Available online at ijci.wcci-international.org

International Journal of Curriculum and Instruction 13(1)
Special Issue (2021) 794–815

IJCI
International Journal of Curriculum and Instruction

Developing knowledge and skills of prospective Science teachers on teaching strategies, models, methods and techniques: an action research

Emre YILDIZ [a] *

[a] *Atatürk University, Kazım Karabekir Education Faculty Department of Science Education, Erzurum 25240, Turkey*

Abstract

This study was conducted to examine the effectiveness of an action plan applied for increasing the level of the strategy, model, method-technique knowledge, and planning and implementation skills of prospective Science teachers. The action research method was used in the study. The participant group consisted of pre-service science teachers attending a state university in 2018. Knowledge test, lesson plan preparation test, and observation form were used as the data collection tools. Descriptive statistics, dependent groups t-test, and content analysis were used to analyze the data. As a result of the research, it was determined that the knowledge level of the teacher candidates after the action was statistically significantly higher than the pre-action knowledge level. It was determined that the pre-service teachers' level of model, strategy, method-technique knowledge after the action was statistically significantly higher than their pre-action knowledge level. It was determined that pre-service teachers' planning and implementation skills before and after the action improved compared to the pre-action level. Also, it was observed that the variety of pre-service teachers' method-technique preferences increased after the action compared to before. As a result, it was determined that the action plan was effective in increasing the knowledge level of teacher candidates and in the development of planning and implementation skills. The action plan can be used in teacher training applications by adding new subjects and making improvements.

Keywords: Prospective Science teacher, model, strategy, method-technique, micro-teaching

1. Introduction

The progress, development, and ability to solve their problems depend on societies the number of qualified and trained individuals. Qualified individuals are individuals who do their job in the best way, maintain their lives in the light of knowledge, and attach importance to their personal development (Rauth & Bowers, 1986). All individuals begin

* Emre YILDIZ. Tel.: +090 442 231 4480
E-mail address: emre.yildiz@atauni.edu.tr

to acquire knowledge, skills, and behaviors that form the basis of learning with their livings and experiences from the moment they start their lives. These characteristics of individuals develop further with the education they receive in the following years and help increase the quality of the individual. For this reason, the quality of the education service provided to the individual has an important place. Teachers have a great responsibility in increasing the quality of education service. Because the teacher is the person who guides and provides learning. From this point of view, it is a necessity for teachers to be qualified individuals.

It is important that teachers who perform the teaching profession as an educatory pay attention to the standards and the level of application of these standards (Gordon, 1996). Although these standards and their implementation methods vary according to countries and societies, the expectation is to create an environment that will provide the best education and to employ manpower. The differences between teachers who fulfill the requirements of their profession and those who do not have basic competence levels and who cannot fulfill their professional requirements directly affect the development of students. As a result of a study conducted in this direction, it was stated that effective teachers are directly effective in students' success (Darling-Hammond, 2000; Haycock, 1998; Jenkins, 2003; Rosenholtz, 1985). Who an effective teacher is and his/her characteristics cannot be easily defined (Korthagen, 2004). When the studies on teacher competencies are examined, the subject area of these competencies are defined as general culture, professional and personal competencies (Sünbül, 2001; Lunenberg, 2002; Sönmez, 2003).

Due to the changes in social life and the speed of the spread of knowledge, significant changes were experienced in the competence and qualifications of teachers in the twenty-first century, and accordingly, the teaching profession has come a long way in professionalization (Darling-Hammond & Berry, 1988). For teachers who were individuals who taught students in the past and transferred their knowledge to students, teaching today is not enough, it is necessary to guide students' learning processes, anticipate future results regarding decisions, participate in social processes and participate in studies on nature conservation (Gelen & Özer, 2008). Developed societies want teachers to be in a lifelong learning process (Tekışık, 2003) and to make an effort to raise students with critical thinking skills (Passmore, 1991).

Each of the students looks at learning from different aspects and they all have different lives. For this reason, teachers need to know the learners well in order to guide the learning process effectively (Melvin, 2011). It is the main task of the teacher to find and apply the best and effective method with the help of his/her skills and to create the desired behavioral change in students (Philips & Soltis, 2005).

Instead of memorizing the science concepts offered to students in science teaching, it is aimed to teach them to learn and to develop their thinking skills, to raise them as

researchers and inquirers, who have problem-solving skills by revealing their abilities, and who have advanced skills at the level of analysis, synthesis, and application (Lind, 2005). Considering the individual differences of the students, it is of great importance to apply methods-techniques suitable for the course and the subject. Because science lessons can reach the determined goals by using the right methods and techniques at the right time. Some many methods and techniques can be used in science education (Kaptan, 1999; Gürdal, Şahin & Çağlar, 2001). The effectiveness of method-techniques varies according to the teacher's mastery of the method, the characteristics of the student, the subject area, and the goals to be gained. Behavioral, cognitive, and psychomotor skills that all methods and techniques will bring to students are different, and teachers' diversification of these methods and techniques will affect learning positively (Doğru & Aydoğdu, 2003). This is only possible if the teachers have a rich method-technique knowledge and application skills.

