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The Effects of Project- and Activity-supported Practiceson Mathematics Education Achievement and Student Views*

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Abstract

Problem Statement: Preservice teachers acquire the knowledge and skills needed for elementary mathematics education by themselves obtaining quality university educations and by being actively involved in mathematics. Thus, it is essential to make room in teacher education for student-centered projects and activities.

Purpose of Study: This study aimed to reveal whether using student-centered project- and activity-supported practices in the course *Mathematics Education II* had an effect on preservice teachers' achievement, as compared to teacher-centered education. It also aimed to identify student views on these two student-centered practices.

Methods: Conducted during the 2009-2010 academic year, the study was designed as a pretest-posttest control group experimental study with third-year teaching students in the Department of Elementary Education, Division of Classroom Education at an Ankara university. To compare student achievement on four of six subproblems, the "Measurement and Geometry Education Test" was used. Data were analyzed using a t-test and one-way analysis of variance. For the fifth and sixth subproblems, student views on the different practices adopted in two student-centered

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groups were collected with the help of two open-ended questions, and content analysis was performed on the resulting qualitative data.

Findings and Results: The first three subproblems examined whether a difference existed between each group's "Measurement and Geometry Education Test" pre and posttest mean scores. A difference in favor of the posttest was found in all three groups, i.e. between the student-centered Groups 1 and 2 and the teacher-centered Group 3. In the fourth subproblem, a meaningful difference was found between the mean achievement scores of the teacher-centered control group and the student-centered project- and activity-supported groups. However, there was no such difference between the mean achievement scores of the two student-centered groups. Although project and activity group students supplied many positive comments on the process, they also expressed some criticism.

Conclusions and Recommendations: It is satisfying that student achievement on the "Measurement and Geometry Education Test" was meaningfully higher at the end of instruction in all three groups. The results favored student-centered project and activity-supported instruction. Using projects or activities in classes positively affected student success. While the project-supported group mostly made positive remarks about group work and project preparation, the activity-supported group mostly made positive remarks about preservice teachers' mathematics education knowledge and skills.

Keywords: Preservice elementary teachers, mathematics education, project-supported instruction, activity-supported instruction, teacher education

Curricula and instruction play an important role in the development of preservice teachers' roles and competencies. The National Education Development Preservice Teacher Education Project teacher training book *Elementary Mathematics Education* (Busbridge & Özçelik, 1997) urges preservice teachers to make a conscious effort to discover the relationships between mathematical concepts and skills in the mathematics education courses they take at university, so that they can use this insight to enable learning in their future classrooms. In addition, changes in 2004 to the Elementary Mathematics Curriculum (Grades 1-5) (Milli Eğitim Bakanlığı [MEB], 2005) significantly affected the perspectives of education faculties on the question, "How will preservice teachers teach mathematics to children?" Active-learning projects and tasks in class might help preservice teachers, who are soon to implement elementary curricula, to equip themselves with the professional knowledge and skills they need.

Previous studies and educator views on use of the student-centered approach to project-based learning in classrooms have shown that it effectively increases student mathematics achievement (Alacapınar, 2008; Aladağ, 2008; Coşkun, 2004; Çakan, 2005; Övez, 2007; Özdemir, 2006; Özdener & Özçoban, 2004; Pierce, 2009; Thomas,

