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RELATIONSHIP BETWEEN MOTOR CREATIVITY AND SCIENCE PROCESS SKILLS OF PRESCHOOL CHILDREN

Münevver Can Yaşar[1], Nezahat Hamiden Karaca[2], Halil Uzun[3*]

Child Development Department, Faculty of Health Sciences, Alaattin Keykubat University, Alanya, TURKİYE[1]

Department of Preschool Education, Faculty of Education, Afyon Kocatepe University, Afyon, TURKİYE[2]

Department of Preschool Education, Kilisli Muallim Rifat Faculty of Education, Kilis 7 Aralık University, Kilis, TÜRKİYE[3*]

munevver2002@gmail.com [1], nhamiden@gmail.com [2], uzunhalil@gmail.com [3*]

*Corresponding Author

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ABSTRACT

This study was conducted to examine the relationship between scientific process skills and motor creativity in preschool children. The study group included 72 children attending kindergartens affiliated to Afyonkarahisar Provincial Directorate of National Education in Turkiye, with normal developmental characteristics, and determined by simple random sampling according to the principle of getting permission from their families. In the study, "General Information Form", "Scientific Process Skills Assessment Scale (SPSAS)" and "Thinking Creatively in Action and Movement (TCAM)" were used as data collection tools. In the analysis of the data obtained; descriptive statistics such as frequency and percentage were used to evaluate the demographic characteristics of children and their families. Pearson correlation coefficient was used to determine the relationship between SPSAS and TCAM. As a result of the study, for the children's points from scales, no relationship was found between SPSAS sub-dimensions, and the fluency and originality sub-dimensions of the TCAM. However, a positive relationship was found between the observation, measurement, communication, prediction sub-dimensions of SPSAS, and imagination sub-dimension of TCAM.

Keywords: Scientific process skills, motor creativity, creativity, preschool education, early childhood development

INTRODUCTION

Is there a relation between the science and creativity? Does science support /influence the creativity or vice versa? In today’s world in which global problems increase with the technological developments, scientific knowledge and creative individuals are more required and answers to these questions emerge as an obligation. This put forwards the necessity of raising children who can produce knowledge, who can retrieve information and take responsibility in their self-learning and can use knowledge in a creative manner in the face of increasingly complex and diverse problems of life. Opinions on science, scientific knowledge and understanding of the nature of science determine how a child summarizes, structures, and processes the knowledge he/she gets from the surrounding environment. Extraordinary performance in scientific fields and technology is mostly considered as the indicator of special scientific talent or capability or creativity. From this point of view, science is an essential field in which children learn scientific concepts, theories and laws and develop the required science process skills required for creativity (Edmondson & Novak, 1993).

Science process skills are the skills which enable the children to discover the meaningful information through experiences and expand the knowledge they gain, improve their learning process, and adapt to life and which increase the permanence of the learning (Carin et al., 2005; Dementiy & Grogoleva, 2016; Duda, Susilo, & Newcombe, 2019; Lind, 2005). Science process skills are defined as thinking skills used to create knowledge, think about the problems, and formulate the results. These skills create the basis for reaching the scientific thinking system and making scientific research and gaining a point of view. Worth (2010), describes science process skills as a part of daily life for children and a method of using science process skills. Children need science process skills to develop a scientific understanding. Due to this reason, American National Science Education Standards research emphasize the necessity of gaining science skills for children as much earlier as possible in order to conduct scientific studies in the following years. (Carin, Bass, & Contant, 2005; Charlesworth & Lind, 2007; Harlen, 2000; Taconis, Ferguson-Hessler, & Broekkamp, 2000; Tu, 2001).

Science process skills are examined in two subgroups. These are basic science process skills and integrated process skills (Martin, Sexton, & Franklin,Mcelroy, 2001). Basic science process skills are making observation, comparison, classification, recording the data, making measurement, using time/space relations, using numbers, making conclusion, communication and making speculation. These skills provide a basis for integrated process skills, (changing the variables and controlling, interpreting the data, making a hypothesis, operational defining, creating a model and making an experiment) which are more complex skills (Brewer, 2007; Carin et al., 2005; Harlen & Qualter, 2004; Lind, 2005). All of these skills have a progressive structure, each one rises above one another (Brewer, 2007). If the basic process skills of children have developed on a stable infrastructure, children will be more successful in applying more complex and abstract skills such as creating hypotheses and distinguishing variables that will help to make an experimentation in later years and develop an understanding of scientific knowledge (Charlesworth & Lind, 2007; Kuhn et al., 2000; Mayesky, 2009). Yamin (2010) states that understanding of scientific knowledge, science process skills and scientific creativity will function as a stimulating forum.

