2.39 The Treasure in My Drawer – What to Do with My Old Cell Phone?

Darius Schindler and Silvija Markic – University of Bremen, Germany;
Carola Hauk – OS Findorff, Germany;
Evelyn Jäschke-Behrendt – Albert-Einstein-OS, Germany;
Marina Wilkes – Wilhelm-Olbers-OS, Germany

Introduction

Since the last school reform in the German Federal State of Bremen, there are two types of schools: (i) grammar schools (Gymnasium) and (ii) secondary comprehensive schools (Oberschule). There is a long tradition of grammar schools in Bremen, and as such there are plenty of materials available for this type of school. Oberschule now offer a new governmentally mandated syllabus, with science being offered as an integrated subject until grade 9 (age 13-14). This is new for both the German schools and the teachers. However, teachers have not been educated to teach this new integrated science subject, with most only having studied one or two of the three traditional science subjects (biology, chemistry and physics). Furthermore, no lesson plans exist for this type of lesson.

Starting from this point, the PROFILES group in Bremen decided to develop teaching materials for integrated science lessons in the Oberschule. Different group of science teachers and science educators are developing new lesson plans which fit the new syllabus for Bremen Oberschule. The present paper is based on a lesson plan developed within the framework of the PROFILES project. The lesson plan is about the topics of metals, and reduction and oxidation within the topic "Treasure of Earth" and is for grade 7 (age 12-13). The developing the background of the lesson plan, the lesson plan itself and the evaluation of its implementation, are presented.

Participatory Action Research

This project is based on Participatory Action Research (PAR) in science education (Eilks & Ralle, 2002). PAR is a joint effort between teachers and science educators for curriculum development, educational research, and classroom innovation.

This paper reports on a group of three chemistry/physics teachers, who are collaborating with a university researcher in a PAR project within PROFILES. The group meets regularly, every three to four weeks, and has been developing the lesson plan. At the group meetings, changes in teaching practice are proposed, negotiated, and refined so that they can be tested and applied in classroom situations, before being reflected upon and improved.

Description of the lesson plan

The lesson plan was developed following the ideas of socio-critical and problem-oriented approaches to chemistry teaching (Marks & Eilks, 2009). More detail on these approaches can be found in Figure 1. These approaches were deemed sufficiently close to the PROFILES 3 stage model as to be taken to be the same.

During the initial textual approach and problem analysis, students work on a developed newspaper article. The article poses a question about having a treasure in a drawer, because of not taking care of old cell phones. Furthermore, the article is based on content that is new for the students. The students are expected to develop questions that should be answered during the science lesson. Following this, students work on clarifying the chemistry background in a laboratory environment. Students are evaluating different metals and their properties. This is followed by an egg-race experiment where students develop an experiment for the production of copper starting from copper oxide.

