IncluSMe

Intercultural learning in Science and Mathematics initial teacher education

Module 9

RELEVANCE OF LANGUAGE IN SCIENCE EDUCATION

Co-funded by the Erasmus+ Programme of the European Union

IncluSMe
Intercultural learning in Science and Mathematics initial teacher education

This module is based on the work within the project Intercultural learning in mathematics and science initial teacher education (IncluSMe). Coordination: Prof. Dr. Katja Maaß, International Centre for STEM Education (ICSE) at the University of Education Freiburg, Germany. Partners: University of Nicosia, Cyprus; University of Hradec Králové, Czech Republic; University of Jaen, Spain; National and Kapodistrian University of Athens, Greece; Vilnius University, Lithuania; University of Malta, Malta; Utrecht University, Netherlands; Norwegian University of Science and Technology, Norway; Jönköping University, Sweden; Constantine the Philosopher University, Slovakia.

The project Intercultural learning in mathematics and science initial teacher education (IncluSMe) has received co-funding by the Erasmus+ programme of the European Union under grant no. 2016-1-DE01-KA203-002910. Neither the European Union/European Commission nor the project's national funding agency DAAD are responsible for the content or liable for any losses or damage resulting of the use of these resources.

IncluSMe project (grant no. 2016-1-DE01-KA203-002910) 2016-2019, lead contributions by Evagorou, M. and Mousoulides, N., University of Nicosia, Cyprus.
CC-BY-NC-SA 4.0 license granted (find explicit terms of use at: https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en)

ICSE
International Centre for STEM Education

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education

Co-funded by the Erasmus+ Programme of the European Union

General overview and aim

The main aim of this module is to tackle the gap between pupils' deficient (second) language competencies and their capacities in science. The module focuses on preparing pre-service teachers on how to support pupils, who are at different stages of acquiring a second language, in learning science in this second language – and prepare students in ITE in this respect.

The module will address learning and teaching mechanisms in multicultural classrooms that hinder concept development in science. Pre-service teachers will learn the role of language in science, and become aware of difficulties that students face with language in science. They will work with case scenarios of classrooms with students that either do not speak the language, or have limited knowledge of it and will design lesson plans to work around these issues.

This module is part of:

- Mathematics and Science Education dimension: pedagogical issues, in particular in respect to dealing with diversity in classrooms.

Co-funded by the Erasmus+ Programme of the European Union

Relevant topics

In this module high emphasis is set on introducing the relevance and role of language in science and how language, and the different cultural background can hinder learning. Pre-service teachers will learn about students' difficulties with language in science and also about frameworks and activities to support students from different language and cultural background. We will also point to the following exemplary challenges in connection to the topic:

- Different use of language in everyday life and science
- Western science and cultural congruency
- Different framework supporting learners from different backgrounds in science
- US programs aimed at supporting Latin speaking students in science and lessons learned.

Learning Outcomes

Students will acquire:

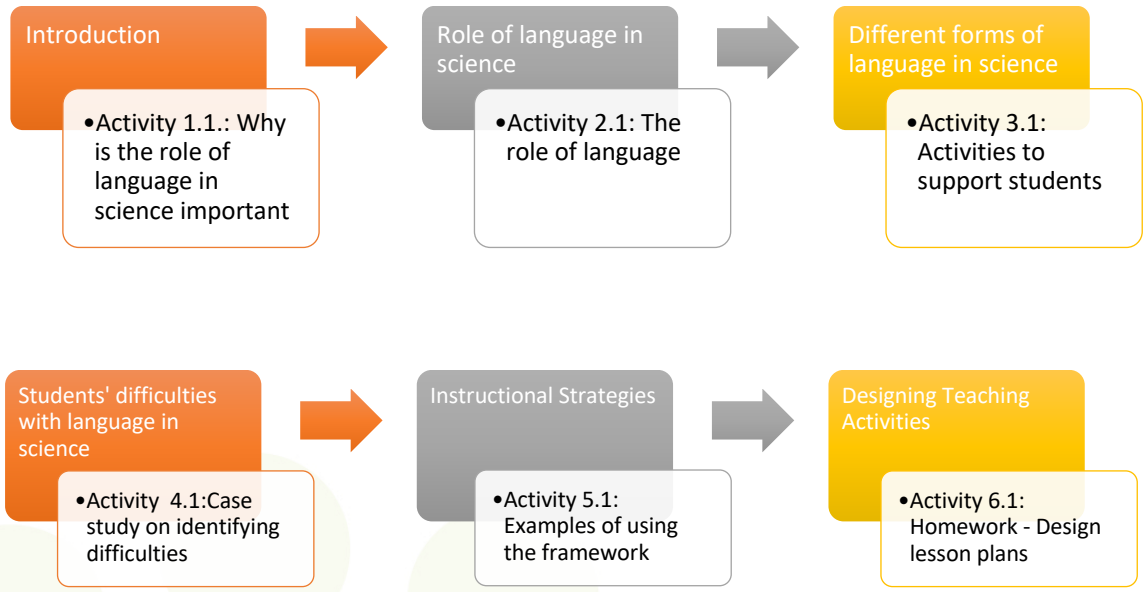
- An awareness of the role and relevance of language in science (Activity 1.1 and all other activities)
- An understanding of the difficulties that students face with language in science, and ways to support them (Activity 2.1)
- Knowledge about the different types of language in science and how to support students in these (Activity 3.1)
- Experience frameworks used to support students' difficulties with language in science (Activity 4.1 & Activity 5.1.)
- Pedagogical strategies to help them design lesson plans to teach science to students from culturally diverse backgrounds (Activity 6.1- Homework)

