

**Canadian Mathematics Education Forum**  
**Report of Working Group: Classroom Practice and**  
**Mathematics Education Research**

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The working group on classroom practice and mathematics education research focused on three core topics: teachers as researchers, teachers as consumers of research, and research as the sharing of experience. Before the Forum we distributed the following question prompts and asked participants to come prepared to share their ideas:

**Teachers doing field research**

- a. What can we see in classrooms where teachers are doing research? (for students, for schools, for teachers)
- b. What supports do these teachers credit in helping them make research happen in their classrooms? What further supports could they have used?
- c. Where did the research get shared?
- d. What are some of the methodologies used in action research?
- e. What supports to teachers need with regard to using research methodologies?
- f. What are some of the issues at various levels around conducting classroom research?

**Teachers as consumers of research**

- a. What can we see in classrooms where teachers routinely refer to “published” research in order to shape their practice?
- b. Of the forums for research dissemination, what makes some more accessible and useful to practicing teachers and teacher educators?
- c. What supports do teachers credit in helping them access and experiment with the results of research?
- d. What further supports could teachers use?

**Research as the sharing of experience**

- a. In what ways can teachers share successful and problematic classroom experience without framing the experience as research?
- b. What issues influence the ability to share?
- c. What are the characteristics of “professional learning communities” in which sharing is both common and productive?

In addition, several participants were asked to give short presentations on some of their experiences as researchers or consumers of research.

## **Presentations**

We began with a talk that established the difference between research methods (techniques for gathering evidence) and methodology (a theory and analysis of how research should proceed), and refreshed our knowledge of techniques (observations, interviews, surveys, questionnaires), and of terminology (qualitative, quantitative).

Margaret drew on the work of Goodchild and English (2002) who note that, “frequently, a description is provided of ‘how’ ... research [is] done but rarely is an analysis given of ‘why’ and more particularly, out of all the methods that could have been used, what influenced the researcher to choose to do the research in the manner described?” (p.xii).

She presented several examples of math education research from *Researching mathematics classrooms: A critical examination of methodology* (Goodchild & English, 2002) and asked the participants to suggest possible research approaches. The cases included: Simon Goodchild’s exploration of mathematics activity of 14/15 year olds in a UK classroom (he used an ethnographic approach); Nora Linden’s investigation of early learning experiences of young special needs children in Norway (she engaged in conversations outside the classroom with various informants – teachers, special needs teachers, parents, and children); Ruth Shane’s investigation of the impact of school teaching experiences on the development of teacher candidates’ pedagogical awareness (she used an intervention and monitoring approach); and Shirley Yates’ investigation of the relationship between student attitudes and attainment in mathematics (she used psychometric instruments and statistical analysis).

By discussing these examples and comparing our suggested approaches to the actual research methods used, the participants developed a working relationship and a shared understanding of the broad range of possibilities in mathematics education research.

The group then moved from a consideration of research in general, to focus on the core themes. Each of the three presentations that follow - an elementary teacher’s reflections on her use of research in the classroom, a faculty of education lecturer’s examples of two projects that illustrate how teachers can use research in conducting an inquiry into their own teaching, and a secondary teacher’s experiences in conducting action research and sharing research results, informed our discussions and the formulation of the recommendations at the end of this paper.

## **Putting research into practice: A teacher's perspective**

*Anna Dutfield*

I was never comfortable with mathematics during elementary and secondary school, and I avoided math classes at university. I was a math-phobe! It was not until I went to teacher's college and had to learn how to teach math that I began to feel more comfortable with learning and doing math.

I was not taught to teach math the way I had learned math; however, once in my own classroom, I reverted to old habits. I continued to teach that way, with little use of concrete materials, over-use of textbooks (drill and kill) and little emphasis on problem-solving or communication in math, until I was appointed to teach grade 3. That is the year in which the province administers the EQAO standardized test in mathematics, reading, and writing. The first year my students did the test, I was lost and they were lost; I knew I had to do something to change my teaching in order to better support my students, so I applied to mark the test.

