Re-Engagement: A Powerful Formative Assessment Practice

Silicon Valley Mathematics Initiative

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Abstract

This article reflects on the use of Re-Engagement as a practice that leverages formative assessment to inform instruction on a "just in time" basis. The importance of student work analysis and the facilitation of heterogeneous lessons that leverage authentic student work samples to move learning forward are discussed. Sample Re-Engagement lessons are exemplified.

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Re-Engagement

A powerful pedagogical approach to using formative assessment to inform and drive instruction is the use of Re-Engagement (Foster & Poppers, 2009; Lewis, Disston, Fisher, Foster, Friedkin & Perry, 2012). It is an organized, coherent, data-driven and targetable form of instruction that puts formative assessment to immediate use. If formative assessment is "students and teachers using evidence of learning to adapt teaching and learning to meet immediate learning needs minute by minute and day by day" (William and Thompson, 2007), then the question that necessarily follows is, " How *should* students and teachers use evidence of learning to adapt teaching and learning to meet immediate learning needs?". Re-Engagement answers that question.

Re-engagement occurs when student work is analyzed then samples from the class set of work are leveraged to drive instruction. Excerpts from student work, specifically chosen for their ability to bring important math ideas into the student arena, are facilitated with the class in a format that promotes student exploration, discussion, and the solidifying of ideas related specifically to the task and generally to the math landscape surrounding the task.
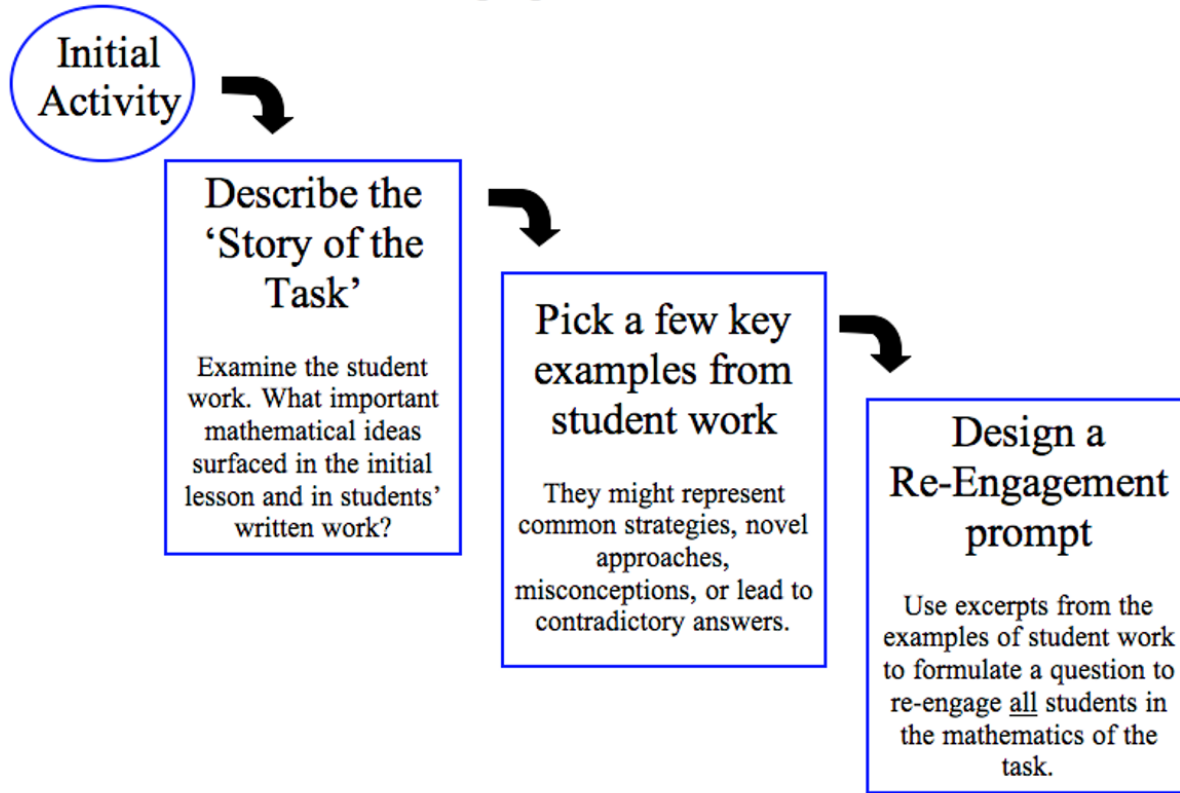
While holistic rubrics provide opportunities for students to self-assess and for teachers to assess in general terms, targeted and actionable formative assessment can be achieved with the use of a strong performance assessment that gives students the opportunity to showcase their thinking, coupled with a point-scoring rubric. A point-scoring rubric helps the teacher to focus on the specific mathematics embodied in each item of a performance assessment so that successful strategies and types of misunderstandings can be uncovered and understood. Misunderstandings that are relevant to the specific group of students can be addressed and successful strategies crowdsourced from the class set of work can be leveraged for the benefit of all students in the class.

