

Effects of Peer Teaching and Microteaching on Teaching Skills of Pre-Service Physics Teachers

Akran Öğretimi ve Mikro Öğretimin Fizik Öğretmen Adaylarının Öğretme Becerilerine Etkileri

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Abstract

This study examines the effects of peer teaching and microteaching on pre-service physics teachers' teaching skills. Peer and microteaching applications are conducted with thirty-nine pre-service physics teachers during the academic years 2005–2006 and 2006–2007. The data were collected through the "Teacher Performance Evaluation Form" which was particularly developed for this study. The findings of the study indicated that peer teaching/microteaching applications positively contributed to the teaching skills of the pre-service physics teachers.

Keywords: Microteaching, peer teaching, teaching skills, pre-service teachers

Öz

Bu çalışmada, akran öğretimi ve mikro öğretim yönteminin fizik öğretmen adaylarının öğretim becerileri üzerindeki etkileri araştırılmıştır. Akran ve mikro öğretim uygulamaları 2005–2006 ve 2006–2007 akademik yıllarında 39 katılımcıdan oluşan grupta uygulanmıştır. Veriler, bu çalışma için geliştirilmiş "Öğretmen Performansı Değerlendirme Ölçeđi" ile elde edilmiştir. Çalışmadan elde edilen bulgular, akran ve mikro öğretim yönteminin fizik öğretmen adaylarının öğretim becerilerine olumlu yönde katkı sağladığını göstermektedir.

Anahtar Sözcükler: Mikro öğretim, akran öğretimi, öğretim becerileri, öğretmen adayları.

Introduction

One of the most important factors in improving the quality of education and the teaching process is the teachers. Therefore, it is very important to train teachers who can compete with the rapidly developing age. From the traditional perspective, the teacher is the source and transmitter of knowledge; however, nowadays s/he has become the guide of the students throughout the learning process. This new role requires the teachers of today to attain new competencies, which creates an obligation to review and revise the teacher education programmes (Evertson, Hawley, & Zlotnik 1985; Klinzing & Folden, 1991; Liston, Whitcomb, & Borko, 2006).

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What is microteaching and peer teaching?

Many studies reported that the traditional teacher education programmes were inadequate in preparing pre-service teachers for the real classroom environment in the future (Goodman, 1986; Ruppell, 2001). Although what a good lesson should be or what qualifications a good teacher should have is learnt theoretically, the complexity of the course environment requires a lot more than theoretical knowledge. Asking questions, managing discussions, and applying the principles of classroom management are among various skills that need to be used. How pre-service teachers should display these skills in a classroom environment is an issue that traditional teacher education programmes usually fail to address (Frye, 1988). Microteaching is a method that was developed at Stanford University (USA) in the 1960s, which addressed many of these problems.

Microteaching, as a type of teaching skill application is evolved through time (Wilson & I'Anson, 2006) and has become more applicable as technology has developed. In time, microteaching applications started to take place effectively not only in pre-service teacher education programmes but also in in-service education programmes (Denight & Gall, 1989; Trott, 1987).

Microteaching is a laboratory-based teacher training method the aim of which is to allow previously determined critical teaching skills to be attained by pre-service teachers (Klinzing & Folden, 1991; Meier, 1968). Therefore, in each application, some critical teaching skills are determined and practiced. This facilitates the understanding and attainment of important teaching skills in a simplified teaching environment when compared to the complex classroom environment. In other words, teaching activity is shortened and focused.

The microteaching environment is a teaching environment which is minimized, limited and somehow artificialized when compared to the real classroom environment. The microteaching method is a teaching experience which is intensified and limited in terms of teaching period, number of students and teaching content. In other words, microteaching is the teaching of a short content to three to five people in five to fifteen minutes. The aim here is not to teach the content but to apply various techniques (Orlich, Harder, Callahan, & Gibson, 1990).

