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Learning and teaching with preservice teachers: An action research for modelling and building faculty-school collaboration[1]

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Abstract. To make refinements in school curricula is not solely enough to improve the quality of education. We need to provide professional development for both in-service and preservice teachers to enable them implement those reforms in their classes. For preservice teachers, field experiences are the best opportunity to observe experienced teachers, make practice of reforms in a classroom setting and learn from their own teaching experiences. In this study, we aim i) to propose a model for faculty-school collaboration in which teacher educators and preservice teachers teach together in an elementary mathematics classroom and ii) to discuss the effects of this model on preservice teachers', mathematics teachers' and students' views and practices. An action research was employed in a 7th grade mathematics classroom to investigate the impacts of the proposed model. The results revealed that our model made meaningful contributions to i) preservice teachers' understanding and practice of teaching mathematics, ii) mentor teacher's classroom practices and iii) elementary school students' participations in mathematics lessons.

Keywords: Elementary mathematics education, preservice teachers, field experience, faculty-school collaboration

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INTRODUCTION

As student-centered teaching practices gained more importance in last two decades (Sowder, 2007), academic outcomes, or specifically mathematical abilities, expected from all students became more complex than ever before (Thames & Ball, 2013). This brings a tremendous pressure in terms of changing both the nature of mathematics learning from rote memorization to active construction and the nature of mathematics classroom from teachers' place to students' place. However, changing their way of traditional mathematics instruction to more student-centered instruction is not straightforward for many teachers (Bayrakdar-Ciftci, Akgun, & Deniz, 2013; Hiebert, 2013). Although in-service teachers can be supported through professional development programs to adapt recent reforms, teacher education programs need to be re-designed or re-organized to enable preservice teachers learn about and make practice of such reforms (Grossman, Hammerness, & McDonald, 2009; McGinnis, Watanabe, & McDuffie, 2005).

Findings of recent studies on teacher education pointed out a need for comprehensive reforms in teacher education programs (Cochran-Smith et al., 2015) such that preservice teachers should be given opportunities to experience the classroom setting that they will be teaching in near future (Cooper & Nesmith, 2013). Besides theoretical and semi-practical courses involved in teacher education programs, field experiences open a window for such teaching experiences and contribute more to development of preservice teachers' professional knowledge and skills (Cochran-Smith et al., 2015). A high-quality field experience provide opportunities for preservice teachers to relate real world contexts with teaching-learning theories (McIntyre, Byrd & Foxx, 1996; McLoughlin & Maslak, 2003; O'Brian, Stoner, Appel & House, 2007) as well as develop their knowledge of students including an appreciation of student differences (O'Brian et al., 2007) and collaborate with and learn from experienced teachers (McLoughlin & Maslak, 2003; O'Brian et al., 2007). On the other hand, a poor field experience is likely to encourage imitation of observed mathematics lessons and foster a status quo attitude (Clary, 1991). Indeed, field experiences not

[1] Initial findings of this study was presented at 13th International Congress on Mathematical Education (ICME 13), Hamburg, Germany.

only contribute to preservice teachers' professional development but also provide an opportunity for teacher educators to update their knowledge of teaching-learning theories and practices as well as evaluate the effects of recent reforms on students' and teachers' views and practices (Rodgers & Keil, 2007). Moreover, high-quality field experiences enable in-service teachers to learn about new trends in the field from both preservice teachers and teacher educators, such as recent technologies used in teaching and learning (Zeichner, 2010). In other words, a strong relationship and collaboration among preservice teachers, teacher educators and mentor teachers provide rich opportunities for improvement of all bodies of this triad. However, recent studies on the effectiveness of field experiences revealed that partners of this triad do not gain much benefits from such collaboration as intended to be so (Cakir, Ogan-Bekiroglu, Irez, Kahveci, & Seker, 2010; Sowder, 2007; Yalin-Ucar, 2012; Zeichner, 2010).

