Investigating of Primary School Teacher Candidates' Mathematics Teaching Performance According to Peer Assessments: Example of Teaching Practice

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Abstract

The aim of this research is to examine developments of primary school teacher candidates' mathematics teaching performance according to peer assessment. Primary school teacher candidates practiced teaching skills within the scope of the Teaching Practice. This research is a longitudinal study. The research's study group has fifty-eight primary school teacher candidates. According to the results of the research, peers rated primary school teacher candidates' final mathematics teaching performance higher than their first mathematics teaching performance. According to the peer assessment, primary school teacher candidates' mathematics teaching performance has improved over time. Accordingly, a significant difference was found in the first (preparation for lesson and lesson association) and second (teaching process) sub-dimensions of the scale when first mathematics teaching performance scores controlled. The source of the difference between peer assessment scores regarding first and second sub-dimensions of the scale can be said the number of teaching practices in mathematics. The primary school teacher candidates who practiced 2 times in mathematics got lower scores in the first and second sub-dimensions than those who practiced 3 and 4 times. According the result, primary school teacher candidates should practice at least 3 times in order to ensure their development "preparation for lesson and lesson association" and "teaching process" for mathematics teaching performance.

Keywords: Mathematics Teaching Performance, Primary School Teacher Candidate, Teaching Practice, Peer Assessment

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INTRODUCTION

Individuals are equipped with the knowledge, skills, values and competencies determined in line with the goals of education. It is important to determine whether the educational objectives have been achieved at the expected level. This determination can be done through measurement and evaluation activities. Thanks to these activities, accurate and effective feedback can be given. Students react differently to the feedback of adults and their peers. While students receive feedback, perceive adults as authoritarian but perceive peers open to negotiation (Cole, 1991).

Students can participate in assessment activities in the form of peer assessment or self-assessment (Falchikov & Goldfinch, 2000). Peer assessment can lead to effective and quality improvements as much as the gains from teacher assessment (Topping, 2009). Therefore, the inclusion of peer assessment in learning processes contributes to important gains.

Peer Assessment (PA)

There are many definitions related to PA in the literature. PA is the situation of receiving mutual feedback between the evaluator and the assessed. PA is an arrangement that allows students to consider and determine the performance of other students with equal status (Topping, 2009). PA is a process in which a student makes quantitative ratings and qualitative comments when evaluating the performance of her/his peer in her/his group or class (Chen, 2010; Raban & Litchfield, 2007). PA is a social activity based on a mutual trust relationship between the evaluator and the evaluate (Panadero, 2016; Panadero & Alqassab, 2019). PA allows the opinions of different evaluators to be taken (Chinn, 2005). PA can also be done in pairs or groups.

The purpose of PA is not just to give a score. The main purpose of PA is to provide feedback to students (Topping, 2009). Since there are more students than teachers in classrooms, feedback from peers can be quicker and more individual than teacher feedback (Topping, 2009). In addition, thanks to PA, students who actively participate in the assessment process develop skills such as critical thinking, independent learning and self-responsibility.

The results of research related to PA have shown that PA contributes both to the behavioral, emotional and cognitive development of students (Hogg 2018; Ramdani & Widodo, 2019; Yuan & Kim, 2018) and has many benefits in terms of education (Dochy, Segers & Sluijsmans, 1999; Latypova et al., 2016; Sluijsmans, Brand-Gruwel, Van Merriënboer & Martens, 2004; Sluijsmans & Van Merriënboer, 2010; Van Zundert, Panadero & Alqassab, 2019).

For example, PA plays a role in developing the ability to objectively criticize the produced work (Nicol & Macfarlane-Dick, 2006). In addition, PA can increase students' thinking, skills and improve cooperation with others (Hwang, Chen & Sung, 2019). Besides, assessment can be not only in school life but throughout life. Therefore, participating in PA at school can develop skills that can be transferred to life (Malan & Stegmann, 2018; Topping, 2009).

PA has the potential to help students learn the assessment process (Chinn, 2005; DiGiovanni & Nagaswami 2001). PA also encourages students to take more responsibility in the learning process (Seifert & Feliks, 2019). According to the results of many studies, when peers provide detailed evaluation and constructive explanations, they benefit from the evaluation process of the students and improve their performance (Sung, Chang, Chiou, & Hou, 2005; Sung, Lin, Lee & Chang, 2003; Tsai, Lin & Yuan, 2002;). PA due to its many benefits; It has been adopted in many fields such as engineering, art, mathematics, business and education (Falchikov & Goldfinch, 2000).

Loughry et al. (2007), stated that PA can be used to evaluate the performance of members, as team members can see the performance and behavior of other members. This also applies to the Teaching Practice class in teacher training programs. In this class, primary school teacher candidates

have the opportunity to practice teaching in a primary school. In Turkey, within the scope of Teaching Practice, the primary school teacher candidates who are divided into groups practice in a primary school classroom. In order to increase the efficiency of teaching practice, PA has been proposed in many studies (Davies, 2000; Double, McGrane, & Hopfenbeck, 2020; Freeman & McKenzie, 2002; Sitthiworachart & Joy, 2004). For this reason, PA is also very important for primary school teacher candidates, as only the group friends (peers) and the primary school teachers (mentors) observe all the performances of a primary school teacher candidate during the practicing. During the teaching practice, the lecturer (tutor) is only obliged to visit the primary school 4 times in Turkey.

Teaching Practice

According to the weekly course schedule of the Ministry of National Education-Head Council of Education and Morality, there are 13 courses in primary school: Turkish, mathematics, life study, science, social studies, foreign language, religious culture and moral knowledge, visual arts, music, play and physical activities, traffic safety, citizenship and democracy, human rights and free activities. In primary school there are seven different courses in the first grade, eight in the second grade, 10 in the third grade and 12 in the fourth grade. A primary school teacher candidate is expected to gain professional and field competencies for all these courses during undergraduate education. The teacher candidate has the opportunity to practice these field and professional competencies in a primary school within the scope of Teaching Practice I and Teaching Practice II at university. Due to the high number of courses, four different grade levels in primary school and the low number of practical courses (only two) in undergraduate education, the primary school teacher candidates who cannot find enough practice opportunities for each one course, feedback they receive at the end of each teaching performance in primary school are very valuable.