However, in addition to microteaching applications, there are other applications that make use of the Stanford model and test basic teaching skills one by one. For instance, Borg, in 1972, used a joint approach he named macroskills, which is a minicourse model as an improved version of microteaching (Cornford, 1991). Another holistic approach was the study at Bolton University in the UK in which the skills were not focused on one by one but the pre-service teachers were asked to teach the lessons as a whole. Some teaching models combine both approaches (Hargie, Dicson, & Tittmar, 1978; Kazu, 1996).

Microteaching and relevant methods could be evaluated under two main categories (Klinzing, 2002) the first of which is "classical microteaching", which was developed at Stanford University to be administered in small groups (Allen & Ryan, 1969). The second one is "peer teaching", which has widely improved and is administered in small groups made up of peers or mentors (Zilfreund, 1966). However, both groups carry the same significance apart from the practice group chosen for the course.

The aim in microteaching applications is to encourage pre-service teachers to think about their behaviours and skills in the classroom rather than having them gain experience through trial and error. In this thinking period, the self-evaluations made by the pre-service teachers and audience comments play important roles. As Collette and Chiappetta (1989) state, "The feedback to presenters is a major element in the training process. It should be given as soon after the presentation as possible, and objectivity is essential. In order to be objective, the feedback must be based on the skills, strategies, techniques, teaching aids, and so on ... as being essential to a good science lesson presentation" (pp. 347-348). As a result of this, it is aimed to establish a process of growth in the mental structures of pre-service teachers.

Microteaching is made use of effectively not only in pre-service teacher education programmes but also in in-service education programmes. In addition to its benefits, the microteaching method also has some limitations (Leith, 1982). Primarily, since the microteaching environment is too controlled, microteaching experiences do not provide the expected experience to the pre-service teachers as the environment is different from the one they would experience in a real classroom environment. Additionally, another disadvantage is that the pre-service teacher is aware of the fact that s/he is being observed by his/ her peers and mentors from a critical perspective. Moreover, it was reported that testing the skills one by one would disturb the unity of the lesson.

The teacher education programmes in Turkey were reconstructed between 1994 and 1998 through the National Education Development Project of the Turkish Higher Educational Council in collaboration with the World Bank. Moreover, an emphasis was given to the field teaching and student teaching, which either did not take place in the previous programme or were allocated very few hours. Through these reforms in teacher education, significant changes were made to the student teaching when compared to that of the previous programmes. In the new programme, student teaching is spread across three terms, during the first two of which the aim is for pre-service teachers to observe the school, students and teaching profession through different perspectives under the supervision of the practice course teacher. The practice course in the last term involves developing teaching skills in the classroom one day a week or two half days a week for a minimum of twelve weeks. This model aimed to develop the professional competencies of the pre-service teachers, improve their conceptual knowledge structures, attain the required skills for applying them in teaching environments and develop positive attitudes towards the teaching profession. One of the most important parts of this process is obviously the microteaching activity. The new teacher education programme emphasizes the importance of microteaching and uses it in courses such as “Special Teaching Methods II” and “School Experience” (Higher Education Council, n.d.).

Purpose

The importance of this study stems from the integration of micro- and peer- teaching methods. Both methods involve advantages and limitations within themselves. This study aims to unite the advantages and availabilities of these methods. The study is also important as it points out that there are certain limitation to how microteaching applications can be used in classroom environments. By presenting a new and applicable example, it is aimed to discuss the outcomes. In this study, pre-service teachers’ teaching experience was divided into two stages. In the first stage, pre-service teachers taught their peers, which was identified as peer teaching. The second stage consisted of pre-service teachers teaching actual students in a real classroom setting. This second stage was identified as microteaching. Therefore, this is considered a combination of peer teaching and microteaching experience. This study aims to observe the changes in teaching skills of pre-service teachers through peer teaching and microteaching.

Method

Participants

The thirty-nine participants in this study were pre-service teachers from a State University, Faculty of Education, Department of Secondary Science and Mathematics Education. The participants in this study were students majoring in physics during the 2005–2006 and 2006–2007 academic years. The study started at the beginning of the ninth semester and continued for almost a year until the school year was over. The participating pre-service teachers had not made any peer teaching and microteaching studies before the application.