We experienced that our school experience courses given in teacher education programs in Turkey do not contribute enough to the development of preservice teachers' professional knowledge and skills in terms of practicing with the reforms to gain necessary experience to build their own reform-oriented mathematics classroom (Cakir et al., 2010; Yalin-Ucar, 2012). Neither school experience courses with 2 – 4 hours of teaching practice in a real classroom environment is sufficient to prepare our preservice teachers for teaching nor are methods courses with almost no room for application in real classroom settings satisfactory to make them be practitioner of different teaching methods. Therefore, we wanted to create a space where teacher educators, preservice teachers and in-service teachers are brought together in an alternative way to enhance preservice teachers' understanding of mathematics teaching. We attempted to construct and apply a model of faculty-school collaboration in which teacher educators and preservice teachers teach together with the help of an elementary mathematics teacher in an elementary mathematics classroom. The purpose of this paper is to present the setting of this collaboration and introduce preservice teachers', mentor teacher's and students' perspectives in this faculty-school collaboration model.

Field Experience in Teacher Education Programs: Problems and Alternatives

Teacher education programs at tertiary level mostly consist of core content courses, pedagogy courses and teaching practices (Cochran-Smith et al., 2015; Grossman et al., 2009). The quality of teacher education programs could be thought as one of the factors influencing the quality of education in general (Knight et al., 2015). Although quantity and variety of courses are counted as indicators of the quality, they are not just enough for improvement unless they are accompanied with practices in a school setting because "teacher quality" does not always guarantee "teaching quality" (Knight et al., 2015). Teacher education programs enable preservice teachers to build up a basis for their professional knowledge and skills however, such knowledge, specifically pedagogical content knowledge is improved through teaching practices (Lannin et al., 2013). Although number and context of the courses may vary from one program to another, methods course and school experience courses are generally offered during the last year of teacher education programs to make preservice teachers learn specific teaching methods of their content and make practice of them in the field. Recent studies revealed that as preservice teachers were given more opportunities to work with students, they became more aware of students' thinking and understanding in terms of what is easy or hard for students and how to scaffold their understanding (Jenkins, 2010; Kazemi & Waege, 2015). In other words, working with students contributes to development of preservice teachers' pedagogical content knowledge, specifically their knowledge of content and students and knowledge of content and teaching (Hill, Ball, & Schilling, 2008).

Teacher education programs offered in universities in Turkey were used to have such similar organizational structure discussed above. The programs are generally designed as a 4-year program such that preservice teachers take core content courses mostly during the first two years while they take pedagogy courses during the last two years (Higher Education Council [YÖK], 2007)[1]. Higher Education Council of Turkey (YÖK) set up regulations about organization

[1] This study was conducted before the recent changes in Teacher Education programs in 2018.

and standards of field experiences in 1998 at the first time (YÖK, 1998) and then those regulations were renewed in 2018 (YÖK, 2018). According to the written regulations and standards, preservice teachers are expected to both observe and learn about school setting and also make practice of teaching the subject matter by using different teaching methods and developing instructional and assessment tools to support students' learning as well as evaluate students' understanding. Furthermore, preservice teachers are asked to teach at different grade levels at least three hours in a week during a 14-week semester. However, much of those recommendations could not be applied in practice because of organizational deficiencies in schools and universities (Cakir et al., 2010; Yalin-Ucar, 2012). In practice, preservice teachers are given opportunity to teach once or twice in a classroom in a semester such that they mostly observe lessons and write reflection papers about those lessons.

For example, in her current study with science teachers, Saka (2019) concluded that newly graduated science teachers think that "they could not receive proper and satisfactory guidance" in their school experience courses and "they cannot reflect the gains from these classes to their professional teaching" (p. 127). One of the new graduates in Saka's study summarized the main problem in the school experience courses as follows:

> All we did in school experience course was sitting in the back row and observing [the class]. I think this practice didn't add much to us. Because listening to lessons was something we've been doing for years. Although our role was different [in this setting], there was no difference between us and students [in the class] in terms of functionality. We were passive [observers] (Saka, 2019, p. 134).