2000, Yıldız, 2008). This approach helps students learn all aspects of disciplines and link mathematical topics with other disciplines and real life (Bell, 2010; Dede & Yaman, 2003; Kaldi, Filippatou & Govaris, 2011; Nastu, 2009; Özdemir & Ubuz, 2006; Özden, Aydın, Erdem & Ekmekçi, 2009; Pierce, 2009; Robinson, 2009; Saracaloğlu, Özyılmaz Akamca & Yeşildere, 2006; Wu & Fan, 2010). It also helps them develop problem solving strategies, create authentic products (models, reports, presentations, etc.) (Blumenfeld et al.,1991; Coşkun, 2004; Dede & Yaman, 2003; Özdemir & Ubuz, 2006; Kaldi, et al.,2011; Korkmaz, 2002; Saracaloğlu et al., 2006; Robinson, 2009, Wu & Fan, 2010), work in groups, and learn social skills, interaction, cooperation, responsibility, social and democratic behaviors, critical thinking, and decision-making (Blumenfeld et al.,1991; Dede & Yaman, 2003; Demirhan, 2002; Erdem & Akkoyunlu, 2002; Kaldi et al., 2011; Korkmaz, 2002; Özdemir, 2006; Özden et al., 2009; Saracaloğlu et al., 2006; Robinson, 2009; Thomas, 2000; Wu & Fan, 2010). The student-centered approach to project-based learning has also been credited with enhancing students' ability to plan and manage time (Bell, 2010), as well as their self-confidence, motivation to learn, attitudes, tendencies, beliefs, and perceptions of self-competency (Alacapınar, 2008; Bell, 2010; Coşkun, 2004; Baran & Maskan, 2009; Kaldi, et al.,2011; Meyer, Turner & Spencer, 1997; Nastu, 2009; Saracaloğlu et al., 2006; Pierce, 2009; Özdemir, 2006; Özdemir & Ubuz, 2006; Thomas, 2000; Toci, 2000; Yıldız, 2008; Yurtluk, 2003; Tertemiz & Şahinkaya, 2010). In addition, it aids in the implementation of learning strategies in the instructional process and helps students take responsibility for learning and constructing knowledge (Başbay, 2005; Blumenfeld et al., 1991; Choo, 2007; Dede & Yaman, 2003; Kayılı & Çerçi, 2001 ; Özdemir, 2006; Özden et al., 2009; Pierce, 2009; Kaldi et al., 2011; Meyer et al., 1997; Thomas, 2000), planning work, researching, questioning, and gathering and organizing information (Bell, 2010; Dede & Yaman, 2003; Erdem & Akkoyunlu, 2002; Kalaycı, 2008; Özdemir & Ubuz, 2006; Robinson, 2009; Saracaloğlu et al., 2006).

Another student-centered approach is activity-based learning, where students are similarly active. Unlike project-based learning, activity-based learning involves teacher presentations, in addition to student-centered work. Despite being beneficial to students, activity-based work may not always be interesting. Activity-based practice gives students higher order thinking skills, in the realm, for instance, of critical thinking, analysis, and the ability to present ideas in logical sequence. As students construct their knowledge, they learn how to transfer learning to real life, using different roles and perspectives. They shape mathematical thought into forms and get the chance to implement these in the classroom (Choo, 2007; Suydam & Higgins, 1977; Toluk Uçar & Olkun, 2007). This helps students analyze and improve their own mathematical knowledge (Choo, 2007). Activity-based learning has been shown to positively affect the instructional process and learning outcomes (Choo, 2007; Kıyoyukı, 2006; Ron, 2002).

All of the knowledge and skills mentioned above not only help preservice teachers successfully teach mathematics; they also make them better teachers overall and affect their professionalism positively (Darling-Hammond & Ricardson, 2009). Most of the research in this field has been geared towards the earlier stages of

education, and most projects and activities have focused on the learning of a specific subject area and its effects on achievement in or attitudes towards a course. However, the present study involves preservice teachers, incorporates projects and activities into a mathematics education course, and examines the effects of this on achievement.

The aim of this study was to reveal whether the use of student-centered projects and activities in the course "Mathematics Education II" had an advantage over teacher-centered practices, as concerns preservice elementary teachers' success in "Measurement and Geometry Education". This study also aimed to identify student views on the two student-centered practices used. The following sub-problems were studied to achieve these aims:

1: Is there a meaningful difference between the "Measurement and Geometry Education Test" pre and posttest mean scores of the student-centered and project-supported Group 1?

2: Is there a meaningful difference between the "Measurement and Geometry Education Test" pre and posttest mean scores of the student-centered and activity-supported Group 2?

3: Is there a meaningful difference between the "Measurement and Geometry Education Test" pre and posttest mean scores of the teacher-centered Group 3?

4. Is there a meaningful difference between the "Measurement and Geometry Education Test" mean achievement scores of Groups 1, 2, and 3?

5: What pros and cons does project-supported instruction have, according to the students studied?

6: What pros and cons does activity-supported instruction have, according to the students studied?

Method

Research Design

This study had a pretest-posttest control group design. Both quantitative and qualitative data were collected and analyzed.

Study Group

Participants were students who were attending the Department of Elementary Education, Division of Classroom Education at an Ankara university during the spring term of 2009-2010 and who were enrolled in three (of five) sections that were equivalent to one another with respect to their "Mathematics Education I" final exam grades. Section equivalence was judged by looking at the grades obtained on the final exam for "Mathematics Education I", which is a pre-requisite for "Mathematics Education II". This exam is considered to have high content validity. With respect to their final examination grades, Group 1 had 43 students and a mean of 69.83; Group

2 had 42 students and a mean of 64.69; and Group 3 had 44 students and a mean of 69.11. Table 1 shows the results of one-way analysis of variance of the final grades.