The variety of the person (lecturer, primary school teacher and peer) whom the primary school teacher candidates get feedback about their teaching performance can be effective in improving the performance of the teacher candidates. Li and Gao (2016) examined the effect of peer assessment on undergraduate students' ability to design lesson plans. In their research, they found that PA improves the skills of students with low and average success but not those with high success.

One of the main factors that increase reliability and validity in PA activities is the use of structured criteria for how to assessment a peer (Tsai & Chuang, 2013). The validity of the PA process increases when students work with structured tools when evaluating their peers (Hafner & Hafner, 2003; Jonsson & Svingby, 2007). In the literature, there is a structured scale developed by Bektaş, Horzum and Ayvaz (2010) for teacher candidates to evaluate their peers in Teaching Practice.

Peer Assessment and Teaching Practice

In the literature, there are researches examining the effect of PA on self-assessment (To & Panadero, 2019), describing thoughts about the use of peer feedback as a tool for teacher training (Seroussi, Sharon, Peled & Yaffe, 2019), investigating the use of online PA as a tool to improve pre-service teachers' assessment skills (Seifert & Feliks, 2019), revealing teachers' perceptions about PA (Önalan, 2018), determining the opinions of pre-service teachers about the involvement of PA surveys in a web-based system developed for the Teaching Practice and examining the lesson plans prepared by pre-service teachers according to peer opinions within the scope of Teaching Practice (Şendur, Kılınç Alpat & Özbayrak Azman, 2017). Although PA has been widely researched (Brutus, Donia & Ronen, 2013; Cartney, 2010; Gielen & De Wever, 2015; Lee, 2019; Lin, Tsai, Hsu & Chang, 2019; Liu et al., 2019; Merry & Orsmond, 2018; Ramon-Casas, Nuño, Pons & Cunillera, 2019), it has not been studied in the scope of mathematics teaching in the Teaching Practice. The results of this study are considered important to contribute to filling this gap in the literature.

Experience only means engaging in activity, while practice means trying to improve performance (Willingham, 2011). So, experience and practice are different things. For example, we cannot say that a person who has been a teacher for 25 years is also a very good teacher. Because a person who has been a teacher for years is experienced, but if this person has not tried to improve her teaching for 25 years, she cannot be said to be practicing. This is the same for primary school teacher candidates attending the Teaching Practice I/II classes. In these classes, they should be not only teacher candidates who gain experience, but also teacher candidates who practice. At this point, feedback and assessment become important. In this process, the task of giving feedback should not only be the teachers' and the lecturers', but this task should be shared with the peers of the primary school teacher candidates involved in the whole process.

The advantages of PA stated in the literature brought along the necessity to include PA in the Teaching Practice I/II classes. For this reason, it is important to follow the performance developments of the primary school teacher candidates in the Teaching Practice according to the PA.

Considering the many problems with mathematics teaching, the importance of primary school teachers' teaching competencies is a matter of curiosity. The critical period in which primary school teachers' teaching competencies develop is the university education period. In the undergraduate, applied classes have a special importance. For this reason, this study is limited to the Teaching Practice, which primary school teacher candidates go to primary school to practice. Teaching Practise is an important class for the development of teacher candidates' professionalism. It is important to reveal how pre-service students prepare the teaching lesson plans-materials, conduct learning process, and give feedback during teaching practice.

Purpose of the research

The aim of this research is to examine developments of primary school teacher candidates' mathematics teaching performance in primary school according to peer assessment. An answer to this question is sought within the scope of the research:

Do the peer assessment scores about primary teacher candidates' mathematics teaching final performances differ according to the number of teaching practices in mathematics class when the peer assessment scores about primary school teacher candidates' mathematics teaching first performances are controlled?

METHOD

Longitudinal study is used in this research since primary school teacher candidates' mathematics teaching performance developments according to peer assessment were examined. In longitudinal studies, the aim is to detect the change and development in the variables provided that the data of the research variables are collected at different times. In other words, in this method, data is collected from the same sample group at different times (Lynn, 2009). Since the data are collected at different times in longitudinal studies, it produces more reliable results compared to cross-sectional scans (Gürbüz & Şahin, 2017).

Participants

There were 73 primary school teacher candidates enrolled in the Teaching Practice I in the spring semester. Within the scope of this class, primary school teacher candidates practiced teaching in a primary school for twelve weeks. Research participants were formed according to the criterion sampling method. These criteria: The primary school teacher candidates should have teaching practice at least twice in the mathematics class in a primary school. In addition, between first and final performances of primary school teacher candidates must be at least 3 weeks. 9 primary school teacher

candidates were not included in the study. Because they practiced only once in the mathematics class. In addition, there was less than 3 weeks between the first and final performances of 6 candidates. As a result, a total of 15 primary school teacher candidates were not included in the research.

This research was conducted on a state university, located in Sakarya, during spring semester of 2019-2020 academic years. Participants were 58 primary school teacher candidates, 5 (9%) males and 53 (91%) females. The ages of the primary school teacher candidates ranged from 20 to 22.

Instrument

Primary school teacher candidates' mathematics teaching performances in primary school were assessment by their peers. In order to determine primary school teacher candidates' mathematics teaching performance levels, Peer Assessment Scale for Activities of Teaching Practice was used. The inventory includes 29 items in the five sub-dimensions of preparation for lesson and lesson association (6 items), teaching process (9 items), classroom management (5 items), feedback (3 items) and communication and evaluation (6 items). The inventory developed by Bektaş, Horzum and Ayvaz (2010). The items in the scale designed to be rated on a five-point Likert type response format. The lowest point that can be taken from the scale is 29 and the highest point is 145. The internal consistency coefficient of the scale is .92. The internal consistency coefficient of the scale calculated within the scope of this research is .89. This value is seen as acceptable value for the level of reliability of the scale.

