Educational Policy Analysis and Strategic Research, V 15, N 4, 2020

Teaching Secondary School Science through Creative Drama Method: A case study approach[1]

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Abstract

The purpose of this study is to evaluate the practicality of creative drama method for students in science teaching. For this purpose the effects of creative drama method on the students' self-efficacy, scientific process skills and attitudes towards science have been investigated. An instrumental case study research method was used to teach the unit "States of Matter and Heat" unit in the 8th grade science curriculum through creative drama. The participants consisted of 20 eight grade students in a secondary school in Kilis. The group guide program, which consists of seven session plans, was prepared by the researchers in line with the views of three science education experts. The practice was carried out by the first author for a total of seven weeks in seven sessions, 80 minutes each. Data have been collected through "Science and Technology Course Self-efficacy Scale (STSS)", "Scientific Process Skills (SPS) test", "Science Course Attitude Scale (Science-AS)", semi-structured interviews and observation. Obtained quantitative data were analyzed by Wilcoxon Signed Sequences test and the qualitative data were analyzed by content analysis. According to the results, the negative aspects of creative drama learning environment affected the practicability of creative drama method and the practicability of creative drama method increased significantly by eliminating these negative aspects. It was also found creative drama method increased their self-efficacy about learning science and attitudes towards science course, but it had no statistically significant effects on students' scientific process skills. In accordance with these results, related suggestions were made for further studies.

Keywords: Creative drama method, practicality, scientific process skills, self-efficacy, science

DOI: 10.29329/epasr.2020.323.6

[1] This study was produced from Semih Dadük's master's thesis titled as "Teaching 'states of matter and heat' unit in the 8th grade science course through creative drama method".

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Introduction

With increasing internationalization, increasing information intensive work and increasing use of information technology, the education system has started to change. Schools have endeavored to produce not only individuals with knowledge but also individuals with high interpersonal relations and communication skills, able to work in various contexts and knowledge literacy skills (Allan, 1996; Burgess, 2000; Lim, 2015; Sakamoto, 1996). Schools are now moving towards a more learner-centered approach to learning for in response to this challenge (Gravoso et al., 2008). Teachers cannot teach students directly. Teachers must provide an environment in which students can learn and learners have full responsibility for their own (Rogers, 1965, p.389). Students did not come to classroom as blank slates waiting to be filled with scientific knowledge. They have already full of ideas or conceptions about the world that are often inconsistent with the scientific concepts teaching in schools (Smith et al., 1993). At this point constructivism challenge these ideas or conceptions and in so doing, bring about their re-construction in order to enable the students to see the world in the same scientific way that the teacher sees it (Ogborn et al., 1996). In a constructivist classroom, the teacher searches for students' understandings of concepts, and then structures opportunities for students to refine or revise these understandings by posing contradictions, presenting new information, asking questions, encouraging research, and/or engaging students in inquiries designed to challenge current concepts (Brooks & Brooks, 1993, p.9).

Constructivist teaching methods such as using drama have been promoted as productive ways of learning, especially in science (Braund, 2015). Drama plays a prominent part in the teaching of some of the humanities (English, history etc.) and has been recommended as an affective teaching strategy for science teaching (Duveen & Soloman, 1994). If students are allowed to experience the actual personal involvement that the use of drama provides they are far more likely to become personally interested in the material being taught (Abrahams & Braund, 2012). In science subjects drama has been said to help students learn concepts, appreciate the nature of science and learn more about science's interactions with society (Ødegaard, 2001). There are different techniques of drama that are used in teaching. Creative drama is one of the drama-assisted learning activities in which a leader and his/ her followers, and situations (Doğru et al., 2010). Creative drama is individuals' making sense or performing an event, an experience, an abstract or concrete concept making use of theater or drama techniques such as role playing, improvisation in a group work by reorganizing an old, cognitive patterns in playful processes where experiences, observations, feelings and experiences are reviewed (San, 1990). With this method, students not only discover information but also get to know themselves with improvisations and as a result they discover themselves (Aksoy Tokgöz, 2004). In addition, creative drama method supports students' imagination and internal motivation (Toivanen et al., 2013). What distinguishes the creative drama method from other student-centered methods is

that it recreates the learning environment with the playful forms (Bertiz, 2005). The games activate the students and the students who become active learn more quickly (Aytaş, 2013). In addition, it is easier to learn abstract and difficult concepts for students through teaching with creative drama method (Danckwardt-Lilliestrom et al., 2017; Hendrix et al., 2012).

