RedFame

Journal of Education and Training Studies
Vol. 4, No. 5; May 2016
ISSN 2324-805X E-ISSN 2324-8068
Published by Redfame Publishing
URL: http://jets.redfame.com

Investigating the Effectiveness of Microteaching in Mathematics of Primary Pre-service Teachers

Savaş Baştürk

Correspondence: Savaş Baştürk, Elementary Mathematics Teacher Education, Faculty of Education, Sinop University, 57000, Sinop, Turkey.

Received: April 1, 2016 Accepted: April 12, 2016 Online Published: April 18, 2016

doi:10.11114/jets.v4i5.1509 URL: http://dx.doi.org/10.11114/jets.v4i5.1509

Abstract

Microteaching is a teacher education technique whose contributions to pre-service teacher education are significant. Through this technique, pre-service teachers can find an opportunity to transform their subject matter knowledge and pedagogical content knowledge into practice. They see and improve their weaknesses of teaching skills such as lesson planning, organization of group work, classroom management, etc. The aim of this study was to investigate the effectiveness of microteaching in mathematics of primary pre-service teachers by using a quantitative approach. The research group involved 131 third grade pre-service teachers from the department of primary school education. In their course entitled "mathematics teaching II", the pre-service teachers lectured mathematics by using microteaching method for only once in a period of 40 minutes. To collect data, a 5-point Likert-type microteaching evaluation form was administered to the pre-service teachers. The exploratory factor analysis was performed. We found seven factors which explain the pre-service teachers' effectiveness in microteaching. The main results of the study indicate that the pre-service teachers had some problems in assessment, organization of group studies, and incorporating students' interest into teaching.

Keywords: teacher training, microteaching, pre-service teacher, primary education, mathematics education

1. Introduction

There are some common points of view on teaching profession which show resistance to many change efforts. It is possible to increase them, but we limit ourselves to cite the most well-known: Teaching is learnt from the own efforts of the individual, the teachers need to develop their own teaching styles themselves, the good teachers work alone, teaching can only be learnt by doing and living, teaching is a matter of common sense and experience (Feiman-Nemser, 2001). Surely, we cannot assert that the experience is trivial in teaching profession, but explaining everything with only experience and common sense is not sufficient in understanding why many students fail in mathematics despite the very experienced teachers (Robert, Lattuati, & Penninckx, 1999).

If teaching is a profession and "teacher training is a disciple which refers to the policies and procedures designed to equip pre-service teachers with knowledge, attitudes, behaviors and skills they require to perform their tasks effectively in the classroom, school and wider community", training pre-service teachers cannot be left to the chance and common sense (Kumar & Parveen, 2013, p. 8). Many researchers believe that one of the most important problems to be considered in the teacher training programs is the disequilibrium of theory and practice (Latham & Vogt, 2007; Parsons & Stephenson, 2005; Smith, 2004). Teaching is a profession which is largely based on practice. However, the importance of theory is undeniable. The fact that someone who learns to drive, knows, in theory, to press the brake pedal or the clutch pedal, to turn the steering wheel, and to change the gears does not mean that s/he knows to drive a car. Similarly, only to know all theoretical knowledge about teaching and learning does not guarantee to be an effective teacher. As a result, it can be asserted that microteaching offers a very efficient opportunity to pre-service teachers for the combination of theory and practice.

1.1 Conceptual Framework of the Study

1.1.1 Microteaching and Its Contribution on Pre-service Teachers

In the sixties, microteaching was born as an application implemented in medical students training to promote their quality (Cruickshank & Metcalf, 1993), and then in line of this same purpose, it began to be used in the teacher training process (He & Yan, 2011). Microteaching is a teacher education technique whose contributions to pre-service teacher

education are significant. Through this technique, pre-service teachers can find an opportunity to transform their subject matter knowledge and pedagogical content knowledge (PCK) into practice. They see and improve their weaknesses of teaching skills such as lesson planning, organization of group work, classroom management, etc.

By meeting some requirements such as the equipment and atmosphere, microteaching can turn into a valuable instructional tool for the pre-service teacher education programs and it can be more effective than traditional teaching (Akalın, 2005; Benton-Kupper, 2001). According to Subramaniam (2006), the microteaching experiences contribute to pre-service teachers to recognize the realities of teaching, to have the opportunity to be aware of their role as a teacher, to understand the importance of planning, decision making, and implementation of instruction, to develop and improve their teaching skills, and to build their confidence for the teaching.

Despite its importance, there are some criticisms for microteaching in the literature. For instance, pre-service teachers consider microteaching environment as artificial and they are unwilling to take part in microteaching activities because of the non-natural classroom environment, material procedures, and time constrained course schedules (Cripwell & Geddes, 1982; Stanley, 1998). In general, the audience is classmates and instructor. They know the topic to be presented beforehand. Therefore, recognizing the possible difficulties in teaching the same topic in a real school environment can be difficult for the lecturing pre-service teacher. No questions can be asked by the audience or the asked questions cannot be like those of students in the actual school setting (Peker, 2009). Other reasons for reluctance and obstacle are the limited time for preparation and wastefulness of microteaching (Lederman & Gess-Newsome, 1991).

As it is a process, microteaching includes some steps. According to Ananthakrishnan (1993) a microteaching process involves nine steps as follows: lesson planning, set induction, presentation, stimulus variation, proper use of audio, reinforcement, questioning, silence and non-verbal cues (body language), and closure. Keep in mind that microteaching is not an activity which can be limited just to the pre-service teacher. It is a social process involving an instructor and peers' oral or written feedback. Therefore, improving the communication among pre-service teachers, their instructors, and peers is an important point to have expected contributions from microteaching (Lin, 2014). In this context, National Research Council (1996) underlines the need that pre-service teachers have regular, frequent opportunities for individual and collegial examination, receive feedback about their teaching, and apply them to improve their practice. Consequently, in addition of being a teaching and learning instrument for teacher training, microteaching is also an efficient and effective instrument to evaluate theoretical and practical training experience of pre-service teachers in the faculties of education.