The experience of marking changed my thinking. By exploring holistic marking of processes rather than just the final solutions, I became more aware of techniques I might be able to integrate into my own teaching. I slowly began taking risks, incorporating problem-solving questions, open-ended challenges, and more manipulative use as part of my regular lessons. I was so intrigued by these new ideas that I began the three year process of completing my Mathematics Specialist additional qualification. That is where my own research began.

During the first of the three courses, assignments were geared to researching one aspect of my math program, with 2 or 3 students only. I learned that I needed to start small, start slow, and start where I was most comfortable. I worked on using problem-solving to cover concepts, develop understanding and promote communication, and developed a few simple open-ended mathematical challenges for one math unit (measurement). The readings, the reflections and the experimentation all contributed to the new ideas, and new teaching methods I was developing.

In Parts 1 and 2 of the specialist I explored student attitudes, took further risks with my whole class, and continually reflected (in writing and just personally) on how new techniques worked, how they benefited my students and how I could use such techniques

in future lessons. All along I had the support of my instructors, my administration and my colleagues. This support was, and still is crucial. I took the initiative to look for additional professional development opportunities to develop and improve my teaching and learning of mathematics. I became affiliated with mathematical associations, subscribed to math journals, and started providing leadership and workshops for colleagues. I continue to do so now, as I complete my Master's of Education, with a focus on the teaching and learning of elementary school Mathematics.

What I have learned over the last 7 or 8 years is that teachers need time, and ongoing support and encouragement to implement changes recommended in the research literature. Great changes can come about but there has to be a need to change, and a desire to change. The inspiration will be different for every teacher, but the key is to find that inspiration and to nurture it.

### **Teacher inquiry as research**

*Pat Margerm*

The two examples of teacher inquiry I will discuss here were course assignments from an Additional Qualifications course in mathematics for primary and junior teachers. The Office of Field Development of York University's Faculty of Education has developed a model for Additional Qualifications courses that combines both instruction and a teacher inquiry component as follows:

[A] unique element of our program is a teacher inquiry project that allows you to explore questions of direct interest related to your own teaching and learning. It is classroom-based and through observation of events in your classroom or other learning environments, you are asked to be curious and look critically and reflectively at your own practice. You are encouraged to seek out and try fresh ideas in your classroom, and to discover explicit links between your learning and your students' learning.

<http://www.yorku.ca/foe/Programs/FD/AQ/Info/>

The outline for the inquiry component, which comprises 60 of the required 125 hours of the course, includes an expectation that teachers will examine best current practice/research.

In the first example, the teacher's inquiry question developed from reading research results on teacher "wait-times". The teacher documented her journey, identifying her initial skepticism about the research on the effect of teacher "wait-time" on student learning, and

describing her further research on the topic, the data collection methods that she developed in order to collect evidence of the impact on student responses and finally her surprise at the results.

In the second example, the teacher's inquiry focused on the impact of cooperative learning on the level of engagement in mathematics lessons. The criteria for determining the level of student engagement was taken from research and used to develop a method of data collection to measure the level of student engagement.

Both of these projects are evidence of the effectiveness of the course model in providing opportunities for teachers to use research to inform practice.

### **Action research and dissemination of results**

*Louis Lim*

There are several key aspects of action research: teachers engage in research with their students, and teachers are in control (i.e., action) of the research. The process is iterative through planning, acting, observing, and reflecting (Kemmis & McTaggart, 1988).

As a high school mathematics teacher, I have conducted several action research studies. Action research has empowered me. It has allowed me to document and critically reflect as I implement the reforms in our new curriculum, and it has provided classroom-based evidence to support or reject changes I have instituted in my instruction or assessment methods.

I first engaged in action research during my M.Ed. thesis work, when I investigated the implementation of multiple assessments in my grade 9 applied mathematics class. I have since looked more closely at written communication in mathematics, including the role of free-writing. At first, my applied students were resistant to open-ended free-writing.