Although organizational issues led deviation from the documented standards of field experiences, there are meaningful attempts to set up university-school collaboration to provide appropriate environment for preservice teachers for practice. 'University within School Model' (Özcan, 2013; Tunç-Pekkan, Karagöz-Akar and Akcan, 2019) was one of such attempts to overcome organizational deficiencies in school experience courses. Tunç-Pekkan, Karagöz-Akar and Akcan (2019) emphasized that within their model, mathematics teacher educators from universities has been assigned to 6th grade classroom in a public school as full-time mathematics teachers. By means of their model, teacher educators and freshman preservice teachers get chance to work in a real classroom and gain teaching experience. They indicated that such experience has potential to develop preservice teachers' pedagogical content knowledge. Lesson Study (Ders İmecesi) was another alternative proposed to overcome main problems in field experience in teacher education (Baki and Aslan, 2015; Bütün, 2015; Güner and Akyüz, 2017). For example, Güner and Akyüz (2017) claimed that noticing is one of the main skills which teacher training programs should focus on and several opportunities and environments should be provided them in order to develop these skills. According to their observation of four senior presservice mathematics teachers, lesson study process was helpful in terms of "understanding how students think mathematically, determining how they should give feedback them and learning the topic more comprehensively" (p. 429).

Moreover, after working with five teacher candidates, five school managers, three trainee teachers, three mentor teachers and four instructors, Arkün Kocadere and Aşkar (2013) proposed that problems in field experience can be categorized in terms of origin of the problem as originating from person and originating from system. They emphasized that especially lack of university – school collaboration seems to be underlying cause of these problems. As a solution, they suggested a social-media based online environment which aims to bring prospective teachers, mentor teachers and instructors together for collaboration.

Although there are creative attempts that can add quantity and quality to teacher candidates' field experience, these attempts are very limited and more research is needed to investigate their effectiveness. We, therefore, attempted to make contributions to these attempts by developing an alternative model for faculty-school collaboration where teacher educators, mentor teachers and preservice teachers create a learning community to work together, share their experiences and exchange their knowledge.

METHOD

Action research is a systematic inquiry that helps researchers to explore the nature of their practice and to improve it (Mills, 2011; Stringer, 2008). Mills (2011) summarized the objectives of educators conducting action research as "gaining insight, developing reflective practice, effecting positive changes in the school environment (and educational practices in general), and improving student outcomes and the lives of those involved" (p. 8). Since these objectives were coherent with the aim of our study, action research was employed to investigate the impacts of our faculty-school collaboration model.

The Setting of the Study

When we initially set up a collaboration with a school in our neighborhood, our purpose was twofold: 1) to provide a space for our preservice teachers to make practice before they start formal field experiences in schools and 2) to contribute students' mathematical understanding via hands-on activities. We began to work with approximately 20 sixth grade students and 10 preservice teachers in 2011. Because the participation of our after-school program was voluntary, we were not able to keep the same number of students and even preservice teachers each week. However, the students who attended regularly told us that they enjoyed in the sessions and they learned about mathematics by using various manipulatives. The preservice teachers noted that working with students helped them to recognize diversity in students' mathematical thinking and understanding. Then, we decided to set up a classroom environment that enable us to keep the same number of students and preservice teachers throughout a semester in order to collect more viable data about the effects of our collaboration program. At the beginning of 2014 Fall, we asked for permission from the partner school's administration to use one hour of elective mathematics lessons given in the 7th grade levels. Then, we offered an elective course at the university for our preservice teachers to make them actively participate in preparation and implementation processes and learn from their own experiences. Based on our earlier experiences, we decided to sustain this collaboration for the following years because such collaboration not only contribute to development of preservice teachers and students but also us, as teacher educators.

Participants

This action research was conducted with two teacher educators (researchers), 16 preservice mathematics teachers, an elementary mathematics teacher and 30 seventh grade students in Istanbul in 2014-2015 academic year. Eight of the preservice teachers (5 females, 3 males) took the elective course during the fall term while the others (6 females, 2 males) in the spring term. All preservice teachers were senior students who were also taking methods course and school experience course in the semester that they were taking this elective course. The researchers served as participant observers who implemented faculty-school collaboration model and observed the effects of this collaboration on teacher educators', preservice teachers', mentor teacher's and students' views and practices.

Data collection and analysis

The main data sources were i) videos of discussions held in the elective course offered for the preservice teachers ii) videos of implementations took place in the elective mathematics lesson in the partner school, iii) preservice teachers' statements of philosophy of education, iv) preservice teachers' weekly reflection papers and task plans, v) interview with mentor teacher vi) teacher educators' reflections and field notes.