When the studies conducted in the literature were examined, it was seen science teacher candidates mostly preferred traditional teaching methods such as instruction and question and answer (Yıldırım, Köklükaya & Aydoğdu, 2016). Similarly, in studies conducted with teachers, it was determined that classroom teachers (Taşkaya & Sürmeli, 2014), science teachers (Yılmaz, 2017), and social studies teachers (Çelikkaya & Kuş, 2009) preferred traditional teaching methods such as instruction and question and answer. Similarly, in another study, it was observed that science teachers preferred traditional teaching methods such as instruction and question and answer, it was determined that these methods did not match the content of the science lesson curriculum and the practices they envisaged, and this was due to teachers' habits and convenience preferences (Şimşek, Hırça & Coşkun, 2013). In another study, the conclusion that the methods with the highest knowledge and ability to use of teachers are instruction and question and answer methods, explains why teacher candidates and teachers tend to use these methods most (Aydemir, 2012; Bulut, 2012). Therefore, it is extremely important in terms of the qualified training of future generations, for teachers to have method-technique knowledge and skills, they learn about these methods and techniques, examine their aspects that facilitate teaching and gain knowledge and skills to apply these methods while they are still teacher candidates. (Ekici, 2000; Saka & Akdeniz, 2001). In this study, the effect of the action plan created by reading-writing-application and microteaching applications on increasing the knowledge level and improving planning and implementation skills of teacher candidates was examined.

The reading-writing-application method is a combination of reading-writing studies and cooperative learning processes. The reading-writing-application method, which aims to construct the newly acquired knowledge with existing knowledge, to create positive bonds between them, to develop academically, socially and psychologically, also to make readings from different sources individually and as a group, to discuss what they have read from different sources and to report and present their work with their group friends

also improves reading, writing, and presenting skills (Stevens, Madden, Slavin & Farnish, 1987; Slavin, 1994, 1995). Since this method was stated to be useful in providing knowledge in the literature (Aksoy & Doymuş, 2011; Koç, 2014; Gupta & Ahuja, 2014), it was preferred to use this method in the part of teaching knowledge about strategy, model, method-technique of the action plan.

The microteaching method offers prospective teachers different and new opportunities in planning and implementing new teaching strategies. The microteaching method focuses on teacher behavior. A teacher needs to be able to use his / her knowledge and skills to be successful. Based on this importance, microteaching is one of the efforts for prospective teachers to apply the knowledge and skills they have acquired, that is, to establish a bridge between the theory and the application. Teacher candidate experience is provided to prospective teachers in micro education by providing a more controlled teaching environment with a low risk of failure compared to a normal classroom is gained. Microteaching has gained an important place in preparation for the teaching profession due to its potential to emphasize the relationship between theory and practice. For teacher candidates, the aim is to apply a technique rather than teaching a subject (Donnelly & Fitzmaurice, 2011; Fernandez, 2010; Majoni, 2017; Otsupıus, 2014). Since it is stated in the literature that this method is effective in the development of practice skills of teacher candidates (Kılıç, 2010; Marulcu & Dedetürk, 2014; Peker, 2009; Savaş, 2012), this method was used in the development part of the strategy, model, method-technique application skills of the action plan.

This research was conducted to examine the effect of the action plan applied on increasing the strategy, model, method-technique knowledge levels of senior science teacher candidates and on the development of planning and implementation skills. The problem statement of the research was determined as: "Is the applied action plan effective in increasing the strategy, model, method-technique knowledge and in developing application skills of science teacher candidates?"

1) Is there a statistically significant difference between teacher candidates' strategy, model, method-technique knowledge levels before and after the action?
2) What kinds of differences are there in teacher candidates' strategy, model, method-technique planning skills before and after the action?
3) What kinds of differences are there in teacher candidates' strategy, model, method-technique application skills before and after the action?

2. Method

2.1. Research design

Action research was used in the research. Action research consists of the implementation process studies of the practitioners themselves or with a researcher in order to understand and solve the problem in case of a possible problem while performing an application (Johnson, 2011). This method was chosen because it was the most appropriate method for the purpose of this study, which was conducted in order to examine the effect of the planned application on the development of the pre-service teachers' knowledge about strategy, model, method-technique issues and their application skills. The plan of the action research process is given in Figure 1.

