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# How to Measure Elementary Teachers' Interest in Teaching Chemistry?

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**The aim of this study was to create an instrument to measure elementary teachers' interest in teaching chemistry. The Interest in Chemistry Teaching Instrument (ICTI) was created to measure both the affective and cognitive components of interest. After establishing the face and content validity of the instrument, the internal consistency of the instrument was verified by calculating Cronbach`s alpha for the items. This was done using questionnaire data collected from 149 Finnish elementary teachers teaching chemistry in integrated chemistry and physics lessons. Exploratory factor analysis (EFA) was used to identify the underlying dimensions of interest. Based on the results of the factor analysis, elementary teachers' interest in chemistry teaching had two components: personal and value-related. The usefulness of the ICTI instrument was tested by conducting a correlation analysis of the measured level of interest and the reported use of teaching methods. As expected, the results indicated a positive correlation between the elementary teachers' interest measured with ICTI and the use of for example inquiry-related methods: creative problem solving and laboratory work. The ICTI may be used, for example, to evaluate and develop in-service and pre-service teacher training.**

## Introduction

In order to improve elementary chemistry teaching and science teaching in general, it is important to understand the factors that influence student learning, such as the interest of teachers and students (e.g., Ebrahim, 2012; Yates and Goodrum, 1990). Like research into interest in general, the interest research on elementary school science teaching has concentrated on students (e.g., Murphy and Beggs, 2003; Murphy and Whitelegg, 2006) rather than teachers. According to previous research, the lack of interest in science among elementary school teachers can lead to the avoidance of science teaching (see Appleton, 2003; Asunta, 2004). Thus, teachers' interest in science might be a crucial factor in effective science teaching at the elementary school level. Measuring teachers` interest is also useful in pre- and in-service teacher education. Interest instrument could be applied during intervention studies to evaluate the effectiveness of the interventions.

The aim of this study was therefore to create an instrument to measure elementary teachers' interest in chemistry and chemistry teaching. Although the lack of elementary teachers' interest in science has been discussed before (e.g., Asunta, 2004; Avard, 2009), a proper instrument for measuring both the affective and cognitive components (see Krapp and Prezel, 2011) of elementary teachers' interest in chemistry and chemistry teaching did not exist. The goal of this study was to create and validate such an instrument. The created instrument was used as a part of a survey that measured elementary teachers' interest in chemistry and the teaching methods they used to teach chemistry.

## Theoretical Background

The work to provide students with a firm foundation in chemistry and to teach them to think scientifically should start at the elementary level. The enthusiasm that teachers' have for their own subject affects the subject choices of students (see Osborne, 2003). The low number of youth choosing to study chemistry has been a concern for several years (see Osborne, 2003; Black and Atkin, 1996).

To frame the topic, the following subsection discusses interest as a phenomenon. This discussion is followed by a short summary of previous studies on elementary school teachers' interest in science. The chapter ends with a discussion of the relationship between the teachers' interest in chemistry and their use of teaching methods. This relationship is studied as an example of the use of the created Interest in Chemistry Teaching Instrument (ICTI).

**Interest as a Phenomenon** As researchers' definitions of the phenomena under study affect the research design as well as the interpretations made of the results of research, it is important in interest research to define how the researcher sees the complex field of concepts related to interest. Interest is connected to several other concepts, such as motivation (e.g., Palmer, 2004) and attitude (e.g., Osborne, 2003). In fact, both motivation and attitude may be considered to be hypernyms of interest (see Bonney, Kempler, Zusho, Coppola, and Pintrich, 2005; Osborne, 2003). Some researchers (e.g., Schreiner and Sjøberg, 2004) see interest and attitude as synonyms, while others (e.g., Gardner, 1996) try to differentiate the concepts.

In this study, interest in chemistry and chemistry teaching was viewed as a phenomenon that shares certain features with motivation and attitude but the terms are still considered separate from one another. One important and differentiating feature of interest is that it originates from the interaction between the individual and the environment (see Krapp, Hidi, and Renninger, 1992). Personal significance is always present in the concept of interest and one may be interested in something but still have a negative attitude towards it – consider the topic of racism, for instance (see Krapp and Prezel, 2011). Therefore, interest was considered to be separate from attitude, motivation, and emotion, even if they share certain aspects.

