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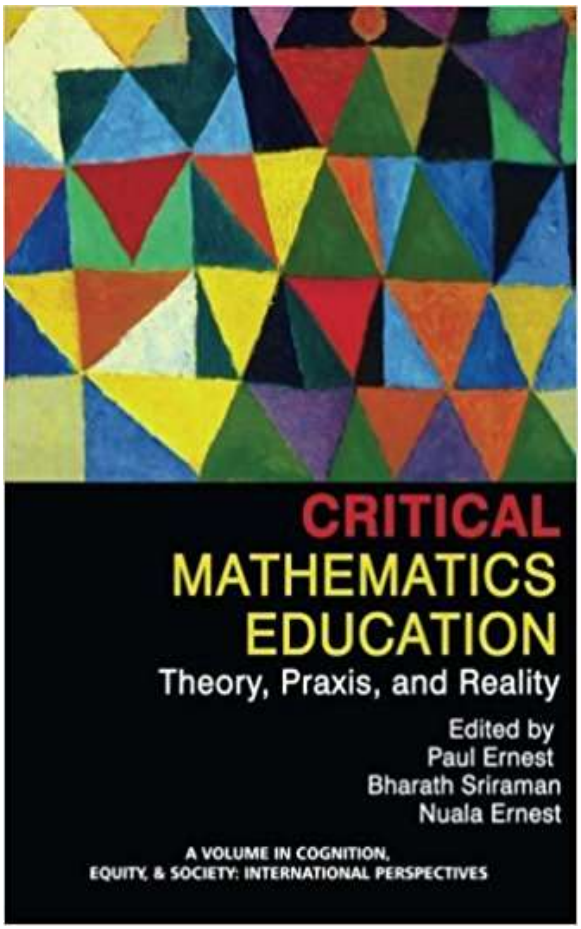


Postmodernism deconstructed traditional knowledge (e.g., art, music, literature, mathematics, etc.) in the essential statement, "All knowledge is perspective," from Friederich Nietzsche. Using postmodernism to reconsider the meaning of mathematics itself and teaching mathematics is a common theme *in Critical Mathematics Education: Theory, Praxis, and Reality*. In this book, critical thinking plays a role in providing different perspectives on teaching mathematics in the 21st century. It means mathematics and mathematics education can make the leap from the natural science perspectives into social, political, global, and even cultural perspectives to reconceptualize the meaning of teaching mathematics.

The themes of cultural perspectives and ethnomathematics (cultural vs. mathematics education) permeate every chapter. Using ethnomathematics as the overarching essential question, the authors in each chapter provide the different perspectives to rethink current mathematics education. Chapters include the following topics: philosophy (chapter 1),

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ethnomathematics (chapters 2 and 10), globalization (chapters 3 and 4), sociology (chapters 5, 6, 7, and 8), language (chapter 9), pedagogy (chapters 11 and 12), politics (chapters 13, 14, and 15), culture (chapter 16) and school mathematics (chapter 17).

Ethnomathematics provides effective resources for curriculum specialists to reconsider the meaning of education in the 21st century. Based on the ethnomathematics position, mathematics curriculum design may need to switch gears from delivering isolated mathematics knowledge to living a creative life with the use of mathematics. It is as Ernest (in chapter 2) mentioned:

> The big challenge we face is the encounter of the old and the new. The old is present in the societal values, which were established in the past and are essential in the concept of citizenship. And the new is intrinsic to the promotion of creativity which points to the future. (p. 26)

The perspectives of "knowing-how" rather than "knowing-what" provide opportunities to upgrade current mathematics curriculum. Ernest indicated a "new concept of curriculum synthesized in three strands: literacy, matheracy and technoracy" (p. 28). The three strands – literacy, matheracy and technoracy (D'Amrosio, 1999b) – clearly reshape the mathematics curriculum design and provide a solid foundation for mathematics curriculum discussions. The meaning of these three are as following:

1. Literary: the capability of processing information such as the use of written and spoken language, of signs and gesture, of codes and numbers;
2. Matheracy: the capability of inferring, proposing hypotheses, and drawing conclusions from data; and
3. Technoracy: the critical familiarity with technology….(p. 28)

Typically a literary concept, the notion of "cultural diversity" needs to be reconsidered in the mathematics curriculum. Language proficiency between students who receive free or reduced lunches and those who do not presents significant differences in needs. Even though mathematics seems more like a universal symbol language without cultural preference or personal bias, teaching mathematics is still based on the ability of students' natural language to understand the academic language of mathematics. Human rights (discussed in chapter 10) still need to be a concern in mathematics education.

The concept of matheracy may provide a foundation for the discussion of global perspectives. For example, the concept of mathematics or mathematics education in the United States actually stands for Western mathematics perspectives. Most people ignore the perspective of "western" and dogmatically assume whatever matheracy skills appear in textbooks is what mathematics education should be in the whole world.

