Designing Learning Analytics for Teacher Learning: An Analytics-Supported Teacher Professional Development (ASTPD) Approach

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Abstract: Researchers have recently emphasized the contribution of learning analytics interventions to the advancement of theory. We propose an analytics-supported teacher professional development (ASTPD) approach and evaluated the impact of the ASTPD approach on teacher learning and reflection about their dialogic instruction. The results show that integrating learning analytics and TPD drawing on educational theories and the TPD context had an impact on the participating teachers' dialogic practice as well as their student learning outcomes.

Introduction

While the recent years have witnessed an increased interest in the use of data to inform educational decision-making, relatively less attention has been paid to the role of theory in designing learning analytics interventions (Knight & Shum, 2017; Wise & Shaffer, 2015). In this paper we propose an analytics-supported teacher professional development (ASTPD) approach, which aims at leveraging learning analytics to facilitate teachers' reflection about their classroom practice. The ASTPD transforms the prevalent video-based TPD activities around the temporal and sequential lesson observations into analytics- and visualization- supported TPD activities, which is likely to increase the efficiency and effectiveness of TPD.

The present study

The ASTPD approach is informed by the sociocultural (Vygotsky, 1978) and situated learning theories (Brown, Collins, & Duguid, 1989). The theories highlight the importance of situating teacher learning in artifacts of practices and mediating teacher learning through productive and meaningful talk, tasks, and tools leveraged by participants' collaborative interpretation and communication of data-based evidence. The ASTPD approach employs learning analytics technologies to provide teachers with the analytics and data in form of visualisation of their own classroom data for using in TPD tasks and activities.

Based on the ASTPD approach, Chen, Clarke, and Resnick (2015) developed a teaching analytics tool, Classroom Discourse Analyzer (CDA) to facilitate in-service teachers' reflection on teacher-students classroom talk interactions in audio- and video- recorded classroom lessons. The authors have upgraded the CDA tool to a web-based version, CDA 2.0, a web platform that presents formative feedback in the formats of interactive graphics, videos and transcripts, not only about the classroom process, but also about data summaries of individual and group classroom interactions. In this study, we report the use of CDA 2.0 in a TPD program. CDA is aimed to leverage learning analytics technologies to ease teachers' search, access, extract, and focus of information in video-based observation of their own and others' teaching, as well as to improve their individual, collaborative, and repeated learning effects. Specifically, CDA provides process- and product- oriented learning analytics support for one important aspect of teacher learning objective, teachers' ability to use of academically productive talk to engage students into deep thinking and reasoning, drawing upon the Accountable Talk theories (Chen et al., 2018; Resnick, Michaels, & O'Connor, 2010).

Data sources

In this paper, we report on the effects of conducting ASTPD sessions for secondary mathematics teachers' learning about dialogic instruction across four semesters in two school years. There were in total 46 sixth- and seventh-grade participating teachers in the same school district. Twenty-four teachers were randomly assigned to the ASTPD treatment group who attended six ASTPD sessions across two years to learn and reflect on their classroom talk in addition to workshop learning, and 22 teachers to the comparison group who only learned about Accountable Talk through the same workshops. No statistical differences of the two groups were found regarding teacher gender, age, years of teaching, and their educational level.

Results and discussion

Teacher Accountable Talk moves

The quality of teacher talk in the two groups was further compared based on teacher's average frequency of accountable talk moves used in one class including *revoice*, *say more*, *press for reasoning*, *challenge*, *restate*, *add on*, *agree/disagree* and *explain others*. The eight talk moves were grouped by four goals (Resnick et al., 2010). First, teachers help individual students share, expand and clarify their own thinking through *say more* and *revoice*. Second, teachers help students listen carefully to one another through asking students to repeat or rephrase other's viewpoints (*restate*). Third, teachers help students deepen their reasoning through *pressing for reasoning* and *challenge*. Lastly, teachers help students think with others through *agree/disagree*, *add on*, and *explain others*. Except for the second goal (teacher talk moves that help students listen carefully to one another), differences on the other three goals between two groups all reached statistical significance in ANCOVAs, suggesting that the ASTPD intervention improved teachers' enactment of productive talk moves in the classroom.

Student average words per turn and achievement

Students in the experimental group spoke more words per turn by the end of the project than the beginning, while numbers of student words per turn in the comparison group were similar in both the pre- and post-test. Students of both groups were instructed to complete a pre-test and a post-test, with different but comparable items. An independent t-test showed that the treatment group and comparison group had a difference regarding the gain scores from pre to post test.

Teacher perceived affordances of the ASTPD approach

We identified four ways in which the ASTPD approach has supported the teachers' learning to enact productive dialogue practices, including: (1) focusing teachers' attention on certain dialogue practices for targeted improvement, (2) raising teachers' awareness of their dialogue practices through quantifying the dialogue practices, (3) deepening teacher reflection on practices through comparison with others' dialogue practices and (4) supporting noticing and reflection on the changes in dialogue practices by continued feedback on changes.

Conclusion and implications

It is conjectured that this new TPD model will maximize the benefits of classroom data in widening teachers' space of reflection. It balances teachers' autonomy to focus on different areas of their own concern while focusing their attention on salient features relevant to dialogue practices and hence creating a space for personalized learning. The paper has significant contributions to the thinking modes related to effective teacher learning and PD facilitated by learning analytics. The ASTPD approach has raised our awareness on the relation between learning and reflection, as well as the emphasis on the relevance of using the teachers' own classroom data in their professional learning community to inform their future practice.

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