This authentic use of formative assessment honors students by addressing the Teaching for Robust Understanding (TRU) Math dimensions of *Agency, Authority, and Identity*, "The extent to which students are provided opportunities to "walk the walk and talk the talk" – to contribute to conversations about disciplinary ideas, to build on others' ideas and have others build on theirs – in ways that contribute to the development of agency (the willingness to engage), their ownership over the content, and the development of positive identities as thinkers and learners" and *Formative Assessment*, "The extent to which classroom activities elicit student thinking and subsequent interactions respond to those ideas, building on productive beginnings and addressing emerging misunderstandings. Powerful instruction "meets students where they are" and gives them opportunities to strengthen their understandings." (Schoenfeld, 2014).
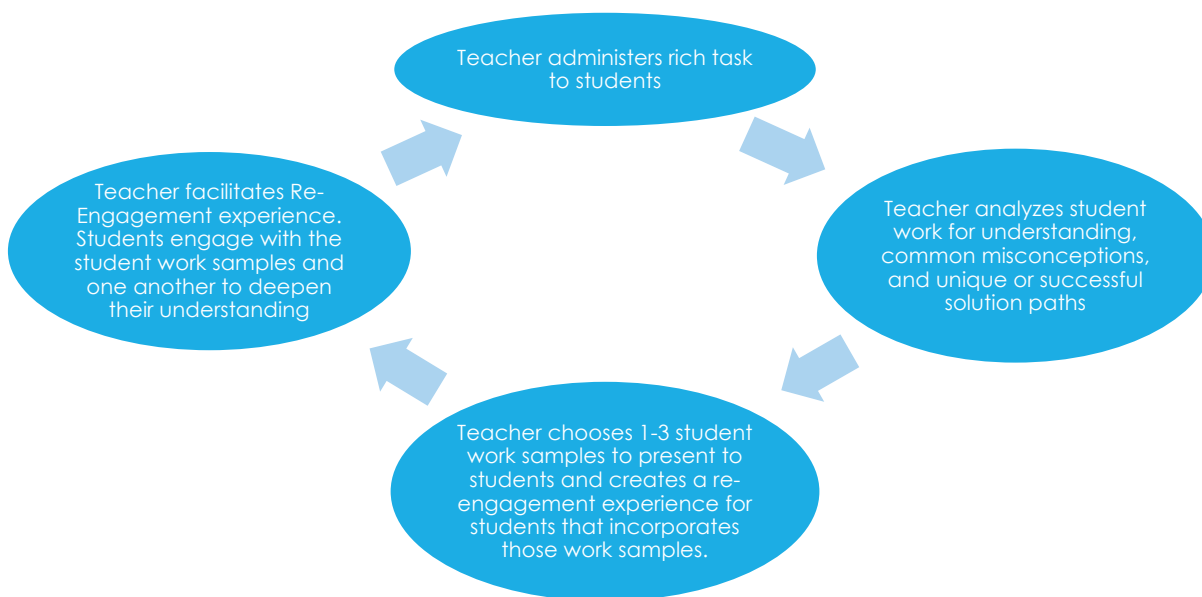
With the administration of any rich student task, teachers commonly find that student work on the task can range from confusion to fragile understanding to mastery. The essential question at this point is, "What next?". While it is tempting to isolate the students who are confused for more skills work or another pass at the information, while the rest of the class does something else (often much richer and more cognitively demanding), Re-Engagement provides a way to keep the whole class together, address misunderstandings and fragile understandings, showcase successful strategies, and challenge all learners at high levels of cognitive demand to engage more fully and deeply with the task, with the purpose of moving understanding forward toward the learning goals of the unit.

