

# THE CONTENT PEDAGOGY RESEARCH PROGRAM IN MATHEMATICS: REFLECTIONS OF A ‘CRITICAL FRIEND’

Michèle Artigue

Professeure émérite de Didactique de Mathématique, Laboratoire de Didactique André Revuz, Université de Paris  
michele.artigue@univ-paris-diderot.fr

## ABSTRACT

The initiative of the Hungarian Academy of Sciences represented a unique opportunity for Hungarian mathematics education researchers and the teachers and teacher educators with whom they were collaborating. The mathematical component of the Content Pedagogy Research Program is organized around two projects. The primary goal of the first project, entitled ‘Complex Mathematics Education in the 21<sup>st</sup> Century’, is ‘to develop a concept, founded on the tradition for mathematics and teaching methodology of Tamás Varga’. The second project focuses on the method for Discovery Learning in Mathematics developed by Lajos Pósa. Being associated with this program was also a unique opportunity for me to enrich my didactic culture.

**Keywords:** Content Pedagogy, Complex Mathematics, Discovery Learning, Hungarian mathematical traditions

In 2016, I was invited by the Hungarian Academy of Sciences to accompany, as a ‘critical friend’, the mathematical component of the Content Pedagogy Research Program this institution was launching. I accepted this invitation without hesitation. Katalin Gosztonyi had just defended her doctoral thesis, prepared in co-supervision between the Bolyai Institute of the University of Szeged and my research laboratory, the LDAR, in the University Paris-Diderot, and along the years of her doctoral studies, we had discussed regularly. Thanks to her, I had discovered the crucial role played by Tamás Varga in the Hungarian curricular reform of the New Math period, the depth and originality of his vision of mathematics education, and more generally of the Hungarian mathematics and educational tradition that had inspired him. In fact, I was not an isolated case. Despite the international interest that György Polya and Imre Lakatos’ perspectives and writings had aroused for decades, this tradition only remained superficially known to most researchers in mathematics education.

We were missing widely accessible publications proposing a systematic description and analysis of this tradition, and helping situate it in the current land-

scape of mathematics education, research studies investigating its exact potential and limits, helping understand its dynamics, and how it was evolving in this rapidly changing world of education, increasingly subject to the pressures of globalization. Compared to other traditions (see, for example, the description and comparison of European didactic traditions proposed in (Werner et al., 2019) resulting from the thematic afternoon at ICME-13), it seemed in a less advanced state of conceptualization and theorizing.

The initiative of the Hungarian Academy of Sciences made it possible to address these needs with institutional recognition and more substantial means. It represented a unique opportunity for Hungarian mathematics education researchers and the teachers and teacher educators with whom they were collaborating. Being associated with this program was also a unique opportunity for me to enrich my didactic culture, and I felt honored by the confidence shown by the Academy of Sciences and especially its President, the professor László Lovász, whose interest in educational issues I had understood when I was President of ICMI, the International Commission on Mathematical Instruction, himself being President of IMU, the International Mathematical Union.

The mathematical component of the Content Pedagogy Research Program is organized around two projects. The first project, entitled 'Complex Mathematics Education in the 21<sup>st</sup> Century', is led by Ödön Vancsó, and, as explained in the presentation text, its primary goal is 'to develop a concept, founded on the tradition for mathematics and teaching methodology of Tamás Varga, which also takes into account the scientific development and technological changes of the past few decades'. The project also includes the extension to secondary education of Varga's methodology, originally conceived for primary education. The second project, carried out by the MTA-Rényi Research Group and led by Péter Juhász, focuses on the method for Discovery Learning in Mathematics developed by Lajos Pósa. Its main goals are to make progress in the conceptualization of this method and its inclusion in current research international trends and discourse, the development of actions and resources to promote its dissemination, and the study of its possible adaptation to contexts other than the informal education of talented students. The two projects also aim at improving the international visibility of the Hungarian tradition of mathematics education and at contributing to the constitution of a research community united around the values of this tradition.