Through structured prompts and by explicitly telling students to develop action plans, I was able to provide students with enough direction so resistance was no longer an issue. Collaboration with university mathematics education researchers has enriched my action research studies. It has helped me direct my studies, find relevant literature, and develop theoretical frameworks. In addition to contacts with my own professors, I have networked at conferences; for instance, I met Dr. David Pugalee, from the University of North Carolina at Charlotte, by attending his session at the NCTM regional conference in

Montreal several years ago; since then I have carried out several projects with him (cf., Lim & Pugalee, in press).

Dissemination of the findings of action research is important. Through articles or conference presentations the teacher researcher can share findings and engage in dialogue with colleagues. In Ontario, there is an annual action research conference hosted by the Ontario Educational Research Council that is attended by teachers and board consultants. Also, there are journals for classroom teachers and teacher educators such as the *Ontario Action Researcher* and *AR Expeditions* that publish action research studies.

Conducting action research has helped me grow professionally, but I do not believe it should be mandatory for all teachers. As Vicki Zack says, “requiring that all teachers should do research implies that teaching alone is not enough, and perhaps reflects a lack of understanding of the demands and drain of teaching, let alone teaching and researching” (Glanfield, Poirier, & Zack, 2003, p. 56).

## **Discussion**

Throughout the sessions we discussed aspects of the working group themes in light of the presentations and the experiences of the participants. We recognized the transforming effect of a research experience on teacher practice, but we realized that there were a number of underlying factors that hold teachers back from learning about research and from participating in research projects. These included: math anxiety – especially among elementary teachers; the belief that teaching math is simply about teaching familiar algorithms and memorizing definitions and rules; and (perhaps most important) the lack of time for taking advantage of mathematics PD opportunities. At the same time, we noted that PD activities are often ineffective in helping teachers change their practice.

We discussed a number of options – most importantly, the provision of long term, research-based and classroom-focused professional development, but also, more research articles and reports written in teacher-friendly language, and an increase in the dissemination of the results of teacher research.

By the end of the sessions the members of our group realized that none of these ideas would be effective unless teachers saw themselves as part of the research community. They would need to be encouraged from the beginning to see themselves as both “users” and

“doers” of research. In turn, teacher educators, and school, board and Ministry personnel would need to change their attitudes towards teachers.

## **Recommendations**

Based on our discussions, the classroom practice and mathematics teacher research working group concluded that research can transform a teacher’s practice. By ‘research’, we mean reading study reports and syntheses, conducting action research, networking to share teaching experiences, experimenting with new materials and tools, acting as host to researchers, and carrying out inquiry projects. We know, however, that to engage in transformative activities teachers require support and encouragement.

At the final session our group offered the following messages to the community of mathematicians and mathematics education researchers:

### ***To Teachers:***

You are part of the research community. Your questions and concerns matter.

### ***To Education Faculties:***

You need to introduce the importance of research in preservice, and build bridges between teachers, researchers and the mathematics community.

### ***To University Math Departments:***

Realize that you are part of the process of math teacher education;  
Think of yourselves as users and “doers” of math education research.

### ***To Math associations:***

Facilitate a broad scale professional learning community around research.

### ***To Boards of Education:***

Support teachers in making use of and conducting research.

### ***To Ministries:***

Explicitly indicate that one of the roles of a teacher is to conduct inquiry into their own practice. Support this practice with funds and professional development opportunities.

The recommendations contained in these messages, are in most cases not costly, but they require a change in attitude. They challenge each stakeholder group to treat teachers as contributing members of the research process.

## References

- Glanfield, F., Poirier, L., & Zack, V. (2003). Teacher research: An empowering practice? In E. Simmt & B. Davis (Eds.), *Proceedings of the 2003 annual meeting of the Canadian mathematics education study group*. Edmonton: CMESG.
- Goodchild, S., & English, L. (Eds.). (2002). *Researching mathematics classrooms: A critical examination of methodology*. Westport, CT: Greenwood Publishing Group, Inc.
- Kemmis, S., & McTaggart, R. (1988). *The action research planner*. Victoria: Deakin University.
- Lim, L., & Pugalee, D. K. (in press). Using journal writing to explore, "They communicate to learn mathematics and they learn to communicate mathematically." *The Ontario Action Researcher*, 7(2).