A strong Re-Engagement lesson includes many of the best formative assessment practices previously outlined in this chapter and synergizes them into a sophisticated lesson that provides a cognitively demanding learning experience in a heterogeneous setting. Re-Engagement provides access to and engages all learners, and facilitates the opportunity for students to own the learning process and be resources for themselves and one another. A Re-Engagement lesson incorporates complex instruction, embeds self-and peer-assessment, provides opportunities for all students, including English Language Learners, to explain and elaborate on their reasoning, and emulates the function of teacher diagnostic comments except that those comments also come from peers. Re-Engagement is a precision tool that uses formative assessment to target relevant instruction where it is most needed at a moment in time.

Re-Engagement Protocol

Initial Activity

Describe the 'Story of the Task'

Examine the student work. What important mathematical ideas surfaced in the initial lesson and in students' written work?

Pick a few key examples from student work

They might represent common strategies, novel approaches, misconceptions, or lead to contradictory answers.

Design a Re-Engagement prompt

Use excerpts from the examples of student work to formulate a question to re-engage all students in the mathematics of the task.

Re-Engagement Cycle

Teacher administers rich task to students

Teacher analyzes student work for understanding, common misconceptions, and unique or successful solution paths

Teacher chooses 1-3 student work samples to present to students and creates a re-engagement experience for students that incorporates those work samples.

Teacher facilitates Re-Engagement experience. Students engage with the student work samples and one another to deepen their understanding

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Snapshot:

A teacher plans and facilitates a Full-Period Re-Engagement lesson.

Fran is an experienced elementary school teacher who has been teaching for over 25 years in diverse classrooms, including learners with special needs. Fran's 5th and 6th grade students have been learning about growing patterns. Fran recently administered the 5th grade performance task *Buttons* (Mathematics Assessment Resource Service, 2003) to his students. They were in the middle of their course of study about growing geometric patterns and algebra, and he wanted to know how his students were doing in terms of their ability to use a geometric arrangement pattern to describe, extend, and make generalization about its numeric pattern. He was also interested to see what connections his students might make between additive and multiplicative reasoning and the *Buttons* task makes a space for this. Fran knew that if he could learn what his students knew at this moment in time and with what they were struggling at this point in the unit, he could then tailor his next instructional steps to respond to what his students need to get closer to meeting the goals of the unit.

The *Buttons* Task

Buttons	Test 5 Form A Rubric		
The core elements of performance required by this task are: • describe, extend, and make generalizations about a numeric pattern Based on these, credit for specific aspects of performance should be assigned as follows:		**Points**	**Section Points**
1. Draws correct Pattern 4.		1	1
2. Gives correct answers as: Pattern 5 = **15** white buttons Pattern 6 = **18** white buttons Gives explanation such as: Pattern 5 has 3 rows of 5 white buttons = 15 white buttons and Pattern 6 has 3 rows of 6 white buttons = 18 white buttons. *Special case:* Gives answers 16 and 19 with correct explanations including black buttons.		1 1 1 2 s c	3
3. Gives correct answer as: **34** Gives explanation such as: Pattern 11 has 3 rows of 11 white buttons = 33 white buttons and 1 black button. *Special case:* Gives answer as 33 with a correct explanation for the white buttons.		1 1 1 s c	2
4. Gives explanation such as: Pattern 24 needs 3 rows of 24 white buttons = 72 white buttons and 1 black button, 73 buttons in all. *Accept alternative correct explanations such as: 69 is divisible by 3, so it cannot be correct.* Gives correct answer as: **73**		1 1	2
	Total Points		**8**

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After administering the Buttons task to his students, Fran used a point scoring rubric to help him focus on the mathematics in the various parts of the task as he closely examined and analyzed his student work.

Upon analysis, Fran determined the following:

Many students were able to see the geometric growth pattern and form a generalization in words or in number algorithms.

Even for students who understood the growth pattern, some explanations and justifications were unclear.

Some students might have found the generalization but they had trouble using it for a specific pattern number or number of buttons.

Some students could find the answers or come close to a solution but used strategies that were inefficient, tedious, and may have led to errors. Common examples included:

- Students used a "drawing and counting" strategy, even for very high pattern numbers, then miscounted.
- Students ignored the black button and solved only for the white buttons every time.
- Students used a bulky "repeated addition" strategy then made calculation errors.
- Students used graphs then, because of graphing inaccuracies, arrived at incorrect solutions.

