

## **Changing practice: Dilemmas, challenges, supports**

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This document leans on the research from the Curriculum Implementation in Intermediate Mathematics (CIIM) Research project to discuss aspects of teacher change. The purpose of the document is to provide insight to coaches as they work with teachers who are working on developing their classroom practices.

Some time ago, Seymour Sarason suggested that "Educational change depends on what teachers do and think - it's as simple and complex as that." (Sarason, 1971, p. 193). The CIIM research was based on this premise and also, along with many other researchers (e.g. Ball & Even, 2004; Boaler, 2002), confirms this premise. While curriculum documents and resources might suggest new directions in mathematics education, the implementation of these new directions depends on what teachers actually do in the classroom and how they think about mathematics and mathematics teaching and learning. Also, the connection between what teachers do and what teachers think is a reciprocal relationship. In other words, what they do affects what they think and what they think affects what they do. Changing classroom practice is a complex task (West & Staub, 2003).

The mathematics curriculum in Ontario represents current thinking and research in mathematics education and encourages engaging students in mathematics content through mathematical activity as outlined in the mathematical processes. The questionnaire data from the CIIM research project (Suurtamm & Graves, 2007) shows us that all teachers incorporate what might be considered traditional practices of providing examples, explaining procedures, and providing opportunities to practice procedures. It also shows us that some teachers also incorporate some inquiry-oriented practices that support the mathematical processes such as teaching through problem solving, encouraging the use of mathematical thinking tools such as manipulatives and technology, promoting multiple representations of mathematical ideas, encouraging mathematical communication, and using a variety of assessment strategies to access and assess student thinking. In other words, new ways of teaching mathematics are emerging but are not used by all intermediate mathematics teachers.

Along with data gathering through our questionnaire and interviews with mathematics educators across the province, the CIIM research project also conducted 9 case studies in school settings in various locations in the province. These case studies were conducted in classrooms where teachers were implementing some of the above-mentioned inquiry-oriented practices. Our purpose in conducting these case studies was to be able to describe such practices as well as to share the challenges that the teachers faced and the ways that they were supported to meet those challenges. Our case studies occurred in classes from Grades 7 through Grade 10 Academic and we saw a variety of practices. For instance, we saw students engaged in problem solving and mathematical argumentation through the use of technology in two Grade 9 Applied mathematics classes. We observed students in a Grade 9 Academic mathematics class engaged in a variety of different mathematical investigations as part of the teacher's use of differentiated assessment. We observed students in several Grade 8 classes using and connecting a variety of

representations as they worked on and presented solutions to problem solving activities. We observed students use algebra tiles and linking cubes to model quadratic relations in a Grade 10 Academic mathematics class. In all situations we saw students discuss and argue mathematical ideas. We were amazed at the innovative and creative ways that teachers are implementing the curriculum and encouraging mathematical activity in their classrooms.

These case studies also provided an opportunity for us to understand the ways that teachers have been supported in their implementation of the curriculum as well as some of the dilemmas and challenges they face. Understanding these supports, dilemmas, and challenges is relevant for those who are coaching teachers as they develop, shift, or work on changing their practice.

### **Dilemmas**

As teachers make changes in their practice, they are often faced with uncertainty. The practices that are being asked of teachers are often difficult to define, feel unfamiliar, and require a certain level of risk-taking. For instance, facilitating problem solving requires that a teacher be able to listen and respond to student thinking. This means that teacher actions cannot be easily prescribed as they depend on what the student does and says. This is very different from planning particular examples to present on the board and asking questions that have expected responses. Thus, facilitating problem solving requires that the teacher is confident or open to taking some risks and not knowing what might happen next. The teacher does not know “what question to ask next” as it depends on what the student is thinking and doing. Thus, we observed teachers in the case studies reflecting on their lessons and often questioning whether they did the right thing at particular moments. They also discussed how the lesson changed direction based on what the students were doing and saying. For the most part, they were comfortable with that change in direction. At times, the teachers were uncertain as to whether they were able to connect the mathematical ideas that arose during the lesson and whether students consolidated their understanding. However, the teachers were able to use informal formative assessment methods the following day to determine the students’ understanding and then moved forward from there.

