girls' group means in the technological application context there was a large effect and in the human being context there was very little effect. However, the distributions showed that between boys' and girls' scores in every context the overlap was substantial. For girls, the most interesting context was *human being* (mean 2.24) and the least interesting context was *ideal* (mean 1.72). For boys, the most interesting context was *technical application* (mean 2.40) and the least interesting context was *investigation* (mean 2.15). Between contexts, the difference for girls was about four fifths of their standard deviation and for boys, the difference was only about two fifths of their standard deviation.

These findings agree with Hoffmann's (2002) German survey. She emphasised that in Grade 10, only 20 % of girls and 60 % of boys found physics lessons interesting or very interesting. She pointed out that girls responded very sensitively to a change of context. In the technology context, the ratio between boys and girls was at the same level. Over 50% of the boys found physics in that context interesting or very interesting and about 17 % of girls found physics interesting or very interesting in the technical application context. On the other hand, about 34 % of girls and 31 % of boys found physics interesting or very interesting in the human being context. The results of the present study indicate that Finnish boys as well as girls responded quite sensitively.

Surveys have been criticised as an unreliable source from which to understand pupils' interests (Osborne, 2003). On the other hand, surveys yield hard data about the statistical significance of the phenomena studied. In the present research, the survey gave information about the power of the gender differences in a number of contexts and helped to evaluate the significance of differences between boys' and girls' interests.

The present research has good external validity. The sampling was conducted carefully and the sample is a reasonable representation of the population. Cronbach's Alpha was between 0.78 and 0.88 for each context item, showing a good level of internal consistency as well.

On the other hand, within-group differences are also large, as Gilbert and Calvert (2003) have argued. Therefore, our results support the conclusion that a physics teacher has to take seriously ideas of the theory of social construction explanation of gender that explains how the environment makes boys and girls. At least, teachers should be aware of how teaching might strengthen gender stereotypes. Both genders must have equal opportunities to become familiar with physics knowledge. Thus, equality could mean teaching and studying these contents through the contexts most likely to arouse pupils' interests.

The results of this research can be used productively in the development of school-level curricula based on the new National Framework Curriculum. Moreover, the data will be valuable for textbook authors, who have a lot of freedom in choosing different approaches and especially contexts, for certain content areas of physics, such as mechanics. Textbooks too often show ideal "bodies" moving, warming up, or absorbing radiation. It is better if phenomena can be connected to real contexts in which students are interested. Our results suggest that differences exist between boys' and girls' interests, and it is possible to explain which contexts are interesting for both genders. Both genders are about equally interested in the human being context, and therefore physical concepts can be approached from the point of view of living organisms, including human beings. On the other hand, teachers have to be aware that there are some contexts in which it may be challenging to arouse interest. Such a context is technological applications, which appears to hold little interest for girls, but was the most interesting for boys.

In order to make physics more interesting, an intervention study could be done with 9th Grade pupils, relating physics to human beings, because in this Grade they usually also have a course in human biology in Finnish schools. The study would need co-operation between the teachers in physics and biology or health education.

Results indicate only small power in the difference between girls' and boys' interest-score means in the investigation context. Thus, choosing investigation objects carefully, investigations could be easily related to the human being context. In order to simultaneously link the boys' preferred technology application context and girls' preferred human being context could be to connect the two, such as the measurement of physiological processes of the human body (such as breathing and heart rate) with technical applications.

In Finland, the beginning of the 21st century is an interesting time in the field of technology education. In the national framework curriculum of 2005, the goals and content for technology education have been described for first time, although there is no subject "Technology". Technology education will be taught integrated into several subjects, such as Educational Handicraft (Handicraft or "Craft" for short), Physics, Chemistry, Biology and Home Economics. The results of this study indicate that the technology perspective is easy to integrate with physics. Science and technology in society is the second most interesting context after the human being context for both boys and girls. The shape of technology education will be changed in the new curriculum because it is defined as an integrating theme, and related topics should be discussed within all school subjects. For example, students can be taught, and have already shown interest in, how energy can be saved or used in more effective ways, or how different musical instruments produce different sounds. From the point of view of girls, subject knowledge in technology is seldom discussed in the broad contexts often popular with them, such as environmental, ecological, and social perspectives. Consequently, this all determines the nature of technological knowledge and processes that students learn.

The technological application context is problematic from a gender equality point of view because mostly boys only are interested in it. Boys like to know how technical applications work but this kind of technical knowledge does not interest most girls. Girls, however, like to know how to use these technical applications in certain contexts. On the other hand, considering future relevance, technical applications are in a core role in further studies in schools of technology (vocational schools or universities). Thus, it is important to find more approaches to develop interests in technical applications for all students. Everyone uses technical applications. Therefore, usability testing and user-centred design could be possibilities in which to pursue this angle.

Uitto et al. (2004) have reported that in their recent study girls appeared to be more interested in environmental issues than boys. Thus, to integrate physics in environmental issues context could be a fruitful approach to show how interesting a subject physics could be for instance in proving multidisciplinary environmental knowledge and the role of technology in solving environmental problems.

The results suggest that physics seems to be seen as a rather uninteresting subject. None of the sum variable score means was over 2.5, the middle point. Examining physics in more detail, the technological application context showed the highest difference in the interest score; it was about one girl group's standard deviation. At the same time, both groups, boys and girls, found physics equally interesting in the context of human beings. It would be useful to conduct an intervention study on students' motivation and learning of physics in this context, focusing, for example, on ergonomics or functioning of the human body, and to compare the result with a control group which receives conventional teaching.

Häussler and Hoffmann (2002) introduced an intervention project based on the following principles: 1) providing opportunities to marvel, 2) linking content to prior experiences, 3) providing first-hand experiences, 4) encouraging discussions on social importance, 5) connecting physics with applications, 6) showing physics related to the human body, and 7) demonstrating the benefit of treating physics quantitatively. The result that physics is an uninteresting subject is alarming because previous studies have revealed that personal interest is related positively to learning, attention, and motivation. Although little is known of how situational interest develops into a long-standing personal interest, it seems self-evident that teachers must first think how they can "catch" and "hold" situational interest during their physics lessons. Schraw et al. (2001) have suggested six broad strategies to do this: 1) offer meaningful choices to students, 2) use well-organised texts, 3) select texts that are vivid, 4) use texts that students know about, 5) encourage students to be active learners, and 6) provide relevance cues for students. A number of authors (e.g., Alexander & Jetton, 1996; Krapp, 2002) have proposed that in certain conditions situational interest may develop into a long-lasting topic-specific personal interest. Unfortunately, very little is known yet about this developmental process. The message of the present study is that to support equal opportunities, we should provide physics teaching that combines both the technological and human contexts.

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