1.1.2 Good Teaching of Mathematics and Steps of a Teaching

As the main purpose of the study was to examine the effectiveness of pre-service teachers' microteaching experience, it was necessary to briefly mention the nature of an effective teaching and the steps of a teaching. In some points we interpreted these practices and steps, and benefited from them during the development of the items of the microteaching evaluation form (MEF) that is the data collection instrument in this study.

Unfortunately, the literature does not offer a clear definition which exhibits what involves a good mathematics teaching. However, from some researchers' efforts in this subject, we can have evidence to suggest what good teaching is and what it looks like (Gallivan, 2014). Even though not the best, research indicates that some teaching practices have potential to enable the learning of mathematics through productive struggle. From the literature, Gallivan (2014) identified these practices as follows: facilitating cooperative groups, using high-level mathematics tasks, facilitating discourse in the classroom, and confronting status issues. Surely, we cannot argue that these practices are exhaustive, but they give us some ideas on what we should pay attention to, when examining the teaching of a teacher or pre-service teacher.

According to Stones (1994), there are three main phases in a lesson. In the first, as called *the preactive*, the teacher should identify the prior knowledge which is necessary for the topic to be taught, plan the materials in its order of presentation, and gather the required resources. The following phase, entitled as *the interactive*, can be described the core place where teaching is carried out. Some tasks expected from the teacher here, are to introduce the aims of the lesson, to engage the pupils, to organize group or individual works, and to hold their attention while s/he asks question etc. The last phase, called *the evaluative*, means the completion of the teaching process. In this stage, the teacher needs to check what degree the lesson plan is implemented. As a result, we can say that a teaching should at least include these three phases to be qualified as a standard lesson.

1.1.3 The Aim of the Present Study

As long as the teacher educators make the efforts to enrich pre-service teachers' training and support them in improving knowledge and practice in line with recent reforms, we always need research on pedagogical approaches and experiences that contributes the teacher educators to this work (Grossman, 2005; National Academy of Education,

1999). Therefore, the purpose of the study was to investigate the effectiveness of primary pre-service teachers in the microteaching of mathematics from a quantitative approach. One of the most effective ways to evaluate the (pre-service) teachers is to observe them during teaching. Therefore, the role of microteaching cannot be neglected in the pre-service teacher's teaching evaluation. In the literature, there are also many studies revealing that the microteaching applications in teacher training are the most useful and applicable approach to identify the pre-service teachers' weakness and deficiencies, contribute their professional progress, and reduce negative effects such as excitement and stress (Amobi, 2005; Arsal, 2014; Fernández, 2005; Kpanja, 2001; Peker, 2009; Subramaniam, 2006). We believe that the results of this study may serve as an improvement in primary pre-service teachers' teaching skills by determining their weaknesses and difficulties.

As underlined in the literature, feedback has a crucial role in the microteaching process. Thus, it is necessary to provide for pre-service teachers feedbacks from the instructor or peers. This can help them to see the strong and weak sides of their teaching performance and give them the opportunity to develop themselves for accessing to the desired level (Farris, 1991; Fernández & Robinson, 2006; Kpanja, 2001). Undoubtedly, one of the most important factors that, makes an evaluation valid is to use tests or instruments that are valid and reliable to collect data. Therefore, an evaluation criterion (form) is a central component of microteaching (Arsal, 2014). Through this study, we also aimed to offer to the literature, an evaluation form, of which the reliability and validity are tested. Consequently, findings from this study may contribute to the literature for evaluating (pre-service) teacher teachings skills and then optimizing teacher education.

2. Method

The research design used for this study was a descriptive survey method. Therefore, pre-service teachers' microteaching performances were determined without interrupting them in any way. Such a research plays an important role in pioneering to qualitative researches. In this context, Shuttleworth (2008) indicates that descriptive research design is quite useful to decide what is worth studying, because quantitative experiments are generally expensive, and take a lot of time.

This research described in this paper is a part of the project which aims to investigate primary pre-service teachers' pedagogical content knowledge of fractions. This paper summarizes the results obtained from the microteaching evaluation form which was one of the data-gathering instruments used in the project to determine the pre-service teachers' microteaching performances.

2.1 Participants of the Study

The participants of the research were 131 third grade pre-service teachers from four sections (71% females and 29% males) in the department of primary school education at a public university in the north of Turkey. The study took place in the sixth semester. Until this time, pre-service teachers took the following courses: basic mathematics I-II, educational science, psychology of education, teaching principles and methods, classroom management, measurement and assessment, teaching mathematics I. During the research, they were taking teaching mathematics II and gaining school experience. Considering the content of all these courses, one can affirm that the research group was suitable enough for such a study. On the other hand, data was collected in the teaching mathematics II course. As in the scope of this course, pre-service teachers were also expected to teach mathematics by using microteaching technique, this facilitated their participation in microteaching activities and then in the research.

2.2 Data Collection and Procedures

In order to obtain data, a five-point Likert-type microteaching evaluation form (MEF) was administered. The MEF was developed by the researcher in the light of the literature review (e.g. Ananthakrishnan, 1993; Bilen, 2014; Gallivan, 2014; Karadeniz, 2009; Lin, 2014; Stones, 1994) and his experiences as a teacher educator. The form comprised of 32 items ranging from "very poor" to "very good" (1=very poor, 5=very good). As the development of a scale was not intended, the steps of scale development process were not strictly followed. Thus, the distribution of the negative or positive items was not equal. Even all items were positive.