Procedure

Teaching Practice is an 8-hour class, 2 of which are theoretical and 6 of which are practical per week. In the theoretical part, the lecturer guides the primary school teacher candidates about activities at the university. This guidance process has been combined with the "Teaching Practice Guide" prepared by the lecturers.

In the practical part of the class, the primary school teacher candidates are divided into groups determined by the university and they practice for twelve weeks in a primary school under the guidance of a teacher (mentor) in primary schools under the Ministry of Education. 3 or 4 primary school teacher candidates were sent to each mentor. There were three primary school teacher candidates in three of the groups and four primary school teacher candidates in sixteen. Each primary school teacher candidates in the study group practiced teaching per week for twelve weeks.

In the first week, primary teacher candidates prepared a "Term Plan" together with their mentor. Each primary school teacher candidates practiced teaching in accordance with the term plan. The Term Plan is a plan that shows in which lesson a primary school teacher candidate will practice each week for a semester. The Term Plan is made specifically for each primary school teacher candidates. For example, one candidate can perform his first performance in mathematics in the 3rd week, while the other candidate can perform in the 4th week. As three or four teacher candidates practiced in the same classroom in primary school, each candidate performed for different class in the same week.

The primary teacher candidates' teaching performances were observed by the other primary school teacher candidates (peers) in the same group. Peers marked the peer assessment scale according to the results of the observation. At the end of the class, peers handed over the peer assessment scale to the primary school teacher candidates. Primary school teacher candidates put the peer assessment scales in the Teaching Practice file.

Data Collection and Data Analysis

At the beginning of the semester, a meeting was held with all the academicians to guide the primary school teacher candidates. In this meeting, Peer Assessment Scale for Activities of Teaching Practice to be used during the Teaching Practice was introduced.

At the end of the semester, each primary school teacher candidates bound the Teaching Practice I file and delivered it to the lecturer. This file contains all activities covering a period such as lesson plans, worksheets, peer assessment scale, and administrative business documents. At the end of the semester, the files delivered to the lecturer were collected. The data obtained from Peer Assessment Scale for Activities of Teaching Practice in the file were transferred to the computer.

Since the number of teacher candidates in the groups differed, the peer assessment scores of the primary student teacher candidates' teaching performance could not be obtained by summing the scores given by all peers. Therefore, the average score was used when calculating the peer assessment scores of the primary student teacher candidates' teaching performance. Firstly, peer assessment scores given to a primary school teacher candidate's teaching performance were summed. This was done for each item on the scale. Then, the total scores of each item were divided by the number of peers (3 or 4). In other words, average score was calculated for each scale item. In this way, the peer assessment scores were made ready for data analysis.

In this research, the number of teaching practices is the independent variable. Peer assessment scores about the final mathematics teaching performance of primary school teacher candidates is the dependent variable. Peer assessment scores about the first mathematics teaching performance of primary school teacher candidates is the co-variable. ANCOVA analysis was used to determine whether the peer assessment scores about the primary school teacher candidates' final mathematics teaching performance differ according to the number of teaching practices, after controlling the peer assessment scores about the primary school teacher candidates' first mathematics teaching performance. In the data analysis, it was first determined that the data were normally distributed, the variances were homogeneous, there was no linear relationship between the dependent variable and the control variable, and the slope of the regression lines was homogeneous. As a result, the necessary assumptions were met in order to perform the one-factor ANCOVA analysis. ANCOVA statistic is used for repeated measure in one factor.

RESULTS

The scores of the primary school teacher candidates from their peers regarding their first and final mathematics teaching performances are presented in Figure 1.

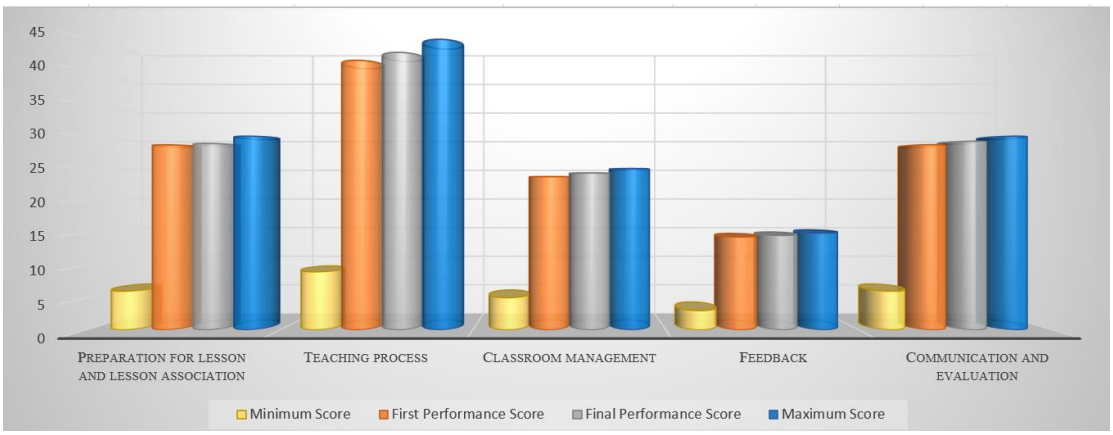

Figure 1. The scores of the primary school teacher candidates' mathematics teaching performances

According to the first mathematics teaching performance of primary school teacher candidates, peer assessment scores are 28.66 for the "preparation for lesson and lesson association" sub-dimension, 41.75 for the "teaching process" sub-dimension, 23.76 for the "classroom management" sub-dimension, 14.40 for the "feedback" sub-dimension, 28.68 for the "communication and evaluation" sub-dimension. According to the final mathematics teaching performance of primary school teacher candidates, peer assessment scores are 28.87 for the "preparation for lesson and lesson association" sub-dimension, 42.98 for the "teaching process" sub-dimension, 24.33 for the "classroom management" sub-dimension, 14.64 for the "feedback" sub-dimension, 29.22 for the "communication and evaluation" sub-dimension.