The creative drama consists of three phases: preparation/warm-up, animation and evaluation/discussion (Adıgüzel, 2015, p.101). Preparation/warm-up phase includes the studies with certain rules and mostly defined by the leader. These studies include meeting, interaction, trust and adaptation, using five senses, observing, physical and tactile studies. Fun children's games and derived games can be used effectively at this phase. The purpose of this phase is to prepare the students for the next phase and to increase the motivation of the students towards the course (Adıgüzel, 2006). The animation phase covers all the situations in which the subject matter is shaped and exhibited in the process and exhibited to other drama participants (Adıgüzel, 2015). It is a phase where improvisation, role-playing and other techniques are used as a starting point within the framework of the subject to be performed (Adıgüzel, 2006). The choice of these techniques is determined by the teacher, taking into account the characteristics of the group and the subject. Performances can be done with the group or individually. Creativity and authenticity are exhibited at this phase (Çopur, 2014). Although, evaluation/discussion is the phase in which creative drama method is evaluated, both cognitive and affective evaluations are made in other phases of creative drama (Akfırat, 2004). This phase can be done in the form of written and oral discussion, test, survey, observation and interview forms and can be done with various scales (Üstündağ, 1998).

Creative drama has rapidly gained importance in education and training in the world and in our country. It can be used as an effective method in the teaching of almost every course at every teaching level (Namdar, 2017, p.264). As reported in the related literature many concepts in science have been taught with creative drama, for example; electricity (Aubusson et al., 1997; Sağırlı & Gürdal, 2002), force and motion (Sedef, 2012), mechanical (Çopur, 2014), astronomy (Ceylan et al, 2015; Francis & Byrne, 1999), environment (Nalçacı, 2012; Teker, 2009; Yalım, 2003; Yılmaz, 2006), genetic (Saka et al., 2016), mitotic division (Wyn & Steginik, 2000), light and sound (Can, 2013), mixtures and solutions (Arielli, 2007), energy (Hendrix et al., 2012), chemical bonds (Danckwardt-Lilliestrom et al., 2017), structure of matter (Demirağ, 2014; Tuncel, 2009), heat and temperature (Kahyaoğlu et al., 2010; Yeşiltaş et al., 2017). The literature, especially related science education, shows that there are many studies investigated the effects of creative drama on attitude (Çokadar & Yılmaz, 2009; Çopur, 2014; Demirağ, 2014; Hendrix et al., 2012; Doğru et al., 2010; Saka et al., 2016; Şahbaz, 2004; Timothy & Apata, 2014; Yağmur, 2010), scientific process skills (Can, 2013; Sedef, 2012; Taşkın-Can, 2013), self-efficacy (Hamurcu, 2008). From these literatures, it can be concluded

that creative drama generally have positive effects on students' self-efficacy, scientific process skills and attitudes towards science excluding some studies (Demirağ, 2014; Hendrix et al., 2012).

The Importance of the Study

The positive effect of creative drama method on students has been known for a long time and it is seen that even in Turkey since 1998, creative drama has been taught as elective or compulsory courses in education faculties (Çopur, 2014; Üstündağ, 1998). But, in literature there has been no study investigating the practicability of creative drama method for students in science teaching.

The Aim of the Study

In this study it was purposed to evaluate the practicality of creative drama method for students in science teaching. Also for this purpose the effects of creative drama method on the students' self-efficacy, scientific process skills and attitudes towards science have been investigated.

Methodology

In this study, instrumental case study was utilized as the research method (McMillan & Schumacher, 2010). The case study is an empirical research method that is used in cases where there is more than one evidence or data source, and a current phenomenon is not clear in the precise lines of the boundaries between the case and the content that works within its life frame (content) (Yin, 1984, p.23; cited in: Yıldırım & Şimşek, 2013, p.313). There are different classifications of the case study. Stake (2003) classified the case study as internal, instrumental and multiple case study. According to the instrumental case study used in the this study, the primary purpose is to reveal the effects of the event rather than to understand the event itself, and to examine a special event, activity or situation, but in order to determine the effect of the event in the most accurate way, the event must be examined in depth (Stake, 2003, p.137).