A panel of experts involving three educators from the department of primary school education established the content validity of the MEF. In terms of readability and understanding, it was reviewed by about 10 pre-service teachers. Furthermore, we performed exploratory factor analysis technique with which it was possible to convert the numerous variables into limited number of meaningful and independent factors.

During the item development process, we identified a set of teaching skills by basing on the literature. Moreover, we considered some components of pedagogical content knowledge (PCK) such as students' difficulties and misconceptions. The distribution of the items of the MEF according to the lesson phases and teaching skills was presented in Table 1:

Table 1. Distribution of the Items of the MEF According to the Lesson Phases and Teaching Skills

Phases of the lesson	*Skills*	*Number of item*
Introduction to the lesson (preactive)	Motivating students, associating new knowledge with previous, informing students appropriately about teaching goals	3 items
Teaching (interactive)	Ensuring students' participation in class, asking questions, organizing group studies, preparing and implementing materials, classroom management, use of board, use of time, integrating technology in the teaching, considering students' difficulties and misconceptions, communication skills such as eye contact with students, use of gestures, taking into account the constructivist principles, etc.	26 items
Close of teaching (evaluative)	Summarizing what is learned, using traditional or alternative assessment techniques	3 items

Regarding the microteaching process followed in this study, the microteaching was planned and implemented by the researcher (also the instructor) in the teaching mathematics course for one semester (14 weeks). The goals for the microteaching session and the items of the MEF were presented to the pre-service teachers by the instructor before the microteaching session. The pre-service teachers should teach five learning objectives determined by drawing lots from the elementary mathematics curriculum (grades 1-4). The microteaching schedule was also determined by this same method. Our microteaching process comprised of three phases: *preparation*, *teaching*, and *evaluation*. In the first phase the pre-service teachers were asked to prepare their lesson plan by conducting research on their learning objectives from the curriculum, the literature (especially important to identify students' misconceptions and difficulties), student or teacher textbooks, and discussing with their practicum school teachers and classmates. In the second phase, they should teach to their classmates about 40 minutes. The classmates were free to ask them questions as a student. The last phase called evaluation involved all evaluation process and the MEF was filled in this phase. Firstly, the lecturing pre-service teacher should evaluate his/her teaching (self-evaluation) by answering to questions such as: Did everything go as planned? What was unexpected? If s/he had the opportunity to teach the same topic again, what would s/he modify? Then, the evaluation of the classmates (peer-evaluation), the jury members (peer-evaluation) and the instructor (expert-evaluation) should follow this self-evaluation.

In their evaluations, three jury members and the instructor should fill the MEF, write their feedbacks during the microteaching as well as the MEF, and share them with the lecturing pre-service teacher and the others. The selection of the jury members were randomly performed by an online random-drawing name generator before the start of microteaching. Finally, we had four MEFs for each lecturing pre-service teacher. Since 131 pre-service teachers participated in the study, 524 MEFs were totally analyzed. The jury members were changed every week. After everyone was assigned to jury, the process of being jury member was restarted. Only seven pre-service teachers' microteaching involved in the main research group of the project was video recorded and analyzed. Accordingly, there were no phases of recording, watching, revising, re-teaching, and comparing the second teaching to the first.

2.3 Data Analysis

The analysis of data obtained was done by using quantitative analysis software. In the line of the research purpose, the arithmetic mean values $\bar{X}$ related to the examination of pre-service teachers' microteaching were calculated.

Factor analysis in order to determine the construct validity of the data collection instrument and the factor structure of items, principal components method and varimax rotation were conducted. As the factors were not correlated, we decided to use orthogonal rotation (Tabachnick & Fiddell, 2007). As in orthogonal rotation, the most commonly used techniques are varimax and quartimax (Büyüköztürk, 2010), we used varimax. The factor analysis consisted of two phases. In the first one, we determined eight factors having eigenvalues greater than 1.0, which was a common criterion for a factor to be useful. They explained 58.843% of the total variance. But, as some items load highly on more than one factor, they were excluded from the analysis (5 items). In the second phase, the rest 32 items were analyzed, as seen in Table 2, seven factors, whose loading value was more than 0.40, eigenvalue greater than 1.0, and explained 59.708% of the total variance, were obtained. These were as follows: effective communication, incorporating students' interests in teaching, preparation of teaching and use of materials, assessment, organization of group work, introduction to teaching, and self-control.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index used to examine the appropriateness of factor analysis. High values (between 0.5 and 1.0) indicate that factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate (Leech, Barrett, & Morgan, 2008). It was found 0.93 and the Bartlett test was significant (i.e. a significance value of less than 0.05). It told us that the variables were correlated highly enough to provide a reasonable basis for factor analysis (Sipahi, Yurtkoru, & Çinko, 2008). Furthermore, the fact that the result of

this test is significant, can be seen as a proof of normality of scores (Büyüköztürk, 2010). Factor loadings, eigenvalues, variance percentages and Cronbach's Alpha coefficient of the factors, were given in Table 2.

