Project Title: Year 2 Making Sense of Mathematics for Teaching High School at RSB

Project Description

The project aimed to provide ongoing learning experiences for secondary math teachers at Riverside School Board (RSB) through collaborative work within a teacher team focused on collective inquiry and action research to deepen student understanding and improve achievement. The teachers in the collaborative team focused their teaching practices around the TQE (Task, Question, Evidence) process, described in detail in each of the "Making Sense of Mathematics for Teaching" series written by Juli Dixon and members of the DNA (Dixon, Nolan and Adams) team. In addition, the team developed strategies to build "Thinking Classrooms in Mathematics" as described by Peter Liljedahl. In doing so, teachers reflected on the quality of mathematics instruction being offered and set targeted goals for continuing to shift their teaching practices and improve student learning.

The teachers met twice this year to set goals for their practice, tried out instructional shifts in practice through their collaborative planning, and shared evidence of student work to reflect upon and make improvements to both teaching and learning. The hope of this project was to create a structure to ensure math teachers engage in job-embedded learning to look at best practices in teaching and learning. Teachers worked together interdependently in order to improve their classroom practice. They shared knowledge and developed new skills that led to new experiences and awareness, and as the results show, shifts in practice. The attitudes, beliefs and habits of the teachers can impact other teachers in their schools and eventually the culture of these schools (Solution Tree: All things PLC). These teachers have been meeting since 2020 to have rich and meaningful conversations about teaching practice and student outcomes. As a result of these conversations, teachers have been supporting each other with the strategies discussed during our regular meetings. As a group we have acknowledged the tendency to focus on procedural rather than conceptual understanding. It is exciting to hear teachers share strategies, challenges, and outcomes to promote conceptual understanding through researched based practice as they target specific strategies to shift their teaching practice.

Project Goals

The goal of this project was and is to continue to support teachers in developing mathematically proficient students through the TQE process as outlined in Making Sense of Mathematics for Teaching to Inform Instructional Quality (M. Boston, A. Candela, and J. Dixon, 2019. Solution Tree Press) and through the practices outlined in Building Thinking Classrooms in Mathematics based on the research of Peter Liljedahl. Through the support of this group, teachers shared how their practices have shifted and the impact that has had on student engagement, learning and success.

Project Outcomes:

The team met on two separate days during the school year. Due to staff shortages and Covid 19 restrictions our meetings were less frequent this year.

The format of the release days is outlined below.

- Sharing challenges and successes
- Developing understanding through comprehension of math ideas, operations, and relationships
- Making sense of procedural strategies by connecting them to conceptual models
- Reflecting on teaching practice; setting personal goals
- Planning time

A schedule of the two release day is described in the table below. The PowerPoints for both days are included in this report.

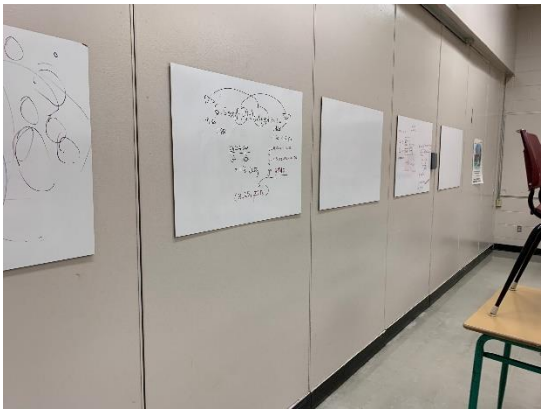
Day	Concepts	
Day 1 November 23	Proportional Reasoning	Big Ideas Proportional thinkers: • Understand ratios as distinct entities representing relationships that are different from the quantities they compare • Recognize proportional relationships in real-world contexts • Have a sense of covariation • Develop a wide variety of strategies for solving proportions and comparing ratios
	Choosing Tasks Evidence	Connections of proportional thinking in algebra Covariation activity, making connections with geometry and slope Three Act Task
Day 2 May 16	Statistics	**Big Ideas** • Different types of graphs, data representations provide different information about the data and the population from which the data was taken • The choice of graphical representation can affect how well the data are understood. Measure of Central Tendency • The mean: activity that shows students how to physically distribute the values so that they numbers are equally distributed https://mathigon.org/task/mean-of-a-data-set • Tasks, surveys and bias
	Choosing Tasks Evidence	Video: Jo Boaler emphasizes it's the approach to tasks Resources (online) for tasks
	Building Thinking Classrooms	Teachers reflected on • Visibly Random Groups • De-front the room • Answering Questions • Building autonomy • Homework and student notes • Assessment and gathering data

