

## Foreword

This book reports on the work carried out within the Erasmus+ PLATINUM project by eight European universities from seven countries: the University of Agder, in Kristiansand, Norway—the coordinator of the project—the University of Amsterdam in The Netherlands, Masaryk University and Brno University of Technology in Czech Republic, Leibniz University Hannover in Germany, the Complutense University of Madrid in Spain, Loughborough University in the UK, and Borys Grinchenko Kyiv University in Ukraine.

In this 21st century, projects aimed at studying and disseminating inquiry-based approaches in the teaching of STEM disciplines in primary and secondary education have proliferated in Europe, benefiting from the impulse of the publication of the Rocard's report in 2007.<sup>1</sup> However, university mathematics teaching has remained mainly traditional, especially in the first university years, crucial for the students' orientation and retention. As the authors point out

Considerable evidence shows that the learning of mathematics widely is highly procedural and not well adapted to using and working with mathematics in science and engineering and the wider world; also that students learn to reproduce mathematical procedures in line with tests and examinations, rather than developing a relational, applicable, creative view of mathematics that they can use more widely. The PLATINUM project was set up to move this situation, with the aim of developing an inquiry-based approach towards the teaching and learning of university mathematics and for the development of an international community of university mathematics lecturers who practice, explore and encourage others to use inquiry-based teaching approaches in teaching mathematics. (p. 7)

The consortium partners were well aware that they were facing a major challenge as university teaching conditions, particularly in the first university years, are not conducive to inquiry-based practices: courses gathering large numbers of students with diverse backgrounds and professional projects, loaded curricula to be covered in a short period of time, etc., not to mention the lack of pedagogical and didactic preparation and experience of such practices for the majority of university mathematics lecturers.

The way the consortium partners organised themselves to meet this challenge is particularly interesting. They have adopted a broad and flexible conceptualisation of IBME (Inquiry-Based Mathematics Education), referring rather to definitions such as that proposed by Dorier and Maaß<sup>2</sup> in the *Encyclopedia of Mathematics Education* than the more demanding characterisations proposed for Inquiry-Based Oriented (IBO) practices in the United States where such practices seem more developed in

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<sup>1</sup>Rocard, M., Cesrmley, P., Jorde, D., Lenzen, D., Walberg-Herniksson, H., & Hemmo, V. (2007). Brussels, Belgium: Office for Official Publications of the European Communities. *Science education NOW: a new pedagogy for the future of Europe*.

[www.eesc.europa.eu/en/documents/rocard-report-science-education-now-new-pedagogy-future-europe](http://www.eesc.europa.eu/en/documents/rocard-report-science-education-now-new-pedagogy-future-europe)

<sup>2</sup>Dorier, J.-L. & Maaß, K. (2020). Inquiry-based mathematics education. In S. Lerman (Ed.), *Encyclopedia of mathematics education* (2nd ed., pp. 384–388). Springer Verlag.  
[doi.org/10.1007/978-3-030-15789-0\\_176](https://doi.org/10.1007/978-3-030-15789-0_176)

mathematics university courses. And they have created tools, especially spidercharts, providing criteria for assessing the degree of inquiry involved in student tasks and their management.

They also formed mixed teams combining a diversity of expertise, those of academic mathematicians and mathematics education specialists, and built the conceptual foundations of their project by positioning all actors, not only students, in an inquiry-based learning posture. The conceptual model which is described in detail in Chapter 2 is, in fact, made up of three nested levels. At the first level, inquiry concerns the mathematics at play in the classroom (lectures, tutorials or other devices); at the second level, it concerns teaching processes, pedagogical and didactic choices and their effects; at the third level, inquiry concerns

the entire developmental process in which participants reflect on practices in the other two layers, and gather, analyse, and feed-back data to inform practice and develop knowledge in practice. (p. 20)

Thus Communities of Inquiry were formed which supported the work and professional development of their members, and were themselves supported by the collective work of the consortium as Chapter 7 and the various case studies show (see for example Chapters 14 and 15).

In the European IBME projects I have been involved in, the collective production of resources in the form of inquiry-based tasks and teaching units has always been an important component. This is also the case in PLATINUM and I particularly appreciated the diversity of the resources produced. As far as students are concerned, they address many mathematical domains—complex numbers, functions of one or more variables, differential equations and dynamical systems, linear algebra, geometry, statistics and numerical analysis—teaching aimed at future mathematicians and mathematics teachers, but also very often service mathematics courses, a sector where, as underlined in Chapter 8, IBME and mathematical modelling are closely linked. They also show that it is possible to engage in inquiry-based practices without revolutionising one's teaching, that many ordinary tasks, if reformulated, can engage students in more conceptual work and bring them into the spirit of inquiry aimed at.

Another interesting and original dimension of this project is the attention paid to students with special needs and the difficulties they may encounter in the different phases of an inquiry process. Chapter 4, which is very informative, is devoted to this dimension. It specifies the forms that these difficulties may take according to the students' profiles and also makes many practical suggestions. Chapter 6 devoted to the creation of teaching units for students' inquiry explains the principles of Universal Design for Learning, "a methodology adopted by PLATINUM partners to strive for an inclusive learning environment reaching the needs of as many students as possible" (p. 118), and Chapter 12 provides an insightful illustration of the use of these design principles. There is no doubt that the work carried out in the PLATINUM project should help us to make IBME more inclusive.

I enjoyed reading the pages of the pre-final manuscript I received. I appreciated its structure, the eight chapters in Parts 1 and 2 which present the project in a very detailed way, its origin, its long maturation, its implementation, its conceptual basis and the ingenious methodological tools developed, connecting these to the six main intellectual outputs structuring the project. I also very much appreciated the eight chapters in Part 3 where each partner presents in great detail one or two case studies and analyses them with great intellectual honesty. In these case studies, the authors also make clear how digital tools—both educational mathematical software already

used in secondary education and professional tools used by mathematicians, and communication tools—have supported the implementation of inquiry-based approaches in their institution, and how they have also helped teams adapt to the new constraints due to the pandemic situation.

There is no doubt in my mind that PLATINUM represents an important milestone for the evolution of practices in university mathematics education. It shows that this evolution is possible if it is thought of as a progressive dynamic, adapted to the contexts, and carried out by communities combining a diversity of expertise and seeing themselves as communities of inquiry. I hope that this book will be a source of inspiration for many academics.

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