Participants

A total of 20 eight-grade students in a secondary school at Kilis in 2016-2017 academic-years participated in this study. The participants were selected through voluntary sampling, which is a non-random sampling method. This sampling method is on voluntary basis. Person or persons participate in the research on a voluntary basis (Baştürk & Başteпe, 2013, p.146-147).

Data Collection Tools

Science and Technology Course Self-Efficacy Scale (STSS)

In order to examine the effect of creative drama method on self-efficacy of students towards science learning, STSS developed by Tatar et al. (2009) was used as pre-test before the practice and post-test after the practice. STSS consists of 27, 5-point Likert type items. The Cronbach Alpha reliability coefficient of the scale was calculated as 0.93. The STSS has three sub-dimensions; these

are “trust in science and technology”, “dealing with the challenges of science and technology “and” trust in science and technology performance”. The Cronbach Alpha reliability coefficients of these dimensions are 0.93, 0.75 and 0.80 respectively. In this study, the Cronbach alpha reliability coefficient of the scale for the pre-test was 0.96 and the Cronbach Alpha reliability coefficient for the post-test was calculated as 0.91.

Scientific Process Skills (SPS) test

In order to investigate the effect of creative drama method on students' scientific process skills, SPS test was used as pre-test and post-test before and after the practice. The SPS test developed by Okey, Wise and Burns (1982) and adapted to Turkish by Geban, Aşkar and Özkan (1989) consists of 36 items (cited in. Geban, 1990). The reliability coefficient was calculated as Cronbach Alpha 0.81 by the researchers who adapted the SPS test to Turkish. Karar and Yenice (2012), who applied the scale on the 8th grade students, removed 10 items with item discrimination index value less than 0.20 from the scale and calculated the reliability coefficient of the new test as 0.78.

Because, this study studies the effect of creative drama method on scientific process skills of 8th grade students, the use of 26-item version of SPS, obtained by Karar and Yenice (2012) were considered to be more appropriate. In this study, the Cronbach's alpha reliability coefficient of the SPS test was calculated as 0.75 and the Cronbach Alpha reliability coefficient was calculated as 0.74. The test has five dimensions: Defining and controlling variables, hypothesizing, operational (functional) defining, designing the research for the solution of the problem, drawing and interpreting graphs. Each question in the test is scored as 1 for correct answers, and each wrong answer is scored as 0. As a result, the highest score from the test is 26 and the lowest score is 0. Scientific process skills test score ranges: 0–8.02 is low level, 8.03–17.62 is medium level and 17.63–26 is high level (Karar & Yenice, 2012).

Science Course Attitude Scale (Science-AS)

In order to examine the effect of creative drama method on students' attitudes towards science course, Science-AS was used as pre-test and post-test before and after the practice. The scale was developed by Geban et al. (1994) and consisted of 11 positive and 4 negative, the total of 15 5-point Likert type items. Cronbach Alpha reliability coefficient of the scale was reported as 0.83. In this study, Cronbach Alpha reliability coefficient was calculated as 0.78 for the pre-test and 0.82 for the post-test.

Semi-Structured Interview

Data were collected through semi-structured interviews to determine the students' opinions about the creative drama method. A semi-structured interview form was prepared by the researchers for this purpose. The researchers developed a semi-structured interview form, which consisted of 8

items at first. Then, according to the feedback of the two experts, the form was arranged and it took the final form consisting of five questions as well as the probes of each question. After the practice, 13 voluntary students were interviewed by using semi-structured interview form. Each interview was recorded with a voice recorder with the permission of the students. Then, these voice recordings were carefully transformed into written text, and the researchers identified the code and the categories and examined them through content analysis.

Semi-Structured Observation

A semi-structured form was developed by the researchers according to the opinions of two faculty members who are specialized in science education. The practice was recorded with a video camera from the beginning to the end, and the records obtained were examined through content analysis by using semi-structured observation form.