Krapp, Hidi and Renninger (1992) divide interest into situational and individual interest. According to them, situational interest is more short-term and less stable than individual interest. Nevertheless, Palmer (2004) argues that situational interest is a valuable construct in science teaching. Certain situations and topics, such as texts or movies, can generate situational interest that supports student engagement in learning (Krapp, Hidi, and Renninger 1992). When considering the development of individual interest as a process, different components of individual interest may be taken into account. Individual interest, the more stable kind of interest, can be divided further into several inter-connected components. Hidi and Renninger (2006) as well as Krapp and Prezel (2011) divide individual interest into cognitive and affective components. For example, values and feelings are considered affective components of interest (see Krapp and Prezel, 2011; Schiefele, 1991).

Interest is also usually focused on a certain topic. Krapp and Prezel (2011) distinguish between two levels of interest in science. On a general level, one can either be interested in science or not. On a more concrete level, one can be interested in a specific field or discipline of science, such as chemistry. This study focused on elementary school teachers' interest in chemistry as a specific field of science and science teaching.

**Elementary Teachers' Interest in Science** Previous research has indicated that elementary teachers sometimes lack interest in science and science teaching (e.g., Asunta, 2004; Avard, 2009). However, these findings are only cursory and there is still a clear lack of research on elementary teachers' interest in science and science teaching. So far, interest in elementary school science teaching has been studied mostly among students. For example, the studies of Murphy and Beggs (2003) and Murphy and Whitelegg (2006) concentrated on 8–11-year-old students and 11–16-year-old students, respectively. Most of the aspects of interest used in these studies are also relevant for studying the interest of teachers (such as situational vs. individual interest, general vs. concrete interest and the development of interest).

Previous studies on elementary teachers' interest in science teaching demonstrate that elementary teachers' previous experiences affect their interest in science as teachers, and that an inquiry-based course in science methods may increase their interest (e.g., Cavallo, Miller, and Saunders, 2002; Jarrett, 1999; Palmer, 2004; Ramey-Gassert, 1995). These studies have focused on science on the general level. For example, in the study by Jarrett (1999), teachers' interest in science was measured before and after an inquiry-based science methods course. One of the problems in the previous studies is that the surveys used in the studies have not been clear enough about which scientific disciplines they discussed. For example, Palmer (2004) admits that the survey used in his research project caused confusion among the respondents because the studied science discipline was not defined.

Elementary teachers' interest in chemistry teaching has previously been studied in a Finnish case study, which concluded that elementary teachers teaching chemistry in integrated chemistry and physics lessons considered chemistry as a rather interesting subject (Rukajärvi-Saarela and Aksela, 2007). However, the study did not discuss the different components of interest. A proper framework and systematic research on elementary teachers' interest in chemistry and chemistry teaching has been missing.

**Teachers' Interest and Teaching Methods in Chemistry** Only a handful of previous studies have focused on the impact of teachers' interest on their choice of teaching methods. Heinonen's (2005) study revealed that teachers are interested in using new methods in teaching, especially methods that are more student-centred and develop social skills. They would also like to use computers more efficiently and increase the amount of co-operational learning. According to Jarrett (1998), pre-service class teachers plan on using activities, which they consider to be fun, interesting and didactic. Jarrett suggests that the use of activities which generate playfulness may motivate teachers to carry out science lessons which increase interest and enjoyment. However, the concepts of motivation and interest are not clearly defined in Jarrett's (1998) study. The motivational factor in choosing teaching methods was also present in the study of Campbell and Wilson (1999), but their study concentrated only on practical work in school science.

The use of teaching methods in chemistry and physics has been studied at different school levels, but most of the studies have focused on the higher than elementary school level. It has been reported that the most used teaching methods in Finnish ninth grade education are teacher-led work and student tasks (Lavonen et al, 2004), and on grades 1–9 the most common methods are teacher monologues, conversation, independent student work, independent pair work, solving teacher given tasks, and the teacher asking questions (Heinonen, 2005).