Table 1

Results of Analysis of Variance of the Mean Final Examination Grades in the Three Sections

Source of variance	*Sum of squares*	*sd*	*Mean of squares*	*F*	*p*	*Meaningful Difference*
Between groups	667,130	2	333,565	1,646	.197	
Within groups	25743,362	127	202,704			
Total	26410,492	129				

$p<0.05$

No meaningful difference existed between the mean final scores of groups 1, 2, and 3 [$F_{(2\text{-}127)}=1.65$, $p<0,05$]. This showed that the sections were equivalent at the beginning of the study, with respect to their "Mathematics Education I" final examination grades. Group 1 was randomly assigned to the status of project-supported group (Experimental 1), Group 2 to the status of activity-supported group (Experimental 2), and Group 3 to the status of control group.

Development of the Measurement Tool

To address the first four sub-problems that were the focus of this study, the researcher developed the "Measurement and Geometry Education Test". The objectives to be measured by this test were identified using the book *Elementary Mathematics Education* (Busbridge & Özçelik, 1997) and the course description. The contents of the course Mathematics Education II mostly included the pedagogical component of "instructional strategies knowledge" (Shulman, 1986; Manizade, 2006). Instructional strategies knowledge includes methods and techniques that correspond to the question, "How do you teach this?" (Gökbulut, 2010). The items on the measurement tool included questions about the basic concepts, principles, and teaching of the subdomains of "Measurement and Geometry". The units covered in "Measurement and Geometry Education" and instructional strategies knowledge constituted the limitations of this study. Items were prepared with the aid of Altun (1998), Baykul (2005), Busbridge and Özçelik, (1997), and the Elementary (grades 1-5) Mathematics Curriculum (MEB, 2005). The initial 44-item measurement tool was evaluated with 145 students, using the ITMEN item analysis program to analyze both item difficulty index (p) and item discrimination index (r). Its alpha reliability was .72. The test used in the study had 35 items, and its alpha reliability was .78.

Experimental Procedures

The study took place during the spring term in the course "Mathematics Education II", which is taken by third-year preservice teachers. This course was taught for three hours each week. The time allocated for the units treated in the study was six weeks. All three sections were taught by the same instructor. The course content and presentations were the same for the three sections, too. Classes were theoretically conducted by the instructor of the three sections. However, classes in Group 1 were supported by group project work on "Measurement and Geometry Education", while those in Group 2 were supported by activities related to "Measurement and Geometry Education" that were prepared individually by students and implemented in the entire class. "Measurement and Geometry Education" classes in Group 3 were fully teacher-centered.

The instructor of student-centered and project-supported Group I gave information about project preparation for the first two weeks and studied related references and research with her students. She then discussed possible project themes or topics. Students chose as themes "string" and "paper". They were asked to voluntarily form groups. During the first week, students reviewed activities from *Elementary Mathematics Education* (Busbridge & Özçelik, 1997), Altun (1998), Baykul (2005), Toluk Uçar and Olkun (2007) and the Elementary (Grades 1-5) Mathematics Curriculum (MEB, 2004). Discussions then ensued about what to do, how groups would operate, how projects would be prepared, samples, and expectations. The instructor prepared a timetable with students, who were asked to develop group work plans and plans for sharing tasks. The first three weeks were allocated to a survey of the literature, and the instructor helped students think about alternatives. Students were asked to create activities that taught the subdomains of "Measurement and Geometry Education" around the themes, connect them to other courses and daily life, and create a final product (such as a magazine, poster, model, material, or diorama). From time to time, guidance was given to students both inside and outside of class. Students prepared their group projects and presented them. Subsequently, group members evaluated themselves and their group work and were evaluated by their classmates, using the forms prepared for these purposes by the students themselves. Students submitted their group folders and products to the instructor. At the end of the term, these products were exhibited in the department corridor.

In the other student-centered and activity-supported Group 2, in addition to the teaching of topics by the instructor, the above-mentioned resources were distributed to students, who were then asked to plan the activities in them individually, prepare worksheets for the entire class, and implement the activities. When needed, the lecturer acted as a guide. Students assessed both implementors of the activities and the activities themselves, using the student-generated graded scoring forms. At the end of the term, each student had a folder of all activities conducted in class and evaluated herself. The instructor also evaluated students' in-class performance and folders. In the control group, known as Group 3, classes were taught in a teacher-centered way. The techniques used were question-answer, discussion, and sample-sharing activities.