According to the peer assessment, primary school teacher candidates got higher scores from their final mathematics teaching performance compared to their first performance. According to the peer assessment, it can be interpreted that the primary school teacher candidates' mathematics teaching performances have improved over time. Since the "Term Plans" of the primary school teacher candidates were not the same, the number of teaching practices in mathematics also differed. ANCOVA test was carried out to reveal the role of number of teaching practice in the improvement of primary school teacher candidates' mathematics teaching performance. Firstly, the results related to the sub-dimension of preparation for lesson and lesson association are presented in Table 1.

Table 1. Descriptive statistics results for preparation for lesson and lesson association sub-dimension

Groups	N	Mean	ss	Adjusted Mean
2 times	27	28.43	1.50	28.43
3 times	17	29.20	1.07	29.30
4 times	14	29.32	1.41	29.19

Regarding the sub-dimension of preparation for lesson and lesson association, when corrected scores of the primary school teacher candidates' final mathematics teaching performance according to scores of their first mathematics teaching performances were examined, it was determined that the scores of those who practice 2 times are 28.43, those who practice 3 times are 29.30 and those who practice 4 times are 29.19. ANCOVA results to test the significance of this difference determined among adjusted mean scores are presented in Table 2.

Table 2. ANCOVA results for preparation for lesson and lesson association sub-dimension

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. (p)	Partial Eta Squared (η2)
First Performance (Reg.)	35.66	1	35.66	28.62	.00	.35
Group	9.75	2	4.87	3.91	.03*	.13
Error	67.29	54	1.25			
Total	48447.28	58				
Adjusted Total	112.93	57				

Within the scope of the preparation for lesson and lesson association sub-dimension, when the scores of primary school teacher candidates' first mathematics teaching performance were controlled, the difference between the final performance scores by number of teaching practices was found to be statistically significant, [$F(1,54)= 3.91$; $p<.05$, $\eta2=.13$]. In other words, it can be said that the reason for the difference between scores of the primary school teacher candidates' final mathematics teaching performance regarding the preparation for lesson and lesson association is the difference in the number of teaching practices in mathematics. Moreover, it was compared which groups were different from each other. According to the Bonferroni test results, there were statistically significant different between those who practice 2 times and those who practice 3 times. Moreover, there were statistically significant different between those who practice 2 times and those who practice 4 times. These differences were in favor of those who practice 4 times. In other words, the primary school teacher candidates who practice 2 times in mathematics received lower scores in the "Preparation for Lesson and Lesson Association" sub-dimension from their peer compared to the primary school teacher candidates who practice 3 and 4 times. As a result, it can be said that the increase the number of

teaching practices, primary school teacher candidates has made a positive contribution to their performance regarding the preparation for lesson and lesson association sub-dimension. Findings regarding the teaching process sub-dimension are presented in Table 3.

Table 3. Descriptive Statistics Results for teaching process sub-dimension

Group	N	Mean	ss	Adjusted Mean
2 times	27	41.99	2.18	42.06
3 times	17	43.76	1.34	43.71
4 times	14	43.93	2.19	43.85

Regarding the teaching process sub-dimension, when corrected scores of the primary school teacher candidates' final mathematics teaching performance according to scores of their first mathematics teaching performance were examined, it was determined that the scores of those who practice 2 times are 42.06, those who practice 3 times are 43.71 and those who practice 4 times are 43.85. ANCOVA results to test the significance of this difference determined among adjusted mean scores are presented in Table 4.

Table 4. ANCOVA results for teaching process sub-dimension

Source of Variation	Sum of Squares	df	Mean Square	F	p	η2
First Performance (Reg.)	71.55	1	71.55	26.93	.00	.33
Group	42.41	2	21.21	7.98	.00*	.23
Error	143.47	54	2.66			
Total	107391.44	58				
Adjusted Total	264.08	57				

Within the scope of the teaching process sub-dimension, when the scores of primary school teacher candidates' first mathematics teaching performance were controlled, the difference between the final performance scores by the number of teaching practices was found to be statistically significant, [$F(1,54) = 7.98$; $p<.05$, $\eta2=.23$]. In other words, it can be said that the reason for the difference between scores of the primary school teacher candidates' final mathematics teaching performance regarding the teaching process is the difference in the number of teaching practices in mathematics. Moreover, it was compared which groups were different from each other. According to the Bonferroni test results, there were statistically significant different between those who practice 2 times and those who practice 3 times. Moreover, there were statistically significant different between those who practice 2 times and those who practice 4 times. These differences were in favor of those who practice 4 times. As a result, it can be said that the increase the number of teaching practices, primary school teacher candidates has made a positive contribution to their performance regarding teaching process sub-dimension. Findings regarding the classroom management sub-dimension are presented in Table 5.

Table 5. Descriptive statistics results for classroom management sub-dimension

Group	N	Mean	ss	Adjusted Mean
2 times	27	24.30	.80	24.35
3 times	17	24.39	.76	24.41
4 times	14	24.32	1.46	24.22

Regarding the sub-dimension of classroom management, when corrected scores of the primary school teacher candidates' final mathematics teaching performance according to scores of their first mathematics teaching performances were examined, it was determined that the scores of those who practice 2 times are 24.35, those who practice 3 times are 24.41 and those who practice 4 times are 24.22. ANCOVA results to test the significance of this difference determined among adjusted mean scores are presented in Table 6.