## Context of the Study

The subjects in this study were Finnish comprehensive school teachers teaching science on the elementary level (grades 1–6). To understand the background of the study, the following subsection briefly discusses the teaching system in Finland and science teaching in Finnish elementary schools. Then some background information about the study subjects is presented.

**Chemistry Teaching in Finland** In Finland children attend a nine-year comprehensive school and from grade 5 onwards, the curriculum contains specific goals for chemistry and physics. A Finnish elementary teacher usually teaches all of the elementary subjects from the beginning of the first grade until the end of grade 6. From grade 7 onwards, specialized science teachers teach chemistry and physics. This study concentrates on elementary school teachers teaching grades 5 and 6. The objectives and core contents of chemistry teaching for grades 5–6 are written in the Finnish core curriculum (see Appendix B).

In Finland, elementary teachers study 3 ECTS credits of chemistry teaching during pre-service teacher teaching, which includes both chemistry content and teaching methods.[†] In addition, there is an optional 3 ECTS credit course in chemistry teaching, and the possibility to study chemistry as a minor subject (additional 25 ECTS credits). Although there are no official statistics on how many elementary school teachers have studied chemistry as a minor subject, the number of such teachers is probably really low.

Finnish elementary teachers have a master's degree, which is considered to give them competence to make decisions concerning their own teaching. The flexibility of the Finnish National Curriculum (Finnish National Board of Teaching, 2004) allow the teachers to choose the teaching and evaluation methods that suit them best. There are no school inspectors or standardised high-stakes tests. This autonomy and independence of the teachers and schools is one of the unique aspects of the Finnish teaching culture, which is based on trust (e.g., Sahlberg, 2011). Chemistry is usually taught with other science disciplines (Martin, Mullis, and Foy, 2007), but in Finland, chemistry and physics have been taught separately from other science disciplines and teachers have a strong autonomy in choosing teaching methods. Therefore, Finland is a convenient place to study elementary chemistry teaching, teacher interest, and the use of teaching methods.

## Method

**Sample and Study Subjects** The data for this study data was collected in 2011 with a postal questionnaire. The participating schools and teachers were chosen by a simple random sampling of Finnish elementary schools. 350 schools, which account for approximately 10% of Finnish elementary schools, were chosen. Each school received the questionnaire forms and the principals were asked to forward the questionnaires to every teacher involved in teaching chemistry.

The study subjects were Finnish elementary teachers teaching grades five and six. 157 answers were submitted, but eight of them had to be discarded because of incomplete background information. Thus, the total sample size was 149. Almost all (90%) of the teachers in the sample exclusively taught grades 5–6 at the time of the questionnaire. 77 (52%) teachers in the sample were women and 72 (48%) were men. In Finland, there are more women than men as elementary teachers, but it is not known if men teach chemistry more often than women. Therefore, it is uncertain if the sample represents the current gender distribution. 13% of the teachers had less than 5 years of teaching experience and more than half (56%) had more than 15 years of teaching experience (see Table 1). There are no official statistics about the distribution of teaching experience among Finnish elementary school teachers. Thus, we do not know how the sample represents the current experience situation in Finnish elementary schools.

Table 1
Background information

| The study subjects | *%* | *F* | *N* |
|---|---|---|---|
| Gender | | | 149 |
| women | 52 | 77 | |
| men | 48 | 72 | |
| Teaching experience (years) | | | 148 |
| < 5 | 13 | 19 | |
| 5-15 | 32 | 47 | |
| 16-25 | 30 | 44 | |
| > 25 | 26 | 38 | |

Most of the teachers had not studied chemistry at a department of chemistry. Only 5 teachers (6%) had completed university-level minor subject studies (25 ECTS credits) in chemistry. However, most teachers (59 %) had studied chemistry at a Department of Teaching as part of their teacher training and 38 teachers (26%) had participated in at least one in-service teacher-training course during their careers.

