AISSPOMMOOTSIIO'PA – A COLLABORATION TO IMPROVE TEACHING AND LEARNING MATHEMATICS AT THE KAINAI NATION

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The Kainai Board of Education, situated at the Kainai First Nations Reserve in Southern Alberta, Canada, initiated the Aisspommootsiio'pa project in 2017. The project intended to develop teacher leadership capacity aimed at improving mathematics teaching and learning at elementary and secondary levels. In this paper, we indicate the theoretical foundations for the project. We also report on its implementation during the first two years, which involved seventeen teachers, and offer suggestions for the extension of the project at a larger scale within the Kanai Nation.

Keywords: Elementary School Education, Mathematical Knowledge for Teaching, Teacher Education - Inservice / Professional Development, First Nations and Indigenous cultures

The Aisspommootsiio'pa Project

In 2017, the Kainai Board of Education (KBE) contacted the Werklund School of Education, University of Calgary, to initiate what was later called the *Aisspommootsiio'pa* project: Translated into English, *Aisspommootsiio'pa* means "supporting each other." Since then, a group of teachers engaged in a professional learning series that included reflection on classroom observations. One specific purpose of the project was to identify and develop mentorship capacity within KBE for future, sustained support for other teachers within the school district, which comprises two elementary schools, one secondary school, and one high school.

During the first year of implementation, a group of observers supported the project creating records of observed lessons for teachers to reflect on. Every observation included at least two observers who recorded images, notes, and events in a timeline, and who rated each lesson using an observation protocol based on a teaching model developed by the Math Minds Initiative (Preciado et al., 2019a). In the second year of the project, teachers also participated as observers and created the reports.

The first two years of the project are considered a pilot in preparation for a future intervention at a larger scale at KBE.

The RaPID Model

The work with teachers in the Aisspommootsiio'pa project followed, and ultimately informed, the Mind Minds Initiative. Research results from this initiative include a sustained improvement in student performance, as measured by the Canadian Test for Basic Skills (Nelson, 1997). This initiative has developed the Raveling, Prompting, Interpreting, and Deciding (RaPID) model for teaching based on research findings on classroom observation and student performance and engagement in mathematics for more than seven years (Preciado Babb et al. 2019a; 2019b). This empirically developed model is consistent with well-established theories of learning from the cognitive sciences, such as: embodied cognition (Varela et al., 1991); socio-cultural theory (Vygotsky, 1986); spatial reasoning (Davis, et al., 2015); conceptual metaphor theory (Lakoff & Johnson, 1999); and conceptual blending theory (Fauconnier & Turner, 2003). The model also draws from theories of influencing learning, such as: affordance theory (Gibson, 1979); variation theory (Marton, 2014); mastery learning (Bloom, 1968); meaningful learning (Novak, 2002); and expert–novice research (Ericsson, et al., 2006).

Protocol for Classroom Observation

The Math Minds Initiative developed a classroom observation protocol, which was used in the Aisspommootsiio'pa project. Table 1 summarizes Levels 1 and 4 of the protocol used for the project in 2018 and 2019. A refined version with details of the RaPID model was later elaborated on by Preciado Babb and colleagues (2019a).

Table 1: Summary classroom observation protocol for Levels 4 and 1

	Level 4	Level 1
Connecting (a) (Raveling)	Contrasting ideas build on prior contrasts and toward a generalized learning target.	Contrasts do not build on prior contrasts. It is challenging to identify a learning target.
Connecting (b) (Raveling)	The known and unknown are systematically bridged; each new idea is anchored to prior understanding that has been effectively summarized to carry forward.	There is little attempt to bridge known and unknown; new ideas are not anchored to prior understanding
Prompting (a)	The teacher separates and effectively draws attention to the key idea; contrasts are clearly juxtaposed, highlighted, and appropriately sequenced.	Key critical features are overlooked.
Prompting (b)	Clear prompt [to each critical discernment] requires learners to make key distinctions.	Multiple ideas are presented before students are offered an opportunity to engage; those who attempt to engage on their own may fall behind.
Monitoring (a) (Interpreting)	Quick/perceptible means of response that provides meaningful information re: student understanding.	Students do not show evidence of understanding or are asked to indicate whether or not they understand: "What part don't you understand?" "Thumbs up if that makes sense."
Monitoring (b) (Interpreting)	All students checked.	Few checked; e.g., individual students called on to respond (out loud or on the board).
Adapting (a) (Deciding)	Group response attends to diverse needs.	Response limited to few learners; many waiting for help or extension; e.g., lengthy conversations with a single child.
Adapting (b) (Deciding)	The teacher clarifies contrasts and adjusts sequencing in ways that address all learners; e.g., clarifying a pattern of variation also allows extended consideration of the related variable(s).	The teacher repeats strategies that didn't work or are unnecessary; the repeated explanation is insufficient for those who didn't get it the first time and redundant for those who did
Engagement	All students engage together in continuously extending understanding	Many students do not participate.

The Aisspommootsiio'pa project included the adoption of resources developed by JUMP Math (https://jumpmath.org/) for teachers at the elementary level. JUMP Math is a member of Math Minds and the teaching resources have informed the development of the RaPID model.

Methods

In order to document the implementation of the Aisspommootsiio'pa project, a qualitative case study was conducted (Yin, 2018) to address the following questions: How do mathematics teaching practices and use of resources change when adopting the selected resource and participating in the learning series? What factors enabled or hampered the implementation of the RaPID model in the classroom?