Instrument

Teacher Performance Evaluation Form

This instrument, which involves various teacher behaviours, was developed by taking the scales existing in the literature into consideration (Cambridge Public Schools, (n.d.), Higher Education Council, (n.d), Jackson Public School District Teacher Performance Evaluation Handbook, (n.d.)). This instrument is a six-point, Likert-type scale ranging from ‘poor’ to ‘excellent’. The instrument was created based on three peer teaching and microteaching applications taught in a methodology course with the participation of one hundred-three students in the previous years. Teacher Performance Evaluation Form, which was forty-three items at the beginning, was administered to the participants as a pilot study. In order to provide the validity of the developed scale, it was given to eight experts in two different universities working in the departments of physics education and educational sciences. The Keiser Meyer Olkin (KMO) test was used to test sample adequacy (considered acceptable if the KMO constant was > 0.60), and was found .915. This value is within acceptable limits known as “very good”. Bartlett’s test of sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. The data is factorable (Approx. Chi-Square = 2387,364; df=120; p<.000). The factorial analysis was conducted using varimax rotation. The analysis concluded that the scale involved three factors. Reliability analysis of the scale produced an alpha coefficient of .91. The descriptive factor analysis results shown in Table 1.

Table 1.

The Descriptive Factor Analysis

ITEM	Factor 1	Factor 2	Factor 3
Factor 1: Personal Competence: Flexibility and Creativity Skills $\alpha = .87$			
1. Behaving in an energetic, ambitious and interested manner	.797	.225	.260
2. Behaving in a friendly manner	.764	.051	.303
3. Displaying self-confidence as a teacher	.638	.301	.062
4. Using voice and tone effectively	.670	.220	.338
5. Using the blackboard appropriately	.755	.344	.183
Factor 2: Method Competence $\alpha = .84$			
6. Coming to the lesson well prepared and planning the lesson well	.236	.584	.233
7. Providing the objectives, targets and behaviours clearly to students	.430	.591	.102
8. Choosing appropriate materials and making use of the teaching technologies	.143	.669	.164
9. Making use of appropriate models or metaphors in explaining abstract topics	.180	.704	.265
10. Relating the subject area to real life	.086	.598	.424
11. Giving appropriate and correct examples related to the subject area	.272	.629	.273
12. Relating the subject area to previous and upcoming lessons	.524	.630	.093
Factor 3: Social Competence: Effective Communication Skills $\alpha = .79$			
13. Providing the continuity of motivation and attention to the lesson	.307	.344	.666
14. Making use of positive enforcement	.267	.131	.814
15. Using the environment effectively by walking around the classroom	.246	.237	.648
16. Asking appropriate questions that would reveal the relationship of the lesson with other content areas	.094	.403	.557
Eigen Factor	7.21	1.3	1.03
% of Variance	45.01	8.1	6.5

Study Programme

This quasi-experimental study was conducted with the voluntary participation of a total of thirty-nine fifth-year pre-service physics teachers, eighteen of whom participated during the 2005–2006 academic year and twenty-one of whom participated during the 2006–2007 academic year. The course instructor and the peers were all present at all peer teaching/microteaching applications and peer evaluations. Peer teaching and microteaching applications were limited to fifteen minutes and all pre-service teachers were asked to teach the same topic during peer teaching. The following paragraphs explain the study programme and the evaluation methods within this process:

Stage 1: Peer Teaching I: The critical analysis of actual teaching principles and skills

Pre-service teachers were asked to present a lesson for fifteen minutes in the light of the methods and skills they had attained theoretically. Before the peer teaching, they were not informed about the skills for which they would be observed during their peer teaching and microteaching experience.

