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SCIENTIFIC FINAL REPORT
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RESEARCH TITLE:

Processes of reflection and enhancement of mathematical knowledge for teaching following peer discussions of videotaped mathematics lessons

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Summary of results & achievements since the last interim report

Our research investigated how mathematics teachers at the secondary level engage in reflection processes in a mindfully designed professional development (PD) environment, and to what degree do these processes affect teachers' knowledge and their professional decisions. The program we studied is a video-based PD project, which we designed for Israeli middle and high school mathematics teachers, named VIDEO-LM (Viewing, Investigating and Discussing Environments of Learning Mathematics), or in Hebrew, ADASHA. Within the project we developed an analytic framework comprised of six "viewing lenses", for discussing videotaped mathematics lessons with teachers: mathematical and meta-mathematical ideas; goals; tasks; interactions; dilemmas and decision-making processes; and beliefs. We termed this analytic framework SLF (Six-Lens Framework).

In the first phase of the research our goal was to characterize, through a systematic multi-site exploration, the processes that teachers undergo when they analyze a videotaped lesson using SLF. The research questions we posed for this phase were therefore the following:

1. What is the nature of the reflective processes that teachers undergo over time, when involved in video-based peer discussions using the SLF?

2. What may be the gains of these peer discussions, in terms of the teachers' mathematical knowledge for teaching (MKT)?

3. Can changes be discerned in the teachers' discourses, and if so what is the nature of these changes?

In the interim report we submitted for the period of October 2015- May 2017, we reported that we completed the data collection for this stage and began analyzing it. Since then, we have successfully completed the analysis and published our results in several scholarly papers. We found many solid and rich evidence for the development of a reflective language among the teachers who participated in VIDEO-LM PD courses (Arcavi & Karsenty, 2018; Karsenty & Arcavi, 2017), and suggested mechanisms to explain this development (Karsenty, 2017, 2018; Karsenty,Peretz & Heyd-Metzuyanim, Accepted). Moreover, we found that teachers went back and forth from analyzing the observed lessons of unknown teachers, to reflecting on their own practice, and particularly so if the lesson was taken from a very different culture (Karsenty & Schwarts, 2016; Schwarts & Karsenty, 2018; 2019). We have also established our preliminary prior findings regarding teachers' gains in mathematical knowledge for teaching, through constructing a methodological tool named "utterances map" that presents shifts in teachers' discussions about mathematical content after watching videos of lessons (Nurick, 2015; Karsenty, Arcavi & Nurick, 2015). The results achieved in this part of the study enabled us to offer an empirically established working model for professional development based on videotaped lessons, that served as the basis for widespread dissemination: more than 75 VIDEO-LM courses were so far conducted across Israel (including the Arab, Druze and Ultra-orthodox sectors), and the VIDEO-LM website (adasha.weizmann.ac.il) has currently about 3000 users. Moreover, the VIDEO-LM model is now used within several research and development projects in Rhodes University, South Africa, and international attention is accumulated around it. In sum, for this phase of the research we have fully achieved our aims.

In the second phase of the research, we aimed to go beyond the period of course participation, and examine if and how teachers' reflective processes manifested themselves in their practices after the course. For this phase we posed the following fourth research question:

4. What kind of impact (if any) do reflective processes, identified during course participation, have on teachers' subsequent professional actions and decisions? Specifically, to what degree will teachers:

- Use the analytical tools included in the SLF when relating to their own practice?
- Point to decisions they have made, with regard to their classroom teaching, that were influenced by reflective skills and knowledge acquired in the course?

To achieve that, we selected 11 teachers from 7 different VIDEO-LM sites, that represent different teacher profiles (in terms of gender, background education, years of experience and level of teaching), and followed them throughout the first year after their participation in the course. The teachers wrote weekly journals and each teacher was interviewed using the method of videoclip interview, adapted from Speer (2005), based on a lesson that was videotaped in his/her classrooms.

In the interim report we noted that the data collection for this phase was nearly completed. Since then, we have finished collecting the data and analyzed several cases. The analysis is still ongoing; however, preliminary findings (Nurick, unpublished; Nurick, Arcavi & Karsenty, in preparation) point to what appears to be a mixture of illuminating phenomena on the one hand, and disappointing discoveries on the other hand. The illuminating part relates to (1) the rich span of reflections found, which enabled us to construct a "taxonomy of reflections"; and (2) the finding that teachers articulated very different types of reflection within the three environments offered to them, i.e., the VIDEO-LM course, the weekly journals and the interviews. We expect that these results will be published soon. The disappointing discovery was that we were not able to find "traces" of the SLF reflective language in the post-course data, at least not to a substantial degree that would suggest an impact created by the course. In other words, it seems that the SLF language effects were not sustained. This finding, which was a surprise for us, initiated our rethinking of the VIDEO-LM model, and we are now in the process of submitting a new proposal to the Israel Science Foundation, based on what we have learned from the current research, and what is yet to be achieved. This proposed research will focus on the issue of sustainability, attempting to investigate how sustainability of video-based PD projects may be defined, operationalized and enhanced, and what methodological tools may be developed to assess its degree.

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