Practice Process

The group guidance program, which consists of seven session plans, was constructed by taking three phases of creative drama. The draft guidance program was presented to the opinions of three experts from the field of science education. The necessary arrangements were made in line with the feedback they gave and final version of the guidance program was formed by the researchers. One of the session plans is included in Appendix 1. As a school of the practice, a secondary school has been determined through easily accessible sampling and necessary legal permissions have been obtained. Before the practice, all eight grade students in this school were informed about the study and creative drama. Only the volunteers were asked to participate in the practice. A total of 20 students from four different classes volunteered to participate in the practice. The practice was carried out by the first author as seven sessions (80 minutes each). The program content consists of three parts: a) core heat (two sessions), b) heat exchange and temperature (three sessions) and c) states of matter and heat exchange (two sessions). Role playing and improvisation techniques were used while implementing creative drama method and during the practice, classical music was played to the students in the classroom.

Data Analysis

In this study, Wilcoxon Signed Ranks Test was used to find out whether the differences between pre-test and post-test scores were statistically significant (Gravetter & Wallnau, 1996). Wilcoxon Signed Ranks Test is used to compare the scores of two dependent groups as an alternative to t test, if the data do not have normal distribution (Akgül & Çevik, 2003).

Additionally, the practice process was camera recorded and then records were examined in detail through semi-structured observation form. Also, immediately after the end of the practice, data were collected through semi-structured interviews with 13 students from the study group. Data

obtained through both interviews and observations were subjected to content analysis. In the content analysis method, a deductive path is followed (Özdemir, 2014), primarily the data are categorized and the frequencies of these categories are determined (Bryman, 2001). In the content analysis method, the researcher interprets and evaluates the text by examining the number, meaning of the concepts in the text and the relation of concepts with each other and the emphasis of concepts and reaches a judgment about the text in hand (Şencan, 2005).

Results

Results on the Practicability of Creative Drama Method for Students

In order to evaluate the practicability of the 8th grade science lesson "States of Matter and Heat" unit with creative drama method, data obtained by semi-structured interview and semi structured observation were analyzed. Content analysis method was used for data analysis. The answers were sought to the question "what are the positive and negative opinions of students about the learning environment with creative drama method and studying of the "States of Matter and Heat" unit through creative drama method?" Therefore, the data obtained from the semi-structured interview to determine the thoughts of students about creative drama method were examined in terms of creative drama method and creative drama learning environment themes and the findings are presented in Table 1.

Table 1. Content analysis results for semi-structured interview data

Theme	Category	Code	Frequency (f)	Percent (%)
Creative Drama Method	Positive	Enjoying learning with games and drama	7	53.85
		The fun of the lessons	5	38.46
		Lessons in different ways	2	15.38
		Learning empathy and imagining	2	15.38
		The ability to story subjects	2	15.38
		Learning group work	2	15.38
		Lessons with music	2	15.38
		Increase friendships	1	7.69
		Psychological relaxation	1	7.69
	Negative	Obligation for drama	1	7.69
		Not enjoying classical music	1	7.69
Creative Drama Learning Environment	Positive	Enjoying having no desks	3	23.08
		Enjoying camera recording	1	7.69
	Negative	Camera recording	3	23.08
		Noise	2	15.38
		Sitting on the floor	2	15.38

As presented in Table 1, interview data were divided into two themes as creative drama method and creative drama learning environment and each theme was divided into two categories as positive and negative. According to the findings on the theme of creative drama method, all of the students interviewed (f=13) had a positive opinion about creative drama method and few students (f=2) mentioned about the negative sides of the creative drama method. In terms of the positive aspects of the creative drama method, students enjoy learning with games and drama (f=7), and then the lessons are studied in a fun way (f=5), while the least is to increase friendship (f=1) and psychological relaxation (f=1). According to students' opinions, obligation for drama (f=1) and classical music (f=1) and camera recording (f=3) are negative aspects of creative drama method. Some of the positive opinions of the students about creative drama method are provided below. Code names are given instead of student names.

"…I like it. I enjoyed learning more drama, listening to music was more fun." (S2)

"…there was a joint study, group work. We learned to be a team. It was good, we developed our friendships." (S1)

One of the negative opinions of the students about the creative drama method reported in the semi-structured interview is provided below.

"… [I did not like that] sometimes we had to role-play." (S7)

As presented in Table 4, students have more negative opinions (f=7), while fewer students have a positive opinion (f=4) about the theme of creative drama learning environment. While students consider the learning environment with the camera (f=3), sitting on the floor (f=2) and noisy (f=2) as negative aspects, having no desks (f=3), recording with the camera (f=1) were considered as the positive aspects of the creative drama learning environment.