- The elective course offered for preservice teachers was planned as a 14-week course for each semester. The preservice teachers and the teacher educators visited the partner school 12 times for implementations in each semester. Each of these discussions sessions and implementations was video-taped. The discussion videos were mainly about implementation plans while lesson videos focused on how this planned was carried out in the class.

- Preservice teachers' statements of philosophy of education was collected both at the beginning and at the end of the semester.
- Preservice teachers wrote reflections papers on how they had implemented mathematical tasks in the lesson.
- Semi-structured interviews were held with the mentor teacher at the beginning and at the end of each semester. There were also unofficial discussions and meetings with the mentor teacher through semester.
- During the implementations, field notes including teacher educators' reflections about preservice teachers' and students' performances were written.

We used implementation videos to support our description of the flow of mathematics lessons while we used discussion videos to determine what preservice teachers notice during the implementations. The semi-structured interviews with mentor teachers consisted of questions about students' reactions to our tasks and any changes in students' behaviors or attitudes in their regular mathematics lessons.

The data of the study was analyzed according to description of Miles and Huberman's (1994) qualitative data analysis. First, each researcher read preservice teachers' reflections, transcripts of videos and field notes. From the first reading, we determined main themes to analyze preservice teacher comments and mentor teacher reflections.

While transcribing discussion videos, we aimed to highlight preservice teachers' recommendations on task plans and their comments about implementations. While analyzing those transcripts and preservice teachers' reflections we attempted to find answers for the following questions: i) what are the preservice mathematics teachers' focus in task implementations, ii) what do they think about students' reactions in these tasks before and after the implementation.

We also attempted to triangulate i) mentor teacher's comments about students' reactions, ii) transcripts of implementation videos and ii) our field notes, to construct main themes for answering how elementary students' behavior in mathematics lessons change through our implementation.

All data was then re-analyzed through the use of emerged themes. While analyzing the preservice teachers' comments, we have three main themes; mathematics, teaching mathematics and communication. In the following result section, we tried to provide long quotations from participants of the study to clarify how we made an inference about their views about our faculty–school collaboration model.

RESULTS

Model of faculty–school collaboration through elective courses

As mathematics education department of one of the largest universities in Istanbul in Turkey, we have been collaborating with an elementary school located very close to our campus since 2011. We initially set up our collaboration as an after-school program where our preservice teachers and students voluntarily participated in this program. We, teacher educators, were designing tasks for the sixth-grade students and preservice teachers were helping us during the implementations. We asked preservice teachers to monitor students' work and provide scaffolding when necessary. Furthermore, in some cases, we wanted them to lead whole discussions at the end of implementation sessions.

At the beginning of 2014 – 2015 academic year, as two teacher educators, we decided to design and implement a hybrid course in which teacher educators and preservice teachers would plan mathematical tasks and activities, apply them in one of the classes of the partner school, and assess and discuss their implementations. In Turkey, elementary school students should take three elective lessons offered by their schools in an academic year. Those elective lessons include not only sports and arts but also some core-content courses such as mathematics and science. In our partner school, most of the students prefer to take elective mathematics lesson besides other electives. As a part of our hybrid course, we offered an elective course for preservice mathematics

teachers in the university. Then we asked for permission of our partner school for undertaking the responsibility of an elective mathematics lesson offered for 7th grade students. We noted that we wanted to collaborate with the mathematics teacher of that elective lesson because we would like to learn about context of such elective lessons to prepare our tasks and also hear about characteristics of students to form our groups that preservice teachers would work with. Together with the mathematics teacher we decided on the general objectives of the lesson and the content of the tasks. Then, we shared those objectives with our preservice teachers and began to work on the tasks in our elective course at the university. The outline of these two elective courses is given in Table 1.