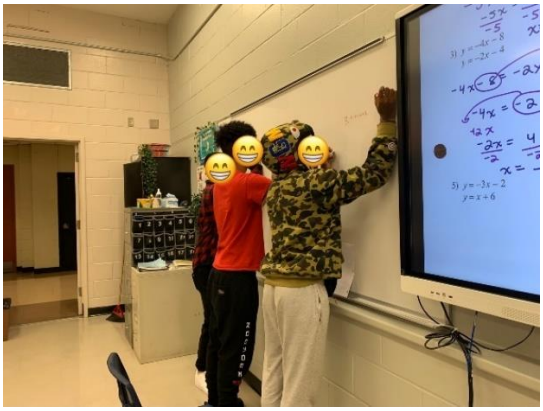
Sharing Strategies and Documents

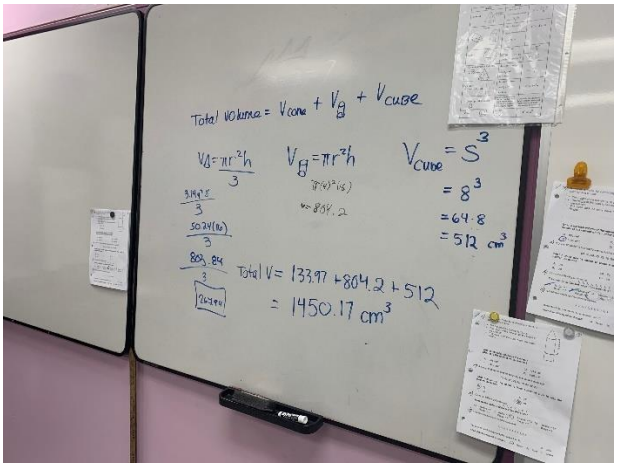
Teachers shared strategies and/or documents, either in person or through Microsoft Teams, and discussed the impact (some success and some challenges) of shifts in practice on student learning.

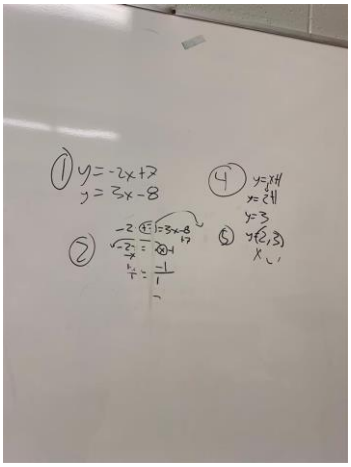
Examples:

1. Using the vertical non-permanent white boards. Teachers found that student initially became engaged but over time some students lost interest over time. Teachers are wondering how to maintain the engagement and rigor throughout the year.





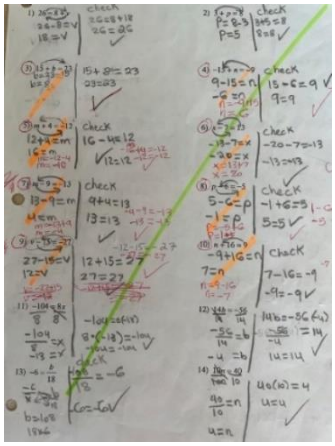




2. Engaging tasks that promote thinking:
   Determining the number of elastics to optimize a doll's bungee jump. (Statistics)

3. Formative Feedback/ non-numerical grading.

This teacher used colour coding to help students develop autonomy and rigour when showing their steps in solving algebraic problems. This shift in practice had a big impact in class. Students who were apathetic became more engaged, autonomous, and developed a growth mindset.



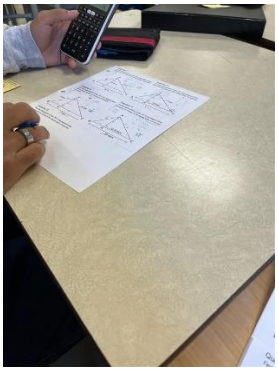
Colour Coding

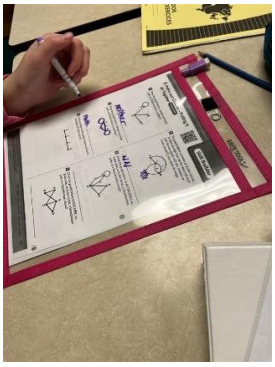
Green: Mastered

Yellow: Progressing

Red: Not yet (rarely used)

4. Thin slicing/group work: While working in groups, students finished one question before attempting a more challenging question. Students were required to check in with the teacher where they would get immediate feedback. The use of non-permanent work surfaces led to deep mathematical conversations between students.