Creativity plays a very significant role in the process of producing scientific knowledge in which science process skills are actively used (Hu & Adey, 2002). In another words, there is a natural integrity between the creativity and science process skills. When the scientists make research, they use their science process skills, creativity, and imagination (Hadzigeorgiou, Fokialis, & Kabouropoulou, 2012). Likewise, children use their science process skills with creative thinking when they take part in research activities. For example, they develop a few possible methods. Determining a problem, making a hypothesis, making an observation and a deduction, selecting a method, determining the variables, controlling the variables and reasoning, developing new methods and solutions for the problems require both scientific thinking and creativity (Özdemir & Dikici, 2017). From this point of view, it is emphasized that early childhood years are of critical importance in the development of creative thinking and cognitive skills. (Gözüm, 2019). By supporting these skills, it will be possible for children to acquire basic scientific process skills such as observation, comparison, classification, measurement, recording, communication, estimation and deduction from an early age in order to gain scientific inquiry skills at a high level. Gaining basic process skills will form the basis for them to use intermediate and advanced scientific process skills such as data collection and organization, inference and prediction in the future. (Kandır, Gözüm ve Türkoğlu, 2018). Observation is the most basic scientific process skill and provides the description of data through the five senses. Children who develop comparison and observation skills start to compare the similarities and differences of objects, allowing them to become aware of the properties of objects. With classification, objects can be classified by color, size, shape, etc. grouping them according to their characteristics. Children who can classify objects according to a feature at an early age can classify more abstract features, thoughts and ideas in later years. Measurement is the ability to make quantitative descriptions indirectly using a measurement term or directly by observation. Communication is all people communicating with each other in various ways. Therefore, communication plays an important role in the acquisition of scientific understanding in early childhood, in which children share their feelings, thoughts and discoveries with each other. (Charlesworth ve Lind, 2007). The acquisition of all these skills takes place in the pre-school period, and for this reason, it can be said that this period is very important.

When studies conducted on science process skills and creativity are examined, it is observed that studies mostly focus on the correlation between science process skills, science education and scientific creativity (Aktamış, & Ergin, 2007; Barrow, 2010; Dikici, Özdemir, & Clark, 2018; Gomes, 2005; Hadzigeorgiou, Fokialis, & Kabouropoulou, 2012; Hu, & Adey, 2010; Hu et al., 2010; Meador, 2003; Özdemir & Dikici, 2017; Schmidt, 2010; Siew, Chong, & Chin, 2014). Even though the correlation between the opinions about the two cognitive variables which are science process skills and scientific creativity are evident, there is no study that statistically examines the strong points of the correlation between the science process skills and motor creativity which is another dimension of creativity. Due to this reason, the predictive power of the science process skills on motor creativity was relationally evaluated.

Motor creativity can be defined as an ability of producing many and original motor response to a stimulus (Wyric, 1968). As cognitive creativity, motor creativity includes fluency, flexibility, and originality criteria (Guilford, 1967; Torrance, 1981). Rationalism expresses the ability of producing many cognitive or motor solutions. Flexibility is the capacity of producing solutions regarding the categories of flexibility, different ideas, or movement. Originality represents the capacity to produce new and unique solutions (Guilford, 1967). Also, motor creativity is comprised of four components such as human body, location, time, and connection (Laban, 1975). Especially when preschool period is considered, the activities including these components, for example, music, dance, drama, and game are a natural learning field for children (Grammatikopoulos et al., 2012; Rebecca, 2011). Creativity covers the scientific processes developed with social interactions, game, and imagination. Creative thinking includes alternative activity that leads new thinking styles and ways for a child (Leggett, 2017). During these activities, as the children can activate their science process skills and retrieve information and structure it, retrieved information can be a strong prerequisite for creativity (Sturza-Milic, 2012). Due to this reason, motor creativity is important part of learning platform of children. In the preschool period, it is easier to observe the motor creativity of the children since they can express themselves better owing to the characteristic (sensorimotor) (Bournelli, Makri, & Mylonas, 2009). Even though motor creativity of children is one of the most appreciated human characteristics, it has been scarcely researched (Renzulli, 2005). When the literature is examined, it has been seen that there are studies on the motor creativity skills of children (Konstantinidou et al., 2005; Zachopoulou, Makri, & Pollatou, 2009), changes in motor developed due to age (Tocci, Scibinetti, & Zelli, 2004; Zachopoulou & Macri, 2005), its relation with game (Trevlas et al., 2003) and its relation with the high level cognitive skills (Delis et al., 2007; Diamond, 2000; Vandervert, Schimpf, & Liu, 2007), which were measured in movement based creativity tasks. However as mentioned previously, the correlation between the science process skills and motor creativity of children in preschool period was not examined. Thus, the degree of differentiation between the science process skills and motor creativity in children is a subject that needs further research. We can examine whether science process skills (observation, comparison, classification, measurement, recording the data, communication, making speculation and making a deduction) specified by Lind (2005) are effective upon the criteria (fluency, originality and imagination) emphasized by Guilford (1967) and Torrance (1981) for motor creativity or not. It is foreseen that this research will make an important contribution to the field when experience of the children in their early years is considered to be significant for their learning process in following years (Mayesky, 2009; Worth & Grollman, 2003).

