

DG 16: The evaluation of mathematics teachers and curricula within educational systems: From promising practice towards some researchable questions

Team Chairs: Glenda Lappan (USA), Michigan State University, USA,
glappan@math.msu.edu
Barbara Clarke, Monash University,
Barbara.Clarke@Education.monash.edu.au

Team Members: Sri Wahyuni, Universitas Gadjah Mada, Indonesia
Mohamed Ahmed Ould Sidaty, Mauritania
Alvaro Poblete, Universidad de Los Lagos, Chile

The questions that were the focus on the discussion were:

How do current requirements for increased accountability in education, and the ensuing trends of widespread evaluation of teachers, curricula, and systems, influence the teaching and learning of mathematics, as well as teachers and learners? What forms of such evaluation can further and accelerate the development of mathematics education rather than distort it?

The following papers were provided as pre-reading to support the discussion:

Manizade, A. G., Clemson University: Developing rubrics and measures for evaluation of mathematics teachers pedagogical content knowledge of geometry and measurement at the lower secondary level: Delphi Study

Wang, X., Shanghai Normal University: An assessment method of mathematical classroom teaching for senior high schools

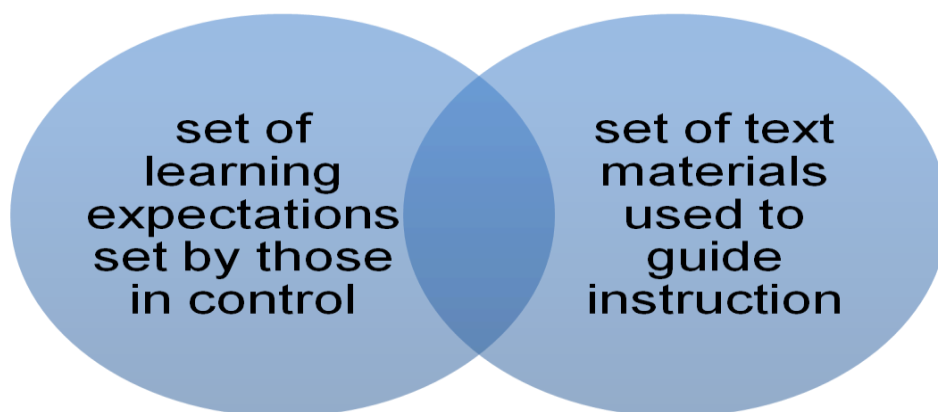
Diaz, V. & Poblete, A.: The evaluation of mathematics learning in context

Poblete, A. & Diaz, V.: The evaluation of the professor of mathematics and quality of education

To further set the context for discussion, the chairs briefly presented the following focus.

The Evaluation of Curricula within Educational Systems

Focus on curriculum as:



As background, Glenda Lappan presented data from an analysis of Grade Level Expectations (GLE) within curricula from 42 US states (Reys, 2006)

They found variation in:

- The **specificity** in the guidance given to teachers on what is expected to be learned
- The level of **complexity** of the standards statements themselves
- The level of **cognitive demand** (very few expectations for explaining and justifying)
- The **grade placement** of GLEs

The consequences of the variation in GLEs created:

- Challenges for the developers of textbooks
- Challenges for interrelating student learning across states or regions of the country
- The recommendations from the CSMC analysis for the United States were to identify major mathematical goals and build learning trajectories for these goals within and across appropriate grade levels and to collaborate to promote clarity and consensus across states.

Questions that guided the discussion

- What is the role of curriculum expectations?
- Who is involved in setting expectations?
- For whom are such documents written?
- What are the consequences of such documents?
- What evaluation plan does each country have for judging a set of expectations?
- How is the decision to change a set of expectations made?
- How are mathematics text materials developed to reflect the expectations?
- Who is involved in the development?
- What help do teachers have or need to enact such materials?
- What kinds of evaluations can help continually improve both learning expectations and their related textbook materials?

The Evaluation of Teachers within Educational Systems

Barbara Clarke shared experiences from her work in the Australian context focusing on the development and use of Professional Standards for Teachers of Mathematics. In evaluating teachers it is important to acknowledge the many tensions including the following.

Standards without standardization—Can we have measurable standards without standardising practice?

Meaningful but manageable processes—Can we balance the need for manageability for teachers and yet provide convincing evidence?

Accountability with individual professional growth—Can an emphasis on teacher professional learning and development be retained?

