Multilingual students use both their first and second languages when they relate subject-specific words and concepts semantically to each other in science learning. The subject-specific words and concepts are often expressed in second language (Arabic), while the explanatory, descriptive and interconnecting words and phrases are expressed in first language. In a semantic perspective, it may be a powerful resource in their meaning-making processes in science. Moreover, in joint negotiations about the expressions in their second language (Swedish), the students move in linguistic loops both between Swedish and Arabic, and between everyday language and a more subject-specific language.

Both the first and second languages are used to develop understanding of paradigmatic relationships between words and concepts that students encounter in science classrooms. Multilingual students use both their first and second languages when they relate subject-specific words and concepts semantically to each other in science learning. The subject-specific words and concepts are often expressed in second language (Swedish), while the explanatory, descriptive and interconnecting words and phrases are expressed in first language (Arabic).

Multilingual students often use both their first and second languages when they relate the science content to prior experience. The everyday experiences are often expressed in first language (Arabic), while the subject-specific language that describes the abstract science content is often expressed in second language (Swedish). In this way, the students move in linguistic loops both between Swedish and Arabic, and between everyday language and a more subject-specific language.

The aim of the study is to investigate whether – and if so, in what ways – a translanguaging (Wei, 2011) science classroom, in which students are enabled and encouraged to use all available language resources (Garcia & Wei, 2013), benefits science learning. More specifically, the study analyses multilingual students' authentic use of both their first and second languages as tools for understanding and to relate the science content to prior experience.

Research questions
- To what extent do multilingual students use available language resources in a translanguaging science classroom?
- In what ways can a translanguaging classroom have an impact on students' learning in science?
- In what ways does the students' use of both their first and second language have an impact on the ability to develop paradigmatic relations of subject-related concepts and words?

Method
In order to capture and collect the students' authentic use in a translanguaging science classroom, an ethnographic data collection and research design was used (e.g. Marcus, 1995; Willis & Trondman, 2003). This means that the strategy was a non-participant observation and sought to avoid interfering with the students' and teachers' actions. The data material comprises of recordings from four video cameras and audio recorders, the researchers' field notes and the collection of different types of students' written texts and other teaching materials.

Linguistic loops
Multilingual students often use both their first and second languages when they relate the science content to prior practical experience. The everyday experiences are often expressed in first language (Arabic), while the subject-specific language that describes the abstract science content is often expressed in second language (Swedish). In this way, the students move in linguistic loops both between Swedish and Arabic, and between everyday language and a more subject-specific language.

Translanguaging practice in science education
Annika Karlsson

The results illustrate the ways in which a translanguaging science classroom constitutes a resource in joint negotiations of the scientific content and its related language for multilingual students, and benefits the students' ability to relate and contextualize the science content to prior experience. The multilingual students move in a kind of linguistic loop (Karlsson et al., 2016) between everyday expressions in their mother tongue (Arabic), and more subject-specific language that describes the abstract science content.

The creation of translanguaging science classrooms, in which students' experiences and diverse cultural and linguistic resources interweave with school science, and in which multilingual students are enabled and encouraged to use all available language resources, has important implications for science education.

Publications