Data Analysis

A dependent samples t-test was used to determine whether there was a difference between the "Measurement and Geometry Education Test" pretest and posttest mean scores of the project-supported, activity-supported, and control groups, in order to answer the first three sub-problems**.** For the fourth subproblem, the three groups were compared, and one-way analysis of variance was used to determine whether there was a statistically meaningful difference between the "Measurement and Geometry Education Test" achievement scores of students in the three groups. Qualitative data were used to answer subproblems five and six. From 2008-2009, when similar experimental procedures were used to seek answers to a different question (Tertemiz & Şahinkaya, 2010), as well as in the year when the present study was conducted, student volunteers were asked to write down the pros and cons of using projects and activities in mathematics education courses. A total of 45 students in the project-supported group and 50 in the activity-supported group expressed their views by typing them on separate computers. Content analysis was performed on the data obtained, and codes were formed. For reliability purposes, codes were checked by an associate professor and an assistant professor. These codes were combined, to identify main and subcategories. Each category was defined in the study by the three most frequent views within it. In order to make the findings easily readable, interpretable and understood, frequencies and percentages were given.

Results

The findings presented address the sub-problems derived from the research question given in the Introduction. As regards the first sub-problem: A t-test for dependent samples was used to establish whether a meaningful difference existed between the "Measurement and Geometry Education Test" pre and posttest mean scores of project-supported Group 1; the results are shown in Table 2.

Table 2

Pre and Posttest Mean Scores, Standard Deviation, and t Values of Project-Supported Group 1

Group I		N	Mean	Std. deviation	t	Sd	P
Project-supported group	Pretest	36	17,92	3,19	-14,604	35	0,000*
	Posttest	36	28,67	3,93			

*p<0.05

As shown in Table 2, the "Measurement and Geometry Education Test" posttest achievement ($\bar{X}$=28.67) of project-supported group students was higher than these students' pretest achievement ($\bar{X}$=17.92). A statistically meaningful difference was

also found between the post and pretest achievement of students in the project-supported group ($p<0.05$).

As regards the second sub-problem: A t-test for dependent samples was used to establish whether a meaningful difference existed between the "Measurement and Geometry Education" pre and posttest mean scores of activity-supported Group 2, the results of which can be seen in Table 3.

Table 3

Pre and Posttest Mean Scores, Standard Deviation, and t Values for Activity-Supported Group 2

Group 2		N	Mean	Std. deviation	t	Sd	P
Activity supported group	Pretest	33	17,61	4,41	-12,413	32	0,000*
	Posttest	33	28,76	4,49			

*p<0.05

Table 3 shows that the "Measurement and Geometry Education Test" posttest achievement ($\bar{X}$=28.76) of activity-supported group students was higher than these students' pretest achievement ($\bar{X}$=17.61). A statistically meaningful difference was also found between the post and pretest achievement of students in the activity-supported group ($p<0.05$).

As regards the third sub-problem: A t-test for dependent samples was used to establish whether a meaningful difference existed between the "Measurement and Geometry Education Test" pre and posttest mean scores of teacher-centered Group 3; the results are presented in Table 4.

Table 4

Pre and Posttest Mean Scores, Standard Deviation, and t Values for the Control Group

Group 3		N	Mean	Std. deviation	t	Sd	P
Control group	Pretest	36	17,36	3,86	-5,004	35	0,000*
	Posttest	36	21,61	5,35			

*p<0.05

As shown in Table 4, the "Measurement and Geometry Education Test" posttest achievement ($\bar{X}$=21.61) of activity-supported group students was higher than these

students' pretest achievement ($\bar{X}$=17.36). A statistically meaningful difference was also found between the post and pretest achievement of control students ($p<0.05$).

As regards the fourth sub-problem: The "Measurement and Geometry Education Test" mean achievement scores (difference between pre and posttest scores) of the three groups in the study (student-centered and project-supported, student-centered and activity-supported, and teacher-centered) are shown in Table 5.