METHODOLOGY

Model of the Research

In this study, which aimed to analyze the correlation between science process skills and motor creativity in preschool children, correlational survey model was used. Correlational survey model is the research model which measures if two or more variables are related or which determine the level of the relation (Karasar, 2013; Büyüköztürk, 2017).

Study Group

In the study, which was carried out to examine the correlation between scientific process skills and motor creativity in preschool children, the study group was determined using the appropriate sampling method. Appropriate sampling method is the selection of the sampling from easily accessible and applicable units due to such limitations as time, money and labour force (Büyüköztürk et al., 2008). Based upon this, a preschool, thought to represent the population of the study, has been selected from the preschools affiliated with Provincial Directorate of National Education. 72 children, who continue to study in this preschool providing convenience in terms of transportation, time and economy and who are normally developed, determined with random sampling method and principle of volunteering and parental consent, were included within the scope of the study. The research was conducted at the end of fall term of 2019-2020.

It has been determined that 41,7 % of the children included in the research are female, 58,3% of them are male, 55,6 % of them are the first child, 22,2 % of them are middle child in the family, 22,2 % of them are last child in the family. 30,6 % of the mothers of the children included in the study are between the age of 25-30, 29,2 % of them are between 31-36, 18,1 % of them are over 37; 15,3% of them are graduates of secondary school, 29,2 % of them are graduates of high school and 55,6% of them are graduates of university; 52,8 % of them do not work, 44,4 % of them work. 5,6 % of the fathers of the children included in the study are between the age of 25-30, 48,6 % of them are between the age of 31-36, 45,8 % of them are at and over the age of 37, 12,5 % of them are graduates of secondary school, 30,6 % of them are graduates of high school and 56,9 % of them are graduate of university, 91,6 % of them work in a regular work and 8,4 % of them do not work.

Data Collection Tools

In order to collect data, "*General Information Form*" was used; while "*Science Process Skills Assessment Scale"* was used to determine the science process skills and "*Thinking Creatively in Action and Movement"* was used to examine the motor creativity skills.

General Information Form (GIF): The form which developed by the researchers includes questions aiming to determine the gender, birth order of the children, age, educational status and working status of mothers and fathers. GIF was filled by the researchers depending upon the information in the personal development file of the children with permission of school management, teachers, and parents.

