TÜRK FEN EĞİTİMİ DERGİSİ
Yıl 6, Sayı 3, Aralık 2009

Journal of
TURKISH SCIENCE EDUCATION
Volume 6, Issue 3, December 2009

http://www.tused.org

A Study on the Effect of Science Activities on Fostering Creativity in Preschool Children

Rasol ABDULLAH MIRZAIE[1]✉, Farideh HAMIDI[2], Ashraf ANARAKI[3]

[1] Assist.Prof.Dr., Shahid Rajaee Teacher Training University, Faculty of Science, Dept.of Chemistry, Tehran-IRAN
[2] Assist.Prof.Dr.,, Shahid Rajaee Teacher Training University, Faculty of Education, Dept.of Psychology, Tehran-IRAN
[3] Master Student, Shahid Rajaee Teacher Training University, Faculty of Science, Tehran-IRAN

Received: 07.12.2008 **Revised:** 17.10.2009 **Accepted:** 21.10.2009

The original language of article is English (v.6, n.3, December 2009, pp.81-90)

ABSTRACT

Although creativity is often viewed as being associated with the notions of "genius" or exceptional ability, it can be productive for educators to view creativity instead as an orientation or disposition toward science activity that can be fostered broadly in the general school population. In this research, we aim to show the effect of science activities on creativity improvement of male preschool children. For this purpose, 30 children randomly were selected, and were indiscriminately assigned to experimental and control groups. Measurement was done with the Torrance's Test of Creative Thinking (TTCT, Figural form B) which has a high validity and reliability. In the experimental group, ten simple science activities were done in 5 weeks by the brainstorming teaching method. After the educational period, experimental and control groups were assessed again with the TTCT. The T-test was used for the analysis of data. Our result showed a significant difference between experimental and control groups and in the experimental group before and after the education at TTCT scores. In fact through the use of science activities and brainstorming teaching method, teachers can increase their children capacity with respect to the core dimensions of creativity; fluency, flexibility, originality and elaboration.

Keywords: Preschool Children; Science Activities; Creativity, Fluency; Flexibility; Originality; Elaboration.

INTRODUCTION

1)What is Creativity?

Theories and ideas about creativity stem from far back in history, unsurprising as Ryhammer and Brolin (1999), point out, given that the development of new ideas and original products is a particularly human characteristic. The notion of 'inspiration' or 'getting an idea' (ibid, page 260), is found in the Greek, Judaic, Christian and Muslim traditions and is founded on the belief that a higher power produces it. During the Romantic era in Europe, the source of inspiration and its artistic expression was seen as being the human being. During this era, originality, insight, the creative genius and the subjectivity of feeling were highly valued. From the end of the nineteenth century, people began to investigate the question of what fostered creativity.

The first systematic study of creativity was undertaken by Galton (1869). His focus was

✉ Corresponding Author email: ra.mirzaei@srttu.edu

'genius' and there followed a hundred or so studies on this theme, defined as achievement acknowledged in the wider public arena. This line of investigation remained prevalent into the 1920s, when the focus in psychology shifted to the investigation of intelligence. Although Binet's work included some investigation of the creative side of intelligence, the major study of creativity in psychology occurred in the 1950s.

Some powerful descriptions of creativity include the following:

Dictionaries define "creativity" with words like "originality, expressiveness and imagination." To take this creativity to practice requires the word "create," which is defined as "causing to exist" or "bringing into being." (Selker, 2005). Creativity is a broad and important area (Heleven, 2003) bringing new ideas and improvements to people's lives. While some still hold that teaching creativity is dubious (Carles, 2003), Nickerson's work reports on teaching and measuring creativity improvement over an extended period of time. He demonstrates that people continued using the acquired creative process and even applied it in new domains (Sternberg, 1999).