Table 5

Mean "Measurement and Geometry Instruction Test" Scores of Groups 1, 2, and 3

Groups	N	Mean	Std. deviation
Project-supported group (Group 1)	36	10,75	4,42
Activity-supported group (Group 2)	33	11,15	5,16
Control group (Group 3)	36	4,25	5,10

The mean "Measurement and Geometry Education Test" achievement score obtained by activity-supported group students ($\bar{X}$=11.15) was higher than that of project-supported group students and teacher-centered control students. However, one-way analysis of variance was used to find whether a statistically meaningful difference existed between the "Measurement and Geometry Education Test" achievement scores of the three groups; the results are shown in Table 6.

Table 6

Analysis of Variance Results Concerning the Mean Achievement Scores of Groups 1, 2, and 3

	Sum of Squares	Sd	Mean of Squares	F	P.	Meaningful Difference
Between groups	1.062,219	2	531,110	22,168	0,000*	* Project-supported group and control
Within groups	2.443,742	102	23,958			*Activity-supported group and control
Total	3.505,962	104				

*p<0.05

Table 7 shows a meaningful difference between the mean achievement scores of teacher-centered control students and students in the student-centered project and activity-supported groups, in favor of the latter two ($p<0.05$). However, there was no meaningful difference between the mean achievement scores of the two student-centered groups; namely, between the activity-supported and project-supported groups.

As regards the fifth sub-problem: The project- supported group (45 students) gave 186 (66%) positive views of the benefits of project- supported instruction and 96 (34%) negative views. The main categories, three most frequent subcategories, and student views were as follows:

Positive Student Views

About group work: Different ideas, brainstorming, idea exchange (39, 87%): "We learned new things by exchanging ideas and brainstorming." Collaborative learning (25, 55%): "We tried collaborative learning ourselves." Fun (10, 22%): "We had a good time with our groupmates." **About Contribution to Personal Development:** Responsibility (9, 20%): "We learned our responsibilities." Using materials and developing hands-on skills (9, 20%): "Most important, it has improved my use of materials." Socialization (5, 11%): "It is conducive to socialization." **About Mathematics Instruction:** Learning by doing (6, 13%): "As it's practical, you learn by doing." Learning different aspects of a topic (6, 13%): "The project enabled me to see the topic from different perspectives." Activity implementation skills (5, 11%): "We got to know the activities in the curriculum closely and implemented them."

About Project Preparation and Presentation: Creative and successful products (21, 47%): "Learning will become more permanent as we practice our ideas and have the opportunity to create concrete products." Fun, interesting, colorful (4, 08%): "Preparing a joint project together was fun." Exhibition (3, 06%): "We exhibited our work. It was useful."

Negative Student Views

Avoiding responsibility in the group, etc. (26, 58%): "Some people in the group had little sense of responsibility." Being time-consuming (21, 47%): "It took too much time."

Difficulty of reaching consensus within groups (20, 44%): "Occasional differences of opinion caused problems.".

As regards the sixth sub-problem: The activity-supported group (50 students) gave 130 (68%) positive views of the benefits of activity-supported instruction and 62 (32%) negative views. The main categories, three most frequent subcategories, and student views were as follows:

Positive Student Views

About Mathematics Education Knowledge and Skills: Getting rid of monotony and boredom and making class fun and interesting (26 students, 52%): "Instruction became more fun. We learned new things to help students enjoy mathematics education and not get bored."

Teaching Experience (14, 28%): "It provided professional development. I got to learn what can happen in class and how to teach." Collating such resources as files, activities, and materials (13, 26%): "When we become teachers, we won't have time

to find such a variety of activities…I'll use them in the future." **About Mathematics Learning Knowledge and Skills:** Permanent, effective, repeated, and better learning (9, 29%): "Mathematical topics were learned tangibly." Making topics concrete (5, 11%): "Concrete examples helped further understanding." Multidimensional thinking (3, 6%): "We saw that there were multiple ways of solving a problem." **About Contribution to Personal Development:** Data under this heading may be summarized as self development (3), responsibility (1), seeing one's deficiencies (1), self-confidence (1), regular study habits (1), class management (1), and hands-on skills (1).

Negative Views

Activities are time-consuming (18, 36%): "They took too much time." Cost (7, 14%): "They are a financial burden." Failing to meet aims (7, 14%): "In crowded classes, some activities could not be understood."

The following conclusions were made based on the findings obtained in regard to the subproblems: A meaningful difference was found between the "Measurement and Geometry Education Test" pretest and posttest mean achievement scores of all three groups (the student-centered project and activity-supported groups and the teacher-centered control group), in favor of the posttest scores. Further, student-centered practices created a meaningful difference in student achievement, as compared to teacher-centered practices. However, no meaningful difference was found between the student-centered groups, with respect to student mean achievement scores.