Table 1. *Outline of university and elementary school elective courses*

Week	**University Elective Course (2 lesson hours)**	**Elective Mathematics Lesson (1 lesson hour)**
Week 1	Course description Expectation from students Summary of learning theories and teaching methods	Preservice teachers' written reflections on mathematics teaching Pre-interview with mentor teacher
Week 2	Constructivism and Social Constructivism Manipulatives & Mathematics How to design, implement and evaluate a mathematical task	First meeting (Each preservice teacher was responsible of a group of 4-students)
Week 3	Discussion on the first mathematical task designed by teacher educators Re-designing the task based on preservice teachers' suggestions	Implementation of the first task
Week 4-10	Discussion on the implementation of the task Discussion on the next mathematical task designed by teacher educators Re-designing the task	Implementation of the tasks
Week 11-13	Discussion on the mathematical task designed by preservice teachers (Each week different group of students) Re-designing the task	Implementation of the tasks
Week 14	Discussion on the implementation Evaluation of the course	Preservice teachers' written reflections on mathematics teaching Post-interview with mentor teacher
Week 15	Elementary School students visited our university. They visited different departments (such as medicine, engineering and mathematics education) to see how mathematics is used in those disciplines.	

Elective course for preservice mathematics teachers at university

At the beginning of the semester, we informed preservice teachers about the setting of the collaboration. We mainly focused on the task design and implementation besides the other issues given in Table 1. We prepared the majority of the tasks prior to the lessons and then shared them

with preservice teachers to get their ideas whether the tasks should be re-designed. Based on preservice teachers' suggestions, we made some changes on the tasks before implementations. After each implementation, we asked preservice teachers to write a reflection paper about students' performances on the tasks and their scaffolding practices. At the end of the semester, we asked preservice teachers to work as a group and prepare tasks for the students.

Elective mathematics lesson for seventh graders at elementary school

At the beginning of the lesson, one of the teacher educators (the first author) was presenting the general outline of the task to whole class. Then, each preservice teacher who was already assigned to a group of four students was telling about the details of the task to their groups. In the first 20 minutes of the lesson, students worked either individually or as a group on the task. Then they shared their ideas with each other and with the preservice teacher. Preservice teachers had responsibility of guiding group discussions by asking each student to contribute to the discussion and using effective questioning to elicit students' mathematical understanding. At the end of the lesson, each group shared their strategies or findings during whole class discussion.

Faculty–school collaboration model: Teacher educators' perspective

Our reflections revealed that we, two teacher educators, learned from each other a lot. While working on task design, we combined our earlier and recent experiences with students. We had chance to reflect our area of specialization on these tasks and bring different perspectives to the tasks. For instance, while deciding on themes of the tasks one teacher educator suggested to use cases that elementary school students were likely to familiar with and the other teacher educator suggested to use appropriate manipulatives to facilitate students' mathematical understanding. Then, we combined our ideas to design rich tasks that students would both enjoy with it and understand the mathematical concepts that tasks conveyed. Furthermore, we learned from our participant preservice teachers and 7th grade students. Preservice teachers provided feedbacks about our tasks and contributed to development of tasks. They also talked about their observations during the implementations such that they pointed out students' some misconceptions and difficulties that we could not foresee before the implementation. Furthermore, they suggested some ways to overcome those misconceptions and difficulties. Indeed, preservice teachers' such observations and recommendations would help us while revising our tasks for the following years and also designing our other courses, specifically our methods courses in terms of discussion of how students learn or cannot learn mathematics.

Moreover, because we undertook the responsibility of carrying out one of the classes' elective mathematics lesson throughout a year, we needed to work as a mathematics teacher such that we need to make a complete plan of each lesson including preparation of mathematical tasks, supplementary materials and assessment tools. Thus, this model was also a field experience for us and helped us to feel the sense of an elementary mathematics classroom.

Faculty–school collaboration model: Preservice teachers' perspective

Our observations led us to conclude that preservice teachers' understanding and practice of mathematics teaching differed meaningfully. At the beginning of the semester, preservice teachers were more directed to getting the correct answers but then, they began to focus on solution process of the tasks. While they were giving away the formulas, algorithms or solutions immediately in the earlier tasks, they started to ask students' own views about the tasks and attempt to understand their thinking through questioning in later implementations.

Furthermore, as we were reflecting on the tasks after implementations, preservice teachers used to suggest adding more sub-tasks to the main task to enable students make more practice. However, after a couple of weeks, they changed their minds that the structure of tasks should provide a space for students to discover or experience the mathematics conveyed in the tasks. The following quotation was from the discussion of a geoboard task before implementation.

Teacher educator: What are your recommendations for this task?