Torrance (1969) saw creativity broadly as the process of sensing a problem, searching for possible solutions, drawing hypotheses, testing and evaluating, and communicating the results to others. He added that the process includes original ideas, a different point of view, breaking out of the mould, recombining ideas or seeing new relationships among ideas. Creativity is commonly associated with and displayed in the development of novel, original and unique ideas or products (Gallagher and Gallagher, 1994).Torrance (1996) similarly suggests the expression of novel ideas is an indicator of divergent thinking and creativity. Creativity includes discoveries of new knowledge in science and medicine, invention of new technology, composing beautiful music, or analyzing a situation (e.g., in law, philosophy, or history) in a new way (Standler, 1998). Creativity is an imaginative activity fashioned so as to produce outcomes that are both original and of value (Feasey, 2005: 2). After Guilford, Getzels and Jackson (1962); Taylor (1956); and Torrance (1962) focused their work on evaluating and developing creativity in children. More recently, however, teachers have preferred to use a variety of means to assess creativity, by monitoring pupils' work, behavior and what they say (Fryer, 1996).

In education in the United Kingdom, for example, Beetlestone (1998) focused on creativity in the early years' classroom, Woods (1995), Woods and Jeffrey (1996), explored teacher creativity, and Craft (1996) looked at how to nourish the creative teacher. Beetlestone (1998) documents practical strategies for fostering creativity within the early year's curriculum, using examples from a large variety of early year's contexts. Woods and Jeffrey work through in-depth case studies to document ways in which a small group of teachers operate creatively in the face of a wider context which arguably suppresses the creativity of the teaching profession. Craft (1996) explores in depth the perspectives of eighteen educators involved in a holistic postgraduate course specifically designed to nurture their own creativity. Sternberg and Lubart (1995) have written about the fluency of ideas.

The classical and contemporary views of creativity differ with respect to the nature of such aspects of creativity as "insight" and with respect to the distribution of a capacity for creative activity within the population. But there is little disagreement between these views of creativity on the centrality of the generative processes of problem posing and problem solving in creative activity.

2) Science in Preschool Classroom

It is known that the innovations and inventions in applied sciences both have important contributions to the development of countries and lay the basis for scientific and technological advancements (Harmander & Çil, 2008). This results in countries' attaching more importance to applied sciences and their teaching at schools. For this purpose, countries attempt to improve science-teaching programs, enhance the qualifications of teachers, and equip the classrooms with required tools and instruments (Özmen, 2004). A good science education program focuses on helping all students gain a solid foundation of core science knowledge and skills. What is essential

for a good science education program is clear and specific learning goals for all students; textbooks and tests that are carefully aligned to those goals; a coherent, well-designed K-12 curriculum; teachers who have the resources and skills to teach effectively; and communities and families that are committed to excellence. With these basics in place, our schools, our teachers, and our students can all succeed. Science is all around you. Your backyard, your kitchen, and other areas around your home provide natural "laboratories" for children. Children are curious; exploring with science can be lots of fun while also teaching them a great deal about themselves and their world (AAAS, 2003). The children at the ages of 3–6 need science education so that they could learn about the environment they live in, natural occurrences, and generate original ideas. Özbey and Alisinanoğlu (2008) believe that for science education primary school period is too late. Science education is necessary in the pre-school period for the children to improve their creativity and learn about different perspectives. Moreover, science education in the pre-school period forms the basis for the science education at primary school and that's why it is necessary in the early years (Özbey & Alisinanoğlu, 2008). The children who enjoy science activities in the pre-school period are expected to develop a positive attitude towards science in their future lives (Çamlıbel Çakmak, 2006).

The initiative is built around four key ideas: (1) that science education is for every child, (2) that science is everywhere in our everyday lives, (3) that parents and families can make a huge difference in helping their children with science education, and (4) that science is a lot of fun.

These activities are intended to show your child that:

~Science plays a part in many everyday activities;

~Science is used in many places and environments;

~Learning science doesn't require expensive equipment and complicated experiments.

~Science responds to children's need to learn about the world around them.

~Children's everyday experience is the foundation for science (Conezio & French, 2002).

Several theoretical assumptions that are widely shared by early childhood professionals underlie these goals:

• Young children are active, self-motivated learners who learn best from personal experience rather than from decontextualized linguistic input (French, 1996; Nelson, 1996).

