▲ In the Middle – From Start to End: Maximizing Instructional Time in the Intermediate Classroom

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We are well into our school year and have now created a mathematical environment in our classroom. When we walk in, we see walls covered with interesting puzzles, bookshelves full of math storybooks, games available to sign out on weekends, and math tools in bins readily available when needed. When we walk in, we hear pairs or triads discussing math problems, questions being asked, and students articulating their mathematical thinking.

Now that we've created this environment, how do we ensure we are utilizing instructional time effectively?

A video study from the TIMMS report had given some insight as to how time was typically spent within mathematics classes in the United States, Japan, and Germany (Fig 2) (Martinez, 2001). Japanese lessons featured a more active learning environment where students worked on problems, struggled with the problems, and then articulated their thinking by sharing different representations of the solution. Lessons from the United States and Germany were more teacher-led, where teachers provided instructional steps, examples, and opportunities to do seat work that were similar to the questions done in class. So how do we structure our class to incorporate a more student-centred lesson?

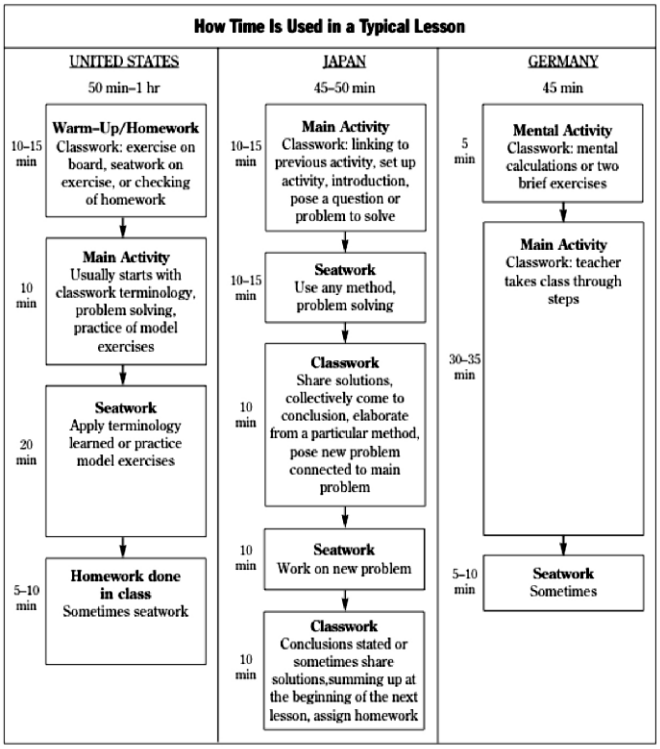


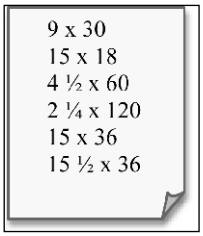
Fig. 2 Uses of time in classrooms in the United States, Japan, and Germany (USDE 1997, p. 57)

Here in Ontario, many are familiar with the three-part lesson format. TIPS4RM (Ministry of Education, 2010) refers to the parts as:

- Part 1 – Minds On
- Part 2 – Action!
- Part 3 – Consolidate Debrief

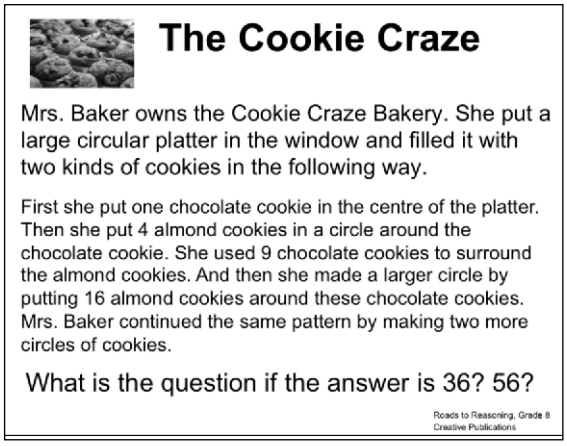
Part 1: Minds On "*Activating Prior Knowledge*" ~ 5–10 minutes

The *Minds On* is the hook to activate prior knowledge that is needed for the task with which students will be engaging in Part 2 of the lesson. A math string is one example of a *Minds On* task. For example, a question might be:



How could you mentally represent earlier calculations in the string to help you figure out later ones?

A *Minds On* can also be a problem. In one classroom, students were given the Cookie Craze problem, shown here from Krulik and Rudnick (2002). Clickers were used to respond to the problem. Discussions followed about how the mathematics was generally represented but further discussed later in *Part 3: Consolidate Debrief*.



The Cookie Craze

Mrs. Baker owns the Cookie Craze Bakery. She put a large circular platter in the window and filled it with two kinds of cookies in the following way.