Positive student views of project-supported instruction revolved around group work, personal development, learning and teaching mathematics, and project preparation and presentation, while negative views mostly emphasized evasion of responsibility within groups, amount of time spent on activities, and difficulty reaching consensus. Positive student views of activity-supported instruction emphasized the knowledge and skills of preservice teachers in teaching and learning mathematics, as well as personal development. Negative views, on the other hand, seemed to focus on the time and cost of activities and failure to achieve aims.

Discussion and Conclusion

The three practices used in this study resulted in increased "Measurement and Geometry Education Test" mean scores for each of the three groups from pretest to posttest. However, this increase was most meaningful for the student-centered groups. Smith (2001: Cited in: Dede & Yaman (2003)) found that project work is effective in science and mathematics education, while Özdemir (2006) showed it to be effective in 7th grade geometry education. Prince (2004) cited Astin (1993), Hake (1998), and Choo (2007), who found that active learning positively affects student achievement. Ron (2002) revealed that well-designed instructional activities have an effect on student comprehension and concept development. Other, previous studies corroborating these findings are generally at the elementary level (Aladağ, 2008; Çakan, 2005; Övez, 2007). Darling-Hammond and Ricardson (2009) integrated

teachers into active learning practices, which offered them opportunities to learn and teach effectively. These teachers' students were also more successful. Another significance of the present study is that it taught preservice teachers strategies, methods and techniques, building their knowledge and skills. Soylu (2009) studied preservice teacher competency in the instructional methods and techniques used in mathematics classes and found that less than 20% felt they were adequately equipped with the constructive, discovery-based, collaborative, modeling, play-based, case study, and problem solving methods and techniques that are used in mathematics classes.

The positive student views obtained in this study of project-based learning are similar to those found by Alacapınar (2008), Çakan (2005), Kalaycı (2008), Kurnaz, Sünbül, Sulak and Alan (2005), and Yıldız (2008). As pointed out by Şahin (2007) and also by Gözüm, Bağcı, Sünbül, Yağız, and Afyon (2005) in a study conducted in a private elementary school, teachers and students stress "learning by doing" when expressing their views of project-based learning. Corroborating the findings of the present study, Gözüm et al. (2005) stated that students' hands-on skills improved as a result of project-based learning; Gözüm et al. (2005) and Yıldız (2008) found that students thought such work enjoyable; Yıldız (2004), Yıldız (2008) and Özdemir (2006) concluded that students gained a feeling of responsibility; Yıldız (2008) and Pierce (2009) stated that students' group work skills improved. Yıldız (2004) also found that students' research skills became better, and Özdemir (2006) and Yıldız (2004) found that creativity improved. In addition, the student views mentioned by Özdemir (2006) on learning from multiple perspectives and sharing ideas among group members also corroborate the findings of the present study. The complaints of preservice teachers in the present study about time are also mentioned in Başbay (2005), Baran and Maskan (2009), Özden et al. (2009). However, while Bell (2010) has stated that students need to manage their time effectively and efficiently while working on projects, Blumenfeld et al. (1991) have suggested giving students enough time to allow them to produce successful projects. In addition, the negative views of students in this study on the difficulty of reaching consensuses within groups are supported by Mueller and Flemmings' (2009, Cited in: Pierce, 2009) finding that certain cooperative groups may experience difficulty agreeing and by Felder and Brent's (1996) finding that some students hate active learning group work, resist cooperation, cause conflicts in groups, and fail to meet group responsibilities.

The positive student views obtained in this study on activity-based learning seem to support the results of Choo's (2007) study on the effects of activity-based learning on student achievement in the course "Career Development and Planning". Choo found that 90.4% of students thought that learning through activities was more interesting, as this gave students a chance to put their knowledge and skills to use, enhanced their understanding, and was more fun than traditional learning methods. The problem of time was also present in activity-based work. Choo (2007) emphasized that even though teachers may have planned meticulously, time still can be a problem in activity-based instruction.

The fact that two-thirds of students in both project- and activity-supported groups voiced positive views is a sign that student-centered practices are needed.