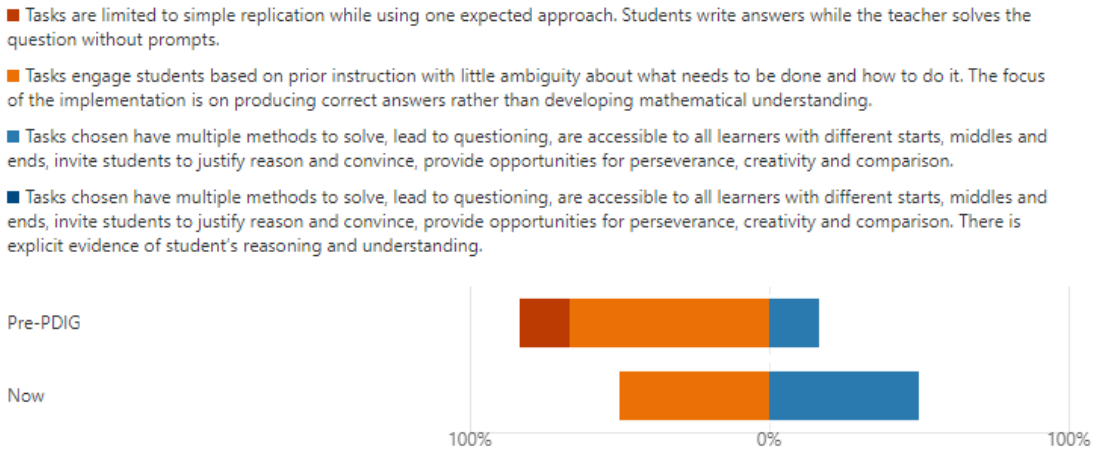
Enumerate the gains in teachers' expertise and how those gains were assessed.

The focus of a learning community is to focus on outcomes, and in this case teaching practice and student learning. The idea was to develop a process where teachers collaboratively examine student work, plan feedback, and design interventions based on student evidence. The hope was that teachers would develop skills recommended by the DNA team to improve student understanding and achievement. In order to assess the gains made in terms of practice, teachers completed a self-evaluation on November 23rd and then again on May 16. They indicated where they thought they were prior do the PDIG project, and where they felt they were at the time they filled out the questionnaire. The self-evaluation tool is based on a rubric measuring the shifts in teaching practice adapted from "Everything You Need for Mathematics Coaching" by M. McGatha, J. Bay-Williams (Corwin, 2018). The rubric is included with this report and can be found on both PowerPoints.

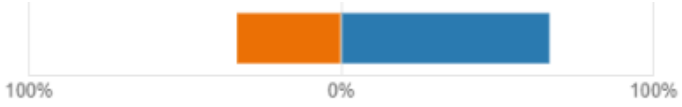
Results

The self-assessment rubric was given first on November 23rd 2021 and again May 16th 2022.