One of the positive opinions of the students about the creative drama learning environment is given below.

"We did not sit at desks. We told stories in a circle. I loved that very much." (S3)

One of the negative opinions of the students about the creative drama learning environment is given below. "…What I did not like was being video recorded and sitting on the floor." (S4)

Table 2 presents the content analysis results of the semi-structured observation data. f refers to the number of observed cases about the code, % refers to the percentage of the code.

As presented in Table 2, observation data were divided into two themes as creative drama method and creative drama learning environment and each theme was divided into two categories as positive and negative. According to the findings on the theme of creative drama method, 84.72% of the observed cases were positive, while 15.28% were negative. In terms of the positive aspects of the

creative drama method, students had fun (f=110), were motivated to answer questions (f=76), followed leader's instructions (f=58), loved drama (f=16), made jokes (f=15) and made constructivist criticism (f=35), while the negative observed cases were boredom (f=35), not enjoying classical music (f=29) and being shy-timid-anxious (f=11).

Table 2. Content analysis results for semi-structured observation data

Theme	Category	Code	Frequency (f)	Percent (%)
Creative Drama Method	Positive	Having fun	110	17.89
		Motivation to answer questions	76	12.36
		Following the leader's instructions	58	9.43
		Willingness	44	7.15
		Participating in group work	43	6.99
		Cooperation	39	6.34
		Curiosity-asking questions	37	6.02
		Active listening	25	4.07
		Adaptation	24	3.90
		Expressing oneself	22	3.58
		Making drama	16	2.60
		Making jokes	15	2.44
		Constructive criticism	12	1.95
	Negative	Being bored	35	5.69
		Not enjoying classical music	29	4.72
		Being shy-timid-anxious	11	1.79
		Not enjoying group work	10	1.63
		Obligation for drama	9	1.46
Creative Drama Learning Environment	Positive	Student-teacher communication	58	15.38
		Student-students communication	48	12.73
	Negative	Intervening friends	103	27.32
		Extra-curricular communication	78	20.69
		Noise	70	18.57
		Not wanting to sit on the floor	20	5.31

As presented in Table 2, among the positive cases observed in the creative drama learning category are; teacher-students communication (f=58) and student-student communication (f=48), while the negative are intervening friends (f=103), extra-curricular communication (f=78), noise (f=70) and not wanting to sit on the floor (f=20).

Findings on the Effect of Creative Drama Method on Self-Efficacy in Science Learning

In order to study the effects of creative drama method on students' self-efficacy towards science learning, Science and Technology Lesson Self-Efficacy Scale (STSS) was applied as pre-test before and post-test after the practice. Since a student did not participate in the post-test and two of the

students had left many items in the post-test blank, the data obtained from 17 students participating in both tests were analyzed (Table 3).

Table 3. Average and standard deviation values of science and technology lesson self-efficacy scale (STSS) pre-test and post-test results

Scale	N	x	Sd
STSS pre-test	17	4.35	0.73
STSS post-test	17	4.60	0.34

As presented in Table 3, the average pre-test for STSS is 4.35 and the post-test average is 4.60. The data were tested with the Wilcoxon Signed Ranks Test in order to find out whether the difference between average values was statistically significant and to what extent the creative drama method influenced students' self-efficacy towards science learning (Table 4).

Table 4. Results of wilcoxon signed rank test analysis of Science and Technology Lesson Self-Efficacy Scale (STSS) pre-test and post-test scores

STSS Post-Test- STSS Pre-Test	N	Mean rank	Rank sum	Z	p
Negative rank	3	3.33	10	-2.046*	.041
Positive rank	8	7	56		
Equal	6	-	-		
Total	17				

* Based on negative ranks

Table 4 shows that there is a significant difference between STSS pre-test and STSS posttest mean ranks ($z = -2.046$; $p < .05$). According to the mean ranks and rank sums of the difference points, the observed difference is in favor of the positive order, i.e. the post-test score. It can be concluded that creative drama method has a positive effect on students' self-efficacy towards science learning.

Findings on the Effect of Creative Drama Method on Scientific Process Skills

In order to study the effect of creative drama method on students' scientific processes, Scientific Process Skills (SPS) test was applied as pre-test before and post-test after the practice. The data obtained from a total of 19 students were analyzed since one student did not take the post-test (Table 5).