• Young children construct knowledge through participation with others in activities that foster experimentation, problem solving, and social interaction (Chaille & Britain, 1997).

• Young children should be allowed to exercise choice in the learning environment (Bredekamp & Copple, 1997).

• Children's social skills develop best when they have opportunities to learn and practice them in the context of meaningful activities (Katz & Mcclellan, 1997).

•The children who enjoy science activities in the pre-school period are expected to develop a positive attitude towards science in their future lives (Çamlıbel Çakmak, 2006).

Children should be actively involved in exploring phenomena that interest them both in and out of class. These investigations should be fun and exciting, opening the door to even more things to explore. An important part of students' exploration is telling others what they see, what they think, and what it makes them wonder about. Children should have lots of time to talk about what they observe and to compare their observations with those of others (AAAS, 1993). Preschool level is the period when children make the most significant progress in the development of cognitive, physical, linguistic, emotional, and social (Şahin, 2000). Ayvacı, Devecioğlu and Yiğit (2002), carried out a study with the result that the teachers found themselves not effective enough in conducting the science activities (quoted in Karaer & Kösterellioğlu, 2005). A similar study was carried out by Karaer and Kösterellioğlu (2005), in provincial Amasya and Sinop to identify the techniques used by preschool education teachers to teach the concepts of science and concluded that the teachers found the science education they had received insufficient and they could not develop themselves professionally due to a number of reasons, among which they listed were that there were no seminars or in-service training activities or that they could not attend the activities. Thus, the quality of education provided in this period is of great importance. Using child curiosity and questions asked by children is the key to increase the quality of education (Bal, 1993; Şahin &

Ökçün, 2000; Aktaş Arnas, 2002; Ardaç, 2003).

The purpose of this study is to investigate the effect of science activities on creativity improvement of male preschool children.

3) Method Used in Instruction of Science Activities

In this work for introducing science activities to children, brainstorming teaching method was used. Brainstorming is a group technique for generating new, useful ideas and promoting creative thinking. Brainstorming is a process for developing creative solutions to problems. It works by focusing on a problem, and then deliberately coming up with as many solutions as possible and by pushing the ideas as far as possible. One of the reasons it is so effective is that the brainstorming not only comes up with new ideas in a session, but also sparks off from associations with other people's ideas by developing and refining them. It can be used to help 1) define what project or problem to work on, 2) to diagnose problems, 3) to remediate a project by coming up with possible solutions and to identify possible resistance to proposed solutions (Alva, 2000).

The use of brainstorming instructions is essential to the production of a large number of good ideas. Most brainstorming instructions are based on Osborn's original instructional components (1963, p.156), which are quoted directly below: (1) Criticism is ruled out. Adverse judgment of ideas must be withheld until later. (2) "Free-wheeling" is welcomed. The wilder the idea, the better; it is easier to tame down than to think up. (3) Quantity is wanted, the greater the number of ideas, the more the likelihood of useful ideas. (4) Combination and improvement are sought. In addition to contributing ideas of their own, participants should suggest how ideas of others can be turned into better ideas; or how two or more ideas can be joined into still another idea (Rossiter & Ilien,1994). Brainstorming is a FUN way to generate a lot of ideas quickly. Because it is simple and easy to use, however, don't lose sight of the fact it can be a very powerful tool.

METHODOLOGY

This research is considered as an experimental design known as pre and post test design with control group. We randomly selected a group of 6 years old boys from one of the preschool centers of region 4 of Tehran and classified them into two fifteen-student groups, i.e. experimental and control groups. For both groups, first, a pretest was performed with Torrance creativity test and their results considered as basic creativity for both two groups. In the next stage, 10 science activities were performed for 5 weeks in the experimental group. In each week, two activities were performed in two separate days in the form of 3 classes including 5 persons in each class. During experiments, educator by designing questions related to the activity leads to stimulate curiosity in the children. That raises attention of kids to do the activity. Through brainstorming teaching method, children expressed their ideas in freedom condition and participated in development of issues in touch with the activity. One week after the last experiment, both groups were retested through TTCT. In our study, science activity is considered as independent variable and creativity growth in children is considered as dependent variable. The analysis of the data was carried out using the SPSS 11.5 software.