Scientific Process Skills Assessment Scale (SPSAS): SPSAS was developed by Tekerci and Kandır (2018). During the scale development phase, a wide literature review was first conducted by Tekerci and Kandır (2018) and created an item pool. The created items were submitted to six academician and a preschool teacher for content validity. Content validity index (CVI) calculated, and it was found to be 0.99. These values revealed that all items in the scale were required, and content validity was provided. The items, which were arranged and finalized as a result of statistical analysis and expert opinions, were applied on 89 children through teacher observations. The data obtained as a result of observing the children were used for reliability analysis during the SPSAS development process. Evaluation of the scale was made in double scoring as Yes/No in the individual evaluation form. Scoring was evaluated as Yes (1)/ No (0). The sub-dimensions of the SPSAS were arranged in 8 sub-dimension and 79 items as *Observation, Classification, Measurement, Record, Communication, Conclusion and Estimation* Sub-dimensions. The reliability of the SPSAS was examined with KR-20 co-efficient in terms of internal consistency. According to the results of KR-20 co-efficient, KR-20 value of the observation sub-dimension was found out to be 730, KR-20 value of the comparison sub-dimension, 770; KR-20 value of the classification sub-dimension, 870; KR-20 value of the measurement sub-dimension, 680; KR-20 value of the record sub-dimension, 770; KR-20 value of the communication sub-dimension, 770; KR-20 value of the conclusion sub-dimension, 770; KR-20 value of the estimation; 810. After all scale development stages, it was determined that SPSAS which developed in a context of doctoral dissertation can be used in the evaluation of the science process skills of 48-66-month-old children and the validity and reliability results of the scale were found out to be in high level. This scale was developed to measure the scientific process skills of preschool children and has been used in many scientific studies (Çilengir Gültekin, 2019; Gill, 2019; Hasanah & Shimizu, 2020; Ormancı & Çepni, 2019; Ünal, 2019; Ünal & Aksüt, 2021).

Thinking Creatively in Action and Movement Test- (TCAM): TCAM was developed by Torrance (1981) and adapted to Turkish by Karaca and Aral (2017). The test was designed to be applied to children, who are between the age of three and eight individually, with the four different activities prepared to evaluate the motor creativity skills of the children. TCAM examines the three sub-dimensions of the creativity, which are fluency, originality and imagination. Fluency evaluates focusing on finding another way of discovering (practice) a talent; flexibility evaluates making changes in different ways easily; originality evaluates coming up with extraordinary and new ideas. This test is comprised of four activities. First, third and fourth activity aims to determine the sub-dimension of fluency and originality; the second activity determines the sub-dimension of imagination. Test is individually applied to children and implemented. Each activity is evaluated considering all evaluation criteria into consideration. Test evaluation is made with the calculation of total scores of fluency, originality and imagination and standard scores, corresponding to the total scores. The second activity is scored during the second activity, while other three activities are evaluated immediately after the implementation of the test. Total score collected from all the criteria in the statistical evaluation gives information about the level of the motor creativity. In addition, it is recommended to apply the test in a comfortable environment, to remove the distracting stimuli from the environment as much as possible, and to apply the test individually or in groups of three or four participants so that they are not affected by each other. Torrance (1981) conducted the validity and reliability study of TCAM with twenty children in the age group of 3-5, and test-retest reliability coefficient was reported as .84 and inter-rater reliability as .90. Karaca and Aral (2017), found in their validity and reliability study that the reliability coefficient was .74 for TCAM.

Data Collection Process

In this research aiming to determine the correlation between science process skills and motor creativity in preschool children, firstly, studies were carried out to determine the study group. Ethically necessary permissions were received to determine the study group from Afyonkarahisar Directorate of National Education. The study was carried out at the end of the fall term of 2019-2020 academic year with the purpose of observing the science process skills. Before the application of the measurement tools with 72 children to be included in the study group, researchers made a meeting with the teachers of four classes taking part in the research and informed about the aims of the study and principles of applying the data collection tools. Later, in a session accompanied by teachers, as well, aims of the study has been told to the families, who gives consent for participation of their children voluntary in the research. SPSAS was applied to the four classes by the children's teachers, and TCAM was applied to these four classes (72 children) by a researcher. The application principles and application time of the SPSAS which was filled out by teacher observations, were explained to the teachers. One week after the teachers filled out the SPSAS separately for each child, the researcher went to the kindergarten for one hour a day for a week in order to meet the children and get the children used to the researcher. Researcher attended routine activities in the kindergarten together with the children. Then, the researcher individually applied TCAM to each child between 15-20 minutes. In addition, the researcher was filled GIF in depending on the information in the personal development files of the children.

Data Analysis

In the analyses of data, descriptive statistics such as frequency and percentage were used to evaluate the demographic characteristics related to the children and their families. Pearson Correlation Coefficient was used to determine the correlation between the scores of SPSAS and TCAM. Correlation analysis is a statistical method used to test the linear relationship between two or more variables and to determine the degree of relationship. In the correlation analysis, the degree of relationship is shown by the correlation coefficient (r). This coefficient can take values between -1 and +1. The magnitude of the absolute value of the correlation coefficient indicates the strength of the existing relationship. The most commonly used correlation analyzes in the literature are Pearson and Spearman correlation analyzes. It was found that the values obtained were between -1.5 +1.5 and showed a normal distribution, and in this framework, Pearson correlation analysis was performed in the research. (Benesty, Chen, Huang, & Cohen, 2009; Genceli, 2007; Sedgwick, 2012).

