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Flipped classroom and language in mathematics teaching

Stefanie Schallert¹ and Konrad Krainer²

¹Bundeshandelsakademie 11, Vienna, Austria, stefanieschallert@gmail.com

²Alpen-Adria-Universität Klagenfurt, Austria

Introduction and theoretical background

We present an action research project of a young secondary mathematics teacher introducing the “flipped classroom” approach into her teaching. The project was implemented and evaluated within the context of a larger initiative where teachers were supported by experienced teacher educators. During the project, the issue of language arose. The poster, written by the teacher and supported by the initiative leader, documents the teachers’ struggle in critically reflecting her project and finding ways to improve her teaching, in particular focusing on the issue of language.

Lage, Platt and Treglia (2000) defined the key-term “inverting” of flipped classroom as follows: “Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa” (p. 32). Therefore, the flipped classroom is a newer teaching approach, where students have to watch videos with teacher instructions as homework most of the time, and the time of the lesson is mostly used for active, group-based or autonomous problem-solving activities.

The Project: Flipped classroom and its implications for language

Participants in this project were 180 students (grades 9-11) at an urban college of business administration in Austria. The flipped classroom model was implemented in six mathematics classes throughout the whole schoolyear 2016/17. The used 5-10 minute interactive videos were produced by the teacher (first author). The goals of the project were to give students the chance to control their own learning, to focus more on understanding than on recall and to reduce teacher lectures to open in-class time for implementing different teaching approaches.

During the school-year, the advisor of the project recommended to also focus on communication and the use of the flipped classroom model (flipping) in mathematics. There are only few research studies that look at these specific topics. The study of Murphy, Chang and Suaray (2016) showed that flipping a linear algebra course improved the students’ skills in communicating mathematical ideas regarding the subject topic.

Investigating one’s own teaching

The main reason for the teacher’s investigations was to get more knowledge about her (flipped classroom) mathematics teaching in order to interpret and improve it (in line with the principles of action research, see e.g., Altrichter et al., 2008). An anonymous online questionnaire with 12 statements was used at the end of the first semester to explore students’ attitudes towards the use of the flipped classroom in their learning of mathematics. The issue of language arose during the project and the idea about the poster presentation with reflections on the process much later. Thus, the methodology did not include special questions on language at that stage. However, there were relevant data related to that, not only because language is necessarily present in any teaching process, but also because numerous decisions about the role and use of language had to be taken.

Videos as a source of learning. An advantage of using videos in a flipped classroom is that everybody can learn at their own pace, because participants can pause or rewind a video at their convenience. If they need more processing time, they can watch difficult parts of the video several times. For example, students with migration background mentioned in their feedback to the project that it was helpful for them to look up some unknown German words. The mathematical language that teachers use in the videos is another interesting aspect of the flipped classroom. Howson (1980) thinks that if mathematics is not discussed in the language of the learners, they do not absorb it as part of their culture. While producing the videos for the described project, the teacher tried on the one hand to adjust the language to students' competencies and on the other hand to be mathematically precise.

Reflections and future

This project has shown that using the flipped classroom model for teaching mathematics can leave students more space to communicate with their schoolmates and the teacher than in a more traditional classroom setting. For instance, there is time to discuss different ways of solving a mathematical problem or to sort out their problems regarding specific video content. In the future, it would be also interesting to try out and investigate mathematics learning in contexts of whole class discussion, as Boukafri, Ferrer and Planas (2015) did in their design experiment. From a methodological point of view, the questionnaire delivered some insights whether the flipped classroom model changed the classroom culture. However, mostly students' comments helped to better understand the reasons for their answers. In the future, the teacher intends to sharpen the focus of her investigation and to try out instruments that allow deeper analysis. Even new media (e.g., mobile phones used for interviews) could be used. This would mean that both the teaching approach and the evaluation instrument reflect the culture of the digital age.

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