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DETERMINING STUDENTS' INTERESTS IN LEARNING SCIENCE USING CONCEPT MAP TECHNIQUES

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Abstract In recent studies related with interest development, a construct of interest is investigated by contextual approaches. Much research has been summarised that these approaches have an important role in increasing and maintaining students' interest in science learning. But there are no studies investigating the structure of students' contextual interest in science subjects using concept map techniques. The main aim of the current study is to develop dimensions through the concept map method created teaching models that enable different levels of school education to plan science teaching (educational purposes). Altogether four different teaching models (one in each science subject) were created using CmapTools program based on the data collected from grade 9 students, whereas in the current paper results from chemistry are presented only. Results indicate that students' interest in chemical reactions and bonding topics is possible to visualise in a teaching model structuring in different contexts – personal, social and science curriculum content-related ways.

Keywords: concept mapping, contextual interests, science learning, CmapTools program

1 Introduction

Students' interest in science has been investigated for decades from different perspectives, but there is still a gap in understanding the relationship between students' interest, the teaching process and the needs of society. Although there are number of factors impacting on students' interest in learning science, important factors predicting students' differing interests in school science are seen as gender, the curriculum focus (content *versus* context), the social environment (school, peers, teachers, parents, friends), different teaching methods and the learning activities/methods (Bergin, 2016; Dawson, 2000; Hulleman, Thoman, Dicke & Harackiewicz, 2017; Potvin & Hasni, 2014; Teppo, Semilarski, Soobard & Rannikmäe, 2017). Recognising this, context-based learning (CBL) approaches, where the main idea is putting scientific concepts, models or topics into a meaningful frame connecting science to everyday life, societal, or technological contexts (Podschuweit & Bernholt, 2017), have been widely implemented in science education for decades (Bennett, Lubben & Hogarth, 2006; de Jong, 2008; Gilbert, 2006; Häussler & Hoffmann, 2000; King, 2012; Podschuweit & Bernholt, 2017; Ramsden, 1997). Research has shown that context-based learning (CBL) has mainly positive effects on students' interest and motivation (Bennett et al., 2006; King, 2012; Ramsden, 1997), but little has been investigated how students' interest in particular science topics is influenced by the context in which the topic is presented. This paper reflects on the role of context based on Gilbert's (2006) description of context - that giving meaning to words, phrases, sentences and using three different contexts (personal, social and science curriculum content-related).

As noted above, different teaching and learning methods are important for raising and maintaining students' interest in science and also to develop a coherent and scientific understanding of important science concepts. An example is the inclusion of concept maps as a useful tool for facilitating meaningful learning and aiding this, CmapTools provides extensive support for visualising knowledge models (Novak & Cañas, 2010). By using concept maps as a graphical representation of the relationship among terms (Cañas, Novak & Reiska, 2015), the current paper seeks to visualise chemistry-related science concepts taking into account the three different contexts (Gilbert, 2006) as mentioned earlier.

The main aim of the current study is to develop a teaching model created and visualised using a concept map method for teaching chemical reactions and bonding. The current study seeks to answer to the following research questions:

- What kind of teaching model can be developed based on grade nine students' contextual interests about chemical reactions and chemical bonding?
- What interests do grade 9 students have in learning about chemistry-related topics?

2 Methodology

The sample for the study composed of 9th grade students (N=848) with an average age of 15,6 who answered to a questionnaire about interest in different chemistry topics.

Although the instrument consisted, in total, of 36 questions covering different science topics (plants undergoing photosynthesis, the nature of chemical reactions and chemical bonding, the Earth's surface and physical phenomena and processes) presented in three contexts - personal, social, content-related, this study only related to the 9 chemistry related items. The topics areas were selected from content indicated in the National curriculum for basic schools (2014) and previous research results (Teppo, 2004; Teppo & Rannikmäe, 2008).