FINDINGS

When Table 1 is examined and when scores of SPSAS and TCAM were compared at 95 % significance level ($p<.05$); positive correlation was determined between the imagination sub-dimension of TCAM and the observation sub-dimension of SPSAS ($r=-.235$, $p=.047$), measurement sub-dimension ($r=-.246$, $p=.037$), communication sub-dimension ($r=-.238$, $p=.044$) and speculation dimension ($r=-.277$, $p=.018$). No significant correlation was found out between the fluency and originality sub-dimensions of TCAM and sub-dimensions of SPSAS. As a result, it can be said that the higher the imagination of children (which is one of the creative movement skills), the higher the scientific process skills of observation, measurement, communication, and prediction skills, the higher. And these sub-dimensions affect each other in a positive way.

Table 1.
Pearson Correlation analysis of SPSAS and TCAM

SPSAS	TCAM	n	r	p
Observation		72	.071	.552
Comparison		72	.075	.533
Classification		72	-.002	.984
Measurement	Fluency	72	.084	.482
Recording		72	.073	.543
Communication		72	.020	.870
Making speculation		72	.136	.255
Making a deduction		72	.109	.361
Observation		72	.085	.478
Comparison		72	.083	.488
Classification		72	-.049	.680
Measurement	Originality	72	-.075	.530
Recording		72	.042	.724
Communication		72	-.023	.850
Making a speculation		72	.038	.753
Making a deduction		72	-.010	.935
Observation		72	.235	.047*
Comparison		72	.071	.555
Classification		72	.127	.289
Measurement		72	.246	.037*
Recording	Imagination	72	.164	.168
Communication		72	.238	.044*
Making a speculation		72	.277	.018*
Making a deduction		72	.131	.272

DISCUSSION, IMPLICATIONS AND CONCLUSION

Interaction of the individual with his/her environment starts at the moment of birth and increases rapidly with growth. For example, as children discover their environment starting from birth, they learn to give different reaction to different objects and remember these reactions (Micklo, 1995). Questioning the reasons of the events they observe with curiosity is among the most prominent characteristics of the children in preschool period. Since the children are curious, have strong imaginative power, they are investigative and questioning in this period, learning process of child based upon doing and experiencing should be considered. Because science education in preschool period should focus on satisfying the curiosity of children rather than transferring information. In science education, children need to be given opportunity to develop their research, examination and observation skills and learn how to think in scientific manner based upon strong scientific basis. The task of a teacher should be to enable them to make research and create a suitable environment for this rather than teaching the information to the children (Aktaş-Arnas, 2002). Science activities have a very important role in enabling the children to develop a positive attitude towards science and scientific ideas (Akman et al., 2010) and develop scientific process skills required for creativity. Lubart (1994) stated that problem solving which is one of the science process skills, can lead to creativity and if there is a problem, this will increase the probability for the creativity to emerge (Aktaş-Arnas, 2002; Kefi, Çeliköz, & Erişen, 2013). The child is interested in science with an innate curiosity. Recently, educationalists and researchers are seeking for new paths to support the teachers in preschool education period (Alisinanoğlu et al., 2012). Based upon all these, this study was carried out to analyze the relation between the science process skills and motor creativity in preschool education. As a result of the study, no relation was found out between the sub-dimensions of science process skills and the fluency and originality sub-dimension of the TCAM. The reason for this may be that there is a positive relationship between fluency and originality, as revealed by Storme et.al (2017) research. While fluency is defined as processing capacity (Kuhn & Holling, 2009) and the ability to quickly evaluate the relationship between terms (Vartanian, Martindale & Matthews, 2009), originality is defined as the ability to solve problems (Abdulla, Paek, Cramond & 2020). However, positive correlation was found out between the observation, measurement, communication, and speculation, which are the sub-dimensions of science process skills and imagination, which is the sub-dimension of TCAM. When the literature was examined, no previous study was found out regarding the impact of the creativity factors in action and movements upon the science process skills of children. Within this frame, this study is considered to make a positive contribution to the literature and be a pioneer for other studies. In general terms, there are many research handling the relation of the creativity with the science process skills and reporting the positive impact of the creativity upon the science process skills (Aguilar & Pifarre-Turmo, 2019; Aslan, Aktan, & Kamaraj, 2013; Aydın-Ceran, 2010; Daud et al., 2012; Demirci, 2007; Denervaud et al., 2019; Hadzigeorgiou, Fokialis, & Kabouropoulou, 2012; Kind & Kind, 2007; Kurtuluş, 2012; Lambert, 2019; Sedef, 2012). Also, some research stated that, some educational programs such as STEM which develops scientific process skills were direct practice for developing cognitive, affective and psychomotor aspects. In addition, science process skills can also enhance students' creativity through motor skills and motor activity throughout the project (Lestari, Sarwi, & Sumarti, 2018; Omar et al, 2014). Within this context, it is thought that creativity will lead to similar positive results in action and movement dimension.

