# DEVELOPMENT OF VIDEO CASES REGARDING TECHNOLOGY USE FOR PROFESSIONAL DEVELOPMENT PROGRAMS

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*Although an adequate use of digital tools in mathematics might raise the quality of learning, they are not common enough in classrooms. One reason is that many teachers do not know how to integrate them in everyday teaching. This is where professional development (PD) programs can help. To bridge the gap between theory and practice, video case-based learning, is used in the presented study.*

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"We can no longer consider that teaching mathematics with technology is just an option" (Artigue, 2013, p. 2). The same applies for Germany, where using technology in mathematics classrooms is compulsory. Many positive effects can be observed while teaching with digital tools. They "allow students to focus more on conceptual issues, not just on the learning of techniques", connect different visualisations or facilitate working with real data (Artigue, 2013, p. 3). Taking these advantages into consideration, one would expect teachers to use technology frequently in their classrooms. Results of various studies are, however, contradictory to these expectations, since technology is not used as often as possible in (German) schools (Lorenz et al., 2017). Some teachers face substantial challenges in planning their lessons and teaching with digital tools. When technology is used, students can be given more autonomy, inquiry-based practices can be integrated and more open tasks can be implemented (Artigue, 2013). However, using open and inquiry-oriented tasks might lead to teachers being confronted with various solutions and unexpected situations. This could be perceived as obstacle and hinder their effort to plan lessons with technology. While teachers justify their rare use of technology with the lack of technical equipment in schools, their knowledge, beliefs and skills must be taken into account as well (Drijvers et al., 2016). Furthermore, teachers often do not know about potential ways to teach and learn mathematics with technology (Lorenz et al., 2017).

These are some reasons why PD programs are required. There are many different courses for learning how to use digital tools, what kind of tasks to give to students or how to teach with technology (Drijvers et al., 2016). Nevertheless, there is a gap between the theory and practice of PD programs. It has been argued, that using video cases might bridge this gap (Seidel et al., 2013). In addition, the method of video case-based learning possesses the advantage of allowing for a deeper analysis of lessons, helping to raise the quality of group discussions (Goeze, 2016) and grasping the intricacy of classroom interaction (Koellner et al., 2018). Videos are more economical, for example, than role-playing learning arrangements, because they can be used more than once, paused and replayed. They play an important role to assist teaching and learning of routines without time pressure (Goeze, 2016).

Using video cases in a PD program means more than just showing the video. They include background information to understand the context of the scene shown. Additional information regarding the content or comments from people in the video can be entailed. The integration into PD programs depends on the pursued aim. They can be used to reflect one's own teaching, foster group discussions or analyse students' learning processes (Goeze, 2016; Koellner et al., 2018). Sherin and van Es (2009) differentiate between three paradigms on how video can be integrated. The paradigms "bring teachers into the […] practice" (p. 21), "learn to notice" (p. 21) are adopted here.

In the presented project, video cases are developed for PD programs for in-service teachers. Thus, we recorded real classroom footage of mathematics lessons, in which digital tools are used. We focused on the use of open tasks that are suitable for students to explore their thinking using digital tools. The scenes selected for cases can be used as prototypes for similar situations, e.g. demonstrating how technology can be used, initiate a fruitful discussion or raise a cognitive conflict for students (Goeze, 2016). The combination of necessary background information, given tasks and comments from students and the teacher in the video make up a case. The research questions are:

1) Which processes of teacher professionalization can be initiated by the video cases?
2) Which impulses can prompt a beneficial use of the video cases in PD programs?
3) For which problematic situations in teaching mathematics with digital technology are video cases necessary?
4) How can the professional vision be trained in PD programs regarding to this topic?

To answer these questions, the cases were used in a PD program and university teacher education courses. Data in form of single interviews with experts, recorded group discussions from the PD sessions and questionnaires are used to inform the (re-)design process. By analysing the answers and discussion topics among participating teachers, we can identify the potential use of a video sequence for PD programs. It becomes apparent that one video case can address manifold issues regarding teaching mathematics with technology. For example, it can help teachers learn how to react to challenging situations, show them how students work with digital tools and which misconceptions or difficulties might arise.

The first results show that the cases can be used for PD programs regarding the topics *teacher (re-)action, tool usage* and *learning processes of the pupils*. These correspond to the levels of the research questions. Another outcome is that teachers have different views on the same video, which can be connected to the professional vision (Sherin & van Es, 2009). This will be analysed in more detail in the next step of the research project.

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