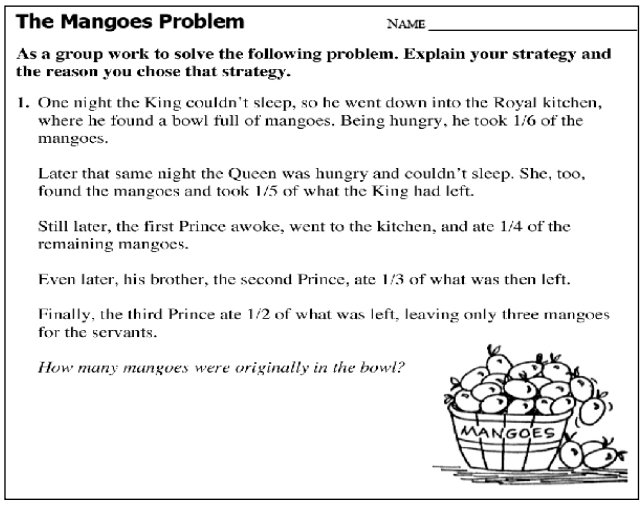
First she put one chocolate cookie in the centre of the platter. Then she put 4 almond cookies in a circle around the chocolate cookie. She used 9 chocolate cookies to surround the almond cookies. And then she made a larger circle by putting 16 almond cookies around these chocolate cookies. Mrs. Baker continued the same pattern by making two more circles of cookies.

What is the question if the answer is 36? 56?

Reads to Reasoning, Grade 8
Creative Publications

Part 2: Action! "The Investigation" ~ 15–20 minutes

The *Action*! is the part of the lesson during which students explore and investigate a new concept. Students can work in pairs or triads to solve a problem. Same-ability groupings allow every student to have a voice and be actively engaged in the process. Often when students are partnered with another student at a different level, the stronger, more assertive student tends to do the work. In this case, a problem from the NCTM Illuminations site was used.



The Mangoes Problem NAME _____

As a group work to solve the following problem. Explain your strategy and the reason you chose that strategy.

1. One night the King couldn't sleep, so he went down into the Royal kitchen, where he found a bowl full of mangoes. Being hungry, he took 1/6 of the mangoes.

   Later that same night the Queen was hungry and couldn't sleep. She, too, found the mangoes and took 1/5 of what the King had left.

   Still later, the first Prince awoke, went to the kitchen, and ate 1/4 of the remaining mangoes.

   Even later, his brother, the second Prince, ate 1/3 of what was then left.

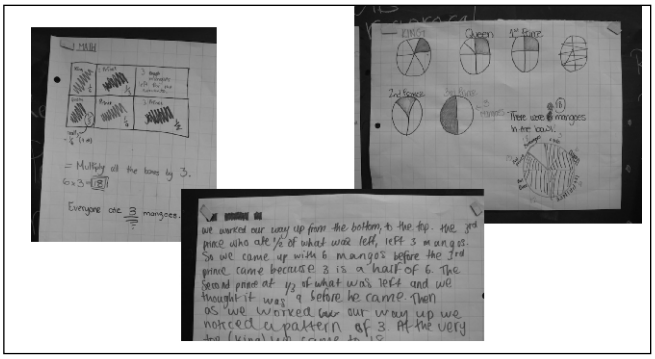
   Finally, the third Prince ate 1/2 of what was left, leaving only three mangoes for the servants.

   How many mangoes were originally in the bowl?

A variety of manipulatives, such as fraction rings and circles, are provided so students can choose tools appropriate to their learning style. Chart paper and markers are used to record students' thinking when they solve the problem.

Part 3: Consolidate Debrief "Summarizing the Learning" ~ 20–30 minutes

The purpose of the *Consolidate Debrief* is to connect the mathematical concepts to the actions students took in Part 2. Students summarize their learning by sharing their strategies, comparing and contrasting solutions, identifying common misconceptions, and raising other math questions that came out of the lesson. This consolidation can be done through a math congress, where students present and justify their work to their peers.



Questioning is a large and important part of the *Consolidate Debrief*. Robert Marzano (2001) describes instructional strategies that increase student learning. The following chart connects some of these strategies to actions taken during a math congress.

Instructional Strategies	During the congress…
Identifying similarities/differences	Ask: *"What is similar about these solutions? What is different?"*
Summarizing	Ask: *"Can someone describe what you think this group did to solve the problem?"* and *"What did you do when you got stuck?"*
Non-linguistic representations	Ask: *"How does the concrete representation connect to the algebraic expression?"*
Co-operative learning	During the task, students work in same-ability pairs/triads to actively involve all learners. These groups present together to justify their solutions.
Providing feedback	Teachers facilitate discussions, providing feedback and encouraging students to also provide feedback to solutions they see.

Now that we have a structure for our lesson, how can we support each other in our schools to have consistency among all our classes? Administrator support is key to making this happen. Scheduled time is needed during the day for teachers to plan together and teach together. Here are some suggestions that can help make this happen:

- **Pairs of teachers co-teach together.** This should be inquiry based, reflective, and collaborative. Teachers can take turns assuming the role of lead co-teacher and can teach either one of their classes together or both classes together. Co-teachers have "live time" professional discussions about what they are observing and doing and make collaborative decisions to best meet the needs of the students. The teachers are learning from each other as their students are learning from them.
- **Collaborative planning.** Teachers of a grade, division, or subject meet and plan lessons that include trying out the task/activity/problem and anticipating what student responses might be. The group could consider a focus for their professional learning, such as "questioning" or time on task for each portion of the three-part lesson. The focus is on planning and instruction and moves the community of teachers in a school along their continuum of learning.
- **Professional learning communities.** This professional learning community can take place right in the classroom. Teachers could have colleagues (teachers, administrators, consultants, coaches) come to co-teach with them. Other teachers can observe this co-teaching session and be involved in the debriefing and planning for the next lesson. The co-teaching model should be ongoing, whether it be once or twice a week or once a month.

Happy planning!

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