In the part of the questionnaire regarding teaching methods, the teachers were asked how often they used the listed methods on a scale of 1 (never) to 5 (often). There was also the option of "I cannot say". Appendix A includes the teaching methods section of the questionnaire. Most of the listed methods were the same as those used in previous evaluative studies of Finnish teachers (e.g., Aksela and Karjalainen, 2008; and Heinonen, 2005).

**Construction of the Instrument** The construction of the Interest in Chemistry Teaching Instrument (ICTI) was based on Item Response Theory. The theory assumes that it is possible to determine quantities in phenomena that are not directly observable. In this study, interest is considered to be such a phenomenon (Cohen, Manion, and Morrison, 2011).

Palmer (2004) points out that interest in science might vary depending on the scientific discipline in question. Thus, to avoid confusion, the questionnaire focused solely on chemistry and chemistry teaching. The ICTI included eleven interest-related items. The items were forced response questions, which were answered on the five-point Likert scale ranging from 1 (I totally disagree) to 5 (I totally agree). There was also the option "I cannot say". The questionnaire combined interest-related items used in previous interest studies (Ahtee and Rikkinen, 1995; Brigido, Bermejo, Conde, and Mellado, 2010; Martin, Mullis, and Foy, 2007; Murphy and Beggs, 2003) with new items created by the researchers.

Two types of items were included in the ICTI: items measuring interest directly (direct interest items) and items measuring the different aspects of interest (component interest items). The direct interest items were: "I am interested in chemistry" and "I am interested in teaching chemistry". Similar items have been previously used in a study on teachers' perceptions on physics, chemistry, biology and geography, for example (see Ahtee & Rikkinen, 1995).

Previous research describes the different aspects of interest. For example, Krapp and Prezel (2011) argue that studies on interest should contain both the affective component, including feelings and values and cognitive components of interest. The pilot version of ICTI included six items related to the affective components of interest. Two of them were related to feelings and four were related to values (see, e.g., Schiefele, 1991). The items related to feelings were: "I have positive emotions towards chemistry" and "Chemistry is boring". The item "I have positive emotions towards chemistry" was adapted from the study by Brigido et al. (2010), in which pre-service primary teachers were asked about the positive (e.g., fun, tranquility, confidence) and negative emotions (e.g., tension, nervousness, worry) they had about physics, chemistry, biology and geography. The item "Chemistry is boring" was obtained directly from the TIMMS 2007 study (Martin, Mullis, and Foy, 2007).

The value-related items in the pilot version of ICTI are: "Chemistry teaching is important", "In-service teacher training is important", "Chemistry is important to society" and "Chemistry is as important a subject as physics". These value-related items were formulated based on previous national and international studies. In the study of Ahtee and Rikkinen (1995), the perceived value of physics, chemistry, biology and geography was one of the four categories of perceptions. In the study of Murphy and Beggs (2003), the appreciation of the importance of science was one of the measured variables. In their study, Murphy and Biggs conducted a factor analysis on the list of different items used in the study to obtain the factors related to the importance of science, receiving enjoyment from science, and one's perceived ability to conduct science. In the study of Heinonen (2005), participation in teaching seminars was one of the items included in his questionnaire. Therefore the item "In-service teacher training (in chemistry) is important" was included in this instrument.

Two of the ten items in the pilot version of ICTI were related to the cognitive components of interest (e.g., Krapp and Prezel, 2011) and these items were based on the items in Ahtee and Rikkinen's (1995) study on teachers' perceptions of science. The interest items used in the pilot version of ICTI are listed in Table 2.

Table 2
Descriptive Statistics of the Interest Items

| Interest items | *N* | *Mean* | *SD* |
|---|---|---|---|
| *Direct interest items* | | | |
| I am interested in chemistry | 149 | 3.45 | .99 |
| I am interested in teaching chemistry | 149 | 3.53 | .92 |
| *Affective component items* | | | |
| *Value-related items* | | | |
| Chemistry is important to society | 148 | 3.83 | .77 |
| Chemistry is as important a subject as physics | 149 | 4.12 | .82 |
| Chemistry teaching is important | 149 | 3.92 | .72 |
| In-service teacher training (in chemistry) is important | 149 | 4.21 | .77 |
| *Feelings-related items* | | | |
| Chemistry is boring† | 148 | 2.14 | 1.10 |
| I have positive emotions toward chemistry | 149 | 3.49 | .94 |
| *Cognitive component items* | | | |
| I consider chemistry to be easy | 149 | 3.15 | .94 |
| I understand chemistry | 147 | 3.63 | .83 |

Note. SD = standard deviation.
† Item was reverse coded.