### **Challenges**

The challenges that teachers face when changing their practice do not always come from within the classroom. Change is complex and teachers are not only influenced by their own beliefs, knowledge, and attitudes but are also influenced by student responses, colleague and administrator impressions, and parent concerns. One challenge that the teachers faced was a feeling of isolation. In many cases, these innovative teachers were viewed as leaders in their schools and thus, did not necessarily have someone at the school level with whom they could discuss their dilemmas and uncertainties. Further, they were often alone in terms of searching out meaningful resources to use in their teaching. All of the case study teachers used a wide variety of resources such as TIPS, a textbook, workshop materials, and other resource books. But they found it very time consuming to seek out these resources and to choose and adapt the activities to suit their class. The fact that they were working in isolation in their school meant that they were doing this on their own. In some cases, they also faced challenges from their colleagues or parents who might question what they were doing in their class as it appeared different from others teaching the same course.

## Supports

Dialogue with colleagues is a very important component of professional development. This had been previously recognized in our questionnaire data. Teachers were asked which resources or learning opportunities helped them with the implementation of the mathematics curriculum, 70% of teachers said that “dialogue with colleagues” helped them somewhat or a lot as shown in the table below.

**Table 1: The degree to which various resources or learning opportunities help implement the curriculum (top 6 choices)**

	Somewhat or A lot
Mathematics textbooks	80%
Dialogue with colleagues	70%
Ministry curriculum documents	60%
Teacher resource books that accompany a textbook	53%
Other published teacher resource books	49%
Professional development workshops	46%

While some of the case study teachers did not necessarily have colleagues in their school with whom they could discuss their ideas, many of them had made networks outside of the school. Many of the case study teachers had been involved in board or provincial initiatives. For instance, some had written some of the TIPS materials and others had been involved in a board-wide lesson study. These initiatives gave them the opportunity to meet and dialogue with colleagues who had ideas similar to theirs and to try out and discuss new ideas in their classrooms. Such opportunities helped to support their changes in practice.

In several cases, the teachers were also supported at the school level by the principal and/or the department head. Administrative support was seen as crucial to the confidence and comfort of the teacher in trying out new ideas. In the case of the use of manipulatives in the Grade 10 class, the entire department worked together to integrate manipulatives in all of their secondary math classes through the direction of the department head. This department head was, in turn, supported by the principal who provided release time so that the department head could work with new teachers on the integration of manipulatives in their courses. One of the Grade 8 case study teachers had been supported to take part in a lesson study initiative in a family of schools setting. This initiative was led by the mathematics coordinator, a secondary Vice-Principal and two elementary school Principals who not only supplied release time but also attended and participated in the preparation sessions with the teachers. These are just two of the many instances of strong administrative support for innovative mathematics teaching and learning.

## Summary

There are many influences on teacher practice. Even when teachers take it upon themselves to make changes in their practice they face many challenges. Some of the challenges are connected to lesson planning and enactment but other challenges have to do with the broader context in which the teacher is situated. A coach needs to be aware that the teacher may have many uncertainties as they move from familiar practices to some that are unfamiliar. Having an opportunity to voice those uncertainties and reflect on their practice is crucial to the teacher developing new practices.

## Case Study Scenarios

The following scenarios **do not** represent specific case studies from CIIM. Rather they are fictitious but are based on some of the understandings that the researchers gathered through CIIM case studies. Thus, each case study scenario presented may represent a composite of ideas drawn from the actual case studies and provides a situation that presents dilemmas and challenges that teachers may face as they change classroom practice. Examining these cases may be helpful to develop coaching strategies.

### Case Study Scenario 1

Sherry –Grade 8 teacher

Sherry is a Grade 8 teacher who is considered the lead math teacher in her school. When you as a coach first meet with her she tells you that she has been involved in a variety of professional development initiatives. These include board-level writing teams and taking part in provincial workshops, such as one presented by Cathy Fosnot. She recalls that in her own schooling she was taught math in a very traditional way and does not feel as though she had a sound understanding of the math she learned. She feels that the professional development opportunities she has had have increased her understanding of math and she is committed to giving her students a different experience of math and a different understanding than her school experiences gave her.