> Preservice teacher A: Now, I see that we should place students at the center of activity. We should give enough time to them so that they will have chance to discover. We should help students to discover the relationship here (Pick's Theorem). Students can find the area of the polygons but they may not figure out the theorem easily. We should give some hints to take their attention to the relationship. For instance, we can insert a small table which has columns to be filled for the number of interior points and boundary points of the given polygon. By looking at the numbers given in the adjacent cells systematically, students may figure out the relationship.

As seen from preservice teacher's recommendation, she highlighted a deficiency of our task plan and suggested to insert a table to the worksheet in order to take students' attention to possible relationship between interior points, boundary points and area of a polygon. She indicated that with the help of such a change, students would be more likely to discover the theorem.

In addition, we observed that preservice teachers developed an understanding of how to notice students' mistakes and how to react them. During the first couple of weeks, preservice teachers attempted to tell the correct answers or explain the procedures when they observed that students found answers incorrectly. However, through the course, with the help of classroom discussions, preservice teachers started to recognize possible reasoning behind the students' wrong answers and changed their way of interaction with students. They did not immediately tell or explain the procedures but attempted to understand the gaps in students' understanding and address to them accordingly. For example, in his reflection paper, one of the preservice teachers noted that

> One of the problems that we faced with in geometry tasks was students' mistakes in measuring length of given figures' sides. In the earlier geometry tasks, I corrected each mistake one by one. I got tired of correcting their mistakes each time. Then I realized that they don't know how to use a ruler. They start measuring from 1, not from 0. Each time they measured the length 1 cm shorter. Although it was not in our implementation plan, I measured the lengths of different objects with students. Then they get used to use ruler appropriately.

As it can be seen from the preservice teacher's reflection, he did not concern with the reasons of students' mistakes at the beginning. However, after he had enough chance to work with them, he was able to figure out students' deep-seated problems about using ruler. Although he did not refer to the role of classroom discussions in his awareness, we observed that not only working with students but also discussing with their peers helped preservice teachers focus on the reasoning behind students' wrong answers.

We also identified that preservice teachers constructed a meaningful understanding about the role of manipulatives in teaching mathematics. In their written reflections as well as during in-class discussions, preservice teachers were able to identify the roles of manipulatives in teaching mathematics, such as, making abstract concepts more concrete, allowing creative classroom environment, drawing students' attention, increasing students' participation and so on. For example, after a construction task with unit cubes, one of the preservice teachers reflected that

> After distributing manipulatives (unit cubes), we waited for a while to let students play with them and get used to them. I asked some questions related to our task. Indeed, we should not allow them to forget what we are doing, so we need to explain how the manipulatives help us to accomplish the given tasks. All students engaged in the task, collaborated with each other and performed very well as a group when they had materials. They discussed how to construct 3D solids by using unit cubes and then worked together to construct them. They really enjoyed in this task.

Briefly, at the beginning of the course, preservice teachers had a tendency to act as a tutor such that they would help students in the form of telling or giving explanations so that students would answer all tasks correctly. Then, based on their experiences with students in the class and our recommendations about their roles during the implementations, they began to recognize that

tutoring did not contribute students' conceptual understanding. They took the role of facilitator or guide to support students' construction of their own knowledge and scaffold their conceptual understanding. Such a role contributed to their pedagogical content knowledge in terms of recognizing the reasoning behind students' difficulties and possible misconceptions in mathematics and also addressing to them effectively.

Faculty–school collaboration model: Mentor teacher's perspective

The major change in the mentor teacher's practice was that she began to use our tasks in her other classes. She indicated that she also developed similar tasks for different grade levels and started to give different term projects for her students. The walls of the classroom also reflected the changes in teacher's practice such that she wanted her students to prepare different posters for current mathematical concept and posted them on the walls of classroom. She also highlighted that students' performances in mathematics lessons changed positively. She stated that

> We generally do not have enough time to implement such tasks. Besides, whenever we attempted to do so, students do not understand what they need to do or why they are doing it. You need to devote too much time for explanations. However, now these students are familiar to mathematical tasks. When I attempt to do similar tasks, they can get organized immediately and start to work on the task collaboratively.