Face validity of the instrument was established by collecting feedback about the items used in the questionnaire from a group of pre-service chemistry teachers. Content validity was established by basing the instrument on relevant theory (see section Theoretical Background). The group who evaluated the content validity of the instrument included a professor of chemistry teacher education, a lecturer in science teacher education, a counsellor from the Finnish National Board of Teaching and a graduate student involved in the project.

**Statistical Analyses** Exploratory factor analysis (EFA) was used to identify the underlying dimensions of interest. The goal for using EFA was both to explain the interest construct and to enable data reduction (see Floyd & Widaman, 1995). The exploratory factor analysis was conducted with the IBM SPSS Statistics 20.0 software.

The Cronbach's alpha coefficient measures the internal consistency among items in a test (Cohen et al., 2011). The reliability of the ICTI was verified by calculating Cronbach's alpha for the items.

The ultimate criterion for the usefulness of an interest instrument consisting of component items and more than one dimension is whether it can provide information beyond the use of only direct interest items (cf. Floyd & Widaman, 1995). The usefulness of the ICTI was tested with a correlation analysis of the teachers' interest, the background variables and the teachers' reported use of teaching methods during lessons. Based on previous research on laboratory work and interest (e.g., Gräber, 1993), a correlation between interest and laboratory work as well as with other methods related to inquiry, such as creative problem solving, was expected.

To examine the correlation of the total score as well as the two subscales of interest stemming from the EFA, three different sums of the interest items were counted. Because the items under study were mainly discrete, the correlations were calculated by using the Spearman correlation coefficient (see Cohen et al., 2011). The significance of the correlations was set at 0.01 and 0.05. Scatter figured of the correlations were also examined.

## Results

**Exploratory Factor Analysis** The factor analysis yielded a two-factor solution. Items that loaded on both factors with loadings over 0.4 were excluded from the final analysis. Therefore second round of EFA was done without direct interest items: "I am interested in chemistry" and "I am interested in chemistry teaching" (see Table 3). In the 2nd rotation eigenvalues equal to or greater than 1.00 were extracted. The rotated two-factor solution explained 32.299 and 25.564 per cent (total of 57.863) of the total variance. The first factor contained different aspects of personal interest. These included feelings-related interest items, such as "I have positive emotions towards chemistry", interest items related to the cognitive aspect of interest, such as "I consider chemistry to be easy". The other factor contained value-related interest items. The factors were named: i) Personal Interest, and ii) Value-Related Interest. The reliability of the factor analysis was verified using the Kaiser-Mayer-Olkin measure of sampling adequacy, which had the value of .806, and Bartlett's test, which showed statistical significance of .001. The factorization was therefore suitable for the data.

Table 3
The Results of the Factor Analysis of the Component Interest Items

| Interest items | Factors and loadings | |
|---|---|---|
| | *Factor 1* | *Factor 2* |
| I understand chemistry | .842 | |
| I consider chemistry to be easy | .823 | |
| I have positive emotions towards chemistry | .732 | |
| Chemistry is boring† | .567 | |
| In-service teacher training (in chemistry) is important | | .731 |
| Chemistry is as important a subject as physics | | .705 |
| Chemistry teaching is important | | .646 |
| Chemistry is important to society | | .569 |

Note: Cut-off point for excluding items from the analysis was set to be 0.4.
† Item was reverse coded.

