# Communication

## The dual role of researcher and teacher: a case study

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During my PhD studies, I conducted research in which I defined myself as a researcher-teacher. The source of my research work was twofold: research findings in the mathematics education literature reporting the benefits of initiating the use of computers in the mathematics classroom, and my own curiosity as a teacher about the possibilities of unlimited computer use. My goal was to examine learning in an environment in which a computer was always available, but its use was optional. Students had the option to decide if, when and how to work with computers. My experience led me, as a researcher and as a trained and experienced teacher, to design an innovative learning environment and to teach in this environment over a two-year period. The role of researcher-teacher leads to a major dilemma in the classroom: how can a single individual react to classroom events so as to take into account the agenda of a researcher as well as that of a teacher?

Several researchers have chosen to assume the role of researcher-teacher motivated by a need to better understand teaching practice. For example, while teaching a third grade mathematics class, Lampert (1990) examined the possibility that the teacher and students in class may come to act as a community of mathematicians. Offering an insider's perspective, Ball (2000) reflected on her own teaching in order to investigate the knowledge needed by mathematics teachers for teaching in a reform-oriented elementary school. And Rosen (in Novotna, Lebethe, Rosen & Zack, 2003) used his experience as a secondary school teacher as a basis for the knowledge he provided to practicing teachers in his work as a teacher-educator. He developed his teaching methods in a classroom setting, with all of its inherent complications.

A different motivation to become a researcher-teacher involves student learning. Zack used her fifth grade elementary classroom to study how mathematical meaning is acquired and shared among students. She related to her dual role as follows: "While researching from the inside has been generative and transformative, it has at the same time been very demanding of time and energy" (Glanfield, Poirier & Zack, 2003, p. 56).

None of the above researchers explicitly discussed the way they balanced the enactment of the two motivating agendas of researcher and teacher. In my research, I attempted to maintain a temporal separation between the roles. I designed the learning environment and materials from the researcher's point of view, before I started teaching, while bearing in mind the practical aspects of classroom life. During the school year, I taught in the classroom from the teacher's point of view, while keeping an "observer's eye" on things, as is typical of a researcher (keeping a diary of interesting occurrences, documenting classroom work). While I was in the classroom, my leading perspective was teaching, although I remained aware of the research. For practical reasons, this perspective limited my ability to observe. I tried to overcome this limitation by means of documentation. After the teaching day was over, I reflected from a researcher's point of view by watching and listening to recorded data from the classroom and studying events that had occurred. I examined students' work files after class from the researcher's perspective, bearing in mind that the students' needs would determine my course of action as a teacher in the next lesson.

The teacher's role is a demanding one. A teacher's first priorities are to respond to the many needs of the students while teaching mathematics at the same time. In some lessons, I found myself acting as a teacher only, while in others the students functioned in a way that allowed me to observe parts of the events as a researcher. One of the things that helped me keep my "research eye" open was my teaching diary. During about a third of the research period, I sent my diary to my supervisors after each lesson. Each of them read the diary and sent back questions, remarks, and insights about my research and even about my teaching. Since both supervisors are experienced researchers, their attitude towards the episodes I described mainly reflected the research perspective. Reading their responses drew my attention to research aspects of my work as a teacher. Indeed, an interested colleague who offers support and interpretation has been shown to be a key factor in the professional development of a teacher (Davis, 1997). The interest, support and interpretations provided by these research experts played a role in shaping my research view of my class.

Below I give some examples from my experience as a researcher-teacher. In some of the examples, a researcher would have investigated more, but my obligations as a teacher towards my students did not allow me to do so. I refer to these examples as clash scenarios. In others, being a teacher helped me identify events that called for research. I refer to them as synergy scenarios. *M-teacher* is use to describe my perspective as a teacher and *M-researcher* is use to describe my perspective as a researcher.

### Clash: M-teacher disturbs M-researcher

In the initial stage of the research, M-researcher designed the learning environment, including modifications to activities. In one such activity, the question shown in Figure 1 was posed during a lesson in the third week of the course.

As designer of the research, M-researcher prepared this question to encourage the use of formulas and to demonstrate the numerical power of Excel. In practice, M-teacher saw that students answered this question using three different tools: some calculated using pencil and paper (or a calculator), some used formulas in Excel, and some answered the question in a Word file. M-teacher was surprised by the use of this third tool and M-researcher was troubled by the thought that students might perceive the

In the Excel file p80.xls you will find the following table Open the file and fill in the table Write down the formulas you used.

| | A | B | C | D |
|---|---|---|---|---|
| 1 | The large number | The small number | The difference between A and B | How many times A is greater than B |
| 2 | 1 | 1/2 | | |
| 3 | 1 | 1/3 | | |
| 4 | 1 | 2/5 | | |
| 5 | 1 | 4/5 | | |

*Figure 1. The basis for a clash scenario.*

computer as a single entity and not distinguish among the different tools They might not understand when the use of Excel is preferable. M-researcher wanted to administer a questionnaire in the next lesson asking students how they worked and why they chose a particular method M-teacher thought that such a questionnaire was not directly relevant to the learning sequence, but ultimately decided to administer the questionnaire M-teacher was surprised to read the students' answers Only one student reported using Word, while the rest reported working manually or using Excel, mentioning the advantage of formulae and the "drag" operation. M-teacher was embarrassed: she had counted ten students who used Word during that lesson What happened? M-researcher wanted to get to the bottom of this issue and compare students' files with their questionnaires, but this time M-teacher decided that at this stage it was sufficient for students to declare the benefits of using Excel. What did M-researcher lose? We have no way of knowing.