The created 36-item instrument was piloted by a group of students and validated by experts. Based on the students' responses, minor changes were made regarding the wording of some items. To validate the content of the instrument, interviews with one science education professor and one researcher were accomplished before the students met the tasks. In addition, one science teacher looked at the items to validate the level of science topics suitable for grade 9 students. Experts were asked to evaluate all 36 items considering its belongingness to personal, social or science curriculum content-related contexts. Agreement between experts was 85%.

Students were asked to evaluate the given topics in a 4-point Likert scale (1-not interested ... 4- very interested). The questionnaire was administered electronically to students using school computers, or tablet computers provided by a data collector responsible for implementing the survey within a school.

Data were analysed in the following stages:

1) For finding out the most and the least interesting chemistry topics in the eyes of students, descriptive statistics (mean, standard deviation, percentages) were determined using SPSS software.
2) Student answers were analysed using a previously devised concept map, whereby different chemistry-related topics were put into the model based on a contextual framework. The concept map was created using the CmapTools program.

3 Results

3.1 Students' contextual interests

Students' interests in all nine chemistry topics are presented on Figure 1. This shows that more than half (range of 52-65%) of grade nine students do not have an interest to learn about topics related with atoms and molecules, chemical bonding and reactions. The most interesting topic for 48% students is related with water salinity in different regions in the world, which based on the framework, is related with social context. Other personal- and social-related topics are found not to be interesting for most students. Thus, we can conclude that students' interest in studying selected chemistry topics depend little on the context, but is not interesting based on content.

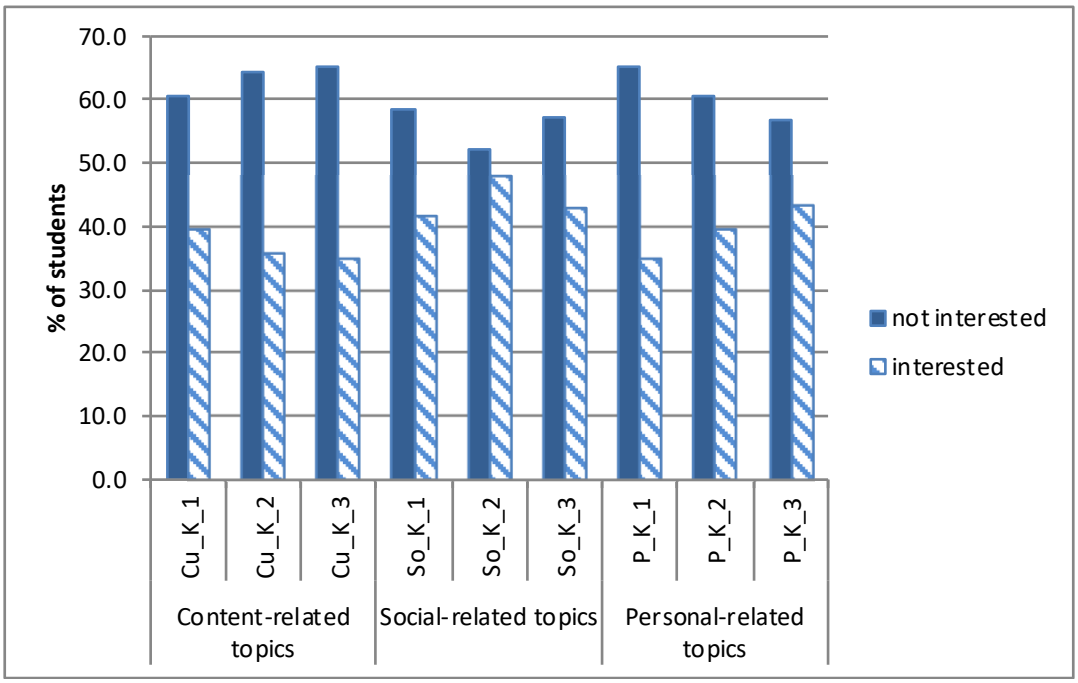

Figure 1. Grade nine students' contextual interests in learning about chemistry-related topics

3.2 Development of the Concept Map

A concept map was created considering a contextual interest framework and students' interest in chemistry-related topics. The concept map, presented in Figure 2, represented relationships between different chemistry content related concepts.

