Intellectual Output (IO) 7: Product and Process Report on the Effectiveness of the EDUCATE Approach

IO7.1 Executive Summary

1. The Context and the Demographics of the EDUCATE Approach

The EDUCATE professional development sessions were run during the school year 2018-2019. In total, 16 video-club groups were formed, four with prospective teachers and 12 with practicing teachers. In total, 76 teachers, 20 prospective and 56 practicing teachers, participated in these video-club groups. Each group met for 6-9 sessions for an average for 16 hours. In total 107 sessions were held, with the total duration of the group meetings reaching almost 260 hours of professional development. During these meetings (which were either audiotaped or videotaped), the participating teachers used the EDUCATE materials produced during the second phase of the project to discuss issues of cognitive activation/challenging work and differentiation. Working in groups, they analyzed records of practice drawn either from the EDUCATE materials or from lessons they videotaped from their classes, as they experimented with ideas discussed during the meetings. In total, 74 of the 76 teachers[1] videotaped and discussed 201 lessons ($\overline{x} = 2.72$ lessons per teacher). At the end of the implementation of the program, the teachers were asked to participate in individual semi-structured interviews. During these interviews, participants were asked to reflect on their participation in the program; to identify its strengths and limitations and the challenges they encountered while participating in it; to talk about what they felt they gained from the program; to name particular examples to support their arguments; and to offer suggestions for potential ways in which the program could be improved.

2. Data Sources and Analyses

For this report, we draw on three sources of data: the 201 lessons collected from teachers' practice, the 107 memos developed to capture key episodes of the video-club meetings, and interviews with 76 teachers.

The lessons were coded using an observation protocol developed in the third phase of the project (see Appendix A). Codes for both the entire lesson and the three different phases of task launching, student autonomous work, and whole-class interaction were developed. Each lesson was coded using this set of 35 phase-level and 10 lesson-level codes. At least 5%-10% of the lessons were coded by a second rater for reliability purposes (in Cyprus, all lessons were coded by two independent raters, who then met to discuss their scores). These results were analyzed quantitatively, using both descriptive statistics and multi-level growth modeling, as well as piecewise models (see Raundenbush & Bryk, 2002)

The memos and the interviews were analyzed using the constant comparative method (Maykut & Morehouse, 1994), looking for patterns in how the teachers experienced the intervention, the challenges they encountered, their perceived benefits of the program, and the suggestions they made for improvement.

3. Main Findings

The quantitative analyses showed a statistically significant improvement in the quality of teachers' practice with respect to the three main overall lesson-level codes: challenging work,

[1] Two teachers one from Ireland and one from Portugal did not contributed any lessons, either because they were not able to videotape lessons or the lessons they videotaped were of bad quality.

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differentiation, and their interplay. For challenging work, this trend was linear with the same slope throughout the program; for differentiation, as well as the interplay between challenging work and differentiation, it was linear with the slope changing at the third videotaped lesson. Positive changes were also observed in about one-third of the phase-level codes, as well. These changes largely pertained to codes related to the phases of student autonomous work and whole-class interaction. Of these, the most notable included using enablers and extenders during student autonomous work, and dealing with cognitive challenge as well as eliciting student thinking and providing opportunities for them to reason mathematically during the phase of whole-class interaction. Interestingly, for student autonomous work, where most of the changes were found, these changes pertained to three of the four codes that captured the interplay between challenging work and differentiation. In fact, looking across phases, statistically significant growth was observed mostly in codes pertaining to challenging work (6 codes), secondly to codes pertaining to the interplay of challenging work and differentiation (4 codes), and finally to codes related to differentiation (2 codes). In most of the cases observed, practicing teachers were found to outperform prospective teachers. Surprisingly, there were some notable exceptions (e.g., using extenders) for which both groups were found to have comparable improvement in their performance. In general, the changes found in teachers' practice were encouraging, given the small number of lessons observed and analyzed (i.e., three per teacher), the relatively short duration of the intervention (i.e., 4-6 months, with groups meeting from 8 to 23.5 hours), that there were not complete datasets for all the teachers (not all teachers had 3 lessons videotaped), and the fact that the participants focused on different aspects of challenging work and differentiation during the training sessions (i.e., with the exception of the sessions utilizing Module 1, different Modules and Cases of Practice within modules were utilized in the four different sites: Cyprus, Greece, Ireland, and Portugal).

The qualitative analyses of teachers' interviews and the memos showed that the participants of all four countries (prospective and practicing teachers) experienced the program positively, since they pointed to several ways in which they felt to have benefited from the program. A key benefit they felt they gained from the program was their opportunity to develop new ways of conceptualizing mathematical challenge and differentiation. The analysis of the memos was particularly informative about this issue. In particular, in line with the project goals, toward the end of the professional development (PD) meetings, the teacher participants considered the two concepts (cognitive activation and differentiation) as being compatible and as working synergistically as opposed to being in opposition. Although there were also some voices of doubt, these largely pertained to adjusting the mathematical challenge to meet different groups of students, especially in mixed ability classes with multiple different groups of students and with large numbers of students.

Other benefits teachers reported in the interviews or mentioned during the PD meetings pertained to the practical ideas the teacher participants gained for working at the intersection of cognitive activation and differentiation (e.g., using enablers and extenders); and their opportunity to analyze their practice and that of their colleagues in a supportive environment that allowed the co-construction of knowledge rather than the reception of knowledge from knowledgeable others.