The globalization perspective change (discussed in chapter 3) is another important issue in mathematics education. People generally assume that developing countries will take the research in mathematics education developed in Western countries and apply it in their countries. The education environment, however, has changed. The "developed" countries no longer control and impose their research agenda and practices on "developing" countries" (p. 45) as mentioned in chapter 3. Ernst pointed out that "The Anglo-centric cultural milieu" has changed because in the 21st century, the perspectives of education have become localized, socialized, and personalized in their schools.

The skill of technoracy is well illustrated in chapter 4 in one of these four concepts: description, inscription, prescription, and subscription. By using these four concepts, the mathematics curriculum designers can focus more on mathematical creativity used in real life rather than solo arithmetic skills. For example, the very notion of "subscription"

appears to include an element of free choice (p. 93). If the curriculum does not enrich free choice opportunities, it "may risk losing less quantifiable kinds of learning like creativity and deep understanding of concepts, social awareness of the role of mathematics modeling in society and other kinds of learning addressed in the international examination regime" (p. 95).

No doubt, the whole world is changing their perspectives in the resignation of time and space. People are rethinking if Western mathematics should dominate the whole world's education system or whether mathematics education should be localized. People are also rethinking if and how mathematics teaching of the past can be effective in the 21st century. Those perspectives stand on Heidegger's idea, "that our understanding of ourselves and our world presupposes something that cannot be fully articulated, a kind of knowing-how rather than a knowing-that" (p 106).

Chapter 6 provides a meaningful discussion of the concept of *equity education* in mathematics education. For example, the well-known phenomenon of students with an affluent status having a positive correlation with their math scores is evaluated thoroughly. Even though society, especially U.S. society, emphasizes equal education in both *de re* and *de facto* perspectives, mathematics education still turns out to be an elite subject for students from rich families. This theory, the *class habitus*, is explained well by the sociologist Pierre Bourdieu. Class habitus is a concept to explain how groups of people share similar dispositions, similar attributes, and similar habits. This means that using ability grouping in mathematics allows the higher performing math students to continue their "habitus" in their mathematics classrooms, which is different from the mathematics classrooms for the lower performing math students. The key point here is that the classroom environment will change teachers' belief systems. Teachers of lower performing students may experience the following:

> In these classrooms, students reported that they were offered a very limited curriculum, that there were significant behavior problems in the classrooms and that the teachers did not appear to believe that the students could learn mathematics (p. 136)

Along with the theory of habitus (in chapters 6, 7 and 8), parents may use the habitus concept to create a good foreground for their children. The concept of foreground by Skovsmose (1994) is summarized as follows: "Intentions are grounded in a landscape of pre-intentions of *dispositions*" (p. 179). To consider children's future development in social, political, and cultural situations, schools would tend to arrange foregrounds for their students. This attitude of creating better foreground for better students facilitates academic hierarchy in this society. In the mathematics field, a group of university mathematicians may use their social power to "take care" of those potentially elite math students. So mathematicians dominated the recent National Mathematics Advisory Panel in the United State (Greer, 2012) and have been accorded considerable power in the ongoing preparation of "Common Core State Standards" in mathematics for the United States (p. 165). These standards represent the dominant ideology in the field of mathematics education.

In chapters 11–17, the authors present pedagogies, politics, cultures, and school mathematics. Teaching knowledge implementation is discussed through case studies. Pedagogical discussions (in chapter 11) in mathematics education are related to how we can provide more opportunities for students to use the mathematics language (discussed in chapter 9), by engaging students in social practice. It is a kind of cultural perspective that teaching mathematics is teaching the isolated knowledge that is beyond human beings. Teaching mathematics provides

rich opportunities for students to use mathematics in real life, to engage mathematics in their personal life, and to make the best observations and decision-making. The best way to put all of those do-math concepts into the pedagogy discourse is activity-based teaching or project-based teaching (Lo, 2010). Students will build their language meaning through pedagogical imagination, practical organization, and explorative reason (Skovsmose & Borba, 2004).

Activity-based or project-based teaching in math education expects the math teacher to create a context that is based on real life situations. Within the project-based tasks, critical questions from teachers can help "pupils critically reflect on different aspects" (p. 239). This kind of inquiry activity can capture students' imaginations and interest in learning. Project-based teaching is also relevant to the use of mathematics from a political perspective because it is the responsibility of 21st century mathematics teachers to enable their students "to take an active and critical participation in the society" (p. 268). No matter the countries or societies in which our students are living, logical citizens are the foundation of 21st century education. The value of ethnomathematics is that it helps us to approach this goal.

In summary, each chapter of *Critical Mathematics Education* guides readers to rethink current mathematics education, reconstruct the design of mathematics curriculum development, and require new perspectives in teaching mathematics in the 21st century. But some questions remain. What is the best way to communicate between developed countries and developing countries? What is an effective role for social, political, global perspectives in our future mathematics education? What is the best way to infuse pedagogical discourse into our teaching knowledge? How can we provide the best teacher education for the 21st century? Using the postmodern theories in this book to analyze different perspectives in mathematics education is a powerful, critical exercise that can inspire mathematics educators around the world to answer these questions and others.

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