Table 2. Factors Structure of the Microteaching Form, Items and Factor Loading (*N=524*)

Factors and variables	Factor loading	Eigenvalue	Variance	Alpha coefficient
Factor 1: Effective communication		10.672	15.331	.889
- Use of gestures	.730			
- Effective use of body language	.728			
- Making appropriate emphasis where necessary	.694			
- Setting the tone of voice	.641			
- Self-confidence	.598			
- Showing enthusiasm and vitality in teaching	.576			
- Eye contact with students	.574			
- Using space in the classroom	.543			
- Speaking in a clear and understandable manner	.506			
- Classroom management	.453			
Factor 2: Motivating and encouraging students' class participation		2.166	9.249	.801
- Ensuring the participation of students in class	.717			
- Ensuring the participation of students in class by using an effective method	.653			
- Asking students questions suitable to their levels	.576			
- Teaching according to the constructivism approach	.516			
- Starting teaching with a remarkable or motivated activity	.441			
Factor 3: Preparation to teaching and use of materials		1.494	9.181	.841
- Number of prepared materials for teaching	.849			
- Relevance of prepared materials to teaching goals	.813			
- Functionality of prepared materials	.805			
- Preparation process before teaching	.470			
Factor 4: Assessment		1.305	8.057	.708
- Using alternative assessment techniques	.635			
- Close of teaching	.607			
- Effective use of technology in teaching	.541			
- Taking students' misconceptions and difficulties into account in teaching	.521			
- Use of board	.512			
Factor 5: Group study		1.237	6.150	.837
- Well-organization of group study	.770			
- Giving place to group study in teaching	.766			
Factor 6: Introduction to teaching		1.135	5.878	.584
- Associating teaching with students' previous knowledge and experiences	.687			
- Informing students appropriately about teaching goals	.662			
Factor 7: Self-control		1.097	5.862	.541
- Attitude towards criticisms	.577			
- Setting speaking speed	.576			
- Effective use of time	.498			
- Controlling excitement	.490			
Principal components factors with varimax rotation p< 0.000 Keiser-Meyer-Olkin Measure of Sampling Adequacy: .93 Barlett's Test of Sphericity: 728				

As seen in Table 2, the obtained factors explained 59.708% of the total variance. In the end of explanatory factor analysis, each of the factors was entitled according to their factor loadings and variables contained. For instance, factor 1 was grouped under the name "effective communication" and refers to pre-service teachers' skills on communication. This factor with 10 variables had high factor loadings (0.45-0.73) and explained 15.331% of the total variance. Factor 2 was grouped under the name "motivating and encouraging students' class participation" and included teaching skills such as ensuring students' participation in class, asking questions suitable to students' levels and starting teaching with a remarkable or motivated activity. These factors with 5 variables had factor loadings varying between 0.41 and 0.72, explained 9.249%, and with the first factor, 24.58% of the total variance.

3. Results

In this section, we presented the results of the MEF. Mean and standard deviation of items were presented in Table 3.

Table 3. Mean and Standard Deviation Value of the Items of the MEF

Items	Mean	Std. Dev.
Factor 1: Effective communication ($\bar{X}$=3.43)		
Speaking in a clear and understandable manner	3.65	0.525
Self-confidence	3.60	0.641
Showing enthusiasm and vitality in teaching	3.57	0.668
Setting the tone of voice	3.48	0.660
Eye contact with students	3.47	0.572
Making appropriate emphasis where necessary	3.42	0.690
Classroom management	3.38	0.728
Use of gestures	3.25	0.559
Effective use of body language	3.24	0.552
Using space in the classroom	3.24	0.677
Factor 2: Motivating and encouraging students' class participation ($\bar{X}$=3.31)		
Asking students questions suitable to their levels	3.60	0.642
Ensuring the participation of students in class	3.42	0.656
Starting teaching with a remarkable or motivated activity	3.38	0.749
Ensuring the participation of students in class by using an effective method	3.35	0.644
Teaching according to the constructivism approach	2.80	0.717
Factor 3: Preparation to teaching and use of materials ($\bar{X}$=3.61)		
Relevance of prepared materials to teaching goals	3.69	0.619
Preparation process before teaching	3.66	0.710
Functionality of prepared materials	3.59	0.783
Number of prepared materials for teaching	3.50	0.748
Factor 4: Assessment ($\bar{X}$=2.86)		
Effective use of technology in teaching	3.37	0.725
Use of board	3.20	0.625
Close of teaching	2.95	0.849
Using alternative assessment techniques	2.44	0.904
Taking students' misconceptions and difficulties into account in teaching	2.37	0.767
Factor 5: Group study ($\bar{X}$=3.3)		
Giving place to group study in teaching	3.37	0.807
Well-organization of group study	3.22	0.825
Factor 6: Introduction to teaching ($\bar{X}$=3.34)		
Informing students appropriately about teaching goals	3.43	0.785
Associating teaching with students' previous knowledge and experiences	3.26	0.750
Factor 7: Self-control ($\bar{X}$=3.57)		
Setting speaking speed	3.77	0.505
Attitude towards criticisms	3.70	0.653
Controlling excitement	3.54	0.585
Effective use of time	3.27	0.783

It is very interesting that no factor has an average over 4. This indicates that the pre-service teachers need to develop their teaching in many points to achieve the desired level. The factor "assessment" has the lowest average (with an average of 2.86) and the factor "preparation to teaching and use of materials" has the highest average with an average of 3.61. The factor "group study" with an average of 3.3 is the second lowest factor of microteaching skills.

If we look more closely at the items of the factors, in the pre-service teachers' assessment performances, it is found that they had poor performances on considering students' misconceptions and difficulties in teaching ($\bar{X}$=2.37), the use of alternative assessment techniques ($\bar{X}$=2.44) and the close of teaching ($\bar{X}$=2.95). As a result, we can conclude that the present education program of the pre-service teachers at these three points should be revised and improved. Regarding their performances of group study, the pre-service teachers were not successful enough in giving place to group study in teaching ($\bar{X}$=3.37) and well-organization of it ($\bar{X}$=3.22). Considering the importance role of group study in the "constructivist" teaching approach, we can assert that the more their knowledge and skills on group study and its well-organization are developed, the more their teaching will be effective.

