SMALL-GROUP DISCUSSIONS – A TOOL TO SUPPORT PROSPECTIVE PRIMARY TEACHERS CONCEPTUAL UNDERSTANDING?

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The opportunity to discuss and argument is considered as an important part of today's science education. Despite this, its use in the classroom is relatively rare. There is few situations where students can discuss and deepen their understanding. Previous research show that students at different levels have misconceptions in different areas of the science curriculum; these misconceptions are also known to be deeply rooted. The teachers´ subject knowledge and own understanding of scientific concepts is therefore very important. In Finland science is an integrated subject in grades 1-6 in the Comprehensive school. This implies that every primary teacher should be ready to teach science. Previous research show that prospective primary teachers have not developed a solid base during their school years. The aim of this study is to investigate if small-group discussions can be a tool in order to make prospective primary teachers aware of their own misconceptions, and at the same time promote, and deepen the conceptual understanding of scientific concepts. The data consists of student misconceptions and small group discussions during a science course. The preliminary results show that although students are using the right concepts in their discussions they are not always able to argue for them or their understanding of the concepts are not very deep.

Keywords: Misconceptions, Conceptual understanding, Peer Learning

INTRODUCTION

Misconceptions in science have been extensively studied in the past (Allen, 2014). They are known to be deeply rooted (Gooding & Metz, 2011) and the longer they exist the more resistant they are to instruction. It is important that students already in primary school develop an understanding of scientific concepts, in line with a more scientifically correct understanding. Primary school teachers play a crucial part in this process so their own understanding of scientific concepts is therefore important. In Finland, primary teachers become Masters of Pedagogy (300 ECTS), a small part of their studies covers the different subjects they will teach (60 ECTS). In the new curriculum for the Comprehensive school in Finland (Finnish National Curriculum, 2014), science will be an integrated subject in grades 1-6. As teachers in science, they need deep knowledge of the subject matter as well as knowledge about instructional strategies in the specific subject area (Schulman, 1986; Ball & McDiarmid, 1990).

The aim of the study is to develop the instruction and teaching methods in the science course for prospective primary teacher and in this way promote a more scientifically correct understanding of concepts among the students. Discussion and argumentation is known to support learning in science (Osborne, 2012), and was used as a part in the intervention.

METHOD

Prospective primary school teachers' misconceptions from different areas of science were sampled, using a multiple-choice questionnaire. The students (N=63) answered the questionnaire during their first class session in the chemistry/physics course. Here we present data focusing on the water cycle. Data were also collected during the course to probe the existence of possible misconceptions concerning water cycle after a teaching

sequence as well as after the small-group discussions. This was done using a mobile-based response system (the Socrative tool). A concept cartoon was used as a starting point for the group discussions. Students were asked to argument why an answer was true and/or why the other answers cannot be true. The small groups of 3-4 students were randomly assigned. The small group discussions (N=12) were taped and transcribed.

RESULTS

The students were asked about the content of the bubbles in boiling water; results from the pre-test before the course, shows that only 20% of the students answered correct, "water vapour", as shown in Table 1. When students attended the third lecture, they were asked the same question in the beginning of the lesson as in the pre-test. The results show that 27,0% of the students answered water vapour. During the lecture, students were discussing the bubbles in boiling water. The discussions reveal that although students are using the correct concepts their understanding of them is not correct as seen from Excerpt 1 and 2. After the discussion, students were asked the same question again as in the beginning, they were also asked which bonds are broken and if boiling is a phase change or a chemical reaction. As can be seen in Table 1 less than 50% of the students chose the right answer to these both questions.

DISCUSSION AND CONCLUSION

The results show that prospective primary school teachers have the same misconceptions as younger children they are going to teach. Our results are in line with the results reported by Osborne & Cosgrove (1983). The misconceptions seem also to be resistant. After the lecture, which included small group discussions, we can see a 10% increase among those choosing the right answers. At the same time when looking at the discussions we see

Students become aware of their misconceptions and they are more focused on what they are going to do in the experiment. They might continue the discussions and argumentations during their laboratory work. In Group 2 the discussion took place after the laboratory work and the discussion may have less impact then. We are now in the middle of the process of analysing the small group discussions to see how the concepts are discussed in the two

Table 1. Students choice of answer to multiple choice questions before and after discussion

Pre-test before course	**Before discussion**	**After discussion**		
Water Vapor	Water Vapor	Water Vapor	Breaking of the H-bond	Phase change
20,0%	27,0%	30,16%	46,0%	41,3%

A. Water consists of H and O. If the bubbles contain only O then H would be left, they would separate.
B. They would then contain only O that is not right.
C. No
A. Water vapor...from liquid ...when it evaporates it becomes gas.
B. Water vapor, but what does water vapor contain
C. Exactly what is it?
A. If we think about water on a micro level the H_2O-molecules are liquid and quite near each other. When they become gas they hover back and forth, it´s the same substance but in another phase.
B. But what do we think about vapor and air? How do we separate them?
A. Vapor then turn into air, when it comes up from the water. Isn´t that the humidity of air?
B. Yes
C. Yes

Figure 1. Excerpt from a discussion between three students A, B and C.

Figure 2. Excerpt from a discussion between three students D, E and F.

REFERENCES

Allen, M. (2014). *Misconceptions in primary science*. (pp. 115-125). New York: McGrawHill.

Ball, D. L., & McDiarmid, G. W. (1990). *The subject matter preparation of teachers*. In Houston W., R. (Eds.) Handbook of research on teacher education (pp. 437-449). New York: Macmillan.

Finnish National Board of Education (2016). National Core Curriculum for Basic Education 2014. Helsinki: Finnish National Board of Education.

Gooding, J., & Metz B. (2011). From misconceptions to conceptual change. *The Science Teacher*, 34-37.

Osborne, R., J. (2012). *The role of argument: Learning how to learn in school science*. In Fraser, B., J., Tobin, K., G. & MvRobbie, C., J. (Eds.) Second International Handbook of Science Education Vol 2 (pp. 933-949). Dordrecht, Heidelberg, London, New York: Springer.

Osborne, R. J., & Cosgrove, M.M. (1983). Children´s conceptions of the changes of state of matter. *Journal of Research in Science Teaching*, 20(9), 97-110.

Schulman, L., S. (1986) Those Who Understand: Knowledge Growth in Teaching. *Educational Researche*r, Vol. 15, No. 2, 4-14