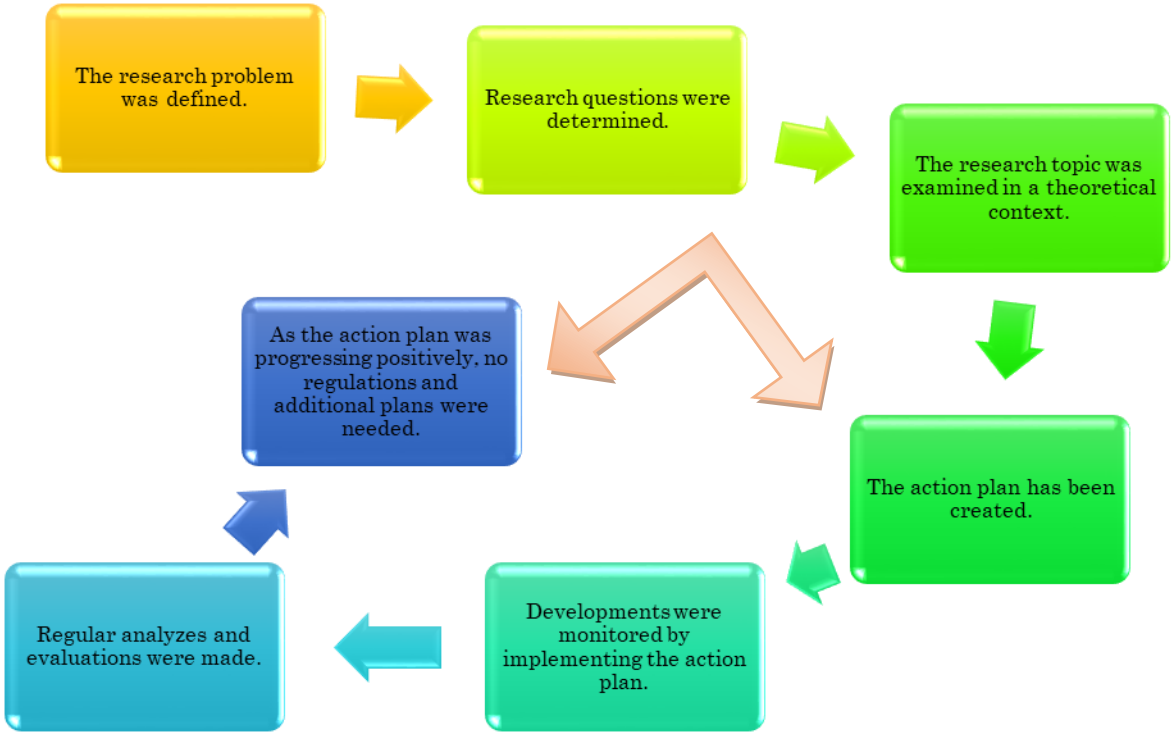

Figure 1. Action research Plan

2.2. Participants

The research was carried out with 26 senior science teacher candidates attending a state university in the spring semester of the 2018-2019 academic year. Criterion sampling, one of the purposeful sampling types, was used to determine the teacher candidates to participate in the study. The strategy, model, method-technique knowledge levels of the teacher candidates were determined as criteria and 29 pre-service teachers

who got under 60 points from the applied knowledge test were determined. The determined teacher candidates were informed about the application and volunteer consent forms were signed. Three pre-service teachers who did not want to participate were excluded from the study group. In the last case, 26 senior science teacher candidates participated in the study. Eight of the teacher candidates are male and 18 are female. Five teacher candidates selected from the study group were studied in order to observe the practical skills of teacher candidates. The maximum diversity sampling method, one of the purposeful sampling types, was used in determining these pre-service teachers. Considering the scores obtained from the knowledge test, teacher candidates who got very low, low, medium, high and very high scores were determined and the application skills of these teacher candidates were observed before and after the action.

2.3. Data collection tools

2.3.1. Knowledge test

The knowledge test used in the research was prepared by the researcher. First of all, the subjects included in the study were determined. A question pool was created by examining the questions and preparatory books of the Public Personnel Selection Examination (PPSE) in educational sciences. In the selection of the questions, care was taken to include all topics and to have more than one question from each topic in case of possible question elimination. A question pool of 65 questions was presented to the opinions of three field experts, 1 assessment-evaluation specialist, and 1 language expert who previously conducted Teaching Principles and Methods, Special Teaching Methods I and II courses together with the expert evaluation form. As a result of the opinions of the experts, the test measures the property it aims to measure without confusing it with other variables (structure validity is provided), all issues that need to be included in the test (content validity is provided), 1 question is removed from the test, 3 problems are used by correcting, correction of language problems, prediction for the solution of the test. It was determined that the time period should be extended and changes should be made in the arrangement of the questions. In line with the recommendations of the experts, the questions asked to be removed from the test were removed and other arrangements were made. The first version of the test, which consists of 62 questions, was applied to a group of 183 senior science teacher candidates. As a result of the analysis of the data obtained from the pilot application, a question with the index of distinctiveness below 0.20 was removed from the test. Two questions with the index of distinctiveness 0.27 and 0.24 were put to the test after editing. The index of the distinctiveness of the questions in the test range between 0.35 and 0.89. It was determined that the average difficulty index of the test was 0.51 and the difficulty index of the questions was between 0.21 and 0.83. The KR-20 reliability coefficient of the test was calculated as 0.82. In the last case, the test consists of 61 questions. Correct answers in the test were scored with 1.64 points, and

those left blank and wrong answers were scored with 0 points. The maximum score that can be taken from the test is 100 and the minimum score is 0.

2.3.2. Lesson plan preparation test

Teacher candidates were given two objectives and asked to prepare a lesson plan in accordance with these objectives. The first of these was: "It makes inferences by observing the brightness of the light bulbs in series and parallel connected on the circuit." and the second one was: "Makes inferences about the factors affecting the rate of photosynthesis." Teacher candidates were expected to include information about the approach they adopted and the methods and techniques they used in their lesson plans, to explain the roles of the teacher and students in the process, detailed information about the application of the selected methods and techniques in the teaching of the subject (teaching scenario), and the implementation of assessment and evaluation activities. In addition to these, subject field knowledge, field education, classroom management, and communication situations should be explained in lesson plans in the evaluation of lesson plans.

2.3.3. Observation form

It was prepared by the researcher in order to determine the performance of teacher candidates in the preparation for the teaching process and in the teaching process. First of all, the classes of the teacher candidates were observed by going to the classes within the scope of teaching practice lesson. The relevant literature was examined and the analysis results of the data obtained from the observation results were considered together and a draft observation form was created. The draft form was submitted to the opinion of 3 science education experts who conducted the teaching practice. In line with expert opinions, some items were relocated and four items were removed from the observation form. Pilot observations were made within the scope of teaching practice lesson using the draft form. The observation form consists of four items in subject field knowledge (SFK), five items in field education (FE), five items in planning the learning-teaching process (PLTP), eight items in the teaching process (TP), eight items in classroom management (CM), and seven items in communication (C) and 37 items in total. Observations in the form created according to the five-point grading; It is classified as poor (1), acceptable (2), medium (3), good (4) and very good (5). The observations were carried out independently by the researcher and a second researcher involved in the process.