A) Study Group

30 six years old preschool boys were selected as a statistical universe from centers of region 4 of Tehran in 2008-2009 school years. These samples were chosen through simple random method.

B) Instrument

a) Torrance's Test of Creative Thinking

Our instrument was the Torrance's Test of Creative Thinking (TTCT). We used TTCT because it can be used from preschool up to graduate students. However, it is easy and amusing for children.

Also, it is a useful screening instrument in order to identify high as well as low creative potential (Bermejo, 2005). Torrance (1966; 1974), described four components by which individual creativity could be assessed:

fluency: the ability to produce a large number of ideas
flexibility: the ability to produce a large variety of ideas
elaboration: the ability to develop, embellish, or fill out an idea
originality: the ability to produce ideas that are unusual, statistically infrequent, not banal or obvious.

Not only TTCT is the most widely used test to measure creativity, but also its use is supported by more evidence of validity than any other creativity test (Khatena, 1989). The TTCT has been translated into 35 languages (Millar, 2001).

The aim of the test was used to evaluate creativity among the children and adolescents. The test consists of two subtests (verbal and figural), each of which has two forms (A and B). According to the TTCT figural manual (Torrance, 1966; 1974), the mean reliability coefficients for the figural tests are: fluency, 0.96, flexibility, 0.94, originality 0.86, and elaboration, 0.91.Students give multiple answers to verbal and figural problems that are marked according to fluency, flexibility, originality and elaboration. In this study the test of figural expression was used to evaluate the level of imagination demonstrated by drawing pictures. In this study, we used the figural form B that includes three subtests: (1) picture construction; (2) picture completion; and (3) circles.

In the first subtest, picture construction, the child was asked to make a picture from the pattern given. It is a piece of colored sticky paper, in bean shape. The abilities that were assessed with this first test are: (a) originality, and (b) elaboration.

The second subtest, picture completion, consisted of 10 lines, a starting point that the child had to use to draw different pictures and to give the pictures a title. What are valued are the elaboration; originality; flexibility and fluency.

The third and final subtest, circles, consisted of 30 circles. The aim was to make as many pictures as possible using the 30 pairs. Fluency was assessed by the aptitude for making multiple associations from a single encouragement, flexibility, from the aptitude for originality and elaboration (Torrance, 1974).

b) Simple Science Activities

In this work, we used some scientific activities in chemistry which were attractive for doing and were found in any kitchen.

The activities are: 1- acid or alkaline that child will observe solutions changing colors.2- volcano that the child will simulate a chemical reaction. 3- Dirty water that the child will pollute water and then attempt to clean it and will discuss environmental practices. 4- Dissolving particles that the child will observe particles dissolving and will improve observation skills. 5- Bouncing egg that the child will observe a transformation of an egg shell. 6- Carbonated rice that the child will observe rice moving up and down and will enlarge vocabulary. 7- Crystals that the child will make crystals and will observe a transformation. 8- Curds and whey that the child will make curds and whey and will improve use of language. 9-float or sink that the child will discover whether objects float or sink and 10 – making bubble that the child will make bubbles with longer insolubility time (Matricardi, 2005).

FINDINGS

For studying hypothesis with regard to variable nature, T- test is used as one of the statistical inferential methods for comparison of the pre and post test results. For facilitating analysis of data and decreasing statistical error, Excel and SPSS softwares were used. Descriptive indices of this research included average and standard deviation of the scores in pre and post test (Table 1).

Table 1. *Pre & post test descriptive data of Torrance's Test of Creative thinking in experimental and control groups*.

