Tackling the Alignment Problem:
The Design of a Learning Analytics Dashboard for Teacher Inquiry

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ABSTRACT: Aligning learning analytics with learning design could offer opportunities for teacher inquiry and thereby support teachers to work as designers. However, in reality the alignment between learning analytics and learning design is often lacking. To mitigate the gap, we engaged three university teachers in co-designing a teacher-facing dashboard of social annotation activities under the guidance of the Activity-Centered Analysis and Design framework. By incorporating design elements as reference points of the analytics, the designed dashboard provides insights for teachers to reflect on and adjust their learning design and teaching practice. To investigate how the dashboard facilitated teacher inquiry, the dashboard was then implemented in four university courses in Fall 2023. This paper reports on findings from the implementations and teacher usage of the dashboard in diverse contexts.

Keywords: Learning design, learning analytics, dashboard, teacher inquiry

1   INTRODUCTION

The importance and value of the alignment between learning analytics and learning design have been highlighted in previous studies (e.g., Macfadyen et al., 2020; Schmitz et al., 2022). To guide the design and adoption of learning analytics, learning design lays a solid foundation for teachers (and other users) to inquire into learning and teaching processes (Law, 2017). When not properly aligned, data provided by learning analytics may not help teachers reflect on their learning design (Mangaroska & Giannakos, 2018), leaving the promise of learning analytics unfulfilled. Recent studies that aspire to address the misalignment have focused on refining methodologies and tools for co-designing learning analytics systems with stakeholders (e.g., Schmitz et al., 2022), engaging teachers in developing learning analytics dashboards (e.g., Kaliisa and Dolonen, 2023), and generating conceptual frameworks for the alignment (e.g., Law and Liang, 2020). However, several gaps still persist in prior literature: (1) the conceptual frameworks developed in most studies are overwhelmingly complicated or generic; (2) empirical studies remain insufficient, with a noticeable absence of reports on the impact of analytics-informed adjustments on learning design and teaching practice; and (3) learning analytics dashboards are mostly descriptive (of what things are) rather than conductive to action-taking (describing how things should be). To address these challenges, the study, informed by a learning design framework, involves teachers in co-designing a teacher-facing dashboard that seeks to align learning analytics with learning design and teacher inquiry. We report the findings of dashboard implementations in courses.

2   THEORETICAL FRAMEWORK

Among various frameworks of learning design, the Activity-Centered Analysis and Design (ACAD) framework has been incorporated into the study to guide the learning design and analytics on the dashboard (Goodyear et al., 2021). The framework conceptualizes two constructs: a design construct to document the learning design of teachers and an analytics construct for displaying analytics metrics

with the reference to learning design. Its key elements – set design (e.g., resources and tools), social design (e.g., groups) and epistemic design (i.e., a sequence of tasks) – provide areas of consideration for eliciting teacher ideas during the dashboard design process.

The learning context used in this study is social annotation. Social annotation, assisted by web annotation tools, allows multiple users to annotate information in one shared document and anchor a discussion in the annotated information. It has been widely used by teachers to support students to achieve diverse learning goals. Social annotation offers a context where the design elements could be uniquely designed by the teacher.

By drawing on the ACAD framework and situating the dashboard design in the social annotation context, we asked the following research questions: RQ1) What design elements and inquiry would teachers choose to display on the dashboard for social annotation activities? RQ2) How does the dashboard support teachers to reflect and adjust their learning design and teaching practice?

3   METHODS

3.1   Context, Participants, and Phases

The study, which consisted of two phases, was situated in online/blended courses at a large public university in the United States. The co-design phase involved three researchers, three teachers who adopted a web annotation tool named *Hypothesis* for their classes, and two developers. This collaborative process unfolded in three stages conducted through Zoom meetings. In these meetings, teachers were engaged to outline their design elements using the ACAD framework, generate inquiry questions based on their respective designs, and co-design analytic measures. The result from the analysis of the meetings transcripts informed the dashboard design. The dashboard has two main components: *the design page* provides a space for the instructor to input design elements; *the analytics page* displays several analytics for social annotation activities. The design parameters are used as references to the analytics, delineating how things should be (Figure 1).