Co-funded by the Erasmus+ Programme of the European Union

Flowchart and Module plan

This module involves a number of sections, structured in 3 tasks, including 3 face-to-face 40 min sessions and 45 mins of homework. It includes lecture parts, group discussions, student presentations and readings and homework. The structure is as follows:

- Introduction: 15 min
- What is the role of language in science: 25 min
- Different forms of language in science: 30 min
- Difficulties students face with language in science: 30 min
- Instructional strategies: 30 min
- Designing teaching activities for students from diverse backgrounds:45 min



Co-funded by the Erasmus+ Programme of the European Union

1. Introduction into the topic "Relevance of language in science" (15 mins)	
1.1. Why is the role of language important?	
	Duration: 15 minutes
This is a "warm up" activity. The intention is to get pre-service teachers start thinking about difficulties that students from diverse language or cultural backgrounds might face in a science classroom.	
This session contributes to the achievement of the following learning outcomes: • An awareness of the role and relevance of language in science (Activity 1.1)	

II. The role of language in science	
2.1. The role of language in science	
	Duration: 20 minutes
In this session the teacher educator presents a theoretical background on the role of language in science in general (not specifically for students with diverse language or cultural backgrounds) and engages students in a discussion on how they would deal with a classroom with specific characteristics to teach Sound in a science lesson. The pre-service teachers are provided with a scenario that they are asked to discuss.	
This session contributes to the achievement of the following learning outcomes: • An awareness of the role and relevance of language in science (Activity 2.1)	

III. Different forms of language in science	
3.1. Activities to support students	
	Duration: 30 minutes
In this session the teacher educator presents the different forms of language in science (oral, written, spoken) and the different types of language and provides examples from	

Co-funded by the Erasmus+ Programme of the European Union

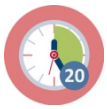
each category. Students are then asked to read the short report from Evagorou (2018) describing activities to support students in each of the categories and share their notes.

This session contributes to the achievement of the following learning outcomes:

- Knowledge about the different types of language in science and how to support students in these (Activity 3.1)

IV. Students' difficulties with language in science

4.1. Activities to support students



Duration: 20 minutes

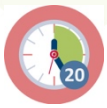
In this session the teacher educator presents a number of difficulties that students face with language in science by providing specific examples. Pre-service teachers are then asked to work with a scenario from a classroom to think about their own practice in the classroom.

This session contributes to the achievement of the following learning outcomes:

- Knowledge about the different types of language in science and how to support students in these (Activity 4.1)

V. Instructional strategies

5.1. Examples of using the frameworks



Duration: 30 minutes

In this session the teacher educator presents a number instructional strategies and frameworks that people have used to support learners whose language in different from the language of instruction in science.

