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Disciplinary Literacy in the Mathematics Classroom
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For too many students mathematics can be described as an endless stream of procedures and facts to be memorized, recalled, and applied correctly when needed without any kind of real applicable understanding. The requirements of an ever-changing workplace dictate that basic skills and routine expertise will not be sufficient for today's students as they become tomorrow's workforce. Instead they will need "the levels of knowledge and understanding that can support transfer to new problems, creativity and innovation, something we now recognize as 'adaptive expertise'" (Pellegrino, 2006). Students need to know both specific content knowledge of mathematics - for example, facts, concepts, skills, procedures, and notations- as well as strategic action knowledge- and how to use that content and knowledge in a generative way to construct new understanding and solve novel problems. Students need to acquire a willingness and ability to work with numbers and quantitative and spatial relationships and "above all, they need to be willing to pursue a quest for certainty-to demonstrate the mathematical attitude" (van Oers, 2001).

For students to develop these capabilities, they must have an opportunity to engage in true mathematical activity in the classroom. This can be characterized as a cycle of investigation that is intended to lead to the development of valid mathematical ideas. This involves investigating patterns, experimenting, forming and testing conjectures, and developing and debating convincing arguments that both prove and explain (Silver, Kilpatriick, & Schlesinger, 2005).

In a disciplinary literacy (DL) classroom, mathematical activity involves the processes of mathematical inquiry- for example, pattern finding, conjecture, generalization, proof, refutation- by enacting learning practices such as discussion and collaboration, proposing and defending mathematical ideas and conjectures, responding thoughtfully to the arguments of peers, and pointing out and correcting their own and other's errors (Goos, 2004). In short, the classroom becomes a community of inquiry where thinking, reasoning, sense making, and problem solving are socially constructed activities.

In order for students to engage in inquiry around important mathematics content, they have to develop a mathematical attitude and mathematical habits of thinking. These habits include: individual reflection and self-monitoring, working backward from the end point (Goos, 2004), looking for patterns, visualizing, trying to understand how and why something works, tinkering (guessing and checking) (Cuoco, Goldenberg, & Mark, 1996), reasoning from and between representations (Boaler & Humphreys, 2005), persevering through difficulties, and drawing on prior knowledge. These practices make it possible for learners to figure out solutions to problems and make sense of mathematical ideas.

Processes of thinking cannot be learned in isolation. The processes of thinking are intertwined with the content of thought. Teaching habits of thinking in isolation from the content does not work because students do not understand when, and how to apply them.

Directly teaching content alone is not the answer either:"Clearly, teaching the underlying principles alone does not improve performance, but equally clearly, performance proficiency does not produce conceptual understanding. We must consistently teach these kinds of knowledge together in action, explicitly acknowledging how the different forms of knowledge work together."

McConachie,S & Petrosky,A.(2010) Content Matters, SanFrancisco, CA, Jossey-Bass, 63-85.