Table 5. Average and standard deviation values of Scientific Process Skills [SPS] test pre-test-post-test results

Scale	N	x	sd	Scientific Process Skill Level
SPS Test Pre-test	19	12.47	4.59	Medium
SPS Test Post-test	19	13.32	4.41	Medium

As presented in Table 5, SPS test pre-test average is 12.47 and post-test average is 13.32. The scientific process skill levels of the study group were medium both before and after the practice. According to this result, the SPS test post-test average increased slightly. However, in order to find out whether the difference between averages was statistically significant and to what extent the creative

drama method influenced students' scientific process skills, the data were tested with the Wilcoxon Signed Rank Test (Table 6).

Table 6. Results of the Wilcoxon Signed Ranks Test of Scientific Process Skills (SPS) test pre-test and post-test scores

SPS Post-Test- SPS Pre-Test	N	Mean rank	Rank sum	Z	p
Negative rank	6	10.17	61	-1.072*	.284
Positive rank	12	9.17	110		
Equal	1	-	-		
Total	19				

* Based on negative ranks

As presented in Table 6, there is no statistically significant difference between SPS test pretest and SPS test posttest mean ranks ($z = -1.072$; $p>.05$). This finding suggests that the creative drama method has no positive effect on the development of students' scientific process skills.

Findings on the Effect of Creative Drama Method on Attitudes towards Science Course

In order to find out the effects of creative drama method on students' attitudes towards science, Science Course Attitude Scale (Science-AS) was applied as pre-test and post-test before and after the practice. Since one student did not participate in the post-test and one student left many items blank in the post-test, the data obtained from a total of 18 students who participated in both tests were analyzed (Table 7).

Table 7. Average and standard deviation values of Science Course Attitude Scale (Science-As) pre-test and post-test results

Scale	N	x	sd
Science-AS pre-test	18	4.36	0.44
Science-AS post-test	18	4.56	0.38

As presented in Table 7, pre-test average of the Science-AS scale is 4.36 and the post-test average is 4.56. According to this result, the post-test average value of Science-AS increased slightly. However, in order to find out whether the difference between the averages was statistically significant and to define the effect of creative drama method on students' attitudes towards science, data were analyzed with Wilcoxon Signed Rank test (Table 8).

Table 8. Results of the Wilcoxon Signed Ranks Test of Science Course Attitude Scale (Science-As) pre-test and post-test scores

Science-AS post-test - Science-AS pre-test	N	Mean rank	Rank sum	z	p
Negative rank	6	5.17	31	-2.173*	.030
Positive rank	11	11.09	122		
Equal	1	-	-		
Total	18				

* Based on negative ranks

As presented in Table 8, there is a significant difference between the Science-AS pre-test and Science-AS post-test averages ($z=2.173$; $p<.05$). According to the mean ranks and rank sums of the

difference points, the observed difference is in favor of the positive ranks, in other words, the post-test scores. This finding suggests that the creative drama method has a positive effect on students' attitudes towards science, and that the creative drama method increases the students' positive attitude towards science.

Discussion, Conclusion and Recommendations

In this study it was investigated the practicability of creative drama method in science teaching for students and was examined the effects of creative drama method on students' self-efficacy, scientific process skills and attitudes towards science. This study is particularly important in terms of testing the practicability of creative drama method for students. Data collected in order to test the practicability of the creative drama method for the students by semi-structured interview and semi-structured observation were studied and it was found that these were in agreement. According to the results of both analyses, students exhibit more positive experiences related to creative drama method, whereas they exhibit more negative experiences related to creative drama learning environment.

According to the data collected with interview on the creative drama method, the students reported that they liked to be taught with the creative drama method and they found it fun and different. In addition, the students stated that the creative drama method helped them to develop their skills of empathy and imagination, to help them narrate the subjects and learn the group work. Similar findings were obtained with the analysis observation data. According to the observation data, the students had fun during the lessons and were willing to participate in the class and group studies. We can claim that these findings resulted from the fact that students played games that attracted their interest during the preparation/warm-up phase of the drama method, real-life stories were told, additionally, students were provided with the opportunities to this their learning on the subject with improvisations, and group-work and collaboration were used.