This session contributes to the achievement of the following learning outcomes:

- Experience frameworks used to support students' difficulties with language in science (Activity 5.1)

Co-funded by the Erasmus+ Programme of the European Union

VI. Designing Teaching Activities	
6.1. Homework – Design Lesson Plan	
	Duration: 30 minutes
In this session the teacher educator presents a scenario to the pre-service teachers and asks them to prepare a lesson plan to teach science to a class with students who do not speak or understand the language of instruction and apply the framework from the previous lesson to support the students.	
This session contributes to the achievement of the following learning outcomes: • Pedagogical strategies to help them design lesson plans to teach science to students from culturally diverse backgrounds	

Materials and resources

Presentation 9 (pptx). Teacher Educator. Relevance of Language in Science Education

Readings and students' handouts

Access to computers for internet research and collaborative work

Granularity

- Skip activity 2.1
- Skip part 6, Activity 6.1

Co-funded by the Erasmus+ Programme of the European Union

References

Aikenhead, G.S. (1996). Science Education: Border crossing into the subculture of science. *Studies in Science Education*.

Evagorou, M. (2018). Short report of the relevance of language in science.

Evagorou, M., Erduran, S. & Mantyla, T. (2015). Knowledge Generation and Communication through 'Seeing' Science: The Role of Visual Representations in Scientific Practices. *Journal of STEM Education*, 2(1), 1-13. doi:10.1186/s40594-015-0024-x

Evagorou, M. & Osborne, J. (2010). The role of language in the learning and teaching of science (pp. 135-157). *In J. Osborne and J. Dillon (eds), Good Practice in Science Teaching*, 2nd edition. McGraw Hill.

Evagorou, M. & Osborne, J. (2010). The role of language in the learning and teaching of science (pp. 135-157). *In J. Osborne and J. Dillon (eds), Good Practice in Science Teaching*, 2nd edition. McGraw Hill.

Keys, C.W. (1999). Language as an indicator of meaning generation: An analysis of middle school students' written discourse about scientific investigations. *Journal of Research in Science Teaching, 36*(9), 1044–1061.

Lee, O. (2003). Equity for linguistically and culturally diverse students in science education A research agenda. Teachers College Record, 105, 465-489.

Meyer, X. & Crawford, B. (2011). Teaching science as a cultural way of knowing: merging authentic inquiry, nature of science, and multicultural strategies. *Cultural Studies of Science Education*.

Wellington, J., & Osborne, J. F. (2001). Language and Literacy in Science Education. Buckingham: Open University Press.

Further readings

Buxton, C. A. (2006). Creating contextually authentic science in a "low-performing" urban elementary school. *Journal of Research in Science Teaching*, *43*(7), 695–721. https://doi.org/10.1002/tea.20105

Co-funded by the Erasmus+ Programme of the European Union

Carlsen, W. S. (2013). Language and Science Learning. In S. Abell, K. Appleton, & D. Hanuscin (Eds.), *Handbook of Research on Science Education* (pp. 71–88). Routledge. https://doi.org/10.4324/9780203824696-7

Cazden, C. (2001). *Classroom Discourse: The Language of teaching and learning*. (Heinman, Ed.). Portsmouth, NH.

Lee, O., & Fradd, S. H. (1996). Literacy skills in science learning among linguistically diverse students. *Science Education*, *80*(6), 651–671. https://doi.org/10.1002/(SICI)1098-237X(199611)80:6<651::AID-SCE2>3.0.CO;2-I

Lee, O., Luykx, A., Buxton, C., & Shaver, A. (2007). The challenge of altering elementary school teachers' beliefs and practices regarding linguistic and cultural diversity in science instruction. *Journal of Research in Science Teaching*, *44*(9), 1269–1291.

Mercer, N., & Littleton, K. (2007). *Dialogue and the Development of Children's Thinking*. Routledge.

Moje, E. B., Collazo, T., Carrillo, R., & Marx, R. W. (2001). "Maestro, what is "quality"?: Language, literacy, and discourse in project-based science. *Journal of Research in Science Teaching*, *38*(4), 469–498. https://doi.org/10.1002/tea.1014

Moore, F. M. (2008). *The Role of the Elementary Science Teacher and Linguistic Diversity*. *Source: Journal of Elementary Science Education* (Vol. 20).

No, J., & Akeinhead, G. (1999). Transcending cultural borders: Implications for cultural teaching. *Research in Science & Technological Education*, *17*, 45–66.

Assessment

Assessment for this module can be connected to the design and presentation of the lesson/teaching-activity (Activity 6.1).
Students can hand in their lesson plan along with the reflection on the process of designing the lesson and activities (see questions in Activity 6.1).
You can use this to assess to what extend pre-service teachers understood and used different aspects of the role and relevance of language in science education.

Co-funded by the Erasmus+ Programme of the European Union