A thematic analysis was conducted on surveys administrated at the end of each professional learning session (four session each year). These data were contrasted to the classroom observation reports (five rounds of classroom observation each year), which included images, notes, and timelines generated using the LessonNote app. Figure 1 shows the timelines generated for two lessons. The image on the left corresponds to what is called a *block lesson* in the Math Minds initiative, while the image on the right corresponds to a *ribbon lesson*. The latter assumes cycles of prompting, interpreting, and deciding, consistent with the RaPID model, whereas the former reflects minimal instruction and support to student during class.

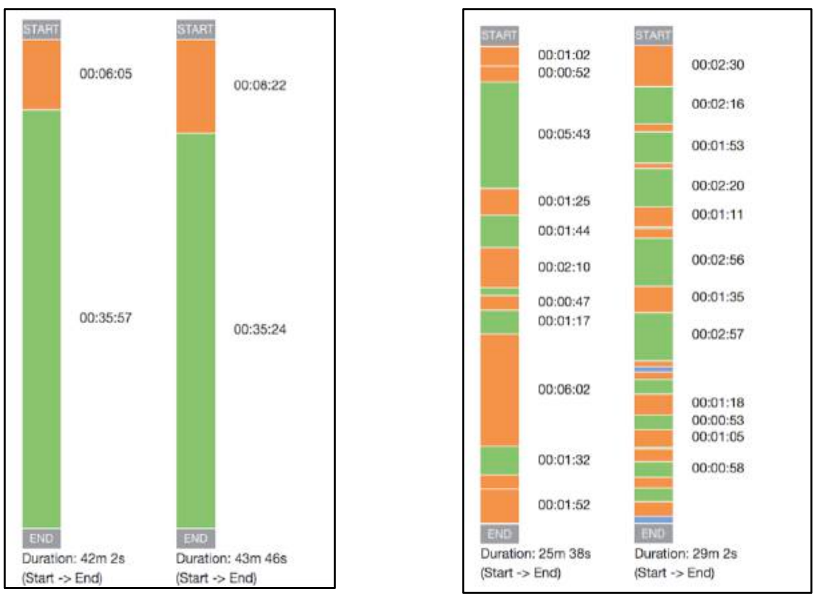

Figure 1: Timelines of classroom observation for two lessons: block lesson in the left and ribbon lesson in the right

Findings

Results of this study are presented as follows in three emergent categories.

Classroom Practices and Teachers' Learning

Teachers reported an appreciation of the RaPID model in the surveys administrated at the end of the professional learning sessions. Some teachers explicitly mentioned teaching practices related to the cycles of interpreting and deciding; this resulted in a more ribbon-like lesson, as shown in Figure 1. The survey entries also included learning about specific aspects of mathematics for teaching, such as different ways of understanding division (partitive vs. quotative). With respect to JUMP Math resource, some teachers indicated that the resource helped them to teach in "small chunks" that focused on critical mathematical features (Marton, 2014) required for students to understand the targeted concepts. Some teachers also indicated that the RaPID model started to inform their teaching of other subjects, not only mathematics.

Implementation Challenges

Despite evidence from surveys of teachers' learning and the impact of the implementation on their teaching practices, there was also indication of challenges for the implementation of the model. These challenges were confirmed by classroom observations and field notes.

One of the challenges in the project related to the adoption of the JUMP Math student teaching and practice booklets. The resources arrived late in the first year of the project and not all the teachers were following the program consistently. In fact, one teacher confessed that she only used the resource for the class that was observed as part of the project. Other teachers in the second year identified the need to try the resource for some years in order to become familiar with it and to be more confident using it.

Lack of time for debriefing and reflecting on observed lessons was also a challenge identified by some teachers. This challenge prompts to the need to allocate specific time for this purpose.

Some teachers also acknowledged the need for more targeted professional learning regarding the mathematics concepts; this was required to better "unravel" the concepts for students, prompt to critical features, interpret students' understanding, and make appropriate decisions.

Mentorship and Capacity Building

One of the observers in the project, also one of the authors of this report, provided feedback to teachers after classroom observation. These teachers emphasized in the surveys and with explicit comments in the professional learning sessions, the support they received from this other teacher, who holds a master's degree in mathematics education. This information was new to the KBE and prompted the need to identify mentorship capacity at KBE.

During the second year of the project, teachers reported being more comfortable having peers observing their class. They also indicated learning through classroom observation. This experience also helped to conceptualize mentorship as peer support in a horizontal fashion, as opposed to a vertical approach in which the mentor is regarded as an expert.

It was also noticed that observers required time to learn to use both the LessonNote application as a tool and the observation protocol used to guide classroom observations.

Discussion

This case study shows evidence of the viability of extending the Aisspommootsiio'pa project to other teachers in the school district and of developing mentorship capacity. The findings in the study can be translated into specific suggestions for this purpose, namely: considering time for teachers to become familiar with the teaching resources; allocating time for classroom debriefing and teacher reflection; training teachers to implement classroom observations; building a trustful relationship between classroom observers and teachers; and embedding teacher professional learning for all teachers involved in the project. These suggestions could be followed with other means of data that could be used to assess the impact of the project on mathematics student learning at the Kainai Nation.

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