Table 6. ANCOVA results for classroom management sub-dimension

Source of Variation	Sum of Squares	df	Mean Square	F	p	η2
First Performance (Reg.)	20.72	1	20.72	33.99	.00	.39
Group	.27	2	.13	.22	.81	.01
Error	32.92	54	.61			
Total	34396.17	58				
Adjusted Total	53.72	57				

Within the scope of the classroom management sub-dimension, when the scores of primary school teacher candidates' first mathematics teaching performance were controlled, the difference between the final performance scores by the number of teaching practices was not found to be statistically significant, [F (1,54) = 0.22; p>.05]. In other words, it can be said that the reason for the difference between scores the of the primary school teacher candidates' final mathematics teaching performance regarding the classroom management is not the difference in the number of teaching practices in mathematics. Findings regarding the feedback sub-dimension are presented in Table 7.

Table 7. Descriptive statistics results for feedback sub-dimension

Group	N	Mean	ss	Adjusted Mean
2 times	27	14.58	.56	14.55
3 times	17	14.69	.46	14.74
4 times	14	14.68	.95	14.68

Regarding the sub-dimension of feedback, when corrected scores of the primary school teacher candidates' final mathematics teaching performance according to scores of their first mathematics teaching performances were examined, it was determined that the scores of those who practice 2 times are 14.55, those who practice 3 times are 14.74 and those who practice 4 times are 14.68. ANCOVA results to test the significance of this difference determined among adjusted mean scores are presented in Table 8.

Table 8. ANCOVA results for feedback sub-dimension

Source of Variation	Sum of Squares	df	Mean Square	F	p	η2
First Performance (Reg.)	9.57	1	9.57	37.44	.00	.41
Group	.43	2	.21	.83	.44	.03
Error	13.80	54	.26			
Total	12446.25	58				
Adjusted Total	23.53	57				

Within the scope of the feedback sub-dimension, when the scores of primary school teacher candidates' first mathematics teaching performance were controlled, the difference between the final performance scores by the number of teaching practices was not found to be statistically significant, [F (1,54) = 0.83; p>.05]. In other words, it can be said that the reason for the difference between scores of the primary school teacher candidates' final mathematics teaching performance regarding the feedback is not the difference in the number of practices in mathematics. Findings regarding the communication and evaluation sub-dimension are presented in Table 9.

Table 9. Descriptive statistics results for communication and evaluation sub-dimension

Group	N	Mean	ss	Adjusted Mean
2 times	27	29.22	.95	29.19
3 times	17	29.16	.98	29.30
4 times	14	29.32	1.44	29.20

Regarding the sub-dimension of communication and evaluation, when corrected scores of the primary school teacher candidates' final mathematics teaching performance according to scores of their first mathematics teaching performances were examined, it was determined that the scores of those who practice 2 times are 29.19, those who practice 3 times are 29.30 and those who practice 4 times are 29.20. ANCOVA results to test the significance of this difference determined among adjusted mean scores are presented in Table 10.

Table 10. ANCOVA results for communication and evaluation sub-dimension

Source of Variation	Sum of Squares	df	Mean Square	F	p	η2
First Performance (Reg.)	17.73	1	17.73	20.03	.00	.27
Group	.14	2	.07	.08	.92	.00
Error	47.81	54	.89			
Total	49600.67	58				
Adjusted Total	65.75	57				

Within the scope of the communication and evaluation sub-dimension, when the scores of primary school teacher candidates' first mathematics teaching performance were controlled, the difference between the final performance scores by the number of teaching practices was not found to be statistically significant, [F (1,54) = 0.08; p>.05]. In other words, it can be said that the reason for the difference between scores of the primary school teacher candidates' final mathematics teaching performance regarding the communication and evaluation is not the difference in the number of teaching practices in mathematics.

DISCUSSION AND CONCLUSION

Teaching performance could be developed with addressing knowledge, skill and attitude (Pardimin & Huda, 2018). Teaching Practice is an important class in which primary school teacher candidates have the opportunity to practice their professional knowledge and skills they have gained during their undergraduate education, and that they see and complement their deficiencies. Therefore, it is expected that there will be a difference between the first and final teaching performances of the primary school teacher candidates at the end of this class. Within the scope of this research, the development of primary school teacher candidates' teaching performance in mathematics was examined according to peer assessment. According to the peer assessment, the primary school teacher candidates' final performances in mathematics in the primary school they attend as part of the Teaching Practice are better than their first performance. According to the peer assessment, the teaching performance of primary school teacher candidates in mathematics has improved over time. Davran (2006) concluded that the teacher competencies of the teacher candidates were "sufficient" before the Teaching Practice, while concluded that the teacher competencies of the teacher candidates were "very sufficient" after the Teaching Practice. According to the results of the research conducted by Davran (2016), the Teaching Practice had a positive contribution to the teacher competencies of teacher candidates. Çetinkaya and Kılıç (2017) concluded that the opinions of the primary school teacher candidates regarding the effectiveness level of the Teaching Practice were generally positive. Researches results in the literature support the results of this research.

Peers generally liked the primary school teacher candidates' mathematics teaching performance in primary school. In the literature, there are the researches which came to the conclusion that the primary school teacher candidates deemed themselves sufficient in terms of their performance in mathematics teaching (Hacıömeroğlu & Şahin-Taşkın, 2010), and which reached the conclusion that the elementary teacher candidates' concerns about mathematics were low (Deringöl, 2018). Researches results in the literature support the results of this research.

