Werklund School of Education

Supporting teachers' use of reSolve tasks through PLCs

reSolve WS

April 2018

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https://vimeo.com/268893255

3 key things

- What it means to have a common goal
- What it means to collaborate
- What it means to have a community of inquiry

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What it means to have a common goal

- A specific situation/focus everyone can contribute to, relate to, and find personally useful

- **Activity 1:** Exploring experience in using reSolve tasks
- Develop knowledge/understanding of what could **work well** to inform use of the reSolve tasks.
- Develop guidelines/principles each person could adopt/adapt

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- **Activity 2:** Exploring a pedagogical theme/topic

- Develop knowledge/understanding of the teacher's role in supporting students' learning with reSolve tasks
- When and how should the teacher intervene?

- Develop guidelines/principles each person could adopt/adapt

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Activity 3: “Concept study” of a mathematical theme/concept

Explore and compile alternative meanings/ representations/instantiations of concepts in reSolve tasks

Develop flexibility in thinking about, and use of, a mathematics concept in a reSolve task

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- **Activity 4:** Exploring students' alternative ways of thinking
- Develop knowledge/understanding of students' thinking of mathematics concepts/procedures in reSolve tasks
- Enhance ability to notice and interpret students' thinking
- Develop guidelines/principles about students' thinking each person could adopt/adapt

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What it means to collaborate

- **Activity 1:** sharing your experiences of what worked well for each person; pooling/combining/merging the information collected and focused on that.
- **Activity 2:** You were to combine/pool the observations you made about teacher intervention
- **Activity 3:** Involved combining your knowledge of a mathematics concept from across grades and different situations.
- **Activity 4:** Involved combining your understanding of students' alternative ways of thinking

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What it means to have a community of inquiry

- The activities involved having you conduct some form of inquiry with the outcome being a set of key ideas/principles/conjectures/knowledge/skills, some recorded on the chart paper. Cycle of testing, revising, retesting …

- Share some outcomes:

  - **Activity 1:** Exploring what worked well

  - **Activity 2:** Exploring teacher intervention

Activity 3: Concept study: exploring alternative meanings/ representations/instantiations of concepts in reSolve tasks

- Share your example

- For the concept multiplication, discuss and compile a list of meanings/representations/ instantiations of it

- **Activity 4:** Exploring students' alternative ways of thinking
- Open-ended inquiry to make a list of things that you notice

- Could be more focused depending on the nature of the student's work; e.g., Jeffrey's case, what do look for?

What does Jeffrey know or can do? What does he not know? How is he making sense of the concept that is different from what is expected? What is his alternative conception?

Summary

- 3 key things to support and sustain a PLC are:
  - **a common goal**
  - **genuine collaboration**
  - **a community of inquiry**

Examples of categories of activities:

1. Exploring personal experience with a specific focus in using reSolve tasks
2. Exploring a pedagogical theme/topic to support students' use of the tasks [e.g., teacher intervention]
3. "Concept study" of a mathematical theme/concept of the tasks
4. Exploring students' alternative ways of thinking

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Mathematics knowledge for teaching

- Specialized content knowledge (SCK)
  - Knowing alternative meanings/approaches/interpretations of a mathematics concept or procedure [65−18]
- Knowledge of content and teaching (KCT)
  - Knowing instructional advantages of different representations; what mathematical representations to use with students and which of those representations are likely to be understood and misunderstood by students
- Knowledge of content and students (KCS)
  - Knowing the ways students understand the content; students' mathematical thinking and alternative approaches [65 – 18 = 53]

Mathematical purpose (for teachers)

- Year 2, place value cards: This task builds students understanding of ***commutativity*** and the ***multiplicative place value properties*** of numbers through the context of skip counting
- Year 3, number chart chess: Students explore the ***place value patterns*** on the number chart as they move along ***rows and columns***. They use place value to aid and model the difference between numbers.
- Year 4, cartoon counting: Students will participate in an exploration of a ***different number base*** to build a deeper understanding of and appreciation for our base-10 ***number system***.

Mathematical thinking

- Explore tasks for mathematical thinking and supporting students' development of it
- Traditional classrooms do not focus on MT
- Not doing mathematics
- Work as a mathematician

Mathematician's perspective

- Mathematics is a method of inquiry and a field of creative endeavor.

