TEACHERS' ATTITUDES AND PERCEPTIONS ABOUT MATHEMATICS TEACHING AND LEARNING

Teachers' own beliefs about mathematics, how children learn mathematics, and what constitutes good teaching affect the way teachers choose to teach mathematics and what they choose to teach.

Research has shown us that many graduates of teacher education programs still end up teaching the way they were taught as students (usually in a traditional manner) despite the quality of their teacher education program. This must change in light of our changing society and the current research on effective mathematics teaching and learning. It is a major challenge for school administrators if a teacher does not believe that change is necessary in the mathematics program.

Teacher beliefs, and the choices teachers make, can have a major impact on how students view mathematics and their learning of it. According to research, it is suggested that teachers' beliefs about mathematics are often limited and may be dualistic, in the sense of having a traditional right/wrong orientation and using mostly single procedures to arrive at the correct answer. A consistent theme found in Cooney, Wilson, Albright, and Chauvots (1998) RADIATE study was that teachers equated good teaching with good telling. In other words, students should understand mathematics step by step and should not be confused. A second theme that was found was that of "caring." Because teachers cared about their students' success in mathematics class, they felt that caring meant enabling students to master basic skills, often putting aside challenging tasks on assessments for those that mimicked the traditional skill-based lessons done in class. This is a reductionist orientation that is counter to reform efforts in mathematics.

Baroody (1998) provides a summary of research on three different views of mathematics that have been identified among teachers:

1. Mathematics as a collection of unrelated basic skills
2. Mathematics as a coherent network of skills and concepts (mathematics as a static body of knowledge)
3. Mathematics as a way of thinking (inquiry process, mathematics as a dynamic field)

Knowledge and beliefs are inextricably intertwined. Our beliefs are like a filter through which new phenomena are interpreted. A teacher's sense of purpose as a mathematics teacher, philosophy of learning and teaching, and sense of responsibility in terms of the community in which he or she teaches are all fused with what the teacher "knows." As well, it is important for teachers to be reflective practitioners. In the case of mathematics, teachers need to see mathematics as a creation of

knowledge rooted in rationality. Mathematics knowledge is not static; it is fluid. Context and reflection play an important role in allowing the knowledge required by reform to be fluid and flexible. Both "what the teacher knows" and the way the knowledge is acquired are important issues.

Administrators can push teachers to change their classroom activities, but we also need to change their fundamental beliefs and attitudes about teaching and learning, the roles of teachers and students, and how teaching and learning should be carried out. For change to be successful, teachers' beliefs, attitudes, and practices need to be aligned.

It seems logical that influencing teachers' beliefs may be essential to changing teachers' classroom practices. At one end of the beliefs continuum are traditional beliefs. Stipek, Givvin, Salmon, and MacGyvers (2001) found that teachers who scored high on these more traditional beliefs were less self-confident about teaching mathematics and enjoyed it less. In their data analysis, five dimensions of beliefs (more traditional beliefs linked to teachers' being less confident about teaching mathematics) were strongly associated with each other:

1. Mathematics is a set of operations to be learned.
2. Students' goal is to get correct solutions.
3. The teacher needs to exercise complete control over mathematics activities.
4. Mathematics ability is fixed and stable.
5. Extrinsic rewards and grades are effective strategies for motivating students to engage in mathematics.

If one looks at the opposite end of the dimensions (reform-based beliefs linked to teachers' being more confident about teaching mathematics), there was consistency in the following beliefs:

1. Mathematics is a tool for thought.
2. Students' goal is to understand.
3. Students should have some autonomy.
4. Mathematics ability is amenable to change.
5. Students will want to engage in mathematics tasks if the tasks are interesting and challenging (not for extrinsic rewards).

The authors speculate that building teachers' self-confidence in mathematics (which requires building their mathematical understanding) could be an important

Three-Part Lesson Model

BEFORE	**Getting Ready** ❑ Get students mentally ready to work on the task. ❑ Be sure all expectations for products are clear.
DURING	**Students Work (the problem)** ❑ Let go! ❑ Listen carefully. ❑ Provide hints. ❑ Observe and assess.
AFTER	**Class Discourse** ❑ Accept student solutions without evaluation. ❑ Conduct discussion as students justify and evaluate results and methods.

Source: Adapted from Van de Walle (2003, p. 43). Reprinted with permission by Pearson Education Canada, Inc.

There is significant value in teaching through problem solving:

- Problem solving places the focus of the students' attention on ideas and sense making.
- Problem solving develops mathematical power.
- Problem solving develops the belief in students that they are capable of doing mathematics and that mathematics makes sense.
- Problem solving provides ongoing assessment data that can be used to make instructional decisions, help students succeed, and inform parents.

SUPPORTING TEACHER GROWTH AND DEVELOPMENT

Principals can use a number of strategies to support teachers as they develop more proficiency in mathematics teaching. The paragraphs below will outline a variety of strategies to help the mathematics improvement initiative in your school move forward.

Be Present in the Classroom

Spend time in classrooms observing teachers and coaching them on teaching for mathematical proficiency. It is important to monitor teachers' mathematics programs to ensure that the components of an effective mathematics program (e.g., teaching through problem solving, integration of communication, inclusion of alternative strategies) are effectively implemented and observed. Provide meaningful feedback and guidance about the mathematics instruction you observe in classrooms.

Elicit the Help of Math Coaches or Instructional Leaders

If you as the principal do not feel competent in coaching teachers, bring in the mathematics consultants or district-level staff to work with teachers on improving their mathematics programs. Lay out clear expectations for teachers so that they design their mathematics instructional programs according to the curriculum their school district is expected to follow and the goal of mathematics proficiency for all.

Have Mathematics Specialists on Your Staff

Hire one or more mathematics specialists if the school is an elementary school. If this is not possible due to staffing or collective agreement limitations, encourage teachers on staff who are interested in improving their mathematics teaching to pursue the formal courses needed to become mathematics specialists themselves. Be sure to pass out information about mathematics additional qualification courses. Encourage participation in mathematics workshops and professional development initiatives, as well as visits to exemplary mathematics classrooms, to assist those teachers interested in becoming mathematics specialists.

Make Math Blocks at Least One Hour Long

It is very important that sufficient time be allocated for mathematics learning. Many schools have adopted a timetable with large blocks of time for literacy learning. A similar block of time should be allocated for mathematics. Ideally, an uninterrupted one-hour block should be allocated for mathematics learning each day.

Title	*Author*	*Number Sense and Numeration*	*Measurement*	*Geometry and Spatial Sense*	*Patterning and Algebra*	*Data Management and Probability*	*Primary*	*Junior*
Adding Animals	Hawkins, Colin	•					•	
Alexander, Who Used to Be Rich Last Sunday	Viorst, Judith	•	•				•	
Amanda Bean's Amazing Dream	Neuschwander, Cindy	•					•	•
Among the Odds and the Evens	Turner, Priscilla	•					•	
Anno's Counting Book	Anno, Mitsumasa	•					•	
Anno's Hat Tricks	Nozaki, Akihiro, & Anno, Mitsumasa							•
Anno's Journey	Anno, Mitsumasa		•				•	•
Anno's Magic Seeds	Anno, Mitsumasa	•			•		•	•
Anno's Math Games	Anno, Mitsumasa	•	•	•	•	•	•	•
Anno's Mysterious Multiplying Jar	Anno, Mitsumasa	•					•	•
Anno's Three Little Pigs	Anno, Mitsumasa, & Morl, Tuyosl	•			•		•	
Arthur's Funny Money	Hoban, Lillian	•					•	
Baseball Counting Book, The	McGrath, Barbara B.	•					•	•

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