2.4. Data analysis

In the analysis of the data obtained from the knowledge test and observation form, the suitability of the parametric tests was examined first. Normality values of the data are given in Table 1.

Table 1. Normality values

Data Source	Kurtosis	Skewness	Minimum	Maximum	Median	Mean	Std. d.	Shapiro-Wilk*
Knowledge Test-pre	-.849	-.201	34.44	59.04	51.00	51.08	9.15	.505
Knowledge Test-post	-.813	.542	65.60	83.64	73.00	73.31	5.36	.77
Observation Form-pre	1.269	1.572	2.17	3.12	2.63	2.64	.13	.08
Observation Form-post	.004	-1.118	3.31	4.20	3.59	3.59	.10	.57

*p<.05

As can be seen from the analysis results given in Table 1, the data provide the assumptions of parametric tests. For this reason, descriptive statistics, dependent groups t-test were used in the analysis of the data. Content analysis method was used in the analysis of the data obtained from the lesson plans and observation notes. The application steps of the content analysis method are given in Figure 2.

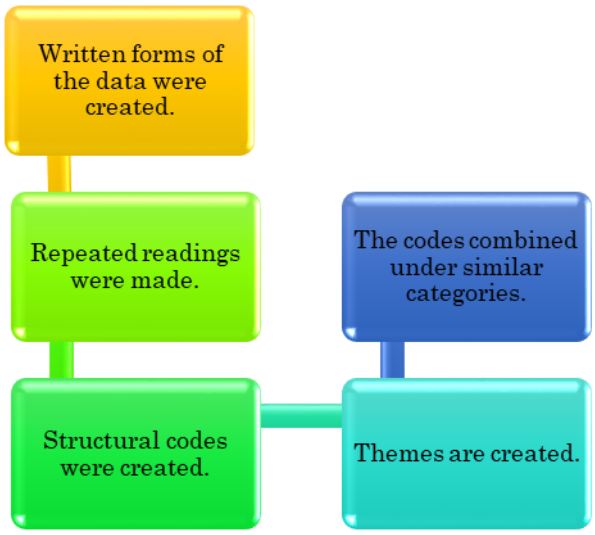

Figure 2. Transactions followed in content analysis

Data were collected by the researcher in two different time periods and analyzed independently from the first researcher by a second researcher involved in the process. The agreement percentages between the analysis made by the researcher and the analysis made by the two researchers were calculated. The values of the compliance percentages are given in Table 2.

Table 2. Percentage value of between analysis

Data Source	Percentage of Compliance at Different Times	Percentage of Agreement Between Two Researchers
Objective-1	83	78
Objective-2	81	75
Observation	86	79

It is seen that the compliance percentages given in Table 2 are over 70%. It can be said that reliability is achieved if the compliance percentage is 70% and above (Miles & Huberman, 1994).

2.5. Action plan

The action plan, including the implementation of the knowledge test before and after the action, was completed in 14 weeks. The subjects studied in the action process and the practices realized are given in Table 3.

Table 3. Subjects and applications

Before Application	Weeks	Subjects	Applications	After Aplication
	Week-1	Application of knowledge test and lesson plan preparation test Make of observations before the action		
Watching Subject Instructor Videos Analysis of Literature Studies on the Subject	Week-2	Mastery learning	Reading-Writing-Application Method Microteaching	Self-criticism Examination of Feedback
		Programmed instruction		
		Learning at school		
		Basic introduction		
		Layered curriculum		
	Week-3	Expository teaching		
		Discovery teaching		
		research and investigation teaching		
	Week-4	Personalized learning		
		Brain-based learning		
		Quantum learning		
		Life-based learning		
		Active learning		
	Week-5	Multiple intelligence		
		Instruction		
	Week-6	Project-based learning		
		Cooperative learning		
	Week-7	Case method		
		Discussion		
	Week-8	5E		
		Experiment		
		Demonstration		
		Brainstorming		
	Week-9	Argumentation		
		Snowball		
		Six hats thinking		
	Week-10	Problem Based Learning		
		Dramatization		
		Role play		
	Week-11	Educational game		
		Analogy		
		Simulation		
		Circle		
		Market place		
		Aquarium		
	Week-12	Concept teaching techniques		
	Week-13	Trip-Observation-Interview		
	Week-14	Application of knowledge test and lesson plan preparation test Make of observations after the action		

As can be seen from the information given in Table 3, knowledge and lesson plan preparation tests were applied before the action and lesson observations of the determined teacher candidates were made. The observations were carried out in the classrooms of the secondary schools affiliated to the Ministry of National Education, where the teacher candidates attended the internship within the scope of the teaching practice course. Teacher candidates prepared their lesson plans in the format given to them before the application and delivered them to the researcher one day before the

observation. Lesson plans were evaluated according to the items under the heading of planning the teaching-learning process in the observation form.