From the analysis of the memos it also became clear that teachers experimented with different ideas, while trying to address the dual goal of cognitive activation and differentiation. For example, drawing on the discussions and the ideas shared during the EDUCATE PD meetings, it became obvious that the teachers had the opportunity to engage in selecting and using rich mathematical tasks, and employing various differentiation strategies. With respect to the phase of task launching, the teachers reported having used different strategies to evoke students' existing knowledge; asking guided questions to elicit students' understanding of the task; and experimenting with having students pair and share their understanding of the assigned tasks. During the phase of student autonomous work, as the teachers reported in the PD meetings, they had opportunities to experiment with generating enablers and extenders, providing

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students appropriate feedback, circulating and monitoring student work, and asking students to work in pairs to support each other. With respect to the phase of whole-class interaction, the teachers reported having had the opportunity to experiment with selecting and ordering different student solutions, handling student erroneous work and misconceptions, and re-voicing and rephrasing student solutions and ideas.

Both in the interviews and in the video-club meetings, teachers also reported changes in their practice, related to setting goals, selecting and designing tasks, and experimenting with different teaching strategies, such as refraining from telling and becoming more attentive to what students say, introducing doubt to engage students in mathematical thinking and reasoning, and posing more open-ended questions. All these changes were meant to cognitively engage as many students as possible through having them work on mathematically challenging tasks. Remarkably, some teachers also reported positive changes in their students' attitudes towards mathematics, as a result of the changes they themselves introduced to their practice.

At the same time, both the interviews and the memos written based on the analyses of the videotaped video-club meetings helped surfaced challenges the teacher participants faced during the EDUCATE PD program. One category of these challenges related to implementing certain ideas discussed in the sessions; these challenges pertained to all phases of task unfolding (task launching, student autonomous work, and whole-class interaction). In particular, regardless of how much the teachers valued the ideas and strategies shared in the sessions, implementing them in their work was not always easy. For example, with respect to task launching, teachers encountered some difficulties in their attempts to select challenging tasks, especially when they were not particularly aware of student needs and prior knowledge (which was typically the case for prospective teachers). With respect to the phase of student autonomous work, teacher participants encountered difficulties in developing enablers and extenders and maintaining some students' interest and commitment in solving challenging tasks. During the phase of whole-class interaction, some teachers encountered difficulties in selecting and sequencing students' work, and handling students' incorrect or unexpected solutions; they also reported having encountered difficulties in handling students' unwillingness to participate in the whole-class discussion or dealing with students' inexperience in sharing their ideas and discussing them with their classmates. Time pressure, working in mixed-ability classes with multiple different groups of students, and having to work with large numbers of students, as well as some other classroom realities (e.g., unproductive student attitudes, and classroom management problems) also imposed obstacles in teachers' attempts to experiment with the ideas discussed in the PD meetings. These challenges were mentioned by both prospective and practicing teachers; prospective teachers mentioned some additional challenges, since they were teaching in classes that they did know before.

Moreover, during the interviews, teachers mentioned some other challenges which were more technical and pertained to how the PD meetings were held; these related to selecting, analyzing, and reflecting on the video clips as teachers were getting prepared for the subsequent video-club meetings.

The teacher participants also made suggestions toward three directions: on the PD approach in general (e.g., using additional resources), on the PD sessions in particular (e.g., receiving more individualized feedback on planning as well as the enactment of a task), and on the EDUCATE materials (e.g., reducing their length, providing more practice-based materials, and including summaries of main ideas).

Overall, from the analyses of teachers' interviews and memos it was clear that the program was positively received by the teacher participants; it also offered them the opportunity to reconceptualize the ways in which they were thinking about cognitive challenge and differentiation, while at the same time providing them with the context and the incentive to experiment with different ideas and strategies while attempting to engage all their students in mathematically challenging work. The challenges they encountered were not surprising, given

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that working on the intersection of cognitive activation and differentiation represents a challenging teaching tasks in and of itself that requires a shift in teachers' way of thinking and working. The suggestions that the teacher participants provided were also reasonable and can be used to improve the quality of the EDUCATE materials and approach.

4. Conclusions

The overarching conclusion is that the EDUCATE program was experienced positively by the teacher participants. It also created a platform for them—be they prospective or practicing—to conceptualize the interplay between cognitive activation and differentiation and to experiment with different ideas and strategies that were co-constructed during the meetings and which could serve either one or both aforementioned goals. The analysis of teachers' lessons showed positive growth in their practice with respect to cognitive activation and/or differentiation; although growth was evident in several aspects of their work, this growth was statistically significant in about a third of the instructional aspects examined. These results, in conjunction with the challenges the teachers reported having experienced are telling of the complexity of working at the intersection of cognitive activation and differentiation and the importance of supporting teachers when putting these ideas into practice. Besides, it needs to be borne in mind that the EDUCATE PD program lasted for six months at most, whereas it was experienced as shorter (e.g., four months) for most of the project participants. Hence, the changes observed in these sessions are considered reasonable. As one of the study participants reminded us in the final interview, changes in teaching occur gradually, and some of what a teacher gains from a project is to be reflected in one's teaching during the forthcoming years. We believe that this enrichment of the teachers' arsenal with ideas and tools as a result of their participation in EDUCATE represents one of the hallmarks of the project, since we envision that the teachers will continue experimenting with these ideas in their practice in the future.

5. References

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