Stage 2: Peer Evaluation I

Peer Evaluation I consisted of two stages. The first stage included each pre-service teacher peer teaching their topic, which was video recorded. Upon completion of all peer teaching and video recording, the evaluation procedure started. This phase was done in classroom environment with the participation of all pre-service teachers. The evaluation procedure included the following: pre-service teacher evaluating him/ herself, peers evaluating the pre-service teacher, instructor evaluating the pre-service teacher and finally the Teacher Performance Evaluation Form completed by the instructor, pre-service teacher and peers. This evaluation process was repeated for all students who had the peer teaching experience. This stage is seen as crucial in bridging the gap between theory and practice. This experience set a basis for the pre-service teachers for the courses they would teach in the future. With this method, they observed their current situation and thought critically about these situations. By observing their peers, they took their positive or negative ways of teaching into consideration and were encouraged to compare their performance with each other.

Stage 3: Peer Teaching II: The application of teaching principles and skills

Pre-service teachers now took the principles and skills they 'internalized' during Peer Teaching I and applied them in designing a learning experience in Peer Teaching II. In this teaching experience, pre-service teachers taught the same content as Peer Teaching I, again for a fifteen-minute period. Pre-service teachers produced more integrated lessons using a single or more skill components. Therefore, the links between theory and practice were reinforced. At this stage, the peer teaching experiences were video recorded.

Stage 4: Peer Evaluation II

Microteaching applications were evaluated as in Peer Evaluation I.

Stage 5: Microteaching and its Evaluation: Student teaching experience in school

At this stage of the study, the pre-service teachers taught at least two class periods in a real classroom setting in schools. The teaching experiences of the students were video recorded. At the end of this application, the taught lessons were watched by the pre-service teachers. Following that, they were evaluated through the Teacher Performance Evaluation Form. At the end of the application, pre-service teachers wrote their evaluations on how their teaching skills had changed.

Stage 6: Peer Teaching III

During the last stage of the study, pre-service teachers carried out peer teaching once again for the last time.

Stage 7: Peer Evaluation III

The Teacher Performance Evaluation Form was administered at the end of the lesson. The evaluation procedure followed the same steps as Peer Evaluations I and II: pre-service teacher evaluating him/herself, peers evaluating the pre-service teacher, instructor evaluating the pre-service teacher and finally the Teacher Performance Evaluation Form completed by the instructor, pre-service teacher and peers.

Results

Evaluation of the Teacher Performance Evaluation Forms: Observing the changes in teaching skills

At the end of each of the four peer teaching and microteaching sessions, following the watching of the video recordings, each participant was evaluated by him/ herself, his/her peers and instructors through the Teacher Performance Evaluation Form. The data collected through this form were later analysed with SPSS 13.0. The Subscale scores were explored within the total group by means of a repeated measures analysis of variance. Preliminary analysis included checks for normality, linearity, influential data points (outliers) and assumptions of repeated-measures (Stevens, 2009). No serious deviations were found. The assumption of sphericity was tested by Mauchly's sphericity test for each subscale and was met for factor 1 and factor 3 ($p > .05$), but was not met for factor 2 ($p < .05$). Therefore, for factor 2, the degrees for freedom were corrected using the Huynh-Feldt corection ($\epsilon = .90$). The following section presents the findings for each factor:

Factor 1: Personal Competence: Flexibility and Creativity Skills

The mean scores were 21.93 (SD=2.50) on the first test, 22.89 (SD=2.48) on the second test, 26.22 (SD=2.65) on the third, and 25.30 (SD=2.25) on the final test. The ANOVA shows that the scores are significantly different, $F(3, 114) = 48.349, p = .000, \omega^2 = .560$ (Table 2). This value corresponds to large values (Cohen & Cohen, 1983). This result denotes that the research has practical significance as well as statistical significance.

Table 2.

The one-way repeated-measures ANOVA results for the factor 1 "Personal Competence: Flexibility and Creativity Skills"

Source	Sum of Squares	df	Mean Square	F	p	ω^2	Observed Power
Within Groups	141.020	38	3.711				
Measure	472.242	3	157.414	48.349	.000	.560	1.000
Error	371.163	114	3.256				
Sum	984.425	155	164.381				

The multiple comparisons were computed in order to determine at which stages these changes occurred by using simple effect comparison method. In order to avoid Type I error, Bonferroni correction was applied in mean comparison tests (Table 3). Repeated-measures pair-

wise comparison tests showed that subjects were significantly lower on the first test than they were on the second and third tests, but that there was no further reduction in completion time between the second and third tests.