It can be concluded that both our tasks and our way of using manipulatives in elective mathematics lesson provided a base for the teacher to use these manipulatives in her regular mathematics classes. The teacher's major concerns about using manipulatives were lack of time and students' unfamiliarity of use of such materials. However, our tasks and implementations helped her to overcome her concerns. Students' eager participation in the tasks encouraged her to integrate manipulatives in her teaching. For example, she gave an assignment about making a set of algebra tiles from a sheet of paper and then she used them in her lesson while teaching about multiplication of binomials.

Faculty–school collaboration model: Elementary school students' perspective

Video analysis showed that 7th grade students participated in all implementations willingly and their eagerness contributed to their confidence in the classroom. Preservice teachers' and mentor teacher's comments also supported this observation. For instance, during one of the classroom discussions after the implementation, one of the preservice teachers told the followings:

> Teacher educator: What do you think about the implementation in this week? How was your experience?
>
> Preservice teacher B: I experienced something which made me very happy in this week. I felt that I deserved it as a result of my efforts. One of the female students in my group was not interacting with me nor her peers. I did not hear her voice during the previous weeks. This week, she started to answer my questions confidently and she explained her thoughts clearly. I previously thought that I had no chance to communicate with her, but now we are getting along with each other. This really made me happy.

As preservice teacher noted, some shy students' confidence level increased throughout the semester such that they began to share their ideas during the group discussions. The mentor teacher also supported preservice teachers' observations about such students. She stated that some of the students who hesitated to communicate in the classroom began to express unexpectedly well communication efforts both with the teacher and their peers after a while.

Students also gained experiences about mathematical tasks, group discussions and use of manipulatives. As students got used to the flow of implementations, we began to spend less time for explanation of the tasks or use of manipulatives. Thus, we saved time for whole class discussion to summarize the mathematical concept that tasks were based on.

DISCUSSION and CONCLUSIONS

This paper explored design, implementation, importance and value of a faculty-school collaboration model within mathematics teacher education. The main aim of our model was to assist in-service teachers, preservice teachers, and teacher educators to change their perceptions and practices about "how to teach" mathematics in the light of educational reforms and research findings. Although mathematics curricula for all grade levels are updated in the line of new approaches or requirements in Turkey, we experience numerous problems during the implementation of these changes in mathematics classroom mostly because of insufficient training about new curriculum (e.g., Bayrakdar-Ciftci et al., 2013). Moreover, teacher education programs do not serve for training of new teachers required for implementing those reforms in schools. Therefore, we attempted to fill the gap between written curriculum and its implementation by preparing mathematical tasks in the line of the curriculum and being model for both in-service and preservice teachers during the implementation.

As we presented in the introduction section, there are some problems in teacher education programs in terms of field experience. Teacher candidates are likely to define their roles as 'passive observers' during field experience (Saka, 2019). As can be seen in outline of our model (Table 1), preservice teachers are the most active participant of our faculty-school collaboration model. They participated in the task/activity design process, they implemented these tasks in real classroom settings and they reflected on about these implementations. Although we, as teacher educator, prepared initial drafts of the tasks, the final drafts was constructed after discussions with preservice teachers. Although teacher educators and mentor teacher were present in the classroom, preservice teachers individually worked with students: they were the teachers of their assigned groups. Moreover, after each implementation, preservice teachers had chance to reflect on their own and students' performances both orally and in written. Therefore, it can be concluded that from planning step to assessment, preservice teachers were the main characters of this faculty-school collaboration model.

As teacher educators, we recognized that preservice teachers have tendency to reproduce mathematics classroom that they were taught several years ago (Doruk, 2014; McGinnis et al., 2005). One of the reasons behind such an approach might be lack of opportunities afforded for preservice teachers to bridge theory and practice (Grossman et al., 2009). Although we were discussing how to apply student-centered teaching strategies in our methods course, we were aware of that preservice teachers may not internalize such strategies unless they make practice with them. Then, we tried to change our way of teaching to make our preservice teachers change their way of teaching mathematics. At least we thought that we "allow future teachers to deal with the many complexities and challenges of today's classrooms" (Cooper & Nesmith, 2013, p. 165). We wanted to provide more opportunities to improve their professional knowledge and skills, specifically their pedagogical content knowledge. Based on preservice teachers' performances in the class and in their written and oral reflections, we convinced that they had found valuable chance to comprehend the essence of student-centered teaching.