Among the most important sources for teaching effectiveness is teacher training depending on the number of teaching practice experience (Poulou, 2003). When the number of teaching practices increases, it could be said that the way teacher candidates do their teaching practice will change (Doğan Temur, Akbaba Dağ, & Turgut, 2017). Because planning for a lesson is recognized as a primary factor impacting the efficacy of classroom instruction, it is expected that teacher candidates' planning skills will improve at the end of the practice (Courtney, Eliustaoglu, & Crawford, 2015). In this research, after controlling the peer assessment scores of the primary school teacher candidates first performance in mathematics, peer assessment scores of primary school teacher candidates' final performances were compared according to the number of teaching practices in mathematics. The source of the difference between the peer assessment scores of primary school teacher candidates' final

performance regarding the reparation for lesson and lesson association sub-dimension in mathematics can be called the number of teaching practices in mathematics. Also, the source of the difference between the peer assessment scores of primary school teacher candidates' final teaching performance regarding the teaching process sub-dimension in mathematics can be called the number of teaching practices in mathematics. The primary school teacher candidates who practice 2 times in mathematics lessons received lower scores in the preparation for lesson association sub-dimension and teaching process sub-dimension from the peer assessment compared to those who practice 3 and 4 times. According to this result, primary school teacher candidates should practice at least 3 times in order to ensure their development regarding the preparation for lesson and lesson association and teaching process in mathematics. Soylu (2012) concluded that Teaching Practice did not affect primary school teacher candidates' ability to use teaching methods and techniques in mathematics. This conclusion reached by Soylu (2012) is not consistent with the results of this research. The reason for this may be the number of teaching practices. Soylu (2012) did not express the number of primary school teacher candidates' teaching practice in mathematics in his study.

It was found that the reason for the difference between final mathematics teaching performance scores of primary school teacher candidates regarding the classroom management, feedback, communication and evaluation is not the difference in the number of teaching practices. When the contents of these sub-dimensions are examined, it is seen that it is not only specific to the mathematics, but also the related content can be gathered on the common denominator in other lessons (eg life study, social studies, visual arts, etc.). For example, the experiences of teacher candidates related to classroom management continued to improve in other lessons in which they practiced apart from mathematics. Therefore, it is not surprising that the development of these skills does not depend on the number of practices in only mathematics. On the contrary, since the skills related to the preparation for lesson and lesson association and teaching process in the scale are specific to the mathematics, the source of the difference in these sub-dimensions was found to be the number of practices in mathematics.

Suggestions

Some recommendations are presented within the scope of this research:

- Thanks to the “Term Plan” made at the beginning of the semester, it should be ensured that each primary school teacher candidates practice at least 3 times in mathematics lessons in primary school.

- The assessment of primary school teacher candidates’ performance should share with peers of teacher candidates. For this reason, peer assessment scales should be developed for each course.

- Due to the branches of classroom teacher candidates, there are different teaching lessons in the undergraduate programs. Due to this variety, the number of applied courses in the undergraduate program should be increased.

- In order to make the peer assessments process more practical and efficient, a program can be developed that will allow peer assessments regarding the performance of candidate teachers in Mathematics lessons to be made online. In addition, self-evaluation can be provided through this way.

- There can be differences between universities in the number of teaching practices for teacher students. For this reason, the developments in teacher candidates' mathematics teaching performances can also be examined in terms of universities.

REFERENCES

Bektaş, M., Horzum, M. B., & Ayvaz, A. (2010). "Öğretmenlik uygulaması dersi öğretmen adayı akran değerlendirme ölçeği" geliştirme çalışması. [A study of developing "peer assessment scale for activities of teaching practice course"]. *E-Journal of New World Sciences Academy Education Sciences*, *5*(3), 1272-1280.

Brutus, S., Donia, M. B. L., & Ronen, S. (2013). Can business students learn to evaluate better? Evidence from repeated exposure to a peer-evaluation system. *Academy of Management Learning & Education, 12*(1), 18–31. https://doi.org/10.5465/amle.2010.0204

Cartney, P. (2010). Exploring the use of peer assessment as a vehicle for closing the gap between feedback given and feedback used. *Assessment & Evaluation in Higher Education, 35*(5), 551-564. https://doi.org/10.1080/02602931003632381

Chen, C. H. (2010). The implementation and evaluation of a mobile self-and peer-assessment system. *Computers & Education*, *55*(1), 229–236. https://doi.org/10.1016/j.compedu.2010.01.008

Chinn, D. (2005). Peer-assessment in the algorithms course, In *Proceedings of the 10th annual SIGCSE Conference on Innovation and Technology in Computer Science Education*, *37*(3), 69-73, New York, USA. https://doi.org/10.1145/1151954.1067468

Cole, D. A. (1991). Change in self-perceived competence as a function of peer and teacher evaluation. *Developmental Psychology*, *27*(4), 682–688. https://doi.org/10.1037/0012-1649.27.4.682

Courtney, S. A., Eliustaoglu, E., & Crawford, A. (2015). Examining the role lesson plans play in mathematics education. In Bartell, T. G., Bieda, K. N., Putnam, R. T., Bradfield, K., & Dominguez, H. (Eds.). *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. (pp. 632-639). East Lansing, MI: Michigan State University.

Çetinkaya, E., & Kılıç, D. (2017). Öğretmenlik uygulaması dersinin etkililik düzeyinin okul yöneticisi, sınıf öğretmeni ve öğretmen adayı görüşlerine göre incelenmesi. [Effectiveness of Teaching Practice Course According to School Administrators, Class Teacher and Teacher Candidate Opinions]. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *21*(2), 561-571.

Davran, E. (2006). *İlköğretim kurumlarındaki öğretmenlik uygulamasının öğretmen adaylarının öğretmenlik yeterliliklerini kazanmaları üzerindeki etkisi (Van ili örneği).* [Unpublished master dissertation]. Van: Yüzüncü Yıl University.