Table 3.

Pair-wise Comparison tests for Factor 1

(I) Factor 1	(J) Factor 1	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
PT I	PT II	-.958	.304	.019	-1.805	-.112
	MT	-4.290	.473	.000	-5.607	-2.973
	PT III	-3.369	.393	.000	-4.463	-2.275
PT II	MT	-3.332	.435	.000	-4.541	-2.122
	PT III	-2.411	.386	.000	-3.485	-1.336
MT	PT III	.921	.439	.257	-.302	2.145

* *The mean difference is significant at the .05 level.*

Practice on peer teaching improved in subjects' Personal Competence: Flexibility and Creativity Skills (PC); Moreover, microteaching produced a further significant improvement in their PC. Yet, there was no further significant improvement in their PC between the third and fourth tests. This indicates that students' improvement in their peer teaching and microteaching process helped improve students' PC. But, further peer teaching after microteaching (PT III) leads to little or no further significant improvement.

Factor 2: Method Competence

The mean scores were 29.14 (SD=3.28) on the first test, 31.09 (SD=3.03) on the second test, 35.81 (SD=3.44) on the third, and 34.98 (SD=2.78) on the final test. The ANOVA shows that the scores are significantly different. $F(3, 114) = 84.143$, $p = .000$, $\omega^2 = .689$ (Table 4). This value corresponds to large values (Cohen & Cohen, 1983). This result denotes that the research has practical significance as well as statistical significance.

Table 4.

The one-way Repeated-measures ANOVA Results for the Factor Method Competence

Source	Sum of Squares	df	Mean Square	F	p	ω^2	Observed Power
Within Groups	243.343	38	6.404				
Measure	1175.453	3	391.818	84.143	.000	.689	1.000
Error	530.849	114	4.657				
Sum	1.949.645	155	402.879				

The multiple comparisons were computed in order to determine the stages in which changes occurred by using simple effect comparison method. In order to avoid Type I error, Bonferroni correction was applied in mean comparison tests (Table 5). Repeated-measures pair-wise comparison tests showed that subjects were significantly lower on the first test than they were on the second and third tests, but that there was no further reduction in completion time between the second and third tests.

Table 5.
Pair-wise Comparison Tests for Factor 2

(I) Factor 2	(J) Factor 2	Mean Difference (I-J)	Std. Error	Sig	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
PT I	PT II	-1.956*	.414	.000	-3.109	-.803
	MT	-6.676*	.569	.000	-8.258	-5.093
	PT III	-5.840*	.531	.000	-7.319	-4.361
PT II	MT	-4.720	.532	.000	-6.201	-3.239
	PT III	-3.884	.368	.000	-4.910	-2.859
MT	PT III	.836	.487	.565	-.520	2.191

*.The mean difference is significant at the .05 level.

Practice on peer teaching improved in subjects’ Method Competence (MC); Moreover, microteaching produced a further significant improvement in their MC. Yet, there was no further significant improvement in their MC between the third and fourth tests. This indicates that students’ improvement in their peer teaching and microteaching process helped improve students’ MC. But, further peer teaching after microteaching (PT III) leads to little or no further significant improvement.

Factor 3: Social Competence: Effective Communication

The mean scores were 13.38 (SD=1.89) on the first test, 16.66 (SD=2.32) on the second test, 19.32 (SD=2.19) on the third, and 18.53 (SD=1.60) on the final test. The ANOVA shows that the scores are significantly different. $F(3, 114) = 134.05, p=.000, \omega^2=.917$ (Table 6). This value corresponds to large values (Cohen & Cohen, 1983). This result denotes that the research has practical significance as well as statistical significance.

Table 6.