After careful student work analysis, Fran realized that his students needed more experiences that required them to move beyond drawing the next figure in the pattern so that they analyze the pattern and represent the growth numerically. He wanted his students to move beyond thinking about "what comes next?" to thinking about the problem as a whole: this involves generalizing what is happening with the growth, but need not necessarily involve variables or algebraic equations. Being able to see what remains the same and what changes in a pattern would help his students to develop algebraic thinking and the ability to make a generalization. Asking questions about how the pattern changes would help his students to move beyond counting and drawing strategies to rules that will solve for any number in the pattern.

Based on these findings, Fran decided that that he would choose two different ways that students were successful on Item 3 of the task then ask his students to make sense of those two students' solutions. He wished to create the opportunity for the entire class to re-engage with the growing pattern, as a way of solidifying their understanding of both the pattern's growth and of an expression to represent that growth, by asking them to make sense of two of their classmates' solutions.

Fran replicated two different Item 3 student solutions onto a single sheet and gave one to each student. Fran has his student seated in table groups of 4. He gave everyone 2 minutes of quiet think time to make sense of the sheet then asked each table group to have a conversation about the two solutions.

Learners A and B

Learner A

3. How many buttons in all does Gita need to make Pattern 11?
34 buttons

Explain how you figured this out.
I x (11 x 3) + 1 = 34 buttons. I added one for the black button in the middle

Learner B

3. How many buttons in all does Gita need to make Pattern 11?
34 buttons

Explain how you figured this out.
I added 4 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 = 34 which is the number of buttons.

- Compare and contrast these two different strategies.
- What is similar and what are the differences?
- Record some of the things you hear at your table on the lines below.

Next, Fran handed out a Learner A sheet and a Learner B sheet to each table. He asked pairs of students at each table to claim one of the solutions and dig in deep to build that solution with square tiles, to make sense of how that learner was thinking about the growing pattern, and why they created the expression to represent the growing pattern the way they did.

Learner A

3. How many buttons in all does Gita need to make Pattern 11?
34 buttons

Explain how you figured this out.
I x (11 x 3) + 1 = 34 buttons. I added one for the black button in the middle

What does Learner A see staying the same? What does Learner A see changing? Draw a picture to show how Leaner A sees this pattern through the first 3 steps. Color coding and modeling with square tiles may come in handy.

Pattern #1   Pattern #2   Pattern #3

Visual Representation
Describe in your own words how Learner A sees this pattern growing. Be sure to mention what is staying the same and what is changing.

Learner B

3. How many buttons in all does Gita need to make Pattern 11?
34 buttons

Explain how you figured this out.
I added 4 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 = 34 which is the number of buttons.

What does Learner B see staying the same? What does Learner B see changing? Draw a picture to show how Leaner B sees this pattern through the first 3 steps. Color coding and modeling with square tiles may come in handy.

Pattern #1   Pattern #2   Pattern #3

Visual Representation
Describe in your own words how Learner B sees this pattern growing. Be sure to mention what is staying the same and what is changing.

As students were working together, Fran circulated through the room to both listen to and watch what students were doing and saying so that he could decide who to ask to present to the whole class at the end of the lesson. He was on the lookout for one pair to present about Learner A and another pair to present about Learner B.

Once it came time to present, Fran facilitated the discussion to allow the students to do the bulk of the talking and explaining. Students grappled with what stayed the same and what was changing. For Learner A, one pair of students saw the one black button as "always there" and the three new dots that always added on for each additional pattern numbers as another arc of a rainbow.

For Learner B, there was a hot debate about where the 4 resided in the pattern. The entire class acknowledged that the 4 stayed the same but some students thought it was in the center of the pattern, while others thought that it was comprised of the one black button at the beginning and the 3 end buttons of each arm of the rows of buttons. The students sustained their own conversation about the two learners for at least ten minutes, asking questions of one another and answering them without Fran's help. Fran finally stepped in at the end to add some clarifications and summarize learning by revoicing some of the important points that had been made by students and by organizing them into a coherent summary.

By the end of the math period, nearly every class member had contributed to the class discussion and Fran was satisfied that learning had been moved forward.