In the implementation phase, four teachers (two participated in the design) used the dashboard in their classes in fall 2023. In the first few weeks, researchers connected teachers online to prepare the dashboard utilization and sent out check-in emails every three weeks. Near the end of the semester, semi-structured interviews were conducted in Zoom. All interviews were recorded and transcribed.

3.2   Data Collection and Analysis

To answer RQ1, we examined the meeting transcripts of each teacher using descriptive coding and in vivo coding to extract their chosen design elements relating to social design and epistemic design, along with their corresponding inquiries (Miles et al., 2018). Then researchers developed themes by merging the similar ideas and preserving the unique ones. To address RQ2, we applied descriptive analysis to examine the log data and conducted content analysis on emails and interview transcripts.

4   FINDINGS

In response to RQ1, teachers defined specific participation roles within the social design component. In epistemic design, teachers devised various tasks, including annotating and replying, responding to prompting questions, tagging to classify annotations, and using sentence framing. When inquiring into

social design, teachers focused on students' social interaction at individual and class level. Regarding the inquiry for epistemic design, teachers sought insights into students' engagement patterns. This included assessing whether students responded to prompted questions, analyzing annotations for signs of confusion, interest, connections, and conceptual understanding, evaluating the quality of annotations, and identifying topics that generated heated discussions.

In response to RQ2, initial findings were reported. By visualizing the analytics results, the dashboard supported teachers to understand students' interaction patterns and engagement in social annotation, providing actionable insights into the learning design and teaching practice. Informed by the dashboard, teachers grasped the enactment of the designed participation roles, identified students who did not participate, and filtered out students' confusions and heated discussion topics. Teachers enacted on the analytics by explaining the roles, reaching out to the absent students, and facilitating in class discussions.
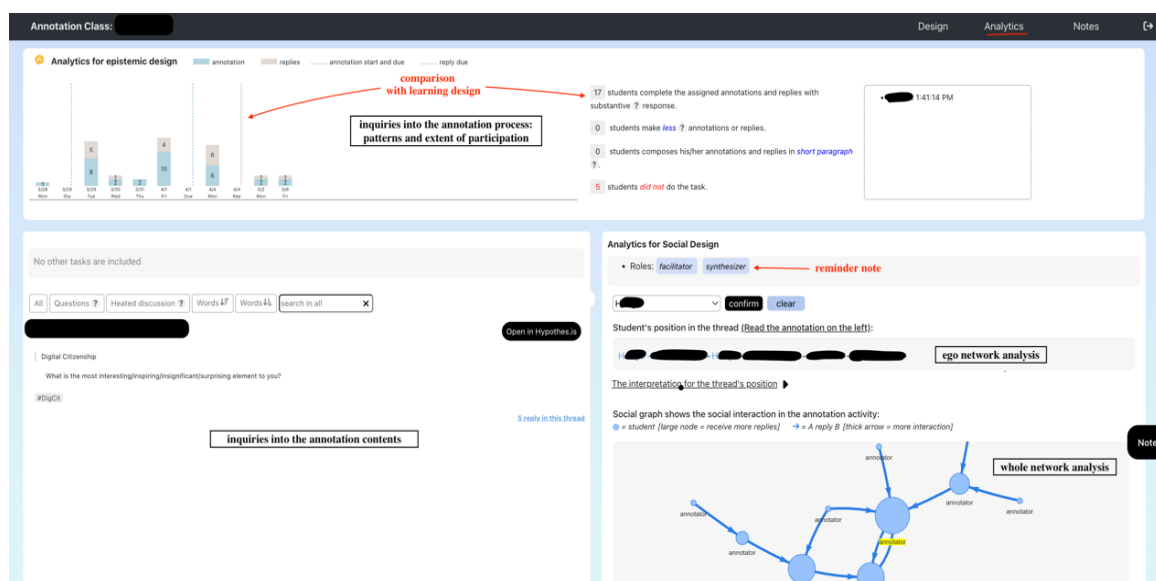

Figure 1: Dashboard analytics page

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