On the other hand, the performances of motivating and encouraging students' class participation also confirm that the pre-service teachers had some difficulties in this point. So, it is difficult to qualify their teaching as a teaching based on constructivist approach ($\bar{X}$=2.80). As their performances on asking students questions suitable to their levels and ensuring the participation of students in class can be evaluated as acceptable (respectively $\bar{X}$=3.60 and $\bar{X}$=3.42). In the matter of starting teaching with a remarkable or motivated activity ($\bar{X}$=3.38) and ensuring the participation of students in class by using an effective method ($\bar{X}$=3.35), it is not possible to talk about an effective performance. The

performances of effective communication generally indicate that the pre-service teachers' communication skills were at an acceptable level. So, they did not encounter great problems in speaking in a clear and understandable manner ($\bar{X}$=3.65), self-confidence ($\bar{X}$=3.60), showing enthusiasm and vitality in teaching ($\bar{X}$=3.57), setting the tone of voice ($\bar{X}$=3.48), eye contact with students ($\bar{X}$=3.47) and making appropriate emphasis where necessary ($\bar{X}$=3.42). However, we cannot say that they were so successful in the performances such as classroom management ($\bar{X}$=3.38), use of gestures ($\bar{X}$=3.25), effective use of body language ($\bar{X}$=3.24) and using space in the classroom ($\bar{X}$=3.24).

As indicated already, in the performances of preparation to teaching and use of materials the pre-service teachers exhibited the best performances. The averages were close to each other and varied between 3.50 and 3.69. According to the performances of self-control, it appeared that there were not great problems in the pre-service teachers' self-control during their teaching. Only using time effectively seemed to cause a bit of problem ($\bar{X}$=3.27). As a result, we can conclude that the pre-service teachers were sufficiently willing and successful in preparation to teaching and endorsing their teaching with materials while they had some problems in assessment and giving place to group studies and organizing them.

4. Discussion

In this study, we tried to investigate the effectiveness of primary pre-service teachers in the microteaching of mathematics through a microteaching evaluation form. The results of the study reveal that the pre-service teachers' averages in any factors do not exceed 4. Therefore, we can conclude that their microteachings need to be corrected and improved in many aspects. The pre-service teachers got prepared to teach well enough and were willing to support their teaching by visual and concrete materials ($\bar{X}$=3.61). On the other hand, although their communication skills were not at the desired level, an average of 3.43 can be considered as acceptable compared to other skills. Another point they were successful was self-control ($\bar{X}$=3.57). We believe that it is due to the fact that they made many presentations and microteaching applications in other lessons so far.

One of the areas in which the pre-service teachers had most problems was assessment. After pedagogical content knowledge (PCK) was defined by Shulman (1986) as a separate field of teacher knowledge, many researchers such as Tamir (1988), Magnusson, Krajcik and Borko (1999), and Hashweh (2005) identified assessment knowledge as a component of PCK. Unfortunately, despite its clear importance for teaching and learning, assessment could not become one of the main focus points of teacher training and it is difficult to say that the assessment courses are adequately addressed in teacher training programs (Dwyer, 1994; Gelbal & Kelecioğlu, 2007). In the elementary school mathematics curriculum, teachers are asked to adopt the constructivist approach in their teaching and their assessment methods (Minister of Education, 2005). Therefore, pre-service teachers should know to construct and apply alternative assessment methods in addition to traditional methods. The pre-service teachers' weakness of assessment identified in this study, are consistent with some studies. For instance, Baştürk and Dönmez (2011) highlighted that the secondary school mathematics pre-service teachers' knowledge of assessment was limited and consisted of only traditional assessment methods such as written and oral examination. In parallel, Gelbal and Kelecioğlu (2007) with the primary school teachers and Canbazoğlu (2008) with the science pre-service teachers found similar results. Thus, we can assert that this problem is not only limited to the primary pre-service teachers who participated in this study, and the university where this study was conducted.

Among the findings on the assessment performances, another point which should be underlined is the lack of taking into account students' misconceptions and difficulties in the teaching. As known, this is also one of the important components of PCK. Many researchers consider students' misconceptions and difficulties as important in constructing novel knowledge (e.g. Brousseau, 1983; Confrey, 1990; Wandersee, Mintzes, & Novak, 1994). In some national curriculum for pre-service teacher training such as that of the UK, pre-service teachers are asked to be taught to recognize and to address common misconceptions (Tanner & Jones, 2003). We think that this insensibility of the pre-service teachers to misconceptions may result from two factors: artificial nature of microteaching and pre-service teachers' lack of knowledge or experiences on students' misconceptions and difficulties on the relevant topics. In fact, there are some studies in the literature, which reported that the pre-service teachers are reluctant to take part in micro-teaching activities due to non-natural classroom environments, material production procedures, and time constrained course schedules (Cripwell & Geddes, 1982; He & Yan, 2011; Stanley, 1998). In the microteaching process in our study, the pre-service teachers should teach before the classmates. By thinking that they do not encounter this kind of misconceptions or difficulties, the pre-service teachers may not consider them in their microteaching. Regarding the second cause, no one can deny that the lack of experience is a reality for pre-service teachers. Therefore, many researchers characterize PCK as an experiential knowledge (Baxter & Lederman, 1999; Gess-Newsome, 1999; Van Driel, Beijaard, & Verloop, 2001). Despite the non-negligible importance of experience, a literature-based research may render pre-service teachers more attentive to students' misconceptions and difficulties. However, in that moment, they are faced with another challenge to find students' misconceptions or difficulties on every topic in the Turkish literature.