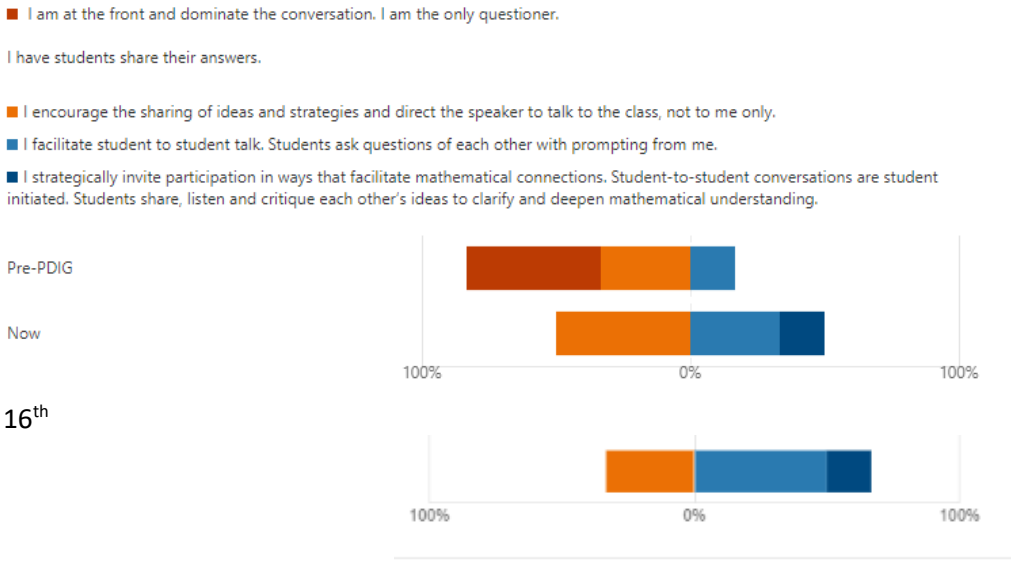
1. Choosing Tasks: November 23rd



May 16th



2. Teacher questioning: November 23rd



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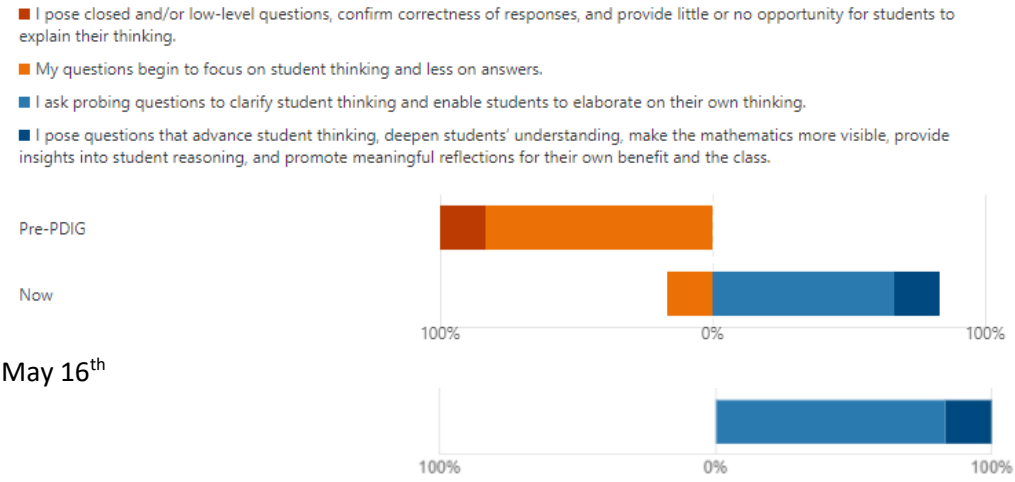
3. Eliciting Student Responses: November 23rd



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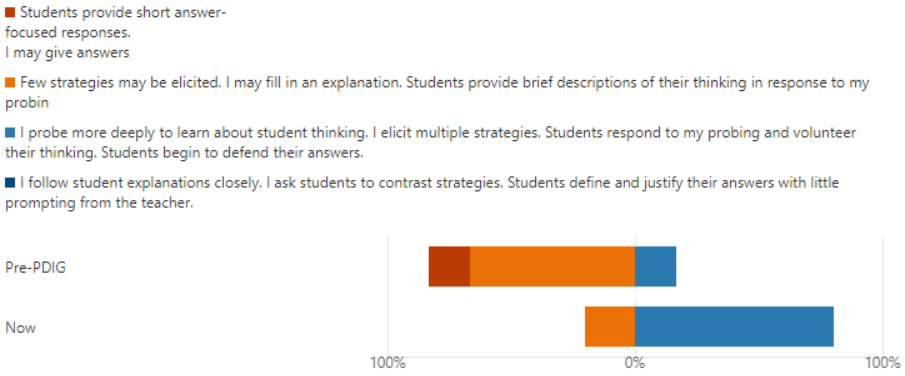
4. Explaining Mathematical Thinking: November 23rd



