

The effects of child-centered methods of teaching mathematic on increasing children's mathematical abilities

Alireza Delbaz¹, Hassan Alamolhodaei¹, Salman Abbasian-Naghneh^{2,*}, Afsaneh Mondak³

¹*School of Mathematical Sciences, Ferdowsi University of Mashhad, Iran*

²*Department of Mathematics, Najafabad Branch, Islamic Azad University, Najafabad, Iran*

³*Department of Management, Dehaghan Branch, Islamic Azad University, Dehaghan, Iran*

Abstract: This study investigates the effects of child-centered methods (according to design practices to the style of play and entertainment) on increasing motivation, creating positive attitudes, reducing anxiety in two skills of mathematic and reading in pre-school (five-year-old children). In this study, 151 children (both boys and girls) were selected from three nursery cities, Birjand, Mashhad and Ghaen. At first, nursery personnel got familiar with methods of implementation and they were placed at the disposal of pamphlets containing lesson plans with 34 exercises for them. Using four distinct tests and motivation standards for education, mathematical anxiety, mathematical attitude, interest in homework (in two skills of mathematic and reading) and interested to relate activities for reading and math was evaluated in pre-test. Then, for two months open method of training with designed exercises with play and entertainment was used. At the end of the period, post-test was done by the researcher. The results showed that child-centered method of teaching using designed exercises had significant influence of increasing motivation, creation of positive attitude and reducing math anxiety. In addition, data analysis revealed that use of appropriate methods of math education and math interest caused to increase interest to math in reading skill and more motivation on doing homework and related activities to this lesson.

Key words: *Child-centered methods; Attitudes toward mathematics; Academic motivation; Math Anxiety*

1. Introduction

Children are valuable capital for future society building. Education in childhood builds the individual and society's future and defines the nation trace. According to problems and children problems cause advancement and society promotion, and negligibility in their problem solving, there will be on irreparable damage. Therefore, investment and programming in primary education is the most sensitive duty of official government and has special priority up to 18th century mathematic as a subject lesson had not any place in school programs. At the first of 19th century, a revolution was created in math education. Britain for the first time put the math on the public programs of schools. In 1959, the first step was taken in math education in primary period on a conference in Chicago. The result was that the success of high school students in math lessons is dependent on quality of the mathematic in the primary school curriculum. Farrell quotes from Broomz (1996) about the importance of math: "mathematics, science and native language are the main topic of primary curriculum, so that learning of these three lessons have important role in learning of other lessons" (Broomz et al., 1382).

Few studies were done to show the effect of child-centered activities in creation of interest and

positive attitudes on children. Fazio claims that, researches on attitude relation with children motivation and learning indicate that attitude with motivation and interest has direct relation since interested students on activities, their attitude is affected positively and learning is done at the best way (Mongillo, 2006). In addition to positive attitude on basic courses such as math probably cause increasing of motivation on other courses such as reading and is the most important activities of nursery.

2. Theoretical background

One of the aspects of religious education and psychology pay attention to it is early years of child's life. Many education specialists believe that characteristics of human is formed in first six years of his life and evolved on further steps of growth. This causes to deep insight in education in pre-school and children as a basis of education are concerned for specialist and educational authorities.

The most important task of pre-school centers is providing secure environment, safe, desirable and a place of loving families for children. For growth of talents and toddlers, educational activities in pre-schools should be based on open environment and stimulus for intellectual, verbal, social, motivational and physical growth of child. Mathematical concepts is one of the most effected and efficient syllabus of

* Corresponding Author.

the course. Richard Carrun, German mathematician says: math is one of the most excellent android leak that reflects will of man and indicator of reason and argument and expressed more interest in perfection and beauty. Researches show that two kinds of development in children's intelligence up to six years means starting before normal training acquired by them. Literature showed that the correct education roles and principles to children in pre-school age should pay attention to different aspects of child growth, especially cognitive growth and foster creative thinking of them. Mathematical and different related concepts are one of the most effective tools for achieving to this system. According to the importance of this period, and also math role on fostering cognitive growth and training, there is one question: how can math be taught to children? The question is one of the most important issues in mathematics education research. Hans Freudental, one of the outstanding math teachers in fourth international conference of math education was held in 1982, 13 major axis are listed for doing research in math field the first of which is about "how math is learned by children?" the principle and its importance shows that thousand failure in children math and their fear and hate of education is remembered in next levels of education.