The present study may lead to changes in teacher-centered classrooms. As opposed to the idea that a teacher teaches and students learn, the idea that students can set their own goals may gain importance. The complaint by the project-supported group that some group members can evade responsibility can be overcome by using more group work in classes, so that students learn group responsibility. At the same time, groups can be formed more carefully. Students who can get along and work together may be grouped together, or the numbers of students in groups could be planned better. Both groups of students in this study complained that projects and activities took too long. This feedback should be considered carefully, and the problem should be overcome with practical solutions, such as by organizing timetables and topics in such a way so as not to bore students. Classes can become completely project- and activity-based. Future student-centered studies might focus on whether students' and lecturers' responsibilities in the instructional process and views have changed.

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Proje ve Aktivite Destekli Uygulamaların Matematik Öğretimi Öğrenci Erişisine Etkisi ve Öğrenci Görüşleri

Özet

Problem Durumu

Sınıf öğretmeni adaylarından gelecekte beklenen rol ve yeterliklerin geliştirilmesinde eğitim fakültesi programlarının ve öğretim elemanlarının rolü büyüktür. Milli Eğitimi Geliştirme Hizmet Öncesi Öğretmen Eğitimi Projesi yayınlarından olan İlköğretim Matematik Öğretimi (Busbridge & Özçelik, 1997) kitabında gelecekte çocukların en iyi şekilde öğrenmelerini sağlamaları amacıyla, öğretmen adaylarının fakültede aldıkları matematik öğretimi derslerinde matematiksel kavram ve becerileri ve bunlar arasındaki ilişkileri keşfetme amacıyla etkin bir çaba içine girmeleri gerektiği vurgulanmaktadır. Ayrıca, 2004 yılında İlköğretimdeki tüm derslerde olduğu gibi İlköğretim (1-5.sınıflar) Matematik Dersi Öğretim Programındaki (Milli Eğitim Bakanlığı, 2005) değişim, fakültelerin öğretmen adaylarına verecekleri "matematiği çocuklara nasıl öğreteceğiz?" konusundaki anlayışlarını da büyük oranda etkilemiştir. Bu amaçla temelinde aktif öğrenme olan, proje ve aktivitelerin derslerde kullanılması, ilköğretim dersleri öğretim programlarının uygulayıcıları olacak öğretmen adaylarının mesleklerinde sahip olmaları gereken bilgi ve becerilerle donanık olarak yetişmeleri yolunda onlara katkı sağlayacaktır.

Çalışmanın Amacı

Çalışmada, sınıf öğretmeni adaylarının "Matematik Öğretimi II" dersinde öğrenci merkezli proje ve etkinlik destekli uygulamaların, öğretmen merkezli öğretime göre öğrenci başarısı üzerinde etkili olup olmadığını ortaya koymak ve öğrenci merkezli iki farklı uygulamaya ilişkin öğrenci görüşlerini belirlemek amaçlanmıştır. Amaca ulaşmak için aşağıdaki alt problemlere cevap aranmıştır:

1: Öğrenci merkezli proje destekli Grup 1'in "Ölçme ve Geometri Öğretimi Testi" ön ve son test başarı puan ortalamaları arasında manidar bir fark var mıdır?

2: Öğrenci merkezli etkinlik destekli Grup 2'nin "Ölçme ve Geometri Öğretimi Testi " ön ve son test başarı puan ortalamaları arasında manidar bir fark var mıdır?

3: Öğretmen merkezli uygulamaların yürütüldüğü Grup 3'ün "Ölçme ve Geometri Öğretimi Testi " ön ve son test başarı puan ortalamaları arasında manidar bir fark var mıdır?

4. Grup 1, Grup 2 ve Grup 3'ün "Ölçme ve Geometri Öğretimi Testi "erişi puan ortalamaları arasında anlamlı bir fark var mıdır?

5: Proje destekli gruba göre, derslerin projelerle desteklenmesinin olumlu ve olumsuz yanları nelerdir?

6. Etkinlik destekli gruba göre, derslerin etkinliklerle desteklenmesinin olumlu ve olumsuz yanları nelerdir?

Yöntem

2009-2010 öğretim yılında Ankara'da bir eğitim fakültesinin ilköğretim bölümü sınıf öğretmenliği anabilim dalında üçüncü sınıf öğrencileri üzerinde yürütülen çalışma, öntest - sontest kontrol gruplu deneysel desen olarak tasarlanmıştır. İlk dört alt problemde öğrencilerin başarılarını ve grupları karşılaştırmak için araştırmacı tarafından geliştirilen "Ölçme ve Geometri Öğretimi Testi" kullanılmıştır. Veriler t testi ve tek yönlü varyans analizine tabi tutulmuştur. 5 ve 6. alt problemlerde, öğrenci merkezli iki farklı uygulamaya ilişkin öğrenci görüşleri, iki açık uçlu soru ile toplanmış ve nitel veriler üzerinde içerik analizi yapılmıştır.