**Internal Consistency** The Cronbach`s alpha coefficient measures the internal consistency among items in a test (Cohen et al., 2011). The reliability of the ICTI was verified by calculating Cronbach`s alpha for the items. Cronbach`s alpha value for the ICTI was 0.861 with all items and 0.809 without the direct interest items. Based on the bigger Cronbach`s value of the ICTI than the instrument without the direct interest items, it is more reliable to include also direct interest items to the instrument than to exclude them. Cronbach`s alpha values for the two different components of interest were 0.791 (sum of the personal interest items) and 0.699 (sum of the value-related interest items). The alpha value was therefore good for the whole instrument as well as for the personal interest items, and acceptable for the value-related interest items.

**Correlation with the Use of Teaching Methods** The usefulness of the ICTI instrument was tested by conducting a correlation analysis of the measured level of interest and the reported use of teaching methods, as well as several background variables.

Table 4 presents the correlations between the reported use of teaching methods and the teachers' interest based on the (i) sum of all interest items (ICTI), (ii) sum of personal interest items, and (iii) sum of value-related interest items. As we expected, the interest of the teachers correlated with the reported use of creative problem solving and laboratory work. The correlations were significant at the 0.01 levels, but they were relatively low with respect to magnitude. In addition to creative problem solving and laboratory work, ICTI also correlated with field trips, concept adoption, group work and co-operational learning on levels 0.01 and 0.05.

The significance and magnitude of the correlations between teaching methods and ICTI were higher or the same than the significance and magnitude of the correlations between teaching methods and interest based on the sum of items from only one component of interest. The sole exception was the use of laboratory work, which had a slightly more significant correlation with the value-related interest than with the ICTI.

In most cases the use of sum of all interest items produced the strongest correlation. There were also some differences in how the two components of interest correlated with the reported use of teaching methods in a similar way. For example concept adoption only correlated with the sum of all interest items and the sum of value-related interest items, but not with the sum of personal interest items. Field trips on the other hand correlated more strongly with the sum of value-related interest items than with the sum of personal interest items.

Neither the measured level of interest nor the reported use of methods correlated significantly with any of the collected background variables, such as the teachers' gender, teaching experience, or extent or type of previous chemistry studies.

Table 4
Statistics and Correlation between Interest in Chemistry and Chemistry Teaching and the Teaching methods

| Teaching methods | N | Mean | SD | | Sum of all interest items (ICTI) | Sum of personal interest items | Sum of value-related interest items |
|---|---|---|---|---|---|---|---|
| Field trips | 131 | 2.02 | .863 | Cc. | .271** | .189* | .248** |
| | | | | sig. | .002 | .030 | .004 |
| Concept adoption | 118 | 2.82 | .984 | Cc. | .224* | .160 | .229* |
| | | | | sig. | .015 | .083 | .013 |
| Laboratory work | 132 | 3.63 | .868 | Cc. | .327** | . 237** | .344** |
| | | | | sig. | .000 | .000 | .000 |
| Group work | 137 | 3.42 | .792 | Cc. | .171* | .163 | .124 |
| | | | | sig. | .046 | .057 | .148 |
| Co-operational learning | 133 | 3.22 | .972 | Cc. | .261** | .261** | .211* |
| | | | | sig. | .002 | .002 | .015 |
| Creative problem solving | 128 | 3.03 | .896 | Cc. | .313** | .289** | .222* |
| | | | | sig. | .000 | .001 | .012 |

Note: Spearman's correlation coefficient was used. Cc. = correlation coefficient, sig. = significance
**p < .001, two-tailed
*p < .005, two-tailed

## Conclusions

The aim of this study was to create an instrument to measure elementary teachers' interest in chemistry and chemistry teaching. The created Interest in Chemistry Teaching Instrument (ICTI) included direct interest items as well as component interest items including affective items measuring both feelings and values, as well as cognitive items (see Krapp and Prezel, 2011; Schiefele, 1991). After establishing the face and content validity of the instrument, the internal consistency of the instrument was verified by calculating Cronbach's alpha for each item. This was done using questionnaire data collected from 149 Finnish elementary teachers teaching chemistry in integrated chemistry and physics lessons. The internal consistency of the sum of the items, as well as the components of interest recognized was shown to be adequate.