The one-way repeated-measures ANOVA results for the factor “Social Competence: Effective Communication”

Source	Sum of Squares	df	Mean Square	F	p	ω^2	Observed Power
Within Groups	93.789	38	2.468				
Measure	869.562	2.865	303.484	134.059	.000	.917	1.000
Error	246.484	108.880	2.264				
Sum	1209.835	149.745	308.216				

The multiple comparisons were computed in order to determine at which stages these changes occurred by using simple effect comparison method. In order to avoid Type I error, Bonferroni correction was applied in mean comparison tests (Table 7). Repeated-measures pair-wise comparison tests showed that subjects were significantly lower on the first test than they were on the second and third tests, but that there was no further reduction in completion time between the second and third tests.

Table 7.
Pair-wise Comparison Tests for Factor 3

(I) Factor 3	(J) Factor 3	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
PT I	PT II	-2.273*	.346	.000	-3.236	-1.310
	MT	-5.937*	.370	.000	-6.967	-4.908
	PT III	-5.144*	.314	.000	-6.017	-4.271
PT II	MT	-3.665*	.375	.000	-4.710	-2.620
	PT III	-2.872*	.245	.000	-3.553	-2.190
MT	PT III	.793	.331	.129	-1.127	1.714

*.The mean difference is significant at the .05 level.

Practice on peer teaching improved in subjects' Social Competence: Effective Communication (SC); Moreover, microteaching produced a further significant improvement in their SC. Yet, there was no further significant improvement in their SC between the third and fourth tests. This indicates that students' improvement in their peer teaching and microteaching process helped improve students' SC. But, further peer teaching after microteaching (PT III) leads to little or no further significant improvement.

Conclusion and Implications for Teacher Education

Based on the findings of this study, it is found that peer teaching and microteaching experiences contribute positively to pre-service teachers' teaching skills. With the help of peer teaching and microteaching applications, pre-service teachers' teaching skills display a statistically significant change. The skills of the pre-service teachers showed a continuous change in the light of the peer and mentor evaluations during the three applications, and these skills were displayed in the school environment. The highest average scores achieved in the evaluation forms during the applications in the real school environment are the indicators of this change. Later, as peer teaching was repeated back at the university, it was observed that these skills became quite satisfactory. However, there were no statistically significance change was found in comparison to previous application scores. This result could be taken to mean that a skill could be attained through three or four applications.

The peer teaching/microteaching method, which was quite expensive and difficult to apply at the beginning in the 1960s, is now a lot easier and financially more applicable thanks to the developing technology (Klinzing & Folden, 1991). Therefore, in teacher education programmes and in in-service education courses, peer teaching is rather applicable. Microteaching or its relative peer teaching should not only be applied in pre-service teacher education programmes but should also be integrated into the in-service education programmes due to its effects on teaching competency.

The most important disadvantage of peer teaching and microteaching is that the peer teaching and microteaching experience is limited to a single teaching experience in the literature (Klinzing & Folden, 1991). Additionally, the peer teaching/microteaching experiences are not usually evaluated. Therefore, naturally, the studies on peer teaching/microteaching would not meet expectations. For a successful application, peer teaching and microteaching experience should take place at least twice. That is how the participants get the chance to correct their previous mistakes or misbehaviours.

One of the main worries about microteaching is the problems that could be faced in real school environments. The problems are caused by the real classroom environment's dynamics such as time and place. Therefore, "peer teaching" as a version of "microteaching" gains importance in teacher education. In this study, the participants preferred to gain experience with a few peer teaching and then apply microteaching in a real classroom environment.

In this study, pre-service teachers were provided with the opportunity to watch the recorded videos and think about their own skills during the evaluation process. It is observed that pre-service teachers do not really think about how they would apply their theoretical knowledge in the classroom or evaluate themselves. Especially with the help of the Teacher Performance Evaluation Form, pre-service teachers were informed about "what they should do in the classroom, visually and in sequence" and they were encouraged to think about that. Peer teaching and microteaching experiences contributed to pre-service teachers' thinking about their previously learnt theoretical knowledge and constructing them in their minds. In other words, peer teaching/microteaching served as a means of producing changes in cognitive structures and activities, rather than (short-term) changes in overt behaviours (see Klinzing & Folden, 1991).

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