A STUDENT-ACTIVE APPROACH TO SCIENCE MODELS AND REPRESENTATION – A WAY TO IMPROVE SCIENTIFIC LANGUAGE OF SECOND LANGUAGE LEARNERS?

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Recent years changes have taken place in European and Swedish schools. The classroom situation has in many schools changed from single-lingual to multilingual. A larger number of students in Sweden are in the beginning of speaking Swedish but who participate in the same teaching as native speakers. The science disciplines, primarily chemistry, are experienced as difficult by many students because chemistry is abstract and contain many subject-specific concepts. It is a great challenge for teachers to offer teaching adapted to all students regardless of first language.

This study intends to investigate how a student-active approach to representations and models in chemistry might be a way to develop the scientific language of second language learners. Active student approach to properties of polymers is a concrete way to visualize and discuss chemical bonding, often perceived abstract otherwise. The study is conducted in a multilingual class, with eight different first languages represented, in upper secondary school in Sweden. The teacher and majority of the students speak Swedish as their first language. Since several languages are represented students cannot use code switching or translanguaging when learning chemistry, to the same extent as in bilingual contexts. In this study, learning is approached as a sociocultural activity focusing on how scientific language develop through interaction with others. Data is collected from classroom practices using audio and video recordings and followed up with semi-structured interviews. Language is analysed from the perspective of adequate scientific language and correct use and understanding of subject-specific concepts using a thematic coding approach. To increase validity intra-rater reliability are used. As the amount of research on how second-language learners use subject specific language while working with models and representations in chemistry is limited, this study might provide useful information about new strategies to improve scientific language of second language learners.

Keywords: The role of Language in Science Education, Modeling-based Learning, Multilingualism

INTRODUCTION

Today many teachers find major challenge in teaching chemistry since changes have taken place in European and Swedish schools. The development has contributed to increased cultural and linguistic diversity in society as well as in schools. This will most probably lead to major challenges for the educational systems especially teaching older students at upper secondary level where the degree of abstraction and the importance of a subject-specific language increases. At the same time, many of the students have only been practicing the second language for a limited time. One area of research and development is how teachers can offer the best learning conditions for all students whilst working in schools with linguistically diverse student populations. I argue we need to find strategies to include all students in education. Nowadays poor academic achievements might lead to exclusion in society.

To master the different science disciplines in general and chemistry in particular is considered difficult by many students, especially as chemistry is abstract and contains many subject-specific concepts. The complex and, in many cases, abstract content of chemistry make both teaching and learning difficult since it is hard to visualize the chemistry that is taught (Arroio & Campos Santos, 2016). It is common that the learning of chemistry and subject-specific concepts occur in multilingual groups. This often means that some of the students learn the new abstract concepts on a second language in a context where the teaching takes place on
the teacher’s first language, which is also the first language for the majority of the students. According to the Swedish Agency for Education, students taught in their second language show lower results than students taught in their first language (Swedish Agency for Education, 2018). Turkan and Liu note that if students do not have necessary language skills in the language of teaching, they often have problems obtaining access to the science content (Turkan & Liu, 2012).

Previous studies have shown offering a more student-active approach to chemistry, group discussions and inquiry etc., leads to build and deepen the student’s use of scientific language and chemistry understanding (Ehdwall & Wickman, 2018; Abir & Judy Dori, 2013). However, these studies are conducted in bilingual contexts where code switching and translanguaging are important tools in the learning process. Studies show that when second language students code switch between their first and second language it can have an essential impact on their language development and learning within the subject-specific content (Karlsson, Nygård Larsson, & Jakobsson, 2016). Furthermore students in the same bilingual context can use translanguaging, students’ abilities to relate and contextualise the science content to prior experience, which has a positive effect on understanding within scientific education (Karlsson, Larsson, & Jakobsson, 2018).

In this study, learning will be approached as a sociocultural activity, where actions are formed by mediating tools encountered in social communities. According to Vygotskij the most important tool in the learning process is language, “the tool of tool” (Vygotskij, 1978). A learning situation should be cognitively demanding with a clear support from the teacher and a content that enables the students to use language in language-developing contexts (Gibbons, Heljesten, Sävström, & Sjöqvist, 2018). This kind of learning situation is rare in the classroom (Lemke, 1990). It is not enough for the students to listen to when the teacher speaks the scientific language. The students' own active and purposeful use of language is fundamental for them when learning the scientific language. Because this is crucial for all students, it might be even more important for second language students. “Learning science means learning to talk science (Lemke, 1990, p. 1). Many studies show that it takes a long time to develop a scientific language, it is a long ongoing process for all students. This of course also applies to the students who have the instructional language as their first language, but it also poses major challenges for the students who are second language learners. According to Thomas and Collier (1997) it takes 5-10 years before second-language learners can take part in the education on the same terms as students taught in their first language (Thomas & Collier, 1997). Furthermore teachers are rarely educated to meet the needs of multilingual pupils and mainly conduct tuition in the language used by the majority of students (Bunar, 2015).

With the above said the idea of studying development of scientific language with second language students in a multilingual context was evolved. The aim of the study is to investigate; how does students as active models and representation makers affect their scientific language development. The research question this study intends to answer is “How is scientific language development of second language learners affected by a student-active approach to science models and representations?”

**METHOD**

The participating grade 11 upper secondary class consists of 23 students, aged 17-20. The class is multilingual, with eight different first languages represented, eight students have Swedish as their second language and fifteen students have Swedish as their first language. The students have a student active approach to the properties of polymers in general and chemical bonding in particular. Data is collected from classroom practices using audio and video recordings and followed up with semi-structured interviews. Data is analysed from the perspective of adequate scientific language and correct use and understanding of subject-specific concepts using a thematic coding approach. To increase validity intra-rater reliability are used.
RESULTS

Data analysis has started this January, results will be presented at the conference.

DISCUSSION

Molander and Wickman opine that studies about language use of multilingual pupils in scientific subjects are frequent conducted in situations where teachers and students speak the same minority language (Ünsal, Jakobson, Molander, & Wickman, 2016) Many studies concern younger students at primary school and in a bilingual context. This study refers to students in upper secondary school in a multilingual context. The teacher and majority of students speak Swedish as their first language and a minority of the students speak Swedish as their second language. Active student approach to properties of polymers is a concrete way to visualize and discuss chemical bonding, often perceived abstract otherwise. As the amount of research on how second-language learners use subject specific language while working with models and representations in chemistry is limited, this study might provide useful information about new strategies to improve scientific language of second language learners.

REFERENCES


