

DEVELOPMENT OF SCIENTIFIC LITERACY: A MULTIDISCIPLINARY STUDY IN MULTILINGUAL SECONDARY SCHOOLS

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Around the world, programs have been developed for science teachers' work on literacy in multilingual settings with the assumption that science teachers need an understanding and a repertoire to move between daily and scientific discourses. This poster presentation reports from a project which aims to gain a better understanding of the development of literacy in science teaching through the study of meaning construction in multilingual secondary classrooms in which teacher, students and texts interact. To that end, leading experts in the field of text analyses, science pedagogy, second language learning and educational linguistics, join their forces in a double case study. These different perspectives on scientific literacy are starting point for small-scale interventions that analyses the interaction of teacher, student and task characteristics. Data is generated through mixed-method approach and include video recording of teachers planning meetings and classroom practice (whole class and student group work) along with questionnaires. Furthermore is students' written work collected and interviews with teachers and focus group interviews with students.

The quantitative data comprises of multiple-choice tests where three types of words chosen from students' textbooks are probed: science concepts, homonyms and general academic words. The preliminary results indicate that time spent in the Swedish school system is decisive; it is almost a linear correlation between results on word tests and the time the students have learned Swedish. Furthermore, it seems that the general academic words raise the greatest challenges. The analysis of the teachers' professional development make use of the interconnected model for professional growth (Clarke & Hollingsworth, 2002) and the results indicate that although the teachers had extensive experience in teaching multilingual students they broaden their competence with new insights an teaching strategies.

Keywords: Scientific Literacy, The role of Language in Science Education, Teacher Professional Development

INTRODUCTION

The role of language for schooling is a broad field in which general aspects of academic language use can be discerned from daily communicative language, in terms of contextual support and cognitive demands (e.g. Cummins 1984; van Dijk & Hajer, 2017). In recent years the connections between academic language functions, vocabulary, grammar and text structures have been revealed as by Schleppegrell (2016) in relation to content based language education. From a sociocultural perspective, students develop these academic literacy skills through participation in activities with a more knowledgeable 'other' (e.g. the teacher), who guides them into scientific ways of thinking and talking. The construction of what Vygotsky (1986) called 'scientific concepts' requires abstract understanding, as compared to daily concepts formation. The teacher mediates the students' understanding of scientific phenomena and concepts and enables them to become participants of new practices (Mortimer & Scott 2003). In this sense, language learning and content learning are inseparable. In addition to general characteristics, each school subject has its specific functional language use that is characteristic for that very field, both in oral and written aspects. In his seminal work *Talking Science*, Lemke (1990) elaborates this approach for the teaching of science mainly by focussing three aspects of language: vocabulary, grammar and semantic patterns. Becoming a central and legitimate participant in the scientific classroom discourse requires discernment and appropriation of all three language

aspects (Lemke, 1990). The construction of meaning takes place not only through verbal and linguistic resources, but also even through images, graphs, diagrams etc (Kress & Van Leeuwen 2006) and the ability to switch between every day and scientific registers, discursive mobility (Nygård Larsson, 2011) is an essential competence.

The aim of this poster presentation is to investigate the development of literacy in science teaching through the study of meaning construction in multilingual secondary classrooms in which teacher, students and texts interact. The focus are on the one hand teachers' professional development (Clarke & Hollingsworth, 2002; Lund Nielsen, 2012) and students meaning making processes in relation to content based language education (Love, 2010; Schleppegrell, 2016).

METHODOLOGY

Within the framework of Systemic Functional Linguistics (SFL) and so called genre pedagogy (Halliday & Martin 1993, Rose & Martin 2012) interventions specifically focus on structural and lexico-grammatical characteristics of school text genres, relating interaction to writing and reading. They all show that a combination is needed of teacher training and teaching material development. For secondary science however, such research designing literacy-focused materials and teacher training would first require a better understanding of scientific literacy practices.

We engaged leading experts in the field of text analyses, science pedagogy, second language learning and educational linguistics, join their forces in a double case study. These different perspectives on scientific literacy are starting point for small-scale interventions that analyses the interaction of teacher, student and task characteristics. We work in close collaboration with two teams of science teachers in two towns in Sweden. Data is generated through mixed-method approach and include video recording of teachers planning meetings and classroom practice (whole class and student group work) along with questionnaires. Furthermore is students' written work collected and interviews with teachers and focus group interviews with students.

PRELIMINARY RESULTS

The analysis of the teachers' professional indicate that although the teachers had extensive experience in teaching multilingual students they broaden their competence with new insights on students ways of interpret words and by that tested new teaching strategies. Their planning sessions show an increasing awareness of combining subject knowledge with language strategies and a beginning awareness of the dynamic relations between every day and scientific registers (rather than a static one). This is also discernable in classroom practice, since the teachers encourage students' to talk, write and reason within a continuum between registers, however the students show a successive movement towards scientific articulations.

The quantitative data comprises of multiple-choice tests where three types of words chosen from students' textbooks are probed: science concepts, homonyms and general academic words. The preliminary results indicate that time spent in the Swedish school system is decisive; it is almost a linear correlation between results on word tests and the time the students have learned Swedish. Furthermore, it seems that the general academic words (for example depends on, consist of, generate) that raise the greatest challenges.

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