Undoubtedly, one of the most important aspects of the teaching and learning process is motivation which has potential to impact all phases of learning and performance. So, teachers should take into account motivational effects of instructional practices and classroom factors to assure that students remain motivated to learn (Schunk, 2012). The findings of this study also indicate that the pre-service teachers' performances on motivating and encouraging students' class participation were not at the desired level. There is a similar situation for the implementation and organization of the group study. Nowadays, learning is not viewed to be isolated, but a collective participatory process in which knowledge to be taught is constructed and peer interaction is taken into account from a cognitive elaboration approach (Salomon & Perkins 1998; Webb 1991). From the crucial role that these skills play in a teaching based on constructivist approach, one can assert that the pre-service teachers' microteaching is very poor in this point. On the other hand, it is not very reasonable to suppose that these skills may be mastered only by receiving some theoretical courses and performing limited teaching applications in both faculties and practicum schools. There is another point, at least as important as these two, that pre-service teachers should see the use of this type of skills by their own lecturers in the faculty lessons. Some research shows that pre-service teachers underline that although lecturers always told about constructivism and ask them to be constructivist in teaching practices; they cannot be a model in this subject (Baştürk, 2011, 2016). This confirms our hypothesis.

5. Conclusion and Recommendations

The study examines the effectiveness of primary pre-service teachers in the microteaching of mathematics from a quantitative approach. In short, this study concludes that the pre-service teachers' teaching performances should be improved at many points. Some performances such as material use, self-control, and communication can be considered as acceptable. However, the performances that can be considered among the sine qua nons of an effective teaching, like providing student motivation and classroom participation, assessment, and group study are very far from being satisfactory.

Even though all of them indicate the limitations of the current pre-service teacher education program, we believe that the impact of pre-service teachers' common views on teaching and learning also is undeniable. For example, by supporting our observations during the microteachings, we can state that many pre-service teachers view assessment as a process outside of the lesson and therefore, they were not clearly willing to embed it in their teaching. According to them, the assessment should take place at the end of the lesson and a simple test consisting of multiple-choice questions is satisfactory for it. By looking at their missing skills in teaching, it can also be concluded that teaching is considered by the pre-service teachers to be limited to rather the teacher and an isolated process from the students. The teachers' teaching skills are affected not only by the organizational conditions of the educational process, but also by their individual characteristics (Rockoff, Jacob, Kane, & Staiger, 2011; Zumwalt & Craig, 2008). For example, the teachers' beliefs on or attitudes to mathematics teaching can create a barrier to innovation in the classroom (Pehkonen, 1999; Törner, 2002). Thus, in further studies, it would be very interesting to include the pre-service teachers' individual characteristics such as beliefs, content knowledge, pedagogical content knowledge etc. in the research design, in order to examine the degree of relationship between individual characteristics and mathematics microteaching performances.

The study reveals some important results on the pre-service teachers' teaching, but this supports only on an evaluation form designed by a quantitative approach. Because they help us to consider where the problem is, the quantitative research is widely used in the social sciences. But, the conclusions produced by statistical, mathematical or computational techniques should be understood by the qualitative research. Thus, further qualitative research is necessary to focus on the pre-service teachers' teaching weaknesses and difficulties. We believe that it will provide us to see the details of the big picture better. On the other hand, the study offers an evaluation form of which the reliability and validity were tested. By using this form in conjunction with other data collection instruments such as teaching and learning belief scale, teaching anxiety scale or self-efficacy scale, the variables which differentiate one pre-service teacher's teaching performances from another can be identified.

Acknowledgements

This work was performed in accordance with Project Search EGTF-1901-12-01 financed by the Council Research in Sciences of Sinop University. The author would like to thank to Sinop University Academic Writing Center for the proofreading of the paper and the primary pre-service teachers for their contribution.

References

Akalın, S. (2005). Comparison between traditional teaching and microteaching during school experience of student-teachers. *Eurasia Journal of Education Research, 20*, 1-3.

Amobi, F. A. (2005). Pre-service teachers' reflectivity on the sequence and consequences of teaching action in a microteaching experience. *Teacher Education Quarterly, 32*, 115-130.

Ananthakrishnan, N. (1993). Microteaching as a vehicle of teacher training: its advantages and disadvantages. *Journal of postgrad medicine, 39*(3), 142-143.

Arsal, Z. (2014). Microteaching and pre-service teachers' sense of self-efficacy in teaching. *European Journal of Teacher Education, 37*(4), 453-464. http://dx.doi.org/10.1080/02619768.2014.912627

Baştürk, S. (2011). Matematik öğretmen adaylarının eğitim fakültesindeki eğitim-öğretim sürecini değerlendirmeleri. [Mathematics teacher candidates' evaluations of teaching and learning process in faculty of education], *International Journal of Human Sciences, 8*(1), 58-94.

Baştürk, S. (2016). Primary pre-service teachers' perspectives on constructivism and its implementation in the schools. *Universal Journal of Education Research, 4*(4), 904-912. DOI:10.13189/ujer.2016.040428.

Baştürk, S., & Dönmez, G. (2011). Matematik öğretmen adaylarının pedagojik alan bilgilerinin ölçme değerlendirme bilgisi bağlamında incelenmesi. [Investigating mathematics student teachers' pedagogical content knowledge in the context of knowledge of assessment.] *Ahi Evran University Journal of Kırşehir Faculty of Education, 12*(3), 17-37.