Davies, P. (2000). Computerized peer assessment. *Innovations in Education and Training International*, *37*(4), 346–355. https://doi.org/10.1080/135580000750052955

Deringöl, Y. (2018). Sınıf öğretmeni adaylarının matematik öğretimi kaygıları ve matematik öğretimi yeterliklerinin incelenmesi. [An Examination of The Mathematics Teaching Efficacy and The

Mathematics Teaching Anxiety of Classroom Teacher Candidates]. *Journal of Theoretical Educational Science*, *11*(2), 261-278. https://doi.org/10.30831/akukeg.364483

DiGiovanni, E., & Nagaswami, G. (2001). Online peer review: An alternative to face-to-face? *ELT Journal*, *55*(3), 263–272. https://doi.org/10.1093/elt/55.3.263

Dochy, F., Segers, M., & Sluijsmans, D. (1999). The use of self-, peer- and co-assessment in higher education. A review. *Studies in Higher Education, 24*(3), 331–350. https://doi.org/10.1080/03075079912331379935

Doğan Temur, Ö., Akbaba Dağ, S., & Turgut, S. (2017). Some reflections from pre-service elementary teachers' practice teaching on the area of understanding data in the math-teaching course. *International Electronic Journal of Elementary Education, 7*(3), 355-370.

Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020). The impact of peer assessment on academic performance: A meta-analysis of control group studies. *Educational Psychology Review, 32*, 481–509. https://doi.org/10.1007/s10648-019-09510-3

Falchikov, N., & Goldfinch, J. (2000). Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. *Review of Educational Research, 70*(3), 287-322.

Freeman, M., & McKenzie, J. (2002). SPARK, a confidential web-based template for self and peer assessment of student team work: Benefits of evaluating across different subjects. *British Journal of Educational Technology, 33*(5), 551–569. https://doi.org/10.1111/1467-8535.00291

Gielen, M., & De Wever, B. (2015). Structuring the peer assessment process: a multilevel approach for the impact on product improvement and peer feedback quality. *Journal of Computer Assisted Learning, 31*(5), 435-449. https://doi.org/10.1111/jcal.12096

Gürbüz, S., & Şahin, F. (2017). *Sosyal bilimlerde araştırma yöntemleri felsefe-yöntem-analiz*, 4. Baskı, Seçkin Yayıncılık, Ankara.

Hacıömeroğlu, G., & Şahin-Taşkın, Ç. (2010). Sınıf öğretmeni adaylarının matematik öğretimi yeterlik inançları. [Elementary Preservice Teachers' Mathematics Teaching Efficacy Belief]. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi*, 23(2), 539-555.

Hafner, J., & Hafner, P. (2003). Quantitative analysis of the rubric as an assessment tool: an empirical study of student peer-group rating. *Int. J. Sci. Educ., 25*(12), 1509-1528. https://doi.org/10.1080/0950069022000038268

Hogg, L. M. (2018). Empowering students through peer assessment: Interrogating complexities and challenges, *Reflective Practice, 19*(3), 308-321. https://doi.org/10.1080/14623943.2018.1437404

Hwang, G. H., Chen, B., & Sung, C. W. (2019). Impacts of flipped classrooms with peer assessment on students' effectiveness of playing musical instruments–taking amateur erhu learners as an example. *Interactive Learning Environments, 27*(8), 1047-1061. https://doi.org/10.1080/10494820.2018.1481105

Jonsson, A., & Svingby, G. (2007). The use of scoring rubrics: Reliability, validity and educational consequences. *Educational research review, 2*(2), 130-144. https://doi.org/10.1016/j.edurev.2007.05.002

Latypova, L. A., Polyakova, O. V., & Latypov, N. R. (2016). University students' peer assessment in the language environment: From rote to meaningful learning. *International Electronic Journal of Mathematics Education, 11*(6), 1911-1917.

Lee, S. B. (2019). Scale-referenced, summative peer assessment in undergraduate interpreter training: self-reflection from an action researcher, *Educational Action Research*, *27*(2), 152-172. https://doi.org/10.1080/09650792.2018.1477609

Li, L., & Gao, F. (2016). The effect of peer assessment on project performance of students at different learning levels. *Assessment & Evaluation in Higher Education*, *41*(6), 885–900. https://doi.org/10.1080/02602938.2015.1048185

Lin, J. W., Tsai, C. W., Hsu, C. C. & Chang, L. C. (2019). Peer assessment with group awareness tools and effects on project-based learning, *Interactive Learning Environments*, https://doi.org/10.1080/10494820.2019.1593198

Liu, J., Guo, X., Gao, R., Fram, P., Ling, Y., Zhang, H., & Wang, J.(2019). Students' learning outcomes and peer rating accuracy in compulsory and voluntary online peer assessment, *Assessment & Evaluation in Higher Education*, 44(6), 835-847. https://doi.org/10.1080/02602938.2018.1542659

Loughry, M. L., Ohland, M. W., & DeWayne Moore, D. (2007). Development of a theory-based assessment of team member effectiveness. *Educational and Psychological Measurement*, *67*(3), 505-524. https://doi.org/10.1177/0013164406292085

Lynn, P. (2009). *Methods for longitudinal surveys*. Chichester, UK: John Wiley & Sons.

Malan, M., & Stegmann, N. (2018). Accounting students' experiences of peer assessment: A tool to develop lifelong learning, *South African Journal of Accounting Research*, *32*(2-3) 205-224, https://doi.org/10.1080/10291954.2018.1487503

Merry, S. & Orsmond, P. (2018). Peer assessment: the role of relational learning through communities of practice, *Studies in Higher Education*, https://doi.org/10.1080/03075079.2018.1544236

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*, *31*(2), 199–218. https://doi.org/10.1080/03075070600572090

Önalan, O. (2018). Novice EFL teachers'views on peer assessment. *Kara Harp Okulu Bilim Dergisi*, *28*(2), 1-20.

Panadero, E. (2016). Is it safe? Social, interpersonal, and human effects of peer assessment: A review and future directions. In G. T. L. Brown & L. R. Harris (Eds.), *Handbook of Human and Social Conditions in Assessment* (pp. 247–266). New York: Routledge.