**Components of Interest** Exploratory factor analysis (EFA) was done to recognize the dimensions of elementary school teachers' interest. Based on the analysis two subscales were formed. The subscales measured two components of interest: i) personal interest, and ii) value-related interest. The value-related component measured how important teachers considered chemistry and chemistry education to be for the surrounding society. The other component included items related to feelings and cognition, and measured a more personal type of interest. Previous research (e.g. Krapp and Prezel, 2011) suggests that interest includes both affective as well as cognitive component. Based on the results of this study, the cognitive component is more closely related to personal feelings about the chemistry than with value-related opinions. Confirmatory factor analysis of a data collected from a different sample of teachers could be used to test the two-component model of interest presented here against other models.

Because the direct interest items measure interest as a whole, they loaded on both factors. When measuring the overall interest of teachers, the items can be included in the sum of interest items to increase the internal consistency of the instrument.

**Usefulness of ICTI** The usefulness of the ICTI was assessed by using the instrument to calculate correlations between the Finnish elementary teachers' interest in chemistry and chemistry teaching and their reported use of various teaching methods. As expected (see Gräber, 1993), the teachers' interest correlated positively with inquiry-related methods (creative problem solving and laboratory work) as well as with field trips, concept adoption, group work and co-operational learning. The comparison of interest with the reported use of teaching methods also showed some differences in how the sum of the items in each component correlated with the reported use of methods (see Table 4), thus supporting the usefulness of the two component model.

The magnitudes of the significant correlations between interest and components of interest were relatively low, explaining only up to 10% of the variation. However, this was expected, as there are likely numerous other elements that affect teachers' choice of teaching methods. Such elements include the teaching material and equipment used (Heinonen, 2005), class size and amount of curricular content (Finnish National Board of Education 2003), the teacher's general classroom management skills (Demiraslan-Cevik & Andre, 2013), and participation in in-service training (Boyle, Lamprianou & Boyle, 2005).

Neither the measured level of interest nor the reported use of methods correlated significantly with any of the collected background variables, which shows that the correlations were not due to some other elements such as teaching experience or the extent of previous studies in chemistry.

**Potential Uses of ICTI** As lack of interest can lead to the avoidance of science teaching (see Appleton, 2003; Asunta, 2004), measuring teachers' interest can be very valuable to researchers interested in elementary school chemistry education. Using pre- and post-test set-ups, the ICTI could be used to measure the effect of teachers' interest on student learning, or the effect of in-service teacher training courses on teachers' interest in chemistry. Information about teachers` interest when applying ICTI during teacher training could be used to improve the teacher education programmes. If used in the beginning of the program, the ICTI could give valuable information on teachers` interest to be used to reflect results with the teachers and target the programme. Comparing the interest of the elementary teachers` to the interest of the pre-service teachers, could give interesting insight to the development teachers` interest. The ICTI also has the potential to be applied to different fields of science, such as in biology, earth science, or physics.

Comparison of the correlations of the different components of interest with the reported use of teaching methods (see Table 4) suggest that using the component scores might provide information beyond that provided by the sum of all interest items. Thus, measuring the two components of interest separately might be of interest, for example in the evaluation of how an intervention might affect the teachers' interest. An interesting qualitative follow-up study might be to find out what could trigger the elementary teachers' interest in chemistry and chemistry teaching (see also Hidi and Renninger, 2006; Krapp, Hidi, and Renninger, 1992).

## Notes and References

† European Credit Transfer and Accumulation System (ECTS) is a standard for comparing the study attainment and performance of students in higher education across the European Union and other collaborating European countries. One academic year corresponds to 60 ECTS-credits (European Communities, 2009).