Baxter, J. A., & Lederman, N. G. (1999). Assessment and measurement of pedagogical content knowledge. In *Examining Pedagogical Content Knowledge: PCK and Science Education,* edited by J. Gess-Newsome and N. G. Lederman, (p. 147-161). Netherlands: Kluwer Academic Publisher.

Benton-Kupper, J. B. (2001). The microteaching experience: student perspectives. *Education, 121*(4), 830-835.

Bilen, K. (2014). Mikroöğretim tekniği ile öğretmen adaylarının öğretim davranışlarına ilişkin algılarının belirlenmesi. [The determination of pre-service teachers' of perceptions related teaching behaviors with microteaching techniques] *Journal of Education Faculty, 16*(1), 181-203.

Brousseau, G. (1983). Les obstacles epistémologiques et les problèmes en mathématiques. [The epistemological obstacles and the problems in mathematics] *Recherches en Didactique des Mathématiques*, *4*(2), 164-198.

Büyüköztürk, Ş. (2010). *Sosyal bilimler için veri analizi el kitabı.* [The handbook of data analysis for social sciences] (11. basım) Ankara: Pegem Akademi.

Canbazoğlu, S. (2008). *Fen bilgisi öğretmen adaylarının maddenin tanecikli yapısı ünitesine ilişkin pedagojik alan bilgilerinin değerlendirilmesi.* [Assessment of pre-service elementary science teachers' pedagogical content knowledge regarding the structure of matter] Unpublished Master of Science Thesis, Gazi University, Institute of Educational Sciences, Ankara.

Confrey, J. (1990). A review of the research on student conceptions in mathematics, science, and programming. In *Review of Research in Education,* edited by C. Cazdan, 16: (p. 3-56), Washington D.C., American Education Research Association. http://dx.doi.org/10.2307/1167350

Cripwell, K., & Geddes, M. (1982). The development of organizational skills through microteaching. *ELT Journal 36*(4), 232-236. http://dx.doi.org/10.1093/elt/36.4.232

Cruickshank, D., & Metcalfe, K. (1993). Improving pre-service teacher assessment through on-campus laboratory experiences. *Theory and Practice, 32*(2), 86-92. http://dx.doi.org/10.1080/00405849309543580

Dwyer, C. A. (1994). *Development of the knowledge base for the praxis III: Classroom performance assessments assessment criteria*. Princeton, NJ: Educational Testing Service.

Farris, R. (1991). Micro-peer teaching: Organization and benefits. *Education, 111*(4), 559-562.

Feiman-Nemser, S. (2001). From preparation to practice: designing a continuum to strengthen and sustain teaching. *Teachers College Record, 103*(6), 1012-1055. http://dx.doi.org/10.1111/0161-4681.00141

Fernández, M. L. (2005). Learning through microteaching lesson study in teacher preparation. *Action in Teacher Education, 26*, 37-47. http://dx.doi.org/10.1080/01626620.2005.10463341

Fernández, M. L., & Robinson, M. (2006). Prospective teachers' perspectives on microteaching lesson study. *Education, 127*(2), 203-215.

Gallivan, H. (2014). *Prospective teachers' conceptions of and performance teaching mathematics to socio-culturally diverse students.* Unpublished Doctoral Dissertation, University of Delaware, USA.

Gelbal, S., & Kelecioğlu, H. (2007). Teachers' proficiency perceptions of about the measurement and evaluatıon techniques and the problems they confront. *Hacettepe University Journal of Education, 33*, 135-145.

Gess-Newsome, J. (1999). Pedagogical content knowledge: an introduction and orientation. In *Examining Pedagogical Content Knowledge: PCK and Science Education,* edited by J. Gess-Newsome and N. G. Lederman, (p. 3-17). Netherlands: Kluwer Academic Publisher.

Grossman, P. (2005). Research on pedagogical approaches in teacher education. In *Studying Teacher Education*, edited by M. Cochran-Smith, and K. M. Zeichner, (p. 425-476). Washington, DC: American Educational Research Association.

Hashweh, M. Z. (2005). Teacher pedagogical constructions: A reconfiguration of pedagogical content knowledge. *Teachers and Teaching: Theory and Practice, 11*(3), 273-292. http://dx.doi.org/10.1080/13450600500105502

He, C., & Yan, C. (2011). Exploring authenticity of microteaching in pre-service teacher education programs. *Teaching Education, 22*(3), 291-302. http://dx.doi.org/10.1080/10476210.2011.590588

Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2008). What does certification tell us about teacher effectiveness? Evidence from New York City. *Economics of Education Review*, *27*, 615-631. http://dx.doi.org/10.3386/w12155

Karadeniz, Ş. (2009). Mikroöğretim değerlendirme formu. [The microteaching evaluation form] http://www.sirinkaradeniz.com/kaynaklar/ppt/Egt/mikroogretim_degerlendirme.doc.

Kpanja, E. (2001). A study of the effects of video tape recording in microteaching training. *British Journal of Educational Technology, 32*(4), 483-486. http://dx.doi.org/10.1111/1467-8535.00215

Kumar, I. A., & Parveen, S. (2013). Teacher education in the age of globalization. *Research Journal of Educational Sciences, 1*(1), 8-12.

Latham, N. I., & Vogt, W. P. (2007). Do professional development schools reduce teacher attrition? Evidence from a longitudinal study of 1000 graduates. *Journal of Teacher Education, 58*(2), 153-167. http://dx.doi.org/10.1177/0022487106297840

Lederman, N., & Gess-Newsome, J. (1991). Metamorphosis, capturing complexity: a typology of reflective adaptation, or evolution? Pre-service science teachers' concerns and perceptions of teaching and planning. *Science Teacher Education, 75*(4), 443-456.