What aspect of the teacher or their teaching is evaluated? In some contexts there may be explicit statements of expectations or standards for teaching. The following list of aspects to be evaluated was generated by an ICME 10 DG (Niss, 2008) and has many similar themes to Standards documents developed in Australia and the USA:

1. Subject matter knowledge for teaching mathematics—including both breadth and depth of knowledge, clear understanding of the connections between concepts, an understanding of potential difficulties students may have, use of appropriate representations and a knowledge of typical misconceptions students have.
2. Knowledge of student learning—including the need to provide opportunities for all student to learn, knowing how children learn, what they have learnt as well as what to do about it.
3. Professional growth—including a commitment to learning themselves and being open to reflection – to keep reassessing their own practice.
4. Teaching practice—successful implementation is essential. This includes planning of appropriate tasks, developing a culture and environment where learning happens and actual teaching and learning.
5. Actual student learning. Have the students learned some important mathematics and can the teacher enable and facilitate independent thinking of students.

Questions that guided the discussion

- What are current productive practices across contexts and systems?

- What aspect of the teacher or teaching is evaluated?
- How is it evaluated? What tools or techniques are being used?
- Who is involved in the decisions on expectations and methods?
- What are the impacts both positive and negative on different stakeholders?

Discussion

The group was quite small but varied in context including country, system setting and experience. The intention was to provide an opportunity for discussion and sharing for those involved and a focus towards producing “researchable questions” as an output of the group. The questions above provided the initial sharing of practices.

In relation to the *evaluation of teachers* there was a clear message of the need for comprehensive expectations and evaluation techniques. No single measure can evaluate a teacher or the complex practice of teaching. Problems were identified in contexts where there was no accountability or external expectations. However there were concerns expressed about simple measures or those divorced from the context. There was successful practice described that focused on the value of a professional learning community where teachers worked together to improve, and challenged and supported each other in that improvement.

There was considerable discussion relating to the mathematical knowledge required for teaching and how this might be evaluated. There is a developing research base in this area with potential to inform systems on both the aspects that need to be evaluated and on tools to enable the evaluation.

In relation to the *evaluation of curriculum*, the discussion focused on the dramatic differences in how curriculum is developed and deployed in different countries. In some countries, the Ministry of Education sets curriculum expectations. In other countries, the United States for example, each state sets curriculum expectations in mathematics and other subject areas. In either system, teachers and curriculum coordinators evaluation and select curriculum materials for classroom use in a particular school.

Researchable Questions

It was agreed that we would frame the discussion to enable a sharing of experiences and practices and develop researchable questions based on these.

Evaluation of Curricula

- What tools do teachers need to evaluate materials?
- What are criteria, tools, or frameworks for evaluating mathematics curriculum materials in ways that are professionally agreed on and for use by teachers, school districts, teacher educators, and researchers?
- What aspects are important to, or needed by teachers?
- What will help teachers in evaluating the conceptual trajectory or development across a set of materials?
- What are the elements of a framework for looking at curriculum materials? What are the mathematical affordances in the materials? How do the materials build? What are the elements of a set of lenses through which that examination could focus?
- How are the materials structured?
- What is the balance between using the kinds of situations that allow students to think through unfamiliar situations and those that promote computational fluency?
- What tool will help teachers determine the assumptions about learning that the authors of the curriculum have?

Evaluation of teachers and teaching

- What mathematics do teachers need to know?
- What makes effective mathematics teaching? Evaluation should reflect what we know about effective mathematics teaching.

- How do we develop an instrument to characterise the mathematical quality of teaching and instruction?
- How does the cycle of evaluate, reflect, and refine work in a school setting?
- In what ways does the cycle of evaluation, reflection, and refining enable professional growth?
- What structures need to be in place in an institution to enable professional growth?
- What are criteria, tools, or frameworks for characterising the mathematical quality of instruction in ways that are professionally agreed on and for use by teachers, school districts, teacher educators, and researchers?

Concluding comments

The evaluation of teachers and curriculum is fraught with multiple agendas. Resolving or just managing the professional, the political and the systemic contexts is difficult. There are many unanswered questions and great potential for researching these. Much of our discussion focused on the teacher in these processes and the following quote from a project (see Clarke, 2005) where teachers were required to develop portfolios to enable evaluation of their practice by others captures much of the tensions and challenges:

‘How does one compare teachers’ work on a “level playing field” while acknowledging that teachers have individual styles and different levels of creativity in their teaching? Some say the only way to do this is in “measurable” things such as students’ results on standardized tests. Has the teacher “added value” (a phrase I abhor) to the students’ abilities over the course of their teaching? I can’t fully agree with this. Teaching is such a complex thing and learning even more so. How can one quantify such a complex human experience? Whilst my subject is Maths, I basically interact with the world through “feeling”. “How does it feel?” is my guideline. A portfolio of work (with the opportunity to speak in one’s own voice about how people feel about teaching) seems a good compromise between “economic rationalist” accounting of students’ results and the “human” side of teaching.’

References:

- Clarke, B. A. (2005). Assessing highly accomplished teachers of mathematics. In M. Coupland, J. Anderson, & T. Spencer (Eds.) *Making mathematics vital: Proceedings of the 20th Biennial Conference of the Australian Association of Mathematics Teachers*, pp. 87-92), Sydney: Australian Association of Mathematics Teachers.
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