4 Conclusions and Implications

Students are interested to learn when science topics are presented and taught the way students perceive as relevant and important for them. This study shows contradictory results comparing with other studies using contextual approaches in a way to promote interest in learning chemistry. It shows that chemistry related topics are uninteresting for students despite the context in which they are presented.

To be aware of students' interest in chemistry or generally in science can help teachers better engage their students, meet their needs and can be facilitated using context-based learning materials.

5 Recommendation

We suggest teachers find the ways to make chemistry interesting and relevant for students showing the practical applications of chemistry in students' everyday lives and in the society. To fulfil this, it is appropriate to follow the developed concept map what offers benefits to both students and teachers.

Future studies can be related with implementation of the developed concept map among chemistry and science teachers to improve chemistry teaching.

6 Limitations

The research results are valid only for the current chemistry topics, contexts and age group (9 students) selected for the study. Therefore, it is not possible to make conclusions related to all students and science topics included in the science curriculum.

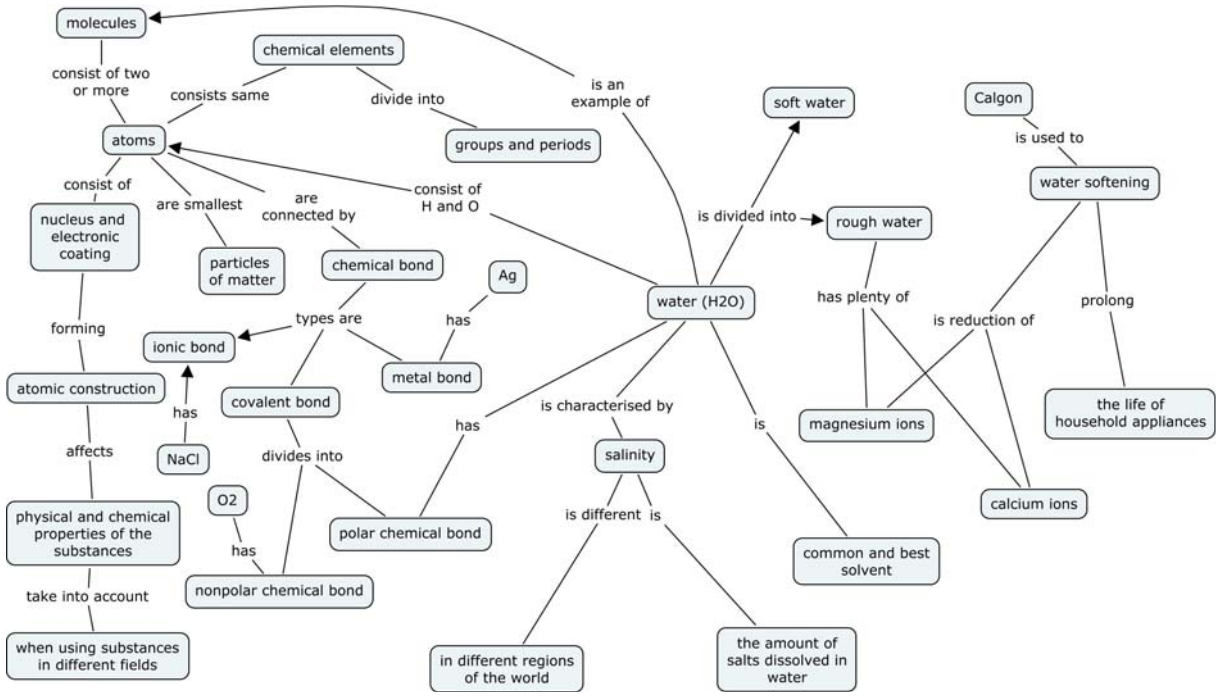

Figure 2. Developed concept map based on chemistry related topics

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