The teacher candidates were divided into five groups of four and two groups of three each, taking into account the results of the initial knowledge test and gender to implement the action plan. Care was taken to ensure that the group members were heterogeneous in terms of knowledge test score and gender and that the groups were in equal structures. The researcher provided one for each group, one for each group, with worksheets related to strategy, model, method-technique, Ministry of National Education Science Lesson Curriculum Book. While preparing the study sheets, PPSE preparation books, and science teaching books were taken and compiled from many different sources. The worksheets contain general definitions and explanations about the subject, the roles of teachers and students, and information about their application in lessons. The teacher candidates were asked to watch the short-term instructor videos sent to them by the researcher before coming to the lesson and to examine the sample field studies. The teacher candidates came together in their groups every week and studied the topics of the week included in the action plan by reading with their group friends. While the groups were doing their reading studies, the researcher followed the group work by traveling between the groups, provided additional information on the topics, created discussion platforms by asking questions to the groups, and answered group questions. 20 minutes has been allocated for reading exercises. Writing studies were carried out in two stages. For the first writing study, all resources were removed and subject reports were prepared within five minutes using only mental processes. In the next five minutes, a randomly selected group presented its report to the other groups. The missing parts of the group were discussed. The next 25 minutes are devoted to the second writing activity, lesson plan preparation. Reading sheets were removed for this writing study, but teacher candidates were allowed to use the Ministry of National Education Science Course Teaching Program book and lesson plan preparation guide. Lesson plans prepared at the end of the writing studies were taken and randomly distributed to the groups. The groups evaluated the lesson plan they received within five minutes.

During the application phase of the method, three groups were determined by drawing lots between the groups. One spokesperson selected from the determined groups, respectively, applied the lesson plan in the classroom environment. Each group was given 15 minutes for the applications. While the group member was applying the lesson plan, video recording was taken and the other groups participated in the application both as a student and as an evaluator. When the application is over, five minutes is reserved for the evaluation of the teacher candidate who made the application. In this way, the applications of the action plan in the classroom were completed. After the lesson, the video recordings were watched by the teacher candidates themselves, and they were asked to make a self-criticism. All of the feedbacks were collected and combined in the practitioner and shared with teacher candidates weekly.

3. Findings

3.1. Findings of the first research question

The dependent groups t-test analysis results made to determine the effect of the action plan on the strategy, model, method-technique knowledge levels of teacher candidates are given in Table 4.

Table 4. Dependent groups t-test analysis results of the data obtained from the knowledge test

Application	N	M	Std. d.	df	t	p*
Pre-test	26	51.08	9.15	25	-13.925	.000
Post-test	26	73.31	5.36			

p<.05

According to the analysis results given in Table 4, it was determined that the post-action strategy, model, method-technical knowledge levels of teacher candidates were statistically significantly higher than their pre-action knowledge levels, ($t_{(25)}$=-13.925; p<.05, η^2=.89). The eta-square effect size, which was classified as a very large effect by Cohen (1988), was calculated as .89. Accordingly, it can be said that the increase in the knowledge level of teacher candidates is 89% due to the action plan implemented.

3.2. Findings of the second research question

The results of the content analysis of the lesson plans prepared by the teacher candidates before the action are given in Table 5.

Table 5. Content analysis results of lesson plans prepared before the action

Theme	Category	Code	Objective-1 f	Objective-2 F
Mistakes Made By Prospective Teachers	The Lesson Plan Is Not Suitable For The Objective	Not suitable for objective	11	24
	No Information Provided in the Plan Regarding the Subject	Lack of knowledge teaching	2	24
	Prospective Teachers' Lack of Field Knowledge	lack of field knowledge	2	
	Not Using Any Method-Technique in the Plan	Lack of method-technical knowledge	13	22
	Missing the Name of the Method-Technique Used	The name of the method-technique used is unknown	2	
	Using Methods and Techniques in The Wrong Format	Incorrect use of method-technique	11	8
	Not Measuring the Level of Achieving Objective	Lack of measurement-evaluation process	25	26
Strengths of Pre-service Teachers in Preparing Lesson Plans	Methods and Techniques Preferred and Properly Used by Pre-Service Teachers	5E	5	4
		Instruction	11	4
		Demonstration	4	
		Question and answer	3	3
		Brainstorming	2	4
	Measuring the Level of Achieving Objective	Evaluation making	1	

According to the results of the analysis given in Table 5, it was determined that the teacher candidates did not prepare their lesson plans following the objective, the information about the subject was lacking in the lesson plans, they did not have method-

technique knowledge, their use was not explained correctly, and the measurement-evaluation process was not performed to determine the level of achieving the objective. Examples of teacher candidates' lesson plans before the action are given in Figure 3.

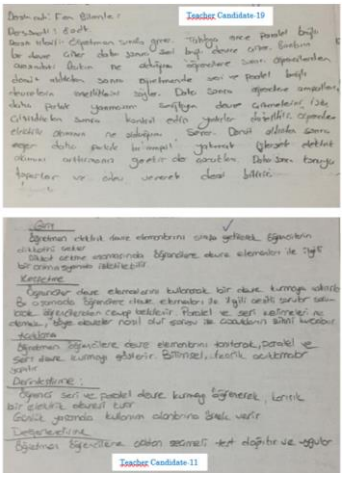

Figure 3. Lesson plan examples of before action

The results of the content analysis of the lesson plans prepared by the teacher candidates after the action are given in Table 6.

