

## Uncovering What Matters in Collaborative Learning

### Impact of Teachers' Engagement in Analytics to Bring About Knowledge Building Discourse

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#### KEY IMPLICATIONS

##### Practical implication

To explore a theory-driven and evidence-based approach to the integration of Learning Analytics (LA) for the development of 21st century competencies as well as content knowledge.

##### Theoretical implication

To derive a pedagogical-intervention framework for LA integration.

#### BACKGROUND

The role of classroom discourse and interaction has been a focus in learning sciences research for decades (Bielarzyc & Collin, 1999; Mercer, 2008). The insights derived from these established research have led to the notion that the types of discourse are determinant of the quality of teaching and learning.

Classroom discourse, in turns, functions as a critical role in assessing the extent of student-driven inquiry. Despite effort to shift towards student-centric practice, we continue to find research depicting our classrooms' interaction to

be mainly teacher centric with little opportunities for students' knowledge construction and authentic student-driven interdisciplinary learning (Hogan, 2014; Deng, Gopinathan, & Lee, 2013).

Supporting authentic inquiry and productive discourse in classrooms are complex educational issues but we believe that current development of technology can offer us a more informed understanding of how research can support teachers to gain better understanding of students' progression and to develop greater trust in the student-driven process.

#### FOCUS OF STUDY

In this research, we unpack discourse structures in classrooms by introducing LA alongside knowledge building technology to help teachers (i) identify discourse markers such as pivotal question or pivotal information and (ii) surface invisible indicators closely aligned to 21st century competencies that support the transitional relationship between the inquiry phases (Zhang, Scardamalia, Reeve, & Messina, 2009; Chen, Resendes, Chai, & Hong, 2017).

## KEY FINDINGS

1. Principles of student-centric learning, discussions and explicit reflections are necessary for purposeful integration of LA to support productive discourse as there can be subjective interpretation of the visualisations (e.g. pedagogical toolkit for LA with interpretation guide and reflection questions).
2. The types of ideas/questions that compelled the teachers to change the course of their inquiry can be categorized along the teacher-centric to idea-centric continuum as: (I) Curriculum/standards (e.g. misunderstanding); (II) Individual students' development/learning (e.g. perceived confusion); (III) Whole class collective effort (e.g. let them chart it); (IV) Real-world problems, authentic ideas (e.g. the class has a question that even scientists are figuring out).
3. Integrating LA feedback into students' reflection has significant influence on the quality of student notes and the kind of thinking scaffolds adopted in their notes.
4. Students' direct engagement with the LA has much greater impact on the quality of their contributions and their learning as seen in their reflection. Teachers' sole engagement with LA has marginal impact on the practice.

## SIGNIFICANCE OF FINDINGS

### Implications for practice

Findings imply that teachers need to integrate opportunities for student engagement with LA feedback in working towards theory-driven, evidence based practice. The pedagogical intervention framework and strategies detailed in the case studies serve as useful resources to guide teachers in design and enactment. The strategies can extend teachers' current understanding on "assessment for learning" and "deep learning" practice in which teachers are still receiving and providing feedback on content knowledge and not on 21st century competencies.

### Implications for policy and research

This work can support the advancement of 21st century competencies standards and benchmarks in class. LA has good potential to unveil critical 21st century competencies and socio-emotional aspect of learning to teachers. Policymakers can also review the frame with respect to their big data focus.

## Proposed follow-up activities

The team has since advanced various designs of LA with Artificial Intelligence capability and exploring the different dimensions of learning informed by multimodal-data, physiological and neurological data.

## PARTICIPANTS

Three teachers along with a class that they taught participated in this study. The student participants included 25 Primary students from one school and 38 Secondary students from another school. Teachers from the two schools were also invited to join in the weekly professional development Learning Team discussion conducted by the PI to understand student discourse and interaction pattern in knowledge building classrooms. A total of 12 teachers participated in weekly discussions.

## RESEARCH DESIGN

We adopt a design-experiment methodology with two iterative mini-design cycle in a major research cycle in each research site. Teachers' reflections and decisions were recorded through a series of eight to 15 lessons over the span of six weeks (one major research cycle). Each teacher went through a planning session at the start of each research cycle.

Intervention: Before every lesson, each teacher would receive a series of visualisations generated from existing LA (Knowledge Forum Analytics and KB Discourse Explorer (KBDex)). These include (i) Word Cloud, (ii) Scaffold Tracker, (iii) Network of Words, (iv) Rotational Leadership, and (v) Network of Students. The teacher would at times show some of the abovementioned LA to the class.

The teacher would do a reflection based on the LA visualisations and the analysis report designed by the researcher. Each teacher was asked questions concerning: words that they found surprising in the Word Cloud, KB scaffolds they would like to see in the KF discussion, what they thought went well in the discussion on KF and what they might do differently in the next lesson, and if the LA shown to them had changed their mind about the lesson plan. These reflections and analysis reports were done in between lessons. Students' survey and interview responses, and their notes on Knowledge Forum were analysed for indicators of improved productive discourse.

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