In other words, in teaching and learning of pre-school child should use game and rhythmic movement and for more tangible learning, different educational tools should be provided. The pre-school children instead of direct training of courses such as mathematic, based of work is centered to learner activities and children in this way get familiar to basic concepts. Fennena (2000) found that children feedback to mathematic has a vital role in their achievement. Bast and Johnson (1967) believed that in some children difficulty understanding numerical relationship starting from the first years of life. Ability to count, understanding of quantities, matching, separation comparing numbers, all are dependent on child experiences and object accessibility (Derakhshan, 1367). So how children learn and method of teaching in learning math has very important role in math learning. As we mentioned, teachers should try children to see various things, manipulate and learn. These types of activities allow children to understand different concepts. Teachers instead of placing direct information to students should use word explanation for them. They should design a collection of exercises and training activities based on games and entertainments to better understanding and discovery.

Group practice is based on game and entertainment and teacher is just a leading role and causes better understanding of math for children. In one hand, lack of success in understanding of math subject cause frustration on other courses and vice versa, success in math course creates motivation in other subject. We selected to investigate in confirming interest to math is for two reasons: first-reading training and math are two main goals of pre-

school. Second- recently Oxford authors university show that reading skill is related to math and similar genes are responsible for these abilities to individual. In this study, authors investigate effects of genetic in reading and math skills in 2800 English 12-year-old children. It is mentioned that is there is a genetic relation between reading and math skill, but special gene is responsible for better understanding of math.

2.1. Motivation

Yound (1961) treat motivation as activate the behavior direct behavior pattern. German (1969) knows it as a factor to stimulate us to move in a certain behavior. Seyfert (1992) said, motivation is a trend to act in a certain behavior. Said (1997) said motivation is starters maintaining and guiding force of behavior. Motivation in learning is related to behavior for learning and promoting in education. Generally, it is one of the developmental incentive, internal force that leads learners to evaluate all aspects of performance according to most excellent criteria, try to success in performance and having fun with success in performance (Shiri and Rajab, 1388).

2.2. Math anxiety

It is defined as "lack of overall comfort that a person experiences in time required to math performance" (Wood, 1988), or anxiety feeling, psychological distress in engaging with assignment, that need to use math knowledge (Richardson, 1972). Kazel in factor analysis shows that math anxiety is on six factors: number, math course, math exam, negative feeling about math, positive feeling and worry about it. He believes that, however, there is a strong correlation between these dimensions, but each of them evaluates aspect of math anxiety.

2.3. Attitude and math attitude

Attitude includes recognition, value, emotional and action dimensions and they mean having believes or informed believes, adopt positive or negative emotional orientation, exciting and feeling fields of person to related subject and orientation for doing an special behavior (2001). Math attitude is one aspect of behavior that imply tendency or lack of tendency in student to math (Kamyab, 1387).

3. Hypotheses development and conceptual mode

This study has four hypotheses:

1. Child-centered training methods (according to designed exercise in game and entertainment) is effective on increasing motivation among five-year-old children in nursery.
2. Child-centered training methods are effective on creating positive attitude to math among five-year-old children in nursery.

3. Child-centered training methods are effective on reducing math anxiety among five-year-old children in nursery.

4. Child-centered training methods are effective on increasing math interest among five-year-old children in nursery.

In this study, child-centered methods are considered as independent variable and increase of motivation and positive attitudes to math course, interest to math and reducing anxiety are dependent variables.

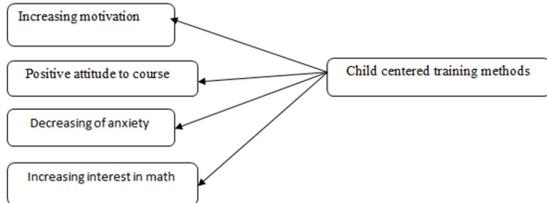


Fig. 1: Variables of the study

4. Data analysis

Statistical population of this study was 151 five-year-old children from Birjand, Mashahd and Ghaen nurses in summer 1393. Data needed for research is from 151 questionnaires that include related questions to research hypotheses. By using appropriate graphs, a description is offered by index position and research hypotheses.

