עבודת גמר (תזה) לתואר
מוסמך למדעים

מוגשת למועצה המדעית של
מכון ויצמן למדע
רחובות, ישראל

Thesis for the degree
Master of Science

Submitted to the Scientific Council of the
Weizmann Institute of Science
Rehovot, Israel

מאת
מרים גור

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דיאלוג חוצה קהילות בחינוך המתמטי: אפיון השפה וההזדמנויות לחצייתה במפגש בין מתמטיקאים ומורי מתמטיקה מנוסים

Cross-community dialogue in mathematics education: Exploring the boundary between mathematicians and experienced mathematics teachers

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שבט התשפ"ב

January 2022

Abstract

Encounters between mathematicians and mathematics teachers occur in various contexts, mostly in academic mathematics courses taught by mathematicians as part of professional training programs for teachers. In these courses, the encounters are not reciprocal, as the mathematicians are situated as providers of knowledge while teachers are situated as recipients of knowledge. Encounters of a more balanced nature, which involve mutual learning, are uncommon, and the literature points to several reasons for this, including asymmetrical power relations and lack of opportunities. The project "M-Cubed" (Mathematics, Mathematics teachers, Mathematicians), which is at the focus of this research, provides teachers and mathematicians with an opportunity for interactions of a more balanced nature, and seeks to learn what occurs during such interactions.

This study explores aspects of *boundary* between mathematicians and experienced mathematics teachers, as reflected in the dialogue between representatives of these communities within the project. In the M-Cubed meetings, participants from the two communities discuss issues that arise from watching videotaped mathematics lessons from the VIDEO-LM project website (this website contains a collection of mathematics lessons, most of which were filmed in Israel during the past decade). The design and conduct of the M-Cubed environment draws on the literature on boundary crossing to conceptualize and study how mathematicians and teachers may learn from and with one another.

The study used a combination of research methods. The first part of the study focused on a qualitative analysis of four dialogues between mathematicians and teachers from the M-Cubed meetings. The findings of this analysis highlight various aspects of the boundary between mathematicians and teachers and distinguish between four kinds of discussions with regard to boundary crossing. The four kinds characterized in the analysis were: (a) exploration of a classroom episode in which teachers and mathematicians moved on parallel trajectories, investigating different issues from different perspectives in a way that does not invite either agreements or disagreements between the two parties; (b) an investigation in which the teachers crossed the boundary and actively inspected a pedagogical question from a mathematical perspective that was proposed by a mathematician in the discussion; (c) a discussion in which the two parties were seemingly in agreement with each other, yet without noticing different interpretations of mathematics learning underlying their articulations, thus the boundary was not identified nor crossed; and (d) a discussion in which a boundary was crossed in a rich mutual discourse that invited teachers to revisit their practices, while another boundary was left unidentified and uncrossed.

The findings of this part of the study indicated that although invitations to cross the boundary were identified in the dialogues, most of these invitations were not taken, or were only partially taken and served for "short trips" to the other side. These findings highlight how an in-depth analysis can discern boundaries that had not been identified in "real time" during the sessions, yielding an understanding that the existence of a dialogue in which the parties relate to and even build on each other's statements does not necessarily indicate mutual learning.

The second part of the study focused on a quantitative analysis of the claims made by participants in the plenary discussions before and after watching the videotaped lessons. This analysis revealed different patterns in how mathematicians and teachers referred to learners and teachers in their claims, suggesting additional aspects of the boundary between these two communities. In addition, the quantitative findings showed that the boundary object, i.e., the videotaped lesson, had an impact on the richness of the discussions. In particular, the post-watching discussions were rich in references to learners and teachers compared to the pre-watching discussions.

The contribution of this study is two-folded; in terms of theoretical contribution, it adds to the body of empirical research on cross-community encounters between mathematicians and mathematics teachers. In terms of practical contribution, it may help session facilitators (or *brokers*, as they are called in the literature on boundary crossing) to be aware of and draw attention to subtle discontinuities in communication that may otherwise remain implicit, and thus to proactively encourage boundary crossing.