Panadero, E., & Alqassab, M. (2019). An empirical review of anonymity effects in peer assessment, peer feedback, peer review, peer evaluation and peer grading, *Assessment & Evaluation in Higher Education*, *44*(2), 1-26. https://doi.org/10.1080/02602938.2019.1600186

Pardimin, & Huda, M. (2018). Investigating factors influencing mathematics teaching performance: an empirical study. *International Journal of Instruction*, *11*(3), 391-402. https://doi.org/10.12973/iji.2018.11327a

Poulou, M. (2003). *Influential factors on teaching efficacy: prospective teachers' beliefs*. Paper presented at British Educational Research Association Annual Conference, Heriot-Watt University, Edinburgh. http://www.leeds.ac.uk/educol/documents/00003151.htm

Raban, R., & Litchfield, A. (2007). Supporting peer assessment of individual contributions in groupwork. *Australasian Journal of Educational Technology*, *23*(1), 34–47. https://doi.org/10.14742/ajet.1272

Ramdani, J. M., & Widodo, H. P. (2019). Student teachers' engagement in facebook-assisted peer assessment in an initial teacher education context: Speaking 2.0, *Journal of Education for Teaching*. https://doi.org/10.1080/09589236.2019.1599503

Ramon-Casas, M., Nuño, N., Pons, F., & Cunillera, T. (2019). The different impact of a structured peer-assessment task in relation to university undergraduates' initial writing skills, *Assessment & Evaluation in Higher Education,* 44:5, 653-663. https://doi.org/10.1080/02602938.2018.1525337

Seifert, T., & Feliks, O. (2019). Online self-assessment and peer-assessment as a tool to enhance student-teachers' assessment skills, *Assessment & Evaluation in Higher Education*, *44*(2), 169-185. https://doi.org/10.1080/02602938.2018.1487023

Seroussi, D. E., Sharon, R., Peled, Y., & Yaffe, Y. (2019). Reflections on peer feedback in disciplinary courses as a tool in pre-service teacher training, *Cambridge Journal of Education, 49*(5), 655-671. https://doi.org/10.1080/0305764X.2019.158113

Sitthiworachart, J., & Joy, M. (2004). *Effective peer assessment for learning computer programming.* Proceedings of the 9th annual SIGCSE conference on Innovation and technology in computer science education (pp. 122–126), Leeds, UK. York, NY: ACM.

Sluijsmans, D. M. A., Brand-Gruwel, S., van Merriënboer, J. J. G., & Martens, R. L. (2004). Training teachers in peerassessment skills: effects on performance and perceptions. *Innovations in Education and Teaching International*, *41*(1), 59–78. https://doi.org/10.1080/1470329032000172720

Soylu, Y. (2012). Öğretmenlik uygulaması derslerinin sınıf öğretmeni adaylarının matematik derslerinde öğretim yöntem ve tekniklerini kullanabilme başarılarına etkisi. [The effect of teaching practice courses on the success of primary school teacher candidates in using teaching methods and techniques at mathematics lessons]. *Milli Eğitim Dergisi, 42*(195), 166-178.

Sridharan, B., Muttakin, M. B., & Mihret, D. G. (2018). Students' perceptions of peer assessment effectiveness: an explorative study, *Accounting Education*, *27*(3), 259-285. https://doi.org/10.1080/09639284.2018.1476894

Sung, Y. T., Chang, K. E., Chiou, S.-K., & Hou, H. T. (2005). The design and application of a web-based self and peer-assessment system. *Computers & Education, 45*(2), 187–202. https://doi.org/10.1016/j.compedu.2004.07.002

Sung, Y. T., Lin, C. S., Lee, C. L., & Chang, K. E. (2003). Evaluating proposals for experiments: an application of webbased self-assessment and peer-assessment. *Teaching of Psychology, 30*(4), 331–334. https://doi.org/10.1207/S15328023TOP3004_06

Şendur, G., Kılınç Alpat, S. ve Özbayrak Azman, Ö. (2017). Kimya öğretmen adayları tarafından yapılan akran değerlendirmeleri ve bu değerlendirmelerin hazırladıkları ders planına yansımaları, *2. Uluslararası eğitimde iyi uygulamalar ve yenilikler konferansı*, http://inoved.org/INOVED2017/abstract/kimya-ogretmen-adaylari-tarafindan-yapilan-akran-degerlendirmeleri-ve-bu-degerlendirmelerin-hazirladiklari-ders-planina-yansimalari

To, J., & Panadero, E. (2019). Peer assessment effects on the self-assessment process of first-year undergraduates. *Assessment & Evaluation in Higher Education*, *44*(6), 920-932. https://doi.org/10.1080/02602938.2018.1548559

Topping, K. J. (2009). Peer assessment. *Theory into Practice*, *48*(1), 20-27. https://doi.org/10.1080/00405840802577569

Tsai, C. C., Lin, S. S. J., & Yuan, S. M. (2002). Developing science activities through a networked peer-assessment system. *Computers & Education*, *38*(1-3), 241–252. https://doi.org/10.1016/S0360-1315(01)00069-0

Tsai, Y. C., and Chuang, M. T. (2013). Fostering revision of argumentative writing through structured peer assessment. *Perceptual and Motor Skills*, *116*(1), 210–221. https://doi.org/10.2466/10.23.PMS.116.1.210-221

Van Zundert, M., Sluijsmans, D., & Van Merriënboer, J. (2010). Effective peer assessment processes: Research findings and future directions. *Learning and Instruction*, *20*(4), 270–279. https://doi.org/10.1016/j.learninstruc.2009.08.004

Willingham, D. T. (2011). *Çocuklar okulu neden sevmez*. Çev., İ. Katırcı. İstanbul: İthaki Yayınları.

Yuan, K., & Kim, C. (2018). The effects of autonomy support on student engagement in peer assessment. *Educational Technology Research and Development*, *66*(1), 25-52. https://doi.org/10.1007/s11423-017-9538-x