In addition, preservice teachers' pedagogical content knowledge somewhat improved because they got better in recognizing students' possible difficulties and misconceptions and providing appropriate scaffolding to eliminate those difficulties which were sign of their knowledge of content and students (Hill et al., 2008). Furthermore, they experienced task design and task implementation processes such that they prepared their own tasks and implemented it at the end of the semester. Such task design and implementation experiences were likely to contribute their pedagogical content knowledge, specifically their knowledge of content and teaching (Hallman-Thrasher 2015).

Since studies on faculty-school collaboration models are generally conducted by education faculty members, they mainly focus on teacher candidates. However, mentor teachers should also be considered as a target of these models and it is important to analyze these models within mentor teachers' perspectives. Our findings revealed that the mentor teacher developed positive views about teaching with reform-based curriculum. The mentor teacher did not want to apply teaching strategies or activities suggested in the curriculum because of her concerns about her

students and time management. Then, she recognized that if she gives enough time for students to accustom to new classroom norms for reform-based curriculum, she can adapt her teaching according to the new curriculum easily. Indeed, she changed her way of teaching in her classes later on.

Furthermore, elementary school students developed positive views about our implementations such that they wanted us to continue our program for the following year. Although we did not assess students' mathematical understanding via objective tests, we observed that almost all students worked on the given tasks and participated in the group discussions willingly. Actually, our proposed model dictated elementary students' active participation. Since each preservice teacher was responsible for at most 4 students, they found chance to work with them closely. As we described in the result section, in the first 20 minutes of the lesson, students worked either individually or as a group on the task and then they shared their ideas with each other and within the guidance of the preservice teacher. Preservice teachers had responsibility of guiding group discussions by asking each student to contribute to the discussion. There was no room for any students to be silent in our implementations.

Lastly, one of the strongest points of our proposed model is that it is practical and convenient, that is it is doable in almost any university setting. Some of the alternative faculty-school collaboration models (such as Tunç-Pekkan et al., 2019) entail very intense workload for both teacher educators and preservice teachers. Although such models provide opportunity to work with students, they also bring too much workload for preservice teachers. For example, in 'university within school model', both teacher educators and preservice teachers are expected to work 2 or 3 days per week in an elementary school (Özcan, 2013; Tunç-Pekkan et al., 2019). Although this model can be applied in small scale departments with limited number of students, it could be difficult to apply it in crowded departments. However, in our model, teacher educators and preservice teachers are expected to work 2 hours in the university and 2 hours in the elementary school per week.

As a result, as teacher educators we become more optimistic about setting up an alternative model for faculty-school collaboration in Turkey. Indeed, after our first trial that we discussed in this paper, we attempted to enrich our model by adding more assessment tools for measuring the development of both preservice teachers' pedagogical content knowledge and students' mathematics achievement as well as any changes in their perceptions and practices. The findings revealed improvement in different aspects of this collaboration for both partners (see Doğan & Kılıç, 2019; Kılıç, Doğan, Arabacı, & Tün, 2018). Based on our findings, we would like to suggest to change field experience courses in mathematics education programs and other relevant teacher education programs in Turkey such that preservice teachers should be allowed to administer elective courses in elementary schools by help of experienced mentor teachers and teacher educators throughout a year. Thus, they get used to teach with reform-based curriculum and make plan for their future teaching based on their own experiences.

Although we were optimistic about the results of the first trial of our proposed model, we observed important deficiencies in our study such that (i) the communication between preservice teachers and in-service teacher was very limited, (ii) preservice teachers had chance only work with small-group students but not with a whole class, and (iii) in-service teacher could not contribute the preparation and discussion of mathematical tasks. It could be argued that it will be beneficial to study on how this faculty-school collaboration model works if we can provide enough opportunity to preservice teachers to work closely with in-service teachers in planning, implementing and assessing the tasks. As a conclusion, despite of some deficiencies, we believe that such alternative models for faculty-school collaborations will contribute to improvement of mathematics education in general as well as preservice teachers', in-service teachers' and teacher educators' professional development.

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