Snapshot:

A teacher plans and facilitates a Mini Re-Engagement lesson

Sandy is an experienced teacher. Sandy's Algebra 1 students have been learning about linear equations and writing expressions and equations that include variables to represent situations. Sandy recently administered the Algebra 1 performance task How Old Are They? (Mathematics Assessment Resource Service, 2007) to her students. Sandy knew that many students were struggling to make sense of mathematical situations described in words and translating them to expressions or equations with one or more variables. In particular, on this task, Sandy saw that students were having difficulty with the two-step process of writing expressions with variables to represent Ben's age in terms of Will's age, then Jan's age in terms of Will's age. As she analyzed the student work, she came across a common misconception. Many student were confusing doubling with squaring when it came to doubling a variable. Sandy decided to create a Mini Re-Engagement lesson to address this misunderstanding. Sandy knows from experience that simply mentioning a misunderstanding and telling students how to correct it has not gained much traction in the past. Sandy plans to create a Re-Engagement math talk addressing items 1 and 2 that will take about 10-15 minutes at the beginning of class.

The *How Old Are They?* Task

How Old Are They?

This problem gives you the chance to:
- form expressions
- form and solve an equation to solve an age problem

Will is w years old.

Ben is 3 years older.

1. Write an expression, in terms of w, for Ben's age.

_____

Jan is twice as old as Ben.

2. Write an expression, in terms of w, for Jan's age.

_____

If you add together the ages of Will, Ben and Jan the total comes to 41 years.

3. Form an equation and solve it to work out how old Will, Ben, and Jan are.

Will is _____ years old

Ben is _____ years old

Jan is _____ years old

Show your work.

4. In how many years will Jan be twice as old as Will? _____ years

Explain how you figured it out.

_____

_____

_____

_____

_____

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MAC RUBRICS 2007 Test 9

Task 4: How Old Are They?		Rubric
The core elements of performance required by this task are: • form expressions • form and solve an equation Based on these, credit for specific aspects of performance should be assigned as follows	points	section points
1. Gives a correct expression: **w + 3**	1	1
2. Gives a correct expression: **2(w + 3)**	1	1
3 Gives correct answers: Will is **8** years old Ben is **11** and Jan is **22** years old Shows correct work such as: w + w + 3 + 2(w + 3) (allow follow through) 4w + 9 = 41 4w = 32	1 1 1ft.	3
4. Gives a correct answer: in **6** years time Gives a correct explanation such as: Will is 14 years younger than Jan so when Will is 14 Jan will be 28. 14 – 8 = 6. Accept guess and check with correct calculations. Solves correct equation.	1 1	2
Total Points		7

After using the How Old Are They? point scoring rubric (Mathematics Assessment Resource Service, 2007) to analyze student work, Sandy has decided to use the work of two different students to provide the opportunity for her class to discuss the *doubling vs squaring* misconception.

Sandy will contrast the work of Learner A, who wrote correct expressions for both items 1 and 2, with Learner B, who wrote an incorrect expression for item 2 that contains the *squaring* misconception. She will then facilitate a student discussion to help her students make sense of the two learners' expressions, giving them a chance to re-engage with the concept and learn from one another's ideas during the discussion.

Sandy has decided to create two posters for her math talk. On one, she will bring back the information from Items 1 and 2 of the task. On the other, she will showcase Learner A's and Learner B's responses and provide some questions to help students engage in the Math Talk Mini Re-Engagement lesson.

Poster 1   **Poster 2**

How Old Are They?

Will is *w* years old.
Ben is 3 years older than Will.

1. Write an expression in terms of *w* for Ben's age.

Jan is twice as old as Ben.

2. Write an expression in terms of *w* for Jan's age.

	Learner A	Learner B
Q1	$w + 3$	$w + 3$
Q2	$2(w + 3)$	$w^2 + 3$

Are these the same? Will both result in the same answer?

If they are not the same, how are they different? Which one do you agree with and why?

Sandy facilitated the Math Talk Mini Re-Engagement lesson by first showing Poster 1 and asking students to share what they remembered about the task. She then showed Poster 2, noted that Learner A and Learner B both had the same expression for Item 1 but different expressions for Item 2. She then asked the questions at the bottom of Poster 2, gave some quiet think time, then facilitated the whole-class discussion. After about 10 minutes, Sandy was satisfied that the difference between $2(w+3)$ and $w^2 + 3$ was better understood and that the class agreed that $2(w + 3)$ was the expression that would correctly find Jan's age.

A Re-Engagement lesson can be short or long, depending on the learning needs of the students at any given point in time. When implemented regularly, whether as a periods-long exploration or a short Math Talk, or somewhere in between, Re-engagement will set the class' expectation that their authentic student work matters and that it will be used on a regular basis to move learning forward.

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