- Mathematicians engage in a journey of inquiry that includes high order of thinking, intuition, and imagination to get to a destination.

Andrew Wiles [1953]

- Fermat was a 17th-century mathematician who claimed that for the general family of equations:

  $x^n + y^n = z^n$ where n is bigger than 2, it is impossible to find a solution.

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Doing mathematics

I can best describe my experience of doing mathematics in terms of **a journey through a dark**, unexplored mansion. You enter the first room of the mansion and it's completely dark.

You stumble around bumping into the furniture, but gradually you learn where each piece of furniture is.

Finally after six months or so, you find the light switch, you turn it on, and suddenly it's all illuminated. You can see exactly where you were.

So each of these breakthroughs, … couldn't exist without – the many months of stumbling around in the dark that precede them.

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- Doing mathematics involves stumbling around in the dark looking for patterns, testing conjectures, and estimation results, for example.

- In general, it involves mathematical thinking.

For students to think mathematically, they need

- to analyze and understand mathematical ideas,
- to perceive or discover structure of, and structural relationship among, the ideas,
- to see how things fit together, i.e., drawing or supporting conclusions about the ideas and their relationships,
- to solve problems involving the ideas,
- to reason in extended chains of argument

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- reSolve task does this!

- PLC explore MT via tasks

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- Relationship between reSolve protocol and reSolve PLC protocol ???

https://vimeo.com/268894622

reSolve Protocol [Odds and Evens - Year 4]	reSolve PLC Protocol [pedagogical task/problem]
reSolve Mathematics is Purposeful - Students experiment, form hypotheses, and then test and prove their theories - Draw on prior knowledge but introduce new contexts for study - A rigorous examination of a simple set of concepts with practical applications	**reSolve PLC is Purposeful** - Teachers experiment, form hypotheses, and then test and prove their theories - Draw on prior knowledge but introduce new contexts for study - A rigorous examination of a simple set of concepts with practical applications
reSolve Tasks are Challenging Yet Accessible - Students given an unstructured problem and then allowed time to interact with the problem on their own terms and to experiment with its possibilities - Allow for a range of approaches to suit student skill levels - Focus on students sharing and working together to recognise patterns in their collective data, and are structured so that all students can make a valuable contribution.	**reSolve PLC Tasks are Authentic and Accessible** - Teachers decide on an unstructured situation and then spend time to identify and interact with a problem on their own terms and to experiment with its possibilities - Allow for a range of approaches to suit different teachers' grade skill levels - Focus on teachers sharing and working together to recognise patterns in their collective data/experiences, and are structured so that all teachers can make a valuable contribution.
reSolve Classrooms Have a Knowledge Building Culture - Class collects and analyzes data as a group - Focus is independent exploration and then collective discussion and analysis in which each student provides their own particular examples	**reSolve PLCs Have a Knowledge Building Culture** - Collect and analyse data as a group. - Focus is independent exploration and then collective discussion and analysis in which each teacher provides their own particular examples

reSolve Protocol [Resolve bakery - multiplication year 5]	reSolve PLC Protocol [mathematical task]
reSolve Mathematics is Purposeful - Conceptual Understanding: to build students' understanding of multiplication - Fluency: flexibility of calculation and having multiple methods available. - Problem solving: creativity when finding ingenious alternative ways to multiply. - Reasoning: students explain their reasoning about multiplication using an array	**reSolve PLC is Purposeful** - Conceptual Understanding: to build teachers' understanding of a concept - Fluency: flexibility of maths process and having multiple methods available - Problem solving: creativity when finding ingenious alternative strategies - Reasoning: explain reasoning/strategies
reSolve Tasks are Challenging Yet Accessible - Accessible to all students; carefully sequenced - Challenge to explain reasoning clearly and open investigation	**reSolve PLC Tasks are Authentic and Accessible** - Accessible to all teachers; carefully sequenced for grade levels - Authentic to "doing mathematics" – reasoning and open investigation
reSolve Classrooms Have a Knowledge Building Culture - Learn from each other work samples and reasoning. - Teacher will actively orchestrate sharing [to highlight connections between solution strategies, explore the efficiency of some strategies over others and allow opportunities for students to ask questions]	**reSolve PLCs Have a Knowledge Building Culture** - Learn from each other work samples and reasoning - Teacher-leader will actively orchestrate sharing