Test	Group	Fluency		Flexibility		Originality		Elaboration	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Pre-Test	Experimental	8.87	4.27	7.33	3.66	7.4	4.67	37.93	21.83
	Control	11.47	3.44	9.13	2.45	7.47	5.01	37.73	14.54
Post-Test	Experimental	14.93	2.89	12.6	2.41	13.67	7.04	55.07	30.77
	Control	11.86	3.78	9.87	2.67	8.07	4.013	34.13	16.18

Pre and post test dimensions of TTCT scores are calculated in experimental and control groups individually. Then, subtraction between obtained scores in mentioned groups are worked out separately. As shown in Table 2 and Figure 1, it was found from T-test, the difference between experimental and control groups in dimensions of TTCT are significant.

Table 2. *Mean standard deviation and result of independent T-Test for comparison difference scores in pre& post tests between experiment and control groups*

Dimension	Group	Mean	Std. Deviation	t	frequency	significance
Fluency	Experimental	6.07	2.79	5.46	28	0.0001
	Control	0.40	2.90			
Flexibility	Experimental	5.27	2.84	4.58	28	0.0001
	Control	0.73	2.26			
Originality	Experimental	6.27	5.32	3.66	28	0.0001
	Control	0.60	2.78			
Elaboration	Experimental	17.13	16.51	4.16	28	0. 001
	Control	**3.6**	**10**			

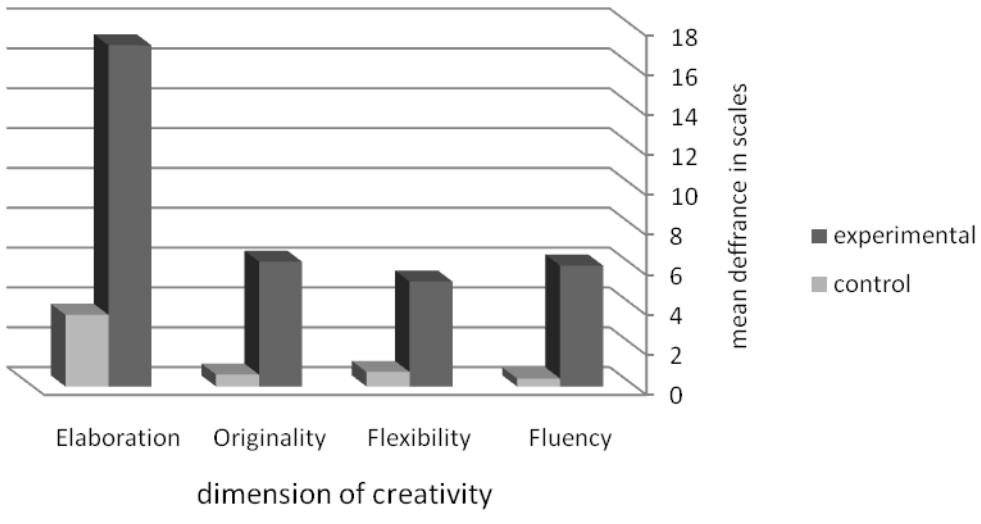

Figure 1. *Pre & post test comparison TTCT test results between experimental and control group*

The findings suggested significant statistical differences for the dimensions of fluency (t (28) = 5.46; p = 0.000), flexibility (t (28) = 4.85; p = 0.000) originality (t (28) = 3.66; p = 0.001) and elaboration (t (28) = 4.16; p = 0.000) evaluated in subtest 3 of TTCT.

DISCUSSION

In this study, the effect of science activities on creativity improvement of male preschool children by brainstorming teaching method was investigated. The results had good agreement with Anderson and Yates, (1999) findings. They reported the creative and education effect on fostering creativity respect to traditional education in six years old children. According our findings, the brainstorming teaching method to increasing creativity in children can be used by doing some selected science activities. Brainstorming method is one of the teaching methods leading to increase creative thinking. This method provides suitable environment for free expression of ideas without any hesitation and criticism. These conditions intend to psychic security for learner. These situations cause to express new ideas with more details by learners. Therefore brainstorming teaching method affect creativity by elaboration item in Torrance's Test. On the other hand, at this state learners express their ideas without limit. With increasing number of learner's ideas, fluency as a one of creative thinking factors would be developed. Expression of more ideas will intend to produce suitable and more various ideas by doing science activities. Therefore, the TTCT scores of originality and flexibility in compression between control and experimental groups will be significant. This finding is in compliance with the findings obtained by Nelson and Lalemi (1991), Golovin (1993), Russell and Meikamp (1994), Bear (1996), Silver (1997), Russ (1998), Dolores (2006) and Te Ture (2006).

