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## **Current interactions between mathematicians and researchers in mathematics education**

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*The interaction between researchers in mathematics and in mathematics education has always been diverse, depending not only on the country and historical period, but also on the educational level considered. In the case of university education the roles become even more varied: producers and “organisers” of knowledge; textbooks authors; designers of university syllabus and programmes; teachers; disseminators; educational research interlocutors; etc. The aim of the panel is to discuss the nature and extent of the collaboration between mathematicians and researchers in mathematics education, the benefits and pitfalls of the relationships and the directions that seem important to strengthen.*

*Keywords: university research; university education; research communities; interactions between research and teaching.*

### **A DIVERSITY OF ROLES AND INTERACTIONS**

One of INDRUM's main objectives is to contribute to the development of research in didactics of mathematics at all levels of tertiary education, with a particular focus on strengthening the dialogue between mathematicians involved in multifaceted university practices such as research in mathematics, research in mathematics education, university teaching, etc. The interactions between the community of researchers in mathematics and the community of researchers in mathematics education have always been diverse, depending not only on the country and historical period, but also on the educational level considered. In the case of university education, the roles of mathematicians and didacticians become closer. Mathematicians are at the same time producers and “organisers” of knowledge, textbooks authors, designers of university educational programmes, teachers of future mathematicians and mathematics teachers, innovators, etc. They not only assume various levels of interlocution with didacticians, but also become part of the object of study of didactics research. Many questions can be asked concerning the relationship between researchers in university mathematics education (UME) and mathematicians depending on the different roles assumed by the latter. When mathematicians act as teachers, the main questioning refers to the ways of collaboration between educational researchers and “practitioners”, from the design, experimentation and data gathering of teaching practices, to the dissemination and

impact of research results. To what extent do teaching questions nourish UME lines of research and what are the conditions needed for the reception and implementation of research results? Environmental factors related to the possible different positions of mathematicians and didacticians in mathematics or education departments, as well as the interactions between research societies, could also be crucial to facilitating or hindering fruitful relationships between both disciplines. And, finally, how do the institutional positions assigned to both communities in the university policy making (curriculum design, university entrance requirements, teacher selection, research project assignment, etc.) shape these relationships?

### **THREE EXPERIENCES**

Three experiences from different countries (Australia, USA and Mexico) can illustrate different ways of collaboration between mathematicians and didacticians. In the Australian case (Bardini & Pierce 2015) the starting point is a divide between mathematicians and mathematics educators, who are located in different faculties (Science and Education) and do not need to share many teaching or research projects. Some collaboration is emerging slowly, especially through national funded projects about the transition from school to university mathematics and the low retention rate in university mathematical sciences. In the case of the USA (Bressoud, Carlson, Mesa & Rasmussen 2013), the initial situation seems to be different, since mathematics departments often offer mathematics education positions and one third of the doctoral programmes in mathematics education are offered by mathematics departments. The study “Characteristics of Successful Programs in College Calculus” launched by the Mathematical Association of America in 2009 and supported by the National Science Foundation is an example of collaboration: amongst the outputs of the project we note the participation of mathematics education researchers in the design and implementation of teacher assistants’ training to help them implement active learning problems. The Mexican case (Possani, Trigueros, Preciado & Lozano, 2010) shows an example of collaboration between 3 research mathematicians, 3 university mathematics teachers and 2 didacticians who worked in the same university institution during a 4-year project about teaching linear algebra using models. The results show some conditions for the collaboration to be effective, such as the need for mathematicians to be open to innovative methods, and some difficulties resulting from the range of approaches in mathematics education. In the three examples we see a growing importance of undergraduate mathematics education within mathematics, especially through its formal inclusion in the respective Mathematical Societies and some joint projects. Difficulties still remain, due to the lack of recognition of educational research, which still appears to be undervalued, in comparison to mathematics research, and the consequent reluctance of mathematicians to become involved in projects that might not bring them enough returns in terms of prestige or publications.

## FINAL QUESTIONS FROM THE AUDIENCE

The panel raised several questions related to the current interactions between mathematicians and researchers in mathematics education:

- What are the reasons for the distance between the two communities? What are the motives to invest in bringing them closer?
- How can we communicate the main results in mathematics education in order to foster their dissemination?
- Can the fact that some mathematicians gravitate towards mathematics education help bring the two communities closer?
- Can we learn something from an international comparison, for example: how much is the evaluation of teaching connected with the interest of mathematicians for mathematics education?
- What are the conditions for the collaboration with university teachers of mathematics? Do they need to understand mathematics education theories?
- When mixed teams, involving mathematicians and didacticians, are formed to deal with a teaching problem at university level, which are the epistemological, didactic or pedagogical obstacles that may appear?
- How are new ideas in mathematics education received by university teachers, by mathematicians and, more generally, by the public or the media? Is there resistance to or support for these ideas?
- Much collaboration between mathematicians and mathematics educators has emerged in the last 10-20 years. There is a need to establish collaboration also within other disciplines in which mathematics is taught (engineers, physicists, biologists, economists, etc.). What forms might this collaboration take?

These are questions which open new lines of research in the field of university mathematics education and should be approached as such.

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