According to interview data, some of the students reported that they liked the classical music they listened during the practice while some stated that they did not like. Similar results were obtained with the observation data. According to observation data, some of the students did not like classical music and they got bored of it. That students got bored may have resulted from the fact that only classical music was played for students and only improvisation and role-play techniques were used during the practice. For this reason, it is believed that using different genres of music addressing all students during the practice of drama method, and the use of different teaching techniques of drama method (pantomime, dramatization, etc.) can help with the solving of that kind of problems. Additionally, according to observation data, some of students did not want to participate actively in the lessons since they felt anxious and shy. This problem may have resulted from the fact that the work group was formed with volunteering students from four different classes, and they did not know each other before the practice.

Less positive cases were observed about the creative drama-learning environment. Among the obtained positive results are, some students liked having no desks in the creative drama learning environment, and also creative drama learning environment had positive effects on the student-student and student-teacher interaction. More negative cases were observed about the creative drama learning environment, some of which students did not like the noise and having to sit on the floor. According to observation data, it was observed that students intervened with each other, had extra-curricular communication during the classes, there was noise in the class and some students did not want to sit on the floor. Creative drama is one of the contemporary teaching methods based on the constructivist learning theory. Teachers' having difficulty in classroom management and noise in the classroom is among the problems encountered in the constructivist learning environments (Yıldırım & Dönmez, 2008). For this reason, this kind of problems is completely natural. It was also observed that the noise during the practice was not at a level disrupting the teaching of the class. Another problem experienced about the creative drama learning environment was that students did not want to sit on the floor. This must have resulted from the fact that the floor was not covered with any kind of carpet-like material.

The this study investigated the effects of creative drama method on students' self-efficacy towards science learning and found that creative drama method increased students' self-efficacy towards science learning. We can claim that this positive effect resulted from the fact that creative drama method provides students with an equipped learning environment and students do their own learning. This finding is in partial agreement with the findings of the study on the effects of the use of creative drama method in science teaching on the self-efficacy beliefs of pre-service teachers conducted by Hamurcu (2008). Hamurcu (2008) reported a statistically significant difference in only one dimension of self-efficacy scale, while there were no significant differences in other dimensions, though there was an increase in post-test scores compared to pre-test scores.

In this study it was found that creative drama method did not have any significant effects on students' scientific process skills. This finding may have resulted from the fact that the practice lasted for a short period of time. This finding is not in agreement with the findings of the study conducted by Taşkın-Can (2013). Taşkın-Can (2013), who conducted a quasi-experimental study for three weeks, taught the subject of 5th grade light and sound subject with creative drama method on the experiment group, and reported that creative drama method increased students' scientific process skills.

In this study, it was found that creative drama method has positive effects on students' attitudes towards science. It was also confirmed with the data obtained with semi-structured interviews. Below are some student opinions in agreement with this finding.

"…I think it's a great idea. I mean learning this way is great. This helps us let go and recover ourselves. We both have and learn." (S7)

"…I find it good. We had fun during classes. This way, we learned by thinking and building in our mind. It was better. I mean we comprehended the subject." (S5)

We can claim that students developed positive attitudes towards science course since they associated concepts related to states of matter and heat subject with daily life during preparation/warm-up phase of creative method, they could express themselves as they wished during animation phase, and they had a relaxed classroom environment. This finding is in agreement with the findings of previous studies conducted on the effects of creative drama method on students attitudes towards science concepts and subjects (Çokadar & Yılmaz, 2010; Çopur, 2014; Demirağ, 2014; Doğru et al., 2010; Hendrix et al., 2012; Kahyaoğlu et al., 2010; Saka et al., 2016; Şahbaz, 2004; Timothy & Apata, 2014).

Consequently, according to the findings of the this study, in the teaching of 8th grade states of matter and heat unit, creative drama method can be highly practicable in terms of students, it can increase students' self-efficacy and attitudes towards science course, yet had no positive effects on students' scientific process skills. Based on the findings of this study, we can recommend that science teachers can use creative drama method in science teaching by meeting the physical requirements of creative drama learning environment. Teachers can use different creative drama techniques (role-play, pantomime, dramatization, etc.) instead of improvisation or role playing and play music in different styles instead of classical music. Additionally, we can suggest researchers of further studies that they investigate the effects of creative drama method on scientific process skills with longer period studies.