Creativity, which is the innate characteristic of an individual, can be developed (Andreasen, 2009). When the characteristics of creative individuals are examined, these individuals can handle a case/phenomenon more differently than the other individuals, bring many solutions for the problems and can solve the problems more easily (Torrance, 1981; Özözer, 2005). When examined from this point of view, it can be said that creative thinking and scientific thinking are closely interlinked. Because individuals thinking creatively in terms of science can find more solutions more easily (May, 2015).

Movement is the first and basic way children can express themselves and their emotions about other individuals and they use in non-vermal communication. Hinitz (1980) says that movement is a way of knowing, discovering and self-evaluation and self-expressing (Pica, 2000). Torrance (1981) stated that children need to develop creative mechanisms to cope with the problems they are not familiar with in daily life and the movement is the best method to put forward it. It is stated that there is a direct correlation between the creative movement and creative thinking (Ruiz, 1995; Justo, 2008) and divergent thinking lies behind the creative thinking and an individual moves from the known to unknown and reaches a new solution not previously encountered through divergent thinking (Guilford, 1967; Torrance, 1981; Wang, 2003, Aral & Yıldız-Bıçakçı, 2014). Torrance (1981) states that divergent thinking covers such dimensions as fluency, originality, and imagination. Basing upon this, with TCAM, it is aimed to express the creativity in movement in children with the sub- dimensions of fluency, originality, and imagination. Fluency can put forward many opinions related to the same stimuli (Isbell & Raines, 2003). Children can learn how to cope with many probabilities and alternatives using their science process skills to find a solution when they face a problem and also find many solutions for the problems. Within this context, the child needs to use his science process skills and creative thinking skills at the same time to solve a problem. It is stated that peculiarly the preschool period is a very critical period for the development of the child, and children are innately creative (Duffy, 2006) and imaginative skills, which form the basis for creative thinking, are developed in the preschool period (Torrance, 1981), due to this reason, children can exhibit imaginative skills in higher levels. Andreasan (2009) and Özözer (2005) emphasized that children have a very significant level of potential and the number of solutions they find for the problems they encounter are higher. Originality, another sub-dimension of TCAM, means individualism, oneness, exceptionalism, privilege, and distinctness (Isbell & Raines, 2003). The originality has a very important role in creativity, which is the talent of producing new idea rather than what is already known and learnt. But no statistically significant correlation was found out between the sub-dimensions of science process skills and fluency, originality sub-dimensions of the TCAM. According to the results of the research, it is impossible to make a correlation between the scores of the students related to the fluency and originality qualities of children under the creativity section and science process skills. Creativity occurs in different ages and in different fields in individuals. It is emphasized that individuals need to have a different environment where they can think differently, express what they think freely and implement to discover and improve the creativity (Aral, 1999). Due to this reason, teachers and parents can be recommended to carry out activities in the preschool period that will help to develop the science process skills and skills of thinking creatively in action and movement and create environments for children.

In terms of the limitations of the research, the fact that 72 children studying in an independent kindergarten in city center of Afyonkarahisar Turkiye might have affected this result.

