Negotiating the Classroom

John Richards
Harvard University, USA
richards/at/cs4ed.com

> Upshot • Borg et al. argue that there is a Mathematics-Negotiation-Learner (M-N-L) structure that can be used as a conceptual framework in order to evaluate the application of radical constructivism in teaching. This structure assumes a coherent consensual domain that is the mathematics being negotiated. However, there are at least four different consensual domains that make up mathematics. The mathematics that is the consensual domain in an RC classroom has distinct features that are designed to support the student's construction of mathematics.

« 1 » In their target article Philip Borg, Dave Hewitt, and Ian Jones argue that there is a Mathematics-Negotiation-Learner (M-N-L) structure that can be used as a conceptual framework in order to evaluate the application of radical constructivism (RC) in teaching. They do an excellent job in targeting the language they are using by careful definitions of these terms. The authors conclude that M-N-L is an effective instrument that helped in determining the extent to which the teacher was sensitive to his own beliefs. While I agree with the authors, in my judgment, the argument falls short by not examining the nature of the negotiation in an RC classroom.

« 2 » In §3 the authors argue that mathematics "is the consensual domain […] of mathematical concepts and skills existing among persons […]." The problem with this definition is that there are multiple consensual domains (CD) that make up mathematics. So what is the CD that is created by an RC teacher? In Richards (1991: 15f), I argued there are (at least) four different CDs in mathematics:

- *Research math* is the spoken mathematics of the professional mathematician and scientist.
- *Inquiry math* is used by mathematically-literate adults, including some mathematics teachers.
- *Journal math* is the language of mathematical publications and papers.
- *School math* is the discourse of the standard realist classroom in which mathematics is taught.

« 3 » Research math and inquiry math are structured according to what Karl Popper (1959) called a "logic of discovery." Journal math is based on journal articles that are designed to transfer information to a community that has already accepted many presuppositions – in our terms, the community is operating with an established CD. School math is patterned after journal math. Both school math and journal math are structured as "reconstructed logic" (in the sense of Popper 1959).

« 4 » The authors define mathematics for the students (MFS) as "[…]the mathematics the teacher intends to teach to a particular group of students" (§3). As it stands this definition is ambiguous between inquiry math and school math. Inquiry math emphasizes the discovery (or rather, the construction) of mathematics. For the teacher and student this involves the negotiation of a CD. School math, as a reconstructed logic, assumes the existence of an established CD. In point of fact, this explains some of the core problems with applying the realist perspective to a classroom. When a student is learning there is a natural negotiation of an evolving CD. In Michael Oakeshott's words, education is an initiation into the conversation "begun in the primeval forest and extended and made more articulate in the course of centuries" (Oakeshott 1962: 199).

« 5 » The challenge for the RC teacher is to support a logic of discovery in the classroom and to promote the student's exploration of mathematics. This leads naturally to a discussion of the nature of the conversation in a mathematics classroom. As Alan Schoenfeld argues, the problem is that teachers are telling students about problem solving. For Schoenfeld, "the primary responsibility of mathematics faculty is to teach their students to think: to question and to probe, to get to the mathematical heart of the matter" (Schoenfeld 1983: 2).

« 6 » The student's construction of mathematics results from an active exploration of, in this case, problem solving. The primary distinction is between the teacher "telling" and the student constructing. The teacher supports construction by posing problems, asking questions, discussing, and suggesting counter-examples in the context of a genuine mathematical discussion. As the authors point out in the lead quote from Paolo Freire, both the student and teacher are learning and teaching. That is because in a genuine mathematical discussion both the teacher and the student are listening.

« 7 » In the article, the teacher-student negotiation is supported by the *Grid Algebra* software. The software is designed explicitly for classroom use to promote exploration. It contributes to establishing classroom culture by structuring and constraining the conversation. Note that the software does not correct the student, it behaves. It is a puzzle that the student acts to solve. In an important sense Grid Algebra is part of the classroom negotiation – involving both the teacher and the student. In less experienced RC teachers it provides a scaffolding for the classroom discussion.

« 8 » The M-N-L structure is indeed useful for evaluating the constructivist teaching within a school context. But, in my judgment, it can play a more powerful role when we analyse the nature of the mathematics that is being negotiated. The nature of inquiry math provides guidance for teachers who want to create a climate of exploration, and it supports teacher preparation that emphasizes the establishment of a positive classroom culture that supports negotiation:

> "In class, try to avoid telling your students any answers […] Confront your students with some sort of problem which might interest them. Then allow them to work the problem through without your advice or counsel. Your talk should consist of questions directed to particular students based on remarks made by those students." (Postman & Weingartner 1969: 194)

John Richards is President of Consulting Services for Education, Inc., http://www.cs4ed.com, and Adjunct Faculty, Harvard Graduate School of Education. He is the senior author of the Software and Information Industry Association's PreK-12 annual market survey and together with Chris Dede he edited *Digital Teaching Platforms* (2012). From the mid-1970s until the late 1980s John worked with Ernst von Glasersfeld, Les Steffe, Paul Cobb, and Pat Thompson on the conceptual foundations of number and on von Glasersfeld's fundamental insights regarding radical constructivism.

Received: 23 October 2016
Accepted: 24 October 2016