## Clash: M-researcher takes over from M-teacher in class

Before the opening lesson of the second year, M-researcher reread her diary entry for the opening lesson from the first year. In the diary, M-teacher indicated that she had felt well prepared for this lesson, since she "knew" what was going to happen. But after the lesson she went on to write the following: "Reading last year's diary was a mistake! It made me expect a certain flow of events, the one that had occurred last year. This expectation led to a 'bumpy' lesson flow, because I was looking for last year's remarks!" In the diary, M-teacher attributed this situation to the "presence" of M-researcher.

## Synergy: M-teacher affects M-researcher by identifying a topic for research

During a classroom activity in which students look for equivalent expressions for a given expression by applying the distributive law, M-teacher saw that students produced some unexpected expressions In the diary entry from that lesson, M-teacher made a note to M-researcher to examine students' working files closely. M-teacher designed a short assessment activity on the same mathematical topic and administered it to the students. M-teacher checked the students' work and found a wide variety of expressions. As a result, M-researcher collected the work of students from other classes for future research. [1]

## Synergy: M-researcher affects M-teacher by creating learning opportunities

In the diary entry prior to the lesson on October 1, M-teacher wrote: "The problem I see in the coming lesson is that the activity does not encourage students to use Excel. It will be interesting to see whether the students surprise me once again." The next day, when M-teacher arrived at school, she faced a dilemma Should she take the class to the computer laboratory or should she stay with her students in the regular classroom, as one of the teachers had asked her to. Here M-researcher interfered and hence M-teacher took the class to the computer laboratory That lesson's diary contained the following entry: "To my delight, M-researcher took over for M-teacher, and I did not give up the computer laboratory." During the activity, students used Excel in a variety of original strategies, yielding the following diary entry:

> I think that the various strategies emerged due to a combination of elements. The activity itself gave no instructions as to how to use Excel, yet students already knew what spreadsheets could offer, and the norm of using the computer for their own needs had been established.

An analysis of students' work in that lesson reveals the nature of students' mathematical activity and how such activity is related to both the instrumental views of the computerized tools that students develop and their freedom to use them [2]

## Concluding remarks

In my work, I had to fulfill the roles of mathematics teacher and researcher at the same time. I used this experience to demonstrate possible ways of moving between these two roles. One must remain aware of the role adopted at any given moment, while realizing that sometimes this will not help, as demonstrated in the above examples Even in a clash scenario, awareness of both perspectives serves to enhance and sharpen the situation.

A teacher's first commitment is to teach mathematics while being responsive to the needs of the students. Hence, in the classroom the teacher must act like a teacher and keep the researcher's voice low, or even silent. Documentation of classroom events will allow for the researcher's voice to emerge during later observations. During analysis, the main perspective should belong to the researcher Awareness of the opportunities afforded by mixing these roles may serve to advance both teaching and research. Activities such as planning learning sequences or analyzing data can be separated in time from the teaching itself. A researcher who teaches may change his or her interpretations as a result of having gained a deeper insider's perspective

Some researchers claim that a good way to promote teacher practice is by engaging teachers in research on their own practice: "The process of understanding and improving one's own teaching must start from reflection on one's

own experience" (Chapman, 2009, p 121; also Reid & Zack, 2010). Engaging in such reflection may shed light on dilemmas encountered during teaching and help in evaluating alternatives to handle them. Yet one can expect dilemmas to emerge, similar to those raised in this study. More thought is required with respect to possible ways of overcoming the dilemmas involved in simultaneously fulfilling the roles of researcher and teacher

## Notes

[1] More details about this activity and the findings regarding learning algebraic manipulations in an Excel environment can be found in Tabach and Freidlander (2008)

[2] The learning that took place in this lesson is reported in Tabach, Hershkowitz and Arcavi (2008).

## References


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4 What are the characteristics of a good mathematics teacher?
6 What ways are there for measuring the effects of the instruction provided in mathematics? In particular, how can the processes that children learn for doing mathematics be attributed to the particular instruction provided?
10 How do we proceed in revamping mathematics curricula in the light of the availability of microcomputers?
12 How can we get teachers to deviate from their prototypes of mathematics instruction and to implement new methods and curricula?
(Merlyn Behr, John Bernard, Diane Briars, George Bright, Judy Threadgill-Sower, Ipke Wachsmuth, FLM 4(3), pp. 22-23)

What is the nature of the problem solving process in mathematics and how is it related to the analogous process in other subject areas?
(David Robitaille, FLM 4(3), p. 26)

1 How can we discover more about children's goals in mathematics classrooms?
2 What role does the media play in shaping mathematical knowledge and metaknowledge?
8 How can we develop more worthwhile problems, which satisfy the criteria both of realism and relevance to the children and of mathematical credibility?
9 How is mathematical meaning shared?
(Alan Bishop, FLM 4(2), pp. 40-41)

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