

Exploring instrumental orchestration practices in the context of formative assessment with technology

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Introduction

In guiding instrumental genesis a teacher needs to assess students' progress. Teachers' interventions involving digital tools can be described using the theory of instrumental orchestration. We would like to study how assessment is part of these interventions of instrumental orchestration with the aim to better understand formative assessment in teaching with technology.

Background of the study

It is commonly acknowledged that digital tools have greatly increased the possibilities and potential for mathematical teaching and learning as well as formative assessment (e.g., Baird et al., 2017). Much research on digital technology in mathematics education has been done with respect to learning with technology, and the significance of the instrumental view is central to current research on digital tools in mathematics teaching and learning (e.g., Drijvers et al., 2010; Trouche, 2004). Instrumentation theory stresses the importance of teachers carefully designing activities and selecting appropriate artefacts for students, to facilitate instrumental genesis in a meaningful and natural way. In addition, this theory has been developed from a more general theory about sequences of situations in mathematics lessons that allows for teachers to build on students' ideas and contributions. Regular whole-class teacher-centered teaching orchestration can be replaced by other formats, such as student-centered practices where students can actively explore mathematics activities through digital tools (Drijvers & Sinclair, 2023). Moreover, the integration of digital tools in the mathematics classroom requires careful consideration of how to orchestrate the lessons, which may affect teachers' assessment practices (Cusi, 2022).

Relation to the conference theme and dimension

Many scholars studied and promoted the role of digital technology in formative assessments in mathematics education. For example, Spector et al. (2016) highlighted that digital technology enhances formative assessment by providing timely feedback, supporting inquiry-based learning, and enabling the analysis of student performance data. This is in line with Dalby and Swan's (2019) finding that the potential benefits of using digital technology in formative assessment include gathering and processing data quickly, providing feedback for students, and enhancing communication and social interaction. In addition, Panero and Aldon (2016) suggest that digital technology can help to strengthen the quality of the assessment of student achievement. These essential features of digital tools allow teachers to effectively transform classroom practices from teacher-centered to student-centered. However, researchers also highlight the complexity of the roles played by the teacher in the context of formative assessment and suggest that the teachers' expertise in the use of digital tools does not necessarily equal a corresponding expertise in the use of digital

technology to support formative assessment (Cusi, 2022). This study adopts the instrumental orchestration theory to study the ways in which teachers' orchestrate formative assessment practices through digital technology. In other words, we want to study the role of formative assessment in how teachers develop and implement orchestration strategies. We would like to gain a deeper understanding of the pedagogical decisions they make, the instructional methods they employ, and the different ways in which they use technology to support formative assessment.

Setup of the study

The research question of this study is: *How do teachers conduct formative assessment as part of their orchestration practices when using digital technology in mathematics classroom?*

We will answer this question by studying classroom videos of technology-rich lessons. This study uses a convenience sampling method and participants are secondary school mathematics teachers from Jiangsu Province in China. To ensure the validity of the study, it chooses relatively high-quality Chinese mathematics teaching lesson videos for observation and analysis. The selected videos are part of the 2022 "Jiangsu Province ICT-integrated High-Teaching Quality Course Competition". When analyzing the data, attention will be focused on understanding how the orchestration types employed by teachers provide them with opportunities to gauge the progress of their students and to assess their work. The results examine teachers' orchestrations and classroom assessment practices with the aim to jointly illustrate teachers' specific orchestration practices with a particular focus on assessing students' competences in a formative way. Hopefully, our findings can be used to provide recommendations for mathematics teachers to conduct new and more student-centered teaching and learning practices with digital technology for mathematics exploration and for classroom assessment.

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