4.1. The distribution of the response to the motivation test

Harter motivation questionnaire is a form 33 questions that response are recorded in 5 degree range of Likert scale (1=never to 5=always). At the end scores are sum and a score is obtained for motivation to math. This score in the experimental group was averagely 95.22 ± 10.45 and in post-experimental group was 110.22 ± 17.52 . Minimum and maximum score in pre-experimental group was 73 and 116 and in post-experimental group was 72 and 129 respectively. Fig. 2 shows the type of distribution of motivation score in both groups.

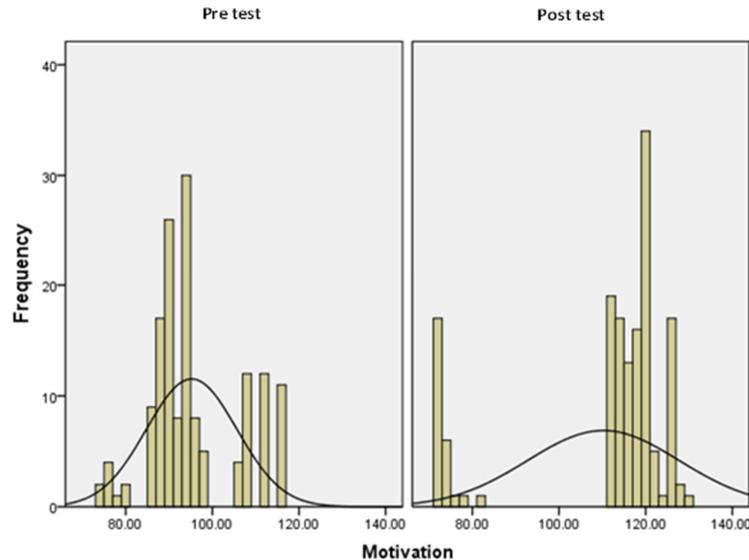


Fig. 2: type of distribution of motivation score in pre and post experimental group

4.2. Distribution of response to attitude test

Attitude scale to math by icon is built on Likert method. This scale has 23 provisions and each of them has four options: totally agree, agree, disagree, and totally disagree. According to contents of each provision or in contrast are scored in 1 to 4. At the end, these scores are sum and a score is obtained for math attitude. Attitude score in pre-experimental group average 53.03 ± 17.09 and in post-experimental group is 75.62 ± 12.82 . Minimum and maximum score in pre-experimental group are 26 and 92 and in post-experimental are 43 and 86 respectively. Fig. 3 shows the distribution of attitude score in both groups.

4.3. Distribution of response to anxiety test

Anxiety scale includes 22 short terms that describe related activities to math. As to marked amount of their anxiety in each situation according to Likert scale in four parts: (4=very much, 3=high, 2=little, 1=none). At the end, scores are sum and a score is obtained. Anxiety score in pre-experimental group average was 56.26 ± 14.12 and in post-experimental group average was 43.41 ± 16.14 . Minimum and maximum score is pre group was 25 and 80 and in post group was 28 and 78. Fig. 4 shows distribution of anxiety score in both groups.

4.4. First hypothesis test

Child-centered training method is effective on increasing motivation among 3-6 years-old children

Zero hypothesis (H0): child-centered training methods are not effective on increasing motivation among 3-6 year-old children.

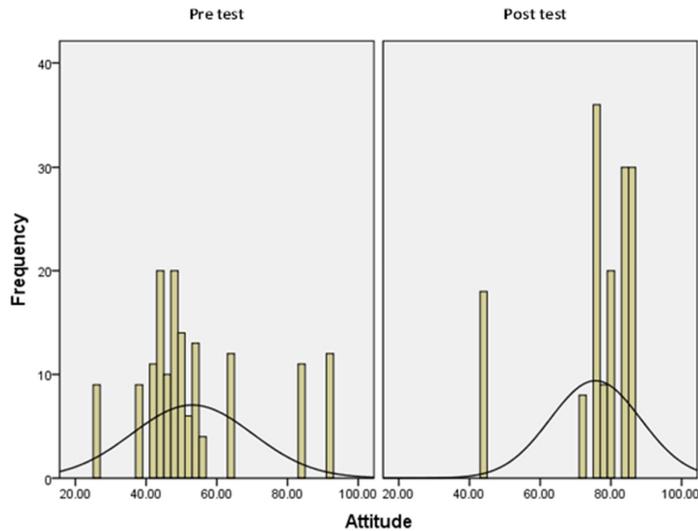


Fig. 3: distribution of score in pre and post experimental group