Over the past three years, I have been accompanying these projects. During my stays in Budapest, I had the opportunity to personally meet the researchers involved, their doctoral students, and the teachers with whom they are collaborating, to attend work meetings, to visit classes and to attend sessions conducted according to the Lajos Pósa method in informal and formal settings. Discussions continued during occasional meetings at international conferences, and also dur-

ing Katalin Gosztonyi's various stays in France. I had access to a wider vision of the program supported by the Hungarian Academy of Sciences during the colloquium organized at the Bolyai Institute in Szeged in 2018. And I also had the chance to be closely involved in the organization of the conference VARGA 100, held last November in Budapest on the occasion of the centenary of the birth of Tamás Varga, and of course to attend it.

It is difficult to sum up in a few lines what I have learned from these three years. In both projects, the teams had strong assets, and from the outset I was impressed, for example, by the quality of the relationships between teachers and researchers, by the number of teachers closely associated with the research projects, and the depth of their engagement. I was also impressed by the mathematical culture of all those with whom I interacted. The challenges, however, were substantial. The first project brought together from the outset several groups which, while interacting, had their own research agenda; coordinating and capitalizing on the different activities carried out to serve the common goal pursued was thus a real challenge. The group engaged in the second project was very strong in terms of action, but had to operate a significant move from educational action towards academic research to achieve its goals. To construct a conceptualization of Tamás Varga's educational vision and methodology taking into account the evolution of cognitive and didactic knowledge and of technological resources for teaching, to inscribe this conceptualization into existing theorizations and forms of discourse was a very ambitious goal. To cope with this ambition, Katalin Gosztonyi's thesis was only a first stone. A similar challenge arose for the theorization of the Lajos Pósa method in the second project, but this project faced another serious challenge: to conceive and investigate the possible ecology of this method created for the detection and nurturing of mathematical talents in informal settings, in other contexts, such as formal mathematics education or disadvantaged students. This is a particularly important challenge, considering the social ambition that these forms of learning and more generally Inquiry Based Education practices to which they relate, as made clear by the panel session at the Varga 100 Conference, should not be reserved for a small elite, the social ambition of quality mathematics education for all (UNESCO, 2011).

Over the past three years, I have been able to measure the efforts and energy expended to move forward, to face these and many other challenges, often under very constrained working conditions. I have been able to measure the progress of conceptualizations, in close interaction with the empirical work and the analysis of the practices of the expert teachers involved. The research carried out on the 'threads of problems' or 'series of problems', for example, in both projects, the connections established with the anthropological theory of the didactic (ATD) and with the Chinese method of variations of problems, attested by the Discus-

sion Group jointly organized with Chinese, French and Italian researchers to be held at the congress ICME-14, are good examples. I have been impressed by the success of actions such as the 'Flying School Program', by the rapid reinvestment of research findings in teacher education. I was also able to measure the efforts made to get closer to other communities such as MCG, the International group for mathematical creativity and giftedness, to strengthen existing international collaborations with Germany, Finland, USA and my own country, to establish new ones, to propose more contributions to major international meetings such as the CERME conferences and even to obtain the organization of the 2023 conference. I have also seen the efforts developed to produce texts, articles (see for instance (Gosztonyi et al, 2018) and (Győri–Juhász, 2018)), even if this effort has not yet produced all the expected results<sup>1</sup>. Finally, I have seen the maturing and growth of a research community and in particular the increasing number of doctoral students, despite the limited potential for doctoral supervision, a particularly encouraging sign.

All those who attended the Varga 100 conference last November, a splendid success, were able to appreciate these advances. Listening to the presentations made by Hungarian researchers and doctoral students at this conference, observing the quality of the discussions, the quality of the various workshops offered and the interest they aroused, receiving extremely positive feedback from the foreign participants, I hope that my Hungarian colleagues feel proud of the work accomplished and have confidence in their ability to achieve the objectives they have set themselves. The national presentation they have proposed at the ICME-14 congress that will be held in Shanghai in the summer of 2021 will be an excellent opportunity to make this work and its outcomes much better known from the international community. Personally, I am ready to continue to accompany them if they wish it and I would like to take the opportunity of this text to publicly thank them for welcoming me so warmly and allowing me to learn so much.

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<sup>1</sup>The special issue of the journal TMCS (Teaching Mathematics and Computer Science) associated with the VARGA 100 Conference to which ten contributions have been submitted by members of the two projects should contribute to the concretization of these efforts.

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