Table 6. Content analysis results of lesson plans prepared after the action

Theme	Category	Code	Objective-1 f	Objective-2 f
Presenting the Outline of the Lesson Plan	The Lesson Plan Suitable For The Objective	suitable for objective	26	26
	Information Provided in the Plan Regarding the Subject	completeness of knowledge teaching	25	23
		pattern of subject concepts	21	17
	Explanation of Security Measures to be Taken in Experiments and Activities	Security precautions	23	14
	Explanation of the Educational Technologies and Materials Used	Educational technologies and materials used	24	26
	Disclosure of Roles of Teachers and Students	The role of the teacher	15	19
		The role of students	20	23
	Methods and Techniques Preferred and Properly Used by Pre-Service Teachers	5E	5	10
		Demonstration	6	14
		Brainstorming	11	12
		Educational game	4	5
		Argumentation	3	10
		Problem Based Learning	3	4
		Case method	6	11
		Predict-Observation-Explain	13	4
		Cooperative learning	2	5
Detailed Explanation of the Scenario	Using Methods and Techniques in The Right Format	use of method-technique correctly	23	22
	Attracting Students' Attention to the Lesson	attracting student attention	21	23
	Measuring the Level of Achieving Objective	measurement-evaluation process	25	26

According to the results of the analysis given in Table 6, teacher candidates prepared their lesson plans by the objective given, information content related to the subject was transferred and concept patterns were given, the security measures to be taken in the experiments and activities, the teaching technologies and materials they used, the roles of teachers and students and their preferred use, they explain the methods-techniques. It was determined that pre-service teachers explained in detail the use of method and technique in lesson plans, what was done to attract students' interest to the lesson, and the assessment-evaluation activities carried out to determine the level of achieving the objective. Examples of teacher candidates' lesson plans after the action are given in Figure 4.

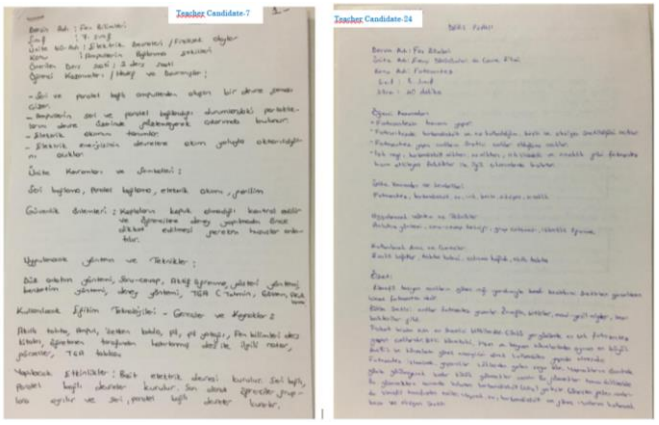

Figure 4. Lesson plan examples of after action

3.3. Findings of the third research question

The dependent groups t-test results of the practice skills score of the teacher candidates obtained from the observations made before and after the action are given in Table 7.

Table 7. Dependent groups t-test analysis results of the data obtained from the observation form

Data Source	Application	N	M	Std. d.	df	t	p*
Knowledge of field	Pre-test	5	2.96	.09	4	-2.875	.045
	Post-test	5	3.42	.29			
Field training	Pre-test	5	2.56	.38	4	-5.982	.004
	Post-test	5	3.72	.36			
Planning the learning-teaching process	Pre-test	5	2.46	.39	4	-5.715	.005
	Post-test	5	3.86	.29			
Teaching process	Pre-test	5	2.63	.20	4	-15.580	.000
	Post-test	5	3.80	.13			
Classroom management	Pre-test	5	2.65	.22	4	-4.106	.015
	Post-test	5	3.31	.32			
Communication	Pre-test	5	2.61	.24	4	-7.364	.002
	Post-test	5	3.43	.25			
Total	Pre-test	5	2.64	.13	4	-17.267	.000
	Post-test	5	3.59	.10			

*p<.05

According to the analysis results given in Table 7, teacher candidates' knowledge of field ($t_{(4)}$=-2.875, p<.05, η^2=.67), field training ($t_{(4)}$=-5.982, p<.05, η^2=.90), planning the learning-teaching process ($t_{(4)}$=-5.715, p<.05, η^2=.89), teaching process ($t_{(4)}$=-15.580, p<.05, η^2=.98), classroom management ($t_{(4)}$=-4.106, p<.05, η^2=.81), communication ($t_{(4)}$=-7.364, p<.05, η^2=.93) and in total ($t_{(4)}$=-17.267, p<.05, η^2=.98) post-action application skills were found to be significantly higher than pre-action skills. Calculated eta-square effect sizes are classified as very large effect by Cohen (1988). Accordingly, the variability observed before and after the action in pre-service teachers' practice skills is 67% for knowledge of field, 90% for field training, 89% for planning the learning-teaching process, 98% for teaching process, 81% for classroom management, 93% for communication and the action plan implemented at a total rate of 98%.

4. Discussion and Conclusions

The effect of the action plan prepared in this study, which was carried out to increase the level of strategy, model, method-technical knowledge of science teacher candidates and to improve their planning and implementation skills, was examined.

It was determined that the post-action strategy, model, method-technique knowledge levels of the teacher candidates were statistically significantly higher than their pre-action knowledge levels. In this case, teacher candidates learn the subject by assimilating the subject themselves during the readings, giving meaning to the information and activating their cognitive structures to understand it, deepening the knowledge with their discussions on the subject; organize the information they have created in their minds during the writing phase, share them with other group friends in order, generate new ideas together, plan the whole process in detail for the course presentation they will make during the implementation phase it can be said that their level of knowledge has increased thanks to the implementation of their plans, evaluating the applications, monitoring and self-evaluation during the implementation phase and the feedback given (Slavin, 1994, 1995; Stevens, Madden, Slavin & Farnish, 1987). The results obtained from this study are consistent with the results of the research, which indicates that the literacy-practice method applied in different sample types is effective in increasing the knowledge level (Ağgül, 2016; Aksoy & Doymuş, 2011; Koç, 2014; Okumus, 2020).