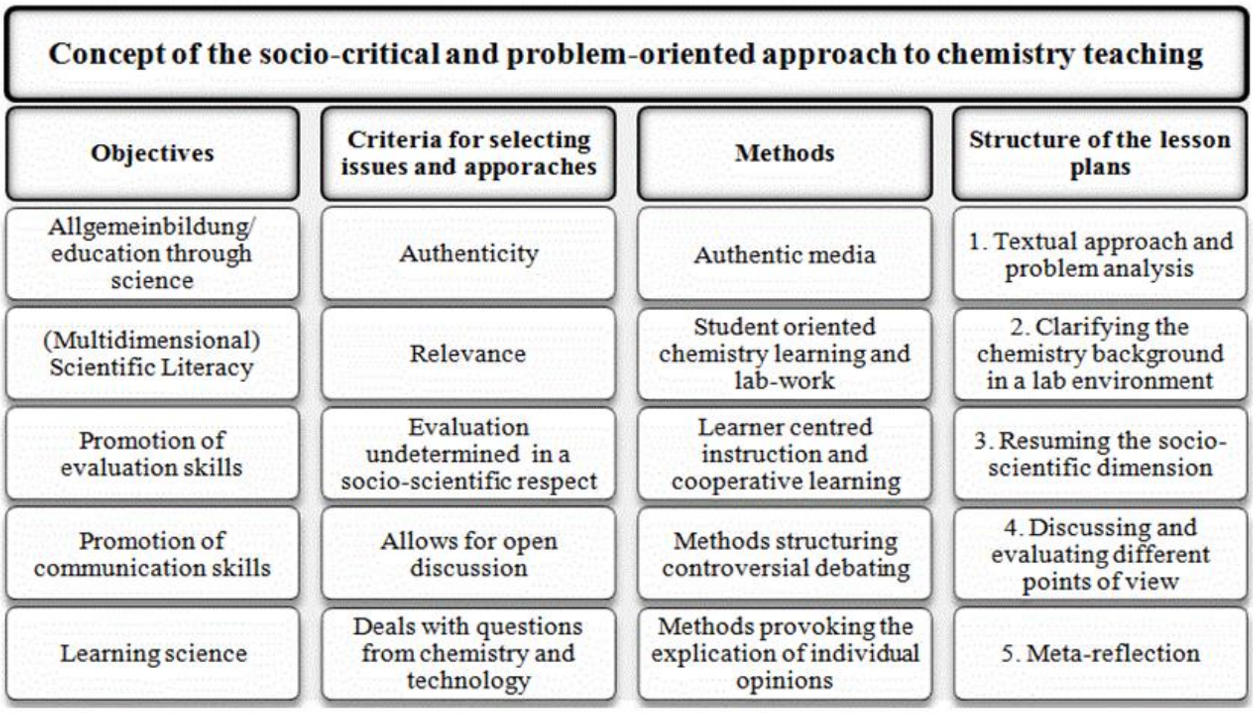

Figure 1. Socio-critical and problem oriented approach in chemistry teaching (deemed to be very similar to the PROFILES 3 stage approach) ©Marks & Eilks, 2009

Furthermore, in this phase, students are provided with texts about the production and recycling of gold and aluminium. In the next phase, students prepare for the discussion through a role play. In the role play, four roles are represented, with each standing for a different viewpoint
about how to handle old cell phones. Finally students reflect on the role play and the lesson plan itself.

Implementation and Results

The testing and evaluation phases took place in four learning groups (grade 7; age 12-13) with a total of 92 students. The four groups were continuously accompanied and observed by university researchers. After each lesson was finished, self-reflection was performed by the teachers and documented using narrative reports. These experiences were regularly discussed by the entire PAR group. All students took a cognitive test and were asked to fill in a student feedback tool consisting of a combination of both an open and a Likert-type questionnaire. Finally, the MoLE questionnaire prescribed by PROFILES, was collected from all four groups.

All teachers welcomed the experimentation when it came to applying the developed lesson plan. After carrying out and reflecting on the lessons, the teachers were very enthusiastic about the lesson plan. They were happy with the product they had produced, with the openness of the lessons and with the overall motivation of their students. This reaction consistently fitted with the feedback given by the students. The learners judged the lessons to be remarkably good. The students said that they had more fun during the lessons than in other lessons. This is also supported by the MoLE questionnaire. Furthermore, they enjoyed the discussion at the end of the lesson and found it was easy for them to participate. When it came to the cooperative learning, students liked the idea of teaching other students and being responsible for their own and the other students' knowledge. The results of the MoLE questionnaire supported this point as well. When students were asked about their opinion about learning the content during the lessons, more than 70% of them agreed that they learned a lot. Students agreed that they had studied an interesting topic, which was also important for

their lives and their future. Finally, almost 90% of the students agreed that the lessons made them think more about their environment and their behaviour, especially when it came to handling old cell phones. This point was triangulated by the MoLE questionnaire.

Furthermore, the results of the MoLE questionnaire showed that the students had more time during the lesson to think about the content of each lesson. The same questionnaire showed that students were more active during the lessons and tried more frequently to participate and understand the subject.

Finally, the expectations of the teachers, which had been set down in the form of a pre-structured test, were exceeded by the students, most of whom achieved unexpectedly positive cognitive results.

Conclusions and implications

The process of collaborative development, utilising the model of PAR, was new for both chemistry/physics teachers and students. Each group dealt with it in an autonomous fashion, aided by the newly-created teaching materials based on the lesson plan. The students were able to co-operatively manage the lesson plan, despite initial doubts expressed by some of the teachers. More important, the lessons made students more conscious about the environmental problems and issues, made them think about these issues and maybe change their behaviour when faced with handling old cell phones.

The initial data seems very promising and motivating for the implementation of further teaching approaches, which are based on the socio-critical and problem-oriented approach on chemistry teaching.

Cooperative efforts between science teachers and teacher educators appear to offer attractive possibilities for developing new teaching materials in chemistry/science lessons. Furthermore, cooperation between experts stemming from multiple disciplines seems to offer a promising path for creating motivating and highly attractive learning environments, which allow science teachers to use successfully socio-critical and problem-oriented approach in PROFILES science teaching. Finally this indicates that the work of the group is a promising way of conducting CPD (Mamlok-Naaman & Eilks, 2012).

References

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