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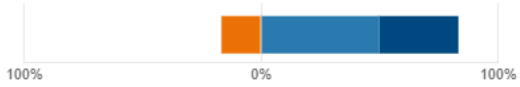
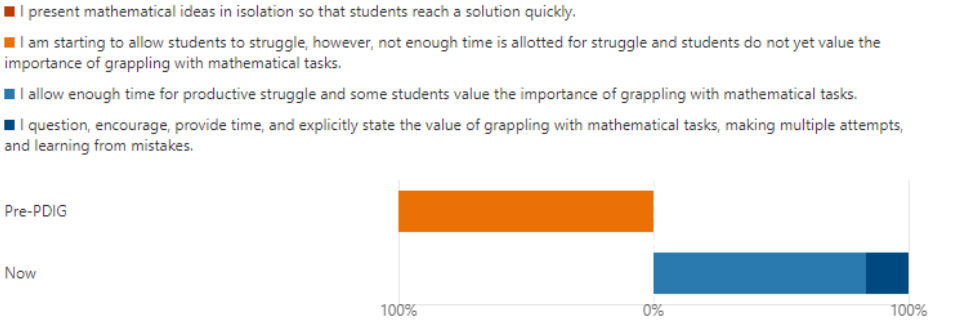


5. Time for Productive Struggle: November 23rd



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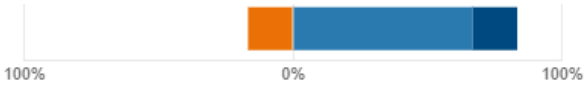
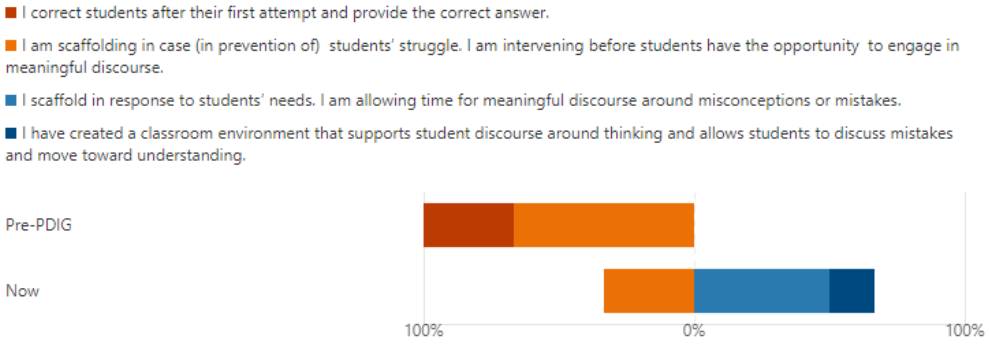


6. Student Discourse and Scaffolding: November 23rd



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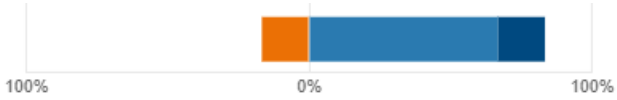
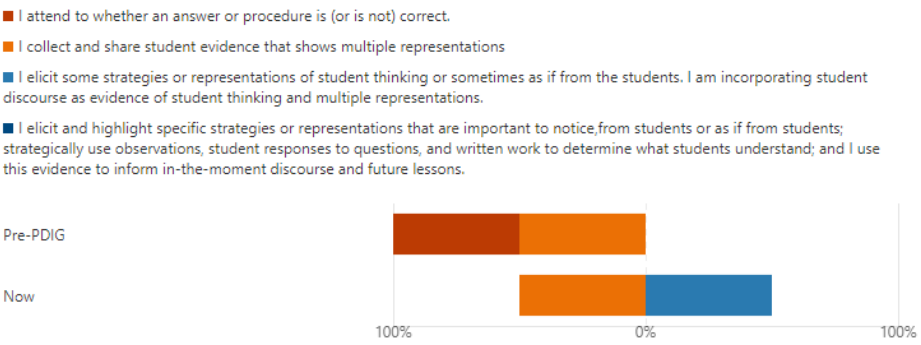
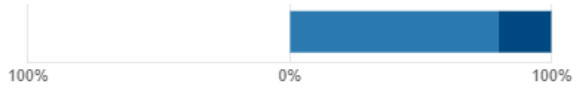


7. Evidence of Students' Thinking: November 23rd



May 16th 2022



Results, continued

The following questions regarding how teachers plan to continue using the TQE process to inform practice were taken from the epilogue of the Making Sense of Mathematics for Teaching for High School.

8. How will you select appropriate tasks to support identified learning goals?

Make more open ended questions.
I will need to evaluate the level of readiness of students and their level of interaction abilities.
By opening them to more than one answer like the area of rectangle
I intend to start with tasks that focus on conceptual understanding before teaching the material, and progressively move towards procedural tasks. Ideally, all tasks would be low-floor/high-ceiling.
I make my selection based on my students and their prior knowledge, and also based on how open-ended the task is.
I would like to try groups of three next year with random assignment of groups

9. How will you facilitate productive questioning during instruction to engage students in the Mathematical Practices?

I will choose how I answer more carefully.
I will open ended questions designed to elicit a more in-depth understanding of the task.
After few examples of some work giving work for them to figure out the rule or pattern
I shall continue to ask students to justify their thinking, compare and contrast their reasoning with other students, and come up with different methods of solving/conceptualizing the same problems.
Using questions like "what do you notice?" and "what do you wonder?" has helped a lot.
circulate. ask students to explain other student's responses. Less inactivity/passivity between group members if place in a different team, "role" each class. Model questioning.

10. How will you collect and use student evidence in the formative assessment process during instruction?

Through student discussion.
Colour codes and explanations of the methods used.
With an objective chart 1-5
Though I respect my colleagues' approach to assessment (e.g. moving towards a 5-point system/colour-coded system instead of percent grades), I do not at this point in time feel ready to follow suit. I will continue to use quizzes/tests (my students have a formative/summative assessment at least once per week, and receive ample written feedback on each evaluation).
Student evidence is used to unpack common errors and consolidate understanding.
I am trying to give more positive reinforcement feedback when students are giving answers that are "outside the box" creative thinking to solve.

11. When asked, how has being a member of this collaborative group helped impact your approach in the classroom, the following responses were given.

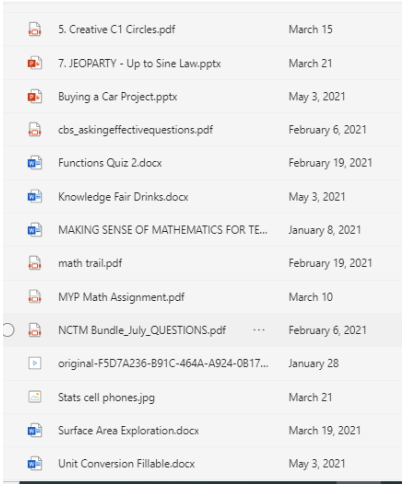
I have implemented many new ideas in my classroom based on other teachers ideas.
I have used many of the strategies and ideas in my class over the past two years. It has made me a more rounded and ended teacher.
Gave me new energy to try and change things up not just for the students but for me also
Being a member of a group of like-minded professionals seeking to improve their teaching has given me more confidence to experiment with new teaching strategies. It has also broadened my horizons regarding what is possible in terms of assessment, homework, notetaking, etc.
Being a member has given me the confidence and reassurance to try things differently. I don't think I would have been able to break away from the expectations of "traditional teaching" without the support of this group.
I am seeing how others approach structuring their classroom and assessment through their examples and through topics address in the book. I am trying to allow meaningful time to struggle and have the classroom be less teacher lead - student -showing student- explaining for others.

Summary and Reinvestment

The results of the self-reflections clearly show that the participants of this team believe they have shifted their practice. Teachers particularly identified the following practices as areas they saw improvement: teacher questioning, eliciting student responses, student discourses and evidence of student thinking.

There appears to be a correlation with the conversations teachers had and where they saw the most shift. It leads me to question whether these practices will be maintained if the conversations stop and emphasizes the importance of continued conversations. Teachers agreed and voiced their intent to continue the conversations with each next year.

The group has explored the TQE process and Building Thinking Classrooms while supporting each other when implementing new strategies. Microsoft Teams was used to communicate and share ideas and documents. Below is a screen shot of some of the material that has been shared.



The teachers plan to continue sharing resources both in this medium and with math teachers within Riverside Secondary Teachers TEAM, in the math folder. This group would like to continue working with the consultant(s) to meet the goals of MAST (DEEN Sub-committee – Mathematics, Science and Science and Technology).

To support other groups of teachers who would like to participate in similar conversations, self-reflection, and professional development, we have attached the documents to this report.

They are

- PowerPoints (pdf) for November 23rd and May 16th
- Self-Reflection Teacher Rubric
- Link to a copy of the form used for self reflection: https://forms.office.com/Pages/ShareFormPage.aspx?id=yvU1dacAMEmZUTDT5qxcGh1wyB1cepJLtfDWDKeK6ZBUMllBRUs2MEJUTzJWOUVQNkpPWlIKRUU3MS4u&sharetoken=MPEATfVXYIYUOHswEvEh
  (requires a Microsoft Office account)