Our results are confirmed by Seligman (1960) study, so that the education must be started from childhood. According to present research findings and Harlen, (1997), for fostering creativity in children, simple practical science activities can be used, so that they should perform these activities as a group work. Harlen (1997) purposed materials can be given to children so they discover information about them by employing, experience and inference. It is the best way for helping children to understand their environment. According to present investigation, involving children in practical activities of science education is going to enhance Creativity.

Therefore it advised that simple science activities be included in preschool curriculum and using of brainstorming teaching method for doing science activities intends to provide a good opportunity for fostering creativity.

SUGGESTIONS

According to the findings obtained from this study, it can be argued that brainstorming teaching method has more positive effects on fostering creativity preschool children, so this teaching method should be used more in teaching and learning processes by doing simple science activities.

The proficiency of the teachers about science lesson should be developed. For this reason, the teachers' need of science education should be determined and in service training program should be organized to satisfy the needs. Therefore they should be helped to acquire the skills to develop teaching and learning materials.

Usually most of the children feel like doing practical experiments of science, therefore, science education especially practical activities are suggested for early childhood education program.

This research has been done with six years old preschool boys; therefore, there seems need to accomplish research with six years old preschool girls.

REFERENCES

Aktaş Arnas, Y. (2002). Okulöncesi Dönemde Fen Eğitiminin Amaçları. *Çocuk Gelişimi ve Eğitimi Dergisi*, 1(6-7), 1–7.

Alva, E.T. (2000). *Brainstorming*. Available at http://www.nwlink.com/~donclark/perform/brainstorm.html.

American Association for the Advancement of Science (AAAS). (1993). (rev2003) *Benchmarks for science literacy: Project 2061*. New York: Oxford University Press.

Anderson, A. & Yates, C.G. (1999). Clay Modeling and Social Modeling: Effects of Interactive Teaching on Young Children Creative Art Making. *Educational Psychology An International Journal of Experimental Educational Psychology*, 19(4), 463-469.

Ardaç, D. (2003). Fen Eğitiminde Güncel Yaklaşımlar. *Çoluk Çocuk Dergisi*, 22, 24-25.

Ayvacı, H.Ş., Devecioğlu, Y., & Yiğit, N. (2002). Okulöncesi Öğretmenlerinin Fen ve Doğa Etkinliklerindeki Yeterliliklerinin Belirlenmesi. *V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Bildiriler Kitabı.* 1–5 Eylül, Ankara. http://www.fedu.metu.edu.tr/ufbmek-5/bkitabi/PDF/OgretmenYtistirme/Bildiri/t277d.pdf

Baer, J. (1996).The Effects of Task Specific Divergent Thinking Training. *Journal of Creative Behavior*, 300(3), 183-187.

Bal, S. (1993). Anaokullarında Fen Çalışmaları. 9. Ya-Pa *Okul Öncesi Eğitimi ve Yaygınlaştırılması Semineri, Ankara, Seminer Kitabı*. İstanbul: Ya-Pa Yayınları, 146–151.

Beetlestone, F. (1998). *Learning in the early years: creative development,* Scholastic, Leamington.

Bermejo, M. R., Ferrándiz, C., & Prieto, M. D. (2005). *An empirical approximation to the creative consistency during the creative process*. Paper presented at The First International Conference 'Creativity: A Multifaceted View', Moscow, pages 15–18,.

Bredekamp, S., & Copple,C. (1997). *Developmentally appropriate practice in early childhood programs*. Rev. ed. Washington, DC: NAEYC.