Before the action, it was determined that the teacher candidates did not prepare their lesson plans by the objective, the lesson plans lacked the information on the subject, they did not have method-technique knowledge, their use was not explained correctly, and the assessment-evaluation process was not performed to determine the level of achieving the objective. After the action, it was determined that the teacher candidates prepared their

lesson plans by the given outcomes, the information content about the subject was transferred and the concept patterns were given, they explained the safety precautions to be taken in the experiments and activities, the teaching technologies and materials they use, the roles of the teachers and students and the methods and techniques they prefer to use. In addition, after the action, it was observed that the teacher candidates paid attention to planning the assessment and evaluation activities to determine the use of methods and techniques, what was done to attract students' interest to the lesson, and the level of achieving the gains. While pre-service teachers preferred the 5E model, instruction, demonstration, question and answer, and brainstorming method-techniques before the action, they also preferred the educational game, argumentation, problem-based learning, case method, cooperative learning, predict-observation-explain method-techniques after the action. determined. Studies in the literature indicate that pre-service teachers prefer traditional teaching methods higher (Yıldırım, Köklükaya & Aydoğdu, 2016). It can be said that this situation stems from the weakness of pre-service teachers' knowledge and application skills towards contemporary methods. In the study conducted by Gür, Dilci, and Arseven (2013), it was stated that the inadequacy of pre-service teachers was due to their lack of education with practices suitable for the constructivist approach. In this study, it was observed that when active practices were offered to prospective teachers, their inadequacies disappeared and their knowledge and skills improved. Although this study focuses on method-technical planning and application skills, the plans and practices prepared in order to attract students' attention to the lesson, subject area knowledge, classroom management, communication, and measuring the level of achievement of goals, therefore, the skills of teacher candidates in these areas are also It can be said that it helps increase.

It was determined that the strategy, model, method-technique application skills of the teacher candidates after the action were significantly higher than before the action. It can be said that this situation increases the skills of teacher candidates in applying the lesson plans prepared by the pre-service teachers at the application stage of the method and evaluating these practices by the researcher, other teacher candidates, and the pre-service teacher himself (Amobi & Irwin, 2009; Berg & Smith, 1996; Ijioma, Obasi & Ifegbo, 2014). The results obtained from this study are consistent with other research results indicating that the micro-teaching method is effective in increasing the practice skills of pre-service teachers (Kılıç, 2010; Marulcu & Dedetürk, 2014; Peker, 2009; Savaş, 2012).

Based on the results of the research, it can be suggested to use literacy-practice and micro-teaching methods together to increase the strategy, model, method-technical knowledge level of prospective teachers and to improve their application skills. It can be used in teacher training applications by adding new subjects to the action plan used in this study and making improvements. Subjects and practices regarding assessment-evaluation, classroom method, and communication skills can be added to the action plan.

References

Aksoy, G., & Doymuş, K. (2011). Effects of cooperative reading-writing-application technique in application in science and technology course. *Gazi University Journal Of Gazi Educational Faculty (GUJGEF)*, *31*(2), 89-115.

Amobi, F. A. & Irwin, L. (2009). Implementing on-campus microteaching to elicit preservice teachers‟ reflection on teaching actions: Fresh perspective on an established practice. *Teacher Education Quarterly, 32*, 115-130.

Aydemir, H. (2012). Competencıes of socıal scıences teachers ın usıng teachıng methods, technıques and strategıes. *Hikmet Yurdu Thought-Comments Social Sciences Research Journal, 5*(9), 81-100.

Berg, Margaret H. & Smith, Janice P. (1996). Using Videotapes to Improve Teaching. *Music Educators Journal,* 4(82), 31-37

Bulut, G., (2012). *The tendency of elementary science and technology teachers on the use of teaching methods and techniques (sample of Hatay city)* (Unpublished master thesis). Fırat University, Turkey.

Çelikkaya, T., & Kuş, Z . (2009). Sosyal bilgiler öğretmenlerinin kullandıkları yöntem ve teknikler. *Journal of Uludağ University Education Facultyi, 22*(2), 741-758. https://dergipark.org.tr/tr/pub/uefad/issue/16690/173469

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. *Educatıon Polıcy Analysıs Archıves, 8*(1), 1-44.

Darling-Hammond, L., & Berry, B. (1999). The evaluation of teacher policy. *Office of Educational Research and Improvement,* 1-97.

Doğru, M., & Aydoğdu, P. (2003). Student opınıons about the problems faced ın the methods used ın scıence teachıng. *Pamukkale University Journal of Education Faculty, 13*(13) , 150-158. https://dergipark.org.tr/tr/pub/pauefd/issue/11130/133120

Donnelly, R. & Fitzmaurice, M. (2011). Towards productive reflective practice in microteaching. *Innovations in Educational Teaching International, 48*(3), 335-346.

Ekici, G. (2000). The methods used by biology teachers in teaching and the problems they face. *Educational Administration in Theory and Practice,24*, 609-620.

Fernandez, M. L. (2010). Investigating how and what prospective teachers learn through microteaching lesson study. *Teaching and Teacher Education, 26*, 351-362.

Gelen, İ., &Özer, B. (2008). Havıng general adequacy of teachıng professıon evaluatıon of the vıews of teacher candıdates and teachers about theır level. *Mustafa Kemal University Journal of Social Sciences Institute, 5*(9), 39-55.

Gordon, T. (2003). *Teacher effectiveness training*. New York: Three Rivers.

Gupta, M. & Ahuja, J. (2014). Effect of cooperative learning strategy on English reading comprehension achievement of seventh graders in relation to their gender. *International Educational E-Journal, 3*(1), 14-27.