Leech, N. L., Barrett, K. C., & Morgan, G. A. (2008). *SPSS for intermediate statistics: use and interpretation*. (3rd edition.). New York: Taylor & Francis Group.

Lin, Y. (2014). *When microblog meets microteaching: a case study of Chinese k-12 pre-service teachers' experiences of using microblog in their reflective practice in microteaching.* Unpublished Doctoral Dissertation, University Of Minnesota, USA.

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In *Examining Pedagogical Content Knowledge: PCK and Science Education,* edited by J. Gess-Newsome and N. G. Lederman, (p. 95-132). Netherlands: Kluwer Academic Publisher.

Minister of Education (2005). *İlköğretimokulu matematik dersi (1-5. sınıflar) öğretim programı"* [Elementary school mathematics curriculum (1-5 grades)]. Ankara: MEB-Talim Terbiye Kurulu Başkanlığı Yayınları.

National Academy of Education (1999). *Recommendations regarding research priorities: an advisory report to the national educational research policy and priorities board*. New York: NEA.

National Research Council (1996). *The national science education standards*. Washington, DC: The National Academy Press.

Parsons, M., & Stephenson, M. (2005). Developing reflective practice in student teachers: Collaboration and critical partnerships. *Teachers and Teaching: Theory and Practice, 11*(1), 95-116. http://dx.doi.org/10.1080/1354060042000337110

Pehkonen, E. (1999). Beliefs as obstacles for implementing an educational change in problem solving. In: *Mathematical Beliefs and their Impact on Teaching and Learning of Mathematics*, edited by E. Pehkonen, and G. Törner, (p. 109-117), Gerhard Mercator-University, Duisburg.

Peker, M. (2009). The use of expanded microteaching for reducing pre-service teachers' teaching anxiety about mathematics. *Scientific Research and Essays, 4*(9), 872-880.

Robert, A., Lattuati, M., & Penninckx, J. (1999). *L'enseignement des mathématiques au lycée: Un point de vue didactique*. [Teaching mathematics in high school: A point of view didactic] Paris: Ellipses.

Rockoff, J. E., Jacob, B. A., Kane, T. J., & Staiger, D. O. (2011). Can you recognize an effective teacher when you recruit one? *Education Finance and Policy, 6*, 43-74. http://dx.doi.org/10.1162/EDFP_a_00022

Salomon, G., & Perkins, D. N. (1998). Individual and social aspects of learning. *Review of Research in Education, 23*, 1-24. http://dx.doi.org/10.2307/1167286

Schunk, D. H. (2012). *Learning theories: An educational perspective* (6th edition). Boston: Pearson Education.

Shulman, L. S. (1986). Those who understand; knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14. http://dx.doi.org/10.3102/0013189X015002004

Shuttleworth, M. (2008). *Descriptive research design*. Retrieved Apr 15, 2015 from Explorable.com: https://explorable.com/descriptive-research-design

Sipahi, B., Yurtkoru, E. S., & Çinko, M. (2008). *Sosyal bilimlerde SPSS'le veri analizi* [Data analysis with SPSS in social sciences] (2. baskı). İstanbul: Beta Basım AŞ.

Smith, J. D. N. (2004). Developing paired teaching placements. *Education Action Research, 12*(1), 99-125. http://dx.doi.org/10.1080/09650790400200241

Stanley, C. (1998). A framework for teacher reflectivity. *TESOL Quarterly, 32*(2), 584-591. http://dx.doi.org/10.2307/3588129

Stones, E. (1994). *Quality teaching: A sample of cases.* London: Routledge.

Subramaniam, K. (2006). Creating a microteaching evaluation form: the needed evaluation criteria. *Education, 126*(4), 666-667.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Upper Saddle River, NJ: Pearson Allyn & Bacon.

Tamir, P. (1988). Subject matter and related pedagogical knowledge in teacher education. *Teaching and Teacher Education, 4*, 99-110. http://dx.doi.org/10.1016/0742-051X(88)90011-X

Tanner, H., & Jones, S. (2003). *Becoming a successful teacher of mathematics.* (2nd edition) London: Routledge Falmer.

Törner, G. (2002). Mathematical beliefs-A search for a common ground: Some theoretical considerations on structuring beliefs, some research questions, and some phenomenological observations. In *Mathematical Beliefs: A Hidden Variable in Mathematics Education?* G. Leder, E. Pehkonen, and G. Törner, (p. 73-94), Dordrecht: Kluwer.

Van Driel, J. H., Beijaard, D., & Verloop, N. (2001). Professional development and reform in science education: the role of teachers' practical knowledge. *Journal of Research in Science Teaching, 38*(2), 137-158. http://dx.doi.org/10.1002/1098-2736(200102)38:2<137::AID-TEA1001>3.0.CO;2-U

Wandersee, J. H., Mintzes, J. J., & Novak, J. D. (1994). Research on alternative conceptions in science. In *Handbook of Research on Science Teaching and Learning*, edited by D. Gabel, (p. 177-210). New York: MacMillan.

Webb, N. M. (1991). Task-related verbal interaction and mathematics learning in small groups. *Journal for Research in Mathematics Education, 22*(5), 366-389. http://dx.doi.org/10.2307/749186

Zumwalt, K., & Craig, E. (2008). Who is teaching? Does it matter? In *Handbook of Research on Teacher Education. Enduring Questions in Changing Contexts*, edited by M. Cochran Smith, S. Feiman-Nemser, and D. J. McIntyre, (p. 404-423). New York: Routledge.