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## Appendix A

**The Survey**

**Background**

1. I am a) a woman b) a man
2. My teaching experience is
   a) less than 5 years b) 5–15 years
   c) 16–25 years d) over 25 years
3. I currently teach grades† a) 1–2 b) 3–4 c) 5–6
4. The size of my school (grades 1–6) is
   a) less than 50 students b) 51–100 students
   c) over 100 students
5. a) I have studied chemistry in the university††
   a) for an approbatur b) for a cum laude approbatur
   c) for a laudatur d) postgraduate studies
   e) none f) something else, what?____________________

b) I specialized in elementary teaching by
a) completing basic studies in teacher training
b) completing basic studies in chemistry in the Department of Chemistry
c) participating in in-service training
d) self-study
e) some other way, what?
___________________________________

***Teaching Methods***

6. How often do you use the following teaching methods in your teaching? Please, check the most appropriate alternative. (5=often, 4=quite often, 3=sometimes, 2=rarely, 1=never, 0=I cannot say).

| | |
|---|---|
| Project work | 5 4 3 2 1 0 |
| Group work | 5 4 3 2 1 0 |
| Pair work | 5 4 3 2 1 0 |
| Concept map | 5 4 3 2 1 0 |
| Mind map | 5 4 3 2 1 0 |
| Debate | 5 4 3 2 1 0 |
| Relaxation | 5 4 3 2 1 0 |
| Suggestopedia | 5 4 3 2 1 0 |
| Field trips | 5 4 3 2 1 0 |
| Concept adoption | 5 4 3 2 1 0 |
| Advance organization | 5 4 3 2 1 0 |
| Process writing | 5 4 3 2 1 0 |
| Co-operational learning | 5 4 3 2 1 0 |
| Creative problem solving | 5 4 3 2 1 0 |
| IT-methods (Simulations, teaching games, etc.) | 5 4 3 2 1 0 |
| Role-plays or plays | 5 4 3 2 1 0 |
| Students' presentations | 5 4 3 2 1 0 |
| Memory models | 5 4 3 2 1 0 |
| Teacher asking questions | 5 4 3 2 1 0 |
| Independent student work | 5 4 3 2 1 0 |
| Conversation | 5 4 3 2 1 0 |
| Teachers' monologues | 5 4 3 2 1 0 |
| Solving teacher given tasks | 5 4 3 2 1 0 |
| Laboratory work | 5 4 3 2 1 0 |
| Something else, what? ____________________ | 5 4 3 2 1 0 |
| Something else, what? ____________________ | 5 4 3 2 1 0 |

***Interest***

7. Please answer the question by checking the most appropriate alternative according to your current teaching situation. (5=I totally agree, 4=I agree, 3=neutral, 2=I disagree, 1=I totally disagree, 0=I cannot say).

| | |
|---|---|
| I have positive emotions towards chemistry. | 5 4 3 2 1 0 |
| I have always been interested in chemistry. | 5 4 3 2 1 0 |
| Chemistry teaching is important. | 5 4 3 2 1 0 |
| In-service teacher training (Chemistry and physics) is important. | 5 4 3 2 1 0 |
| I am interested in chemistry. | 5 4 3 2 1 0 |

| | |
|---|---|
| Chemistry is important to society. | 5 4 3 2 1 0 |
| Chemistry is as important a subject as physics. | 5 4 3 2 1 0 |
| Chemistry is boring. | 5 4 3 2 1 0 |
| I understand chemistry. | 5 4 3 2 1 0 |
| I am interested in teaching chemistry. | 5 4 3 2 1 0 |

† Grades 1−2: 7−9-year-olds, grades 3−4: 9−11-year-olds, grades 5−6: 11−13-year-olds

† † Approbatur: basic studies (25 ECTS credits), cum laude approbatur: intermediate studies (60 ECTS credits), laudatur: advanced studies (approx. 120 ECTS credits)

## Appendix B

**A summary of the Objectives and Core Contents of Chemistry Teaching for Grades 5–6 as Presented in the Finnish Core Curriculum**

The objectives for chemistry teaching are that pupils learn to (Finnish National Board of Teaching, 2004):

- Make observations and measurements and come to conclusions about them
- Look for information and weigh the reliability of the information
- Make simple scientific experiments safely
- Recognize causal relationships
- use scientific knowledge to describe, compare and classify concepts in chemistry
- Understand the dangers of drug abuse

The core contents for chemistry teaching are:

- Air and atmosphere
- Properties and the importance of water, investigation of natural waters and water purification
- Classification of soil substances, separation methods
- Origin, utilization and recycling of products
- Active substances of intoxicants and their effects