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Appendix-1

Session Plan-I

Lesson	Science
Class	8
Unit	States of Matter and Heat
Subject	Heat Exchange and State Change
Time	40+40
Subject acquisitions	8.6.3.1. He concludes that there is heat exchange during the change of state. It is mentioned that the temperature of the pure substances remains constant during the change of state. 8.6.3.4. He relates the changes in the state of daily life with the heat exchange.
Key Concepts	Temperature, heat, energy, core heat
Course tools	Rope, ball
Learning - Teaching Methods and Techniques	Creative drama method, improvisation, role playing
Preparation/warm-up phase (25 minutes)	The teacher makes warm-up movements with the students. It divides students into 3 groups. Students are reminded of the istop game and the rules of the game that the teacher has designed are explained. A rope is given to each group. All group members must hold the rope with one hand. The student, whose name is said, holds the ball thrown into the air and quickly holds the rope that his group has. The student whose name is said and unable to hold the ball is eliminated. The game continues until one last group remains. If the game lasts long, the group with the highest number of students is announced as the winner. The teacher appears and takes care to be at the same distance to each group. The teacher takes the ball in his hand. He tells the name of a member of the groups throws the ball up and plays the role of a referee in the students' game. At the end of the game, the teacher reminds the students of the movements of solid, liquid and gaseous matter particles. Assuming that each student is a particle in the game, he asks questions to make the conclusion that the student who leaves to hold the ball during the game takes heat and therefore leaves the group. In the meantime, the student, who lost the bond with the teacher group, broke the bond between the particles as a result of the solid substance taking heat and as a result, it became liquid; The student throws the ball in the air and holds the string tightly on the rope of the group, and asks the students to construct the questions that will make the conclusion that the liquid substance turns into solid state by bonding with other particles. In addition, it prepares the ground for the simulation that the energy used by the student to catch the ball thrown into the air is the energy given to the group and that the energy spent to return to the group to hold on to the rope is the heat that the matter gives out. Teacher leaves the group, which is assumed to be solid, to catch the thrown ball, to the event that the solid becomes liquid by taking heat (melting); In the group, which is assumed to be liquid, it likened the phenomenon of a student's throwing the ball up and coming to the group from outside and approaching each other in the group, making the liquid solid by giving heat (freezing). In addition, teacher from a group supposed to be liquid leaves a student to leave the ball to catch the ball thrown, the liquid becomes gaseous by evaporation (evaporation); In the group that is supposed to be gas, a student throws the ball up and comes to the group from the outside, and it is similar to the fact that the people approaching each other even if there is a small amount of gas (condensation). Teacher asks questions to students so that they can make these inferences. In addition, in the group assumed to be a solid, the first main melting point where the student left the group to catch the ball was compared to the first main freezing point on which he was held on the rope when he returned to the group. Likewise, the main evaporation event in which the student leaves the group is likened to the condensation event for the group, which is assumed to be a liquid

	substance. The freezing and melting points and evaporation condensation points are equal for each substance and the point at which the student is separated and the same point when joining the group is explained by the students based on the simulation. As a result of the game, the questions of the group, whose numbers are different from the two groups with different numbers, are quicker and therefore, the assumption that these two groups are solids will have different melting temperatures in both groups. The teacher gives examples of substances with different melting temperatures.
Animation phase (30 minutes)	Students are divided into three groups. Groups are solid, liquid and gaseous substances; They are asked to design and play a scenario within the framework of state changes and the concepts of melting, freezing, evaporation, and condensation that occur during this change. After the students' performances are over, the teacher asks questions of imperfection if there is incomplete learning. It is emphasized subject acquisitions.
Evaluation/discussion phase (25 minutes)	Students are asked to create a circle. Attention is paid to earning subject acquisitions within the framework of the following questions. • What is melting and freezing? • What is the melting point, freezing point, evaporation point, condensation point? • What is the reason why the air gets warm when it is snowing or raining? • What is the reason we cool off after pouring water on concrete in summer? • Pure water normally freezes at 0 oC, but impure water freezes at lower temperatures, what is the reason? • What do you think is the reason for keeping water in barrels when storing large amounts of fruit and vegetables? What is the reason that the roads are salted in the winter?