Positive correlation can be found out between the fluency and originality dimension in the within the frame of creativity in action and movement and science process skills as a result of the repetition of the research with the study groups in different and large scale. In the research results, positive correlation was found out between the observation, measurement, communication, and speculation which are among the sub-dimensions of science process skills and imaginative power, sub-dimension of creative thinking in movement and action. It can be said that the imaginative power, the sub-dimension of creative thinking in action and movement, can be developed in classroom and out-of-class environments child attends with motor skills. Therefore, Civelek and Akamca (2018) states that outdoor activities, in which motor skills are more used, are more effective than the classroom activities in developing the observation, classification and measurement skills of children. In the study of Karaca et. al., it was found that the mother's age and profession best predicted the sub-dimension of fluency and the mother's profession best predicted the sub-dimension of novelty. Scibinetti, Tocci and Pesce (2011) which aimed to determine how common and different points related to motor creativity and creative thinking and executive functions affect children and which was conducted with children aged between 7-8, positive correlation was found out between creative movement and creative thinking, rationalism and imaginative power. Examining the correlation between motor creativity and motor information in preschool children aged between 6-6,5, Sturza-Milic (2012) found out that children with higher motor information level got higher scores than the children with lower levels and it is very important to provide an environment where children can express their motor creativity. Within this frame, educationalists are recommended to creative environment for children to support their science process skills. Furthermore when children learn the scientific concepts in preschool with curiosity, need to discover their natural environment and by doing and experiencing, they will gain skills in making observation, asking question, making speculation and perceive cause-effect relation (Brever, 2007; Lind, 2005). Most of the education programs which are prepared for children and in which active participation is enabled with the motor skills of children can contribute to the science process skills of the child. In PrePS (Preschool Pathways to Science) program prepared in accordance with the constructivist approach based upon the opinions of Piaget and Vygotsky, it is stated that younger children below the age of 4 and 5can gain the abilities to make observation, make speculation, control their estimations, and record the observation and gain the abilities expected from scientists and many observers (Gelman & Brenneman, 2004). Also, in accordance with this result, it can be said that the higher the imaginative skills of children are, the higher their observation, measurement, communication, and estimation skills are. Hu and Adey (2010) define the imaginative skill in children as a sub-dimension of creative science process skills in their research on creativity in science process skills. This imagination described as the impulsive power behind the creativity is stated as the prerequisite for creativity. Because individual starts to question with the imagination, which is a necessary function for life and adds a new dimension to the current case/event/object, therefore realizes himself/herself (Kartal, 2014). Especially preschool children have a deep imaginative power. When children face a problem, they find solutions for the problem in their imaginative world and even they re-attempt. Therefore, children using their imagination can produce unusual and extraordinary solutions and can learn how to cope with the problems they face with the solutions they produce (Harmanlı, 2002). At the same time, high level of imagination, which is a prerequisite for creativity, contributes to the child in terms of many aspects. For example, children in preschool are more active as part of their nature and they express themselves with movement. According to Fan (2017), the imagination they reflect to their movements functions to find a solution for the problems they face in science process and supports their science process skills. Scientific process skills are composed of such processes as observation, comparison, classification, measurement, recording, communication, speculation and making a deduction. Therefore, their imagination and motives to act enable them to discover, observe, speculate, making experiment, measure and share the conclusions they get with their environment (Hansel, 2017). Children whose imaginative skills are supported observe the cases around them using their five basic sense organs, recognize the mistakes or deficiencies considering the details. They collect many qualitative and quantitative data about the variables examined during the observation and make measurement. They use their communication skills to speculate about the measurement results they get with the collected data. In this regard, as a result of the research, it is not surprising that children with higher observation, measurement, speculation and communication sub-dimensions of science process skills have higher level of imaginative skills. Also, according to Lin, it has been reported that children with higher creative skills are socially stronger and more open to communication (Lin, 2019).

Since the children in preschool period are curious, investigative, questioning and have strong imaginative skills, they need to learn by doing and experiencing. In preschool period, children need to develop their investigation, questioning, critical thinking, problems solving and decision making, be lifelong learners and they need to be developed in terms of knowledge, understanding, attitude and value related to the science process skills. Accordingly, teachers can be recommended to design activities which enable certain action and movements in children to develop creativity and at the same time in which children can use or improve their science process skills. Studies such as conferences and seminars can be organized to increase the awareness of teachers and educators about Creative Thinking in Action and Movement and Scientific Process Skills. It is thought that the repetition of this study with different sample groups and studies involving the effects of variables belonging to the child and parents will contribute to the literature in order to provide an idea for future research. In addition, when the study group attend to the first grade of primary school, a comparison can be made using the same measurement tools and it is thought that the findings obtained from this comparison will guide teachers / educators in their practices about motor creativity and scientific process skills.

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