Çamlıbel Çakmak, Ö. (2006). *Okul Öncesi Öğretmen Adaylarının Fene Ve Fen Öğretimine Yönelik Tutumları İle Bazı Fen Kavramlarını Anlama Düzeyleri Arasındaki İlişkinin İncelenmesi*. Yayımlanmamış Yüksek Lisans Tezi, Abant İzzet Baysal Üniversitesi Sosyal Bilimler Enstitüsü, Bolu.

Carles, C. (2003). *Definitions of creativity*. from http://members.ozemail.com.au/~caveman/Creative/Basics/definitions.htmhttp://members.ozemail.com.au/~caveman/Creative/Basics/definitions.htm.

Chaille, C., & Britain, L. (1997). *The young child as scientist: A constructivist approach to early childhood science education*. New York: Longman.

Conezio, K., & French, L.(2002). *Teaching and learning about science. Science in the Pre-school Classroom Capitalizing on Children's Fascination with the Everyday World to Foster Language and Literacy Development.*

Craft, A. (1996). Nourishing educator creativity: a holistic approach to CPD. *British Journal of In-Service Education*, 22(3), 309-322.

Dolores, M. (2006). Prietocreative abilities in early childhood. *Journal of Early Childhood Research*, 4(3), 277-290.

Feasy, R. (2005). *Creative science. Achieving the WOW factor whit 5-11 year's olds*.P2.

French, L.A. (1996). I told you all about it, so don't tell me you don't know: Two-year-olds and learning through language. *Young Children*, 51(2), 17–20.

Fryer, L. (1996). *Creative Teaching and Learning*. London: Chapman.

Gallagher, J.J., & Gallagher, S.A. (1994). *Teaching the gifted child*. Allyn & Bacon: Boston.

Galton, F. (1869). *Hereditary Genius: an inquiry into its laws and consequences*, Macmillan, London.

Getzels, J. W., & Jackson, P. W. (1962). *Creativity and Intelligence: Explorations with Gifted Students*. New York: Wiley.

Golovin,R.W.(1993). *Creativity enhancement as a function of classroom structure cooperative learning vs. the traditional classroom*. Paper presented at the annual meeting of the