Gür, Y., Dilci, T. & Arseven, A. (2013). The opinions of preservice teachers in transition from traditional approach to constructivism: A discourse analysis. *Karadeniz International Scientific Journal, 1*(18), 123-135. https://dergipark.org.tr/tr/pub/kdeniz/issue/16857/175463

Gürdal, A., Şahin, F., & Çağlar, A. (2001). *Science education principles, strategies and methods*. Istanbul: Marmara University.

Haycock, K. (1998). Good teaching matters: How well qualified teachers can close the gap. *Thinking K-16, 3*(2), 1-19.

Ijioma, B. C., Obasi, M. N. & Ifegbo, P. C. (2014). Integrating microteaching theory + practice in concurrent and consecutive teacher education programmes: Benefits and challenges. *Report and Opinion, 6*(9), 22-26.

Jenkins, L. (2003). *Improving student learning: Applying Deming's quality principles in classrooms.* ASQ Quality Press.

Johnson, A. P. (2011). *Short guide to action research* (4th edition). Pearson Educaton.

Kaptan, F. (1999). *Teeching scince*. İstanbul: National Education.

Kılıç, A. (2010). Learner-centered micro teaching in teacher education. *International Journal of Instruction, 1*(3), 77-100.

Koç, Y. (2014). *Informing science and technology teachers about cooperative learning model, application of the model in the classroom and evaluation of the obtained data: Case of Ağrı*. (Doctoral dissertation thesis), Atatürk University, Turkey.

Korthagen,F. A. J. (2004). In Search of good teachers: towards a more holistic approach in teacher education. *Teaching and Teacher Education, 20*, 77-97.

Lind, K. K. (2005). *Exploring science in early childhood education*. New York: Thomson Delmar Learning.

Lunenberg, M. (2002). Designing a curriculum for teacher educators. *European Journal of Teacher Education*, 2(3), 264-277.

Marulcu, İ., & Dedetürk, A. (2014). Pre-service science teachers' micro-teaching practices: An action research. *Mustafa Kemal University Journal of Social Sciences Institute, 11*(25), 353-372.

Melvin, L. (2011). *How to keep good teachers and principals: practical solutions to today's classroom problems.* R&L Education.

Majoni, C. (2017). Assessing the effectiveness of microteaching during teacher preparation. *European Journal of Research and Reflection in Educational Sciences, 5*, 31-36.

Okumus, S. (2020). The effect of cooperative reading-writing-application method on environmental science learning and writing skills development. *International Journal of Progressive Education*, *16*(1), 168-191.

Otsupıus, I. A. (2014) Microteaching: A technique for effective teaching. *African Research Review, 8*, 183-197

Passmore, J. (1980). *Teaching to be critical*. In J. Passmore, The philosophy of teaching (pp. 166-182). London: Duckworth.

Peker, M. (2009). Opinions of preservice mathematics teachers on expanded micro teaching experiences. *Turkish Journal of Educational Sciences, 7*(2), 353-376.

Phillips, D.C. & Soltis, J. F. (2004). *Perspectives on learning* (4th ed.). New York: Teachers College.

Rosenholtz, S. J. (1985). Political myth about education reform: Lessons from research on teaching. *Phi Delta Kappan, 66*(5), 349-355.

Saka, A. & Akdeniz, A. R. (2001, September). *An approach to give biology teachers the skills to develop and use worksheets.* Beginning of the New Millennium Science Education Symposium in Turkey, İstanbul.

Savaş, P. (2012). Micro-teaching videos in EFL teacher education methodology courses: Tools to enhance English proficiency and teaching skills among trainees. *Procedia - Social and Behavioral Sciences, 55*, 730 – 738.

Şimşek, H., Hırça, N., & Coşkun, S. (2013). Preference and application levels of teaching methods and techniques of primary school science and technology teachers: the case of Şanlıurfa. *Mustafa Kemal University Journal of Social Sciences Institute, 9*(18), 249-268. https://dergipark.org.tr/tr/pub/mkusbed/issue/19552/208334

Slavin, R.E. (1994). *Handbook of cooperative learning methods*. The Greenwood Educator's Reference Collection.

Slavin, R.E. (1995). *Cooperative learning: Theory, research, and practice*. (2nd edition), Boston: Allyn and Bacon.

Sönmez, V. (2003). *Introduction to the teaching profession* (ed. Sönmez, V.). Ankara: Anı.

Stevens, R. J., Madden, N. A., Slavin, R. E., & Farnish, A. M. (1987). Cooperative integrated reading and composition: Two field experiments. *Reading research quarterly*, 433-454.

Sünbül, A. M. (2001). *Introduction to the teaching profession* (ed. Ö. Demirel, and Z. Kaya) Ankara: PegemA.

Taşkaya, S. M., & Sürmeli, H. (2014). Evaluation of teaching methods used by classroom teachers in science and technology lessons. *Gaziantep University Journal of Social Sciences*, *13*(1), 169-181.

Tekışık, H. H. (2003, September). *Teacher's teaching-teaching competencies and duties*. International World Conference on Teacher Education, Ankara.

Yıldırım, E. G., Köklükaya, A. N., & Aydoğdu, M. (2016). Teaching methods and techniques preferences of the science teacher candidates and reasons of this preference. *Journal of e-Kafkas Edcutaional Research, 3*(1), 15-25. https://dergipark.org.tr/tr/pub/kafkasegt/issue/19198/204113

Yılmaz, Ö., (2017). Teaching strategies, methods and techniques preferred by science teachers: opinions of pre-service science teachers. *Iğdır University Journal of Social Sciences Institute, 12*, 493-510.