Uygulama bahar döneminde "Matematik Öğretimi II" dersinde yapılmıştır. Ders haftada 3 saattir. Araştırmada ele alınan üniteler için ayrılan süre 6 hafta haftadır. Her üç gruba da aynı öğretim elemanı girmektedir. Her üç grup için hazırlanan ders içerikleri ve sunumları aynıdır. Her üç grupta dersler teorik olarak öğretim elemanı tarafından işlenmiştir. Farklı olarak, Grup 1'de dersler öğrencilerin grup olarak hazırladıkları "Ölçme ve Geometri Öğretimi"ne ilişkin proje çalışmalarıyla desteklenmiştir. Grup 2'de dersler öğrencilerin bireysel hazırladıkları ve tüm sınıfa yaptırdıkları "Ölçme ve Geometri Öğretimi"ne ilişkin aktivitelerle desteklenmiştir. Grup 3'te ise "Ölçme ve Geometri Öğretimi" tamamen öğretmen merkezli işlenmiştir.

Araştırmanın Bulguları

İlk üç alt problemde her bir gruba ait "Ölçme ve Geometri Öğretimi Testi" ön-test ve son-test başarı puan ortalamaları arasında fark olup olmadığına bakılmıştır. Öğrenci merkezli uygulamaların yapıldığı Grup 1, Grup 2 ve öğretmen merkezli öğretimin yapıldığı Grup 3'ün ön test başarı puan ortalamaları ile son test başarı puan ortalamaları arasında son test lehine her üç grupta da manidar fark bulunmuştur. Dördüncü alt problemde; öğretmen merkezli uygulamanın yapıldığı kontrol grubundaki öğrencilerin "Ölçme ve Geometri Öğretimi Testi" erişi puan ortalamaları ile öğrenci merkezli uygulamaların yapıldığı proje ve etkinlik destekli gruplardaki öğrencilerin erişi puan ortalamaları arasında manidar bir fark bululurken, öğrenci merkezli uygulamaların yapıldığı proje ve etkinlik destekli gruplardaki öğrencilerin erişi puan ortalamaları arasında manidar bir fark bulunmamıştır. Proje ve etkinlik destekli gruplardaki öğrencilerin sürece ilişkin olumlu görüşlerinin çokluğu ve ortak yanları yanı sıra olumsuz görüşleri de mevcuttur.

Sonuç ve Öneriler

Her üç grupta da yapılan öğretimle öğrenciler başlangıçtaki durumlarına göre farklıdırlar. Bazı yeni davranışlar kazanmışlar; önceden sahip oldukları bazı davranışlar istendik yönde değişmiştir. Bu durum derslerin proje ve etkinliklerle desteklenmesi lehine manidardır. Öğrenci görüşlerine bakıldığında, proje destekli grupta olumlu görüşler daha çok grup çalışması, kişisel gelişime katkı, matematik öğrenme - öğretmeye katkı ve proje hazırlama ve sunma üzerinde yoğunlaşırken olumsuz görüşler az da olsa grup içinde sorumluluktan kaçma, uzlaşmada güçlük ve zaman konusundadır. Etkinlik destekli grupta ise olumlu görüşler matematik öğrenme – öğretme bilgi ve becerileri kazanma, kişisel gelişime katkı yönünde iken,

olumsuz görüşler az da olsa diğer gruptaki gibi zaman alıcı olması, masraflı ve bazen amaca ulaşamama doğrultusundadır.
Öğrencilerin tamamına yakınını öğrenci merkezli uygulamalardan memnun olmaları ve erişileri üzerindeki olumlu etkisi bu tür çalışmaların sınıf ortamında kullanılmasının yararlı olacağına işarettir. Ancak zaman sorunu ve grup içi sorumluluklar konusu üzerinde durulmalıdır. Dersler tamamen proje ve etkinlik temelli işlenebilir. Yapılacak öğrenci merkezli çalışmalarda öğretim elemanı ve öğrencinin öğrenme – öğretme sürecindeki sorumlulukları ve bakış açılarında bir değişim olup olmadığı araştırılabilir.

Anahtar Kelimeler: sınıf öğretmeni adayı, matematik öğretimi, proje destekli öğretim, etkinlik destekli öğretim, öğretmen yetiştirme