midsouth educational research association New Orleans, LA, pasges10-12.
Harlen,J.(1997). *Science experience for the early childhood years.*
Harmandar,M., Çil, E. (2008). The Effects of Science Teaching Through Team Game Tournament Technique on Success Level and Affective Characteristics of Students. *Journal of Turkish Science Education*, 5(2), 26-46.
Heleven, M. (2003). *An inspirational list of creativity and innovation resources*, from http://www.creax.com/creaxnet.
Karaer, H., & Kösterellioğlı, M. (2005). Amasya ve Sinop İllerinde Çalışan Okul Öncesi Öğretmenlerin Fen Kavramlarının Öğretilmesinde Kullandıkları Yöntemlerin Belirlenmesi. *Kastamonu Eğitim Fakültesi Dergisi.* 13(12), 447-454.
Katz, L.,D. & McClellan. (1997). *Fostering children's social competence: The teacher's role*. Washington, DC: NAEYC.
Khatena, J. (1989). *Intelligence and creativity to multitalent*. The Journal of Creative Behavior, 23(2): 93–7.
Matricardi, J., & McLarty, J. (2005). *Science activities A to Z*, Clifton Park, NY : Thomson Delmar Learning.
Millar, G. W. (2001). *The Torrance Kids at Mid-life*. Westport, CT: Ablex.
Nelson,A.& Lalemi,B.(1991).*The role of imagery training on Toho O'codham children's creativity scores*.Journal of American Indian education,30(3):24-32.
Nelson, K. (1996). *Language in cognitive development: The emergence of the mediated mind*. New York: Cambridge University Press.
Osborn, A.F. (1953). (rev. 1957, 1963), *Applied Imagination: Principles and Procedures of Creative Problem-Solving*, New York, Charles Scribner's Sons.
Özbey, S., & Alisinanoğlu, F. (2008). Identifying the General Ideas, Attitudes and Expectations Pertaining to Science Activities of the Teachers Employed in Preschool Education. *Journal of Turkish Science Education*, 5(2), 82-94.
Özmen, H. (2004). Fen Öğretiminde Öğrenme Teorileri ve Teknoloji Destekli Yapılandırmacı (Constructivist) Öğrenme, *The Turkish Online Journal of Educational Technology.* 3(1). Article 14.
Prieto, M., Parra,J., Ferrándo,M., & Carmen Errándiz, C. (2006). Creative abilities in early Childhood. *Journal of Early Childhood Research*, 4(3), 277–290.
Rossiter, J,R. & Ilien, G.R. (1994). New "Brainstorming" Principles. *Australian Journal of Management*, 19(1). 61-72.
Russ, S.W. (1998). Play Creativity and Adaptive Functioning Implications for Play Interventions. *Journal of Clinical Child Psychology*, 27(4), 469-480.
Russell, R.S., Meikamp, J. (1994). *Creativity Training a Practical Teaching Strategy*. Proceedings of the Annual National conference of the American Council on Rural Special Education, 14th, Austin,Texas,March, pages 26-32.
Ryhammar, L., Brolin, C. (1999). Creativity research: historical considerations and main lines of development. *Scandinavian Journal of Educational Research*, 43(3). 259-273.
Şahin, F. (2000). *Okul Öncesinde Fen Bilgisi Öğretimi ve Aktivite Örnekleri*. Ya-Pa Yayınları, İstanbul.
Şahin, F., Ökçün, F. (2000). Okul Öncesinde Aktivitelerle Fen Kavramlarının Geliştirilmesi Üzerine Bir Araştırma. *Öneri Dergisi,* 3(13), 23–30.
Seligman,M.(1960). *Helpessness*. W.H.Freeman Company, San Francisco.
Selker,T.(2005). Fostering motivation and creativity for computer users. *International Journal of Human-Computer Studies*, 63(4-5), 410-421.
Silver, E.A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *ZDM - Zentrallblatt fur Didaktik der Mathematik*, 97(3), 75-80.
Standler, R.B. (1998). *Creativity in Science and Engineering*. This document is at http://www.rbs0.com/create.htm begun 25 May 1997, revised 25 Dec 2002.
Sternberg, R.J. (1999). *In: R. Sternberg, Editor, Hand Book of Creativity*. Cambridge University

Press, New York.
Sternberg, R. J., & Lubart, T. I. (1995). *Defying the Crowd: Cultivating Creativity in a Culture of Conformity*. New York: Free Press.
Taylor, C.W. (1956). *Research Conference on the Identification of Creative Scientific Talent.* Salt Lake City, UT: University Utah Press.
Te Ture, R. (2006). *Fostering Creativity in Science Investigative Planning: Small Measures for Fostering Creativity in Science Investigative Planning?* STER papers, pages 3-25.
Torrance, E. P. (1962). *Guiding Creative Talent*. Englewood Cliffs, NJ: Prentice Hall.
Torrance, E.P. (1966). Torrance tests of creativity, Personnel Press, Princeton.
Torrance, E.P. (1966). *The Torrance Tests of Creative Thinking –Norms-Technical Manual Research Edition –Verbal Tests, Forms A and B –Figural Tests, Forms A and B.Princeton,* NJ: Personnel Press.
Torrance, E.P. (1969). *Creativity. What research says to the teacher,* series no.28, National Education Association, Washington, DC.
Torrance, E.P. (1974). The *Torrance Tests of Creative Thinking.* Bensenville, IL: Scholastic Testing Service.
Torrance, E.P. (1996). *The Torrance Tests of Creative Thinking.* Bensenville, IL: Scholastic Testing Service. Paper presented to an invitational seminar, Chadwick Street Recreation Centre, London, 14 February, 2001.
Woods, P. (1995). *Creative teachers in primary schools.* Open University Press, Buckingham.
Woods, P., & Jeffrey, B. (1996). *Teachable moments: the art of teaching in primary schools.* Open University Press, Buckingham.