Sherry is very interested in developing her classroom practice to include more investigation, having students represent mathematical ideas in a variety of ways, and having students share and discuss their solutions. When you ask her about lesson planning she tells you that she pays close attention to the curriculum documents and even discusses the curriculum expectations with her students and their parents and talks to them about the verbs that are in the document. She has talked to parents about the idea that she is developing classroom practices to more adequately address the curriculum and to make sure that she students develop a sense of algebraic reasoning that is needed in Grade 9.

Sherry wants to focus on her use of open-ended problems. You observe her lesson and you see that she poses a problem and has students work in pairs to explore the problem and put their solutions on chart paper. She provides them with a variety of manipulatives to use as they explore problems. As students are working on the problems, Sherry circulates and records the different strategies that the pairs are using. After students have worked on the problem for a while she gathers all of the students together and uses her notes to choose different pairs to present their strategies. She specifically chooses the pairs to show a diverse range of thinking about and representing the problem and does not hesitate to ask students who may not have completed the solution but have come up with some interesting ideas to explore them. After each pair's presentation she pauses so that some members of the class can paraphrase the solution and others can ask questions about it. She then consolidates some of the ideas presented.

- 1) You are very impressed by Sherry's problem solving classes. The students are engaged and are very innovative in their approaches to problems. One thing that Sherry wants you to help her with is making sure that she is focusing on the important mathematical ideas

that students will need to know for Grade 9. She says that often she does not know where the lesson will take her because the students come up with a variety of different solutions. What are some things that you, as a coach, can do to help Sherry examine the mathematical ideas in her lessons?

You have now worked with Sherry for a few months and she is feeling more confident that she is focusing on important mathematical ideas. Her students are also developing some very unique representations for their problem solutions through diagrams, manipulatives, and even a dramatization.

Sherry recently decided to take part in a school board initiative with her Family of Schools. After a few meetings there is a discussion of setting up a lesson study group. Sherry joins another Grade 8 teacher and two Grade 9 teachers and together they design a lesson on integer operations that involves some peer tutoring, some teacher-led work, and a short game. They feel that this lesson can be taught at both the Grade 8 and Grade 9 level. The teachers visit one another's classrooms and observe the lesson being taught in a variety of settings. All of the teachers find this worthwhile as they are able to see the different contexts of high school and Grade 8. Sherry enjoyed seeing some of her former students in the Grade 9 class but wondered whether they were a bit overwhelmed with the size of the school and the busy-ness of the hallways. One of the Grade 9 teachers, Mark, explains that even the teachers have to shift rooms so there is no time to post student work and the desks in the classroom have to stay in rows as that is how the other teachers prefer them. Their discussion then settles on assessment of the ideas from the lesson. Mark said that he is going to assess the integer work with a multiple-choice test. Sherry was planning on having the students create games that required the use of all the operations. She is surprised that Mark suggested a multiple-choice test and he explains that he often uses multiple-choice tests for assessments to help to prepare the students for EQAO. He then shows Sherry some sample EQAO assessments so she can see what students have to do in Grade 9. Sherry leaves the meeting and starts to question whether what she is doing in her class is really preparing students for Grade 9. She has never used multiple-choice tests to assess her students.

2) Sherry contacts you with real doubts about whether what she is doing in Grade 8 is actually preparing her students for Grade 9. She saw a very different climate when she visited the secondary school and is really confused as to whether her instructional and assessment ideas are in line with what students will be expected to do in Grade 9. What is your response as a coach?

## Case Study Scenario 2

Josh – Grade 9 teacher

Josh is in his 6<sup>th</sup> year of teaching and is the most junior member of the mathematics department in a large secondary school. When you first meet him he states that he has taught a number of Grade 9 Applied and Academic courses as well as some senior courses. He uses a variety of resources for teaching and mentions that when the TIPS materials first became available to him he started using several of the activities with his Grade 9 Applied class and was very satisfied with how engaged his students were. He also states that he attended several sessions in the board where the materials were presented and the board math coordinator who was presenting noticed that Josh had many good ideas of ways to engage his students. Later, when the new TIPS4RM materials were being written, the coordinator asked Josh to join her on a writing team to write some activities for TIPS4RM. Josh created some tasks and used these and the tasks of others in both his Grade 9 Applied and Academic courses. He even shared some of the activities with his department but he noticed that very few of the activities were used by the other teachers of Grade 9. He didn't mind because it meant that the materials and resources required for his class were readily available.

Josh's work with the coordinator has helped Josh to be invited to other professional development opportunities. Last year Josh was able to attend a series of professional development opportunities on differentiated instruction. After attending these sessions he realized that he could begin using differentiated instruction and differentiated assessment by organizing units so that students have some choice as to which activities and tasks they would complete and submit to show that they have achieved the expectations of the unit. Josh used this idea in both his Grade 9 Applied and Academic courses in the first semester of the year and he felt that it worked really well. However, towards the end of the semester he wondered how he could extend this work with differentiated instruction so that it wasn't just about students making choices of assignments.

1) How would you as a coach help Josh to extend his use of differentiated instruction and assessment?

After you have worked with Josh for a while and he is developing his confidence with new ways of differentiating instruction he faces a challenge. It is nearing the end of the term and his colleagues in the department who were also teaching Grade 9 Academic are questioning Josh's use of student-choice as they believe that it could inflate the students' marks. They also question whether this use of differentiated instruction and assessment should be used at all as they claim that it is not very good preparation for Grade 10 Academic where there would certainly be no choice.

2) How do you help Josh deal with this dilemma?

### Case Study Scenario 3

#### Sandy and Phil – Grade 10 Applied and Grade 8

Sandy has been called an exemplary geography teacher who has an excellent rapport with the students, particularly in the Applied classes. However, after her second year of teaching, due to declining enrollment, she was asked to teach a math class and she was given a Grade 10 Applied class. She didn't mind as she had taken two courses in math-related subjects at university. In fact, after teaching Grade 10 math her first year, she took her Intermediate math qualifications over the summer through an on-line course. The principal is very pleased as there are few discipline problems reported. The math department head has supported Sandy and given her the opportunity to go to several workshops within the board. In fact, at the end of last year she went to two sessions about creating more mathematical communication within the classroom. Sandy enjoyed those sessions and met another teacher there who is teaching Grade 8 at their feeder school. Sandy and Phil decided that they would work together to do some peer-coaching on creating a math talk community. For the past several months they take turns visiting one another's classrooms. Sandy goes over during one of her prep periods every two weeks and Phil does the same.

They have decided that they would like to involve you as their coach and they have invited you to come and observe Sandy's class. While you watch, you see specific teacher behaviours that they have been working on. For instance, Sandy poses a question to the students and the students then turn to the person beside them to discuss the question posed. Students then provide answers and the teacher does not correct those answers but allows students to respond to the other students. At some points, pairs of students get up to present solutions and the teacher asks if there are any questions and the students sit down after answering questions. Phil is observing with you and mentions that it takes a while to learn to not jump in with the next response but to let the students argue mathematically. You think that they have done a great job to encourage mathematical discussion. However, the students have been arguing for the entire period about multiplying integers and the class ends with the students agreeing that when you multiply a negative and a positive, the sign of the answer is the sign of the bigger number. You also notice that during the discussion of multiplication of integers the students did not use any models for integers (hot and cold cubes, thermometers, number lines, etc.). You sit down to debrief the lesson with Sandy and Phil.

Sandy and Phil are proud of the way the students argued but want some advice from you as to where they should begin the next day. Sandy is not too pleased that the class ended with this misconception about integer multiplication. What do you do? How do you help with the planning for the next lesson?

**References:**

- Ball, D. L., & Even, R. (2004). The International Commission on Mathematical Instruction (ICMI) – The Fifteenth ICMI Study: The Professional Education and Development of Teachers of Mathematics. *Journal of Mathematics Teacher Education*, 7 (3), 279-293.
- Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. *Journal for Research in Mathematics Education*, 33, 239-258.
- Sarason, S. (1971). *The Culture of the School and the Problem of Change*. Boston: Allyn & Bacon.
- Suurtaam, C., & Graves, B. (2007), *Curriculum Implementation in Intermediate Mathematics (CIIM): Research Report*. Toronto, ON : Queen's Printer.
- West, L., & Staub, F.C. (2003). *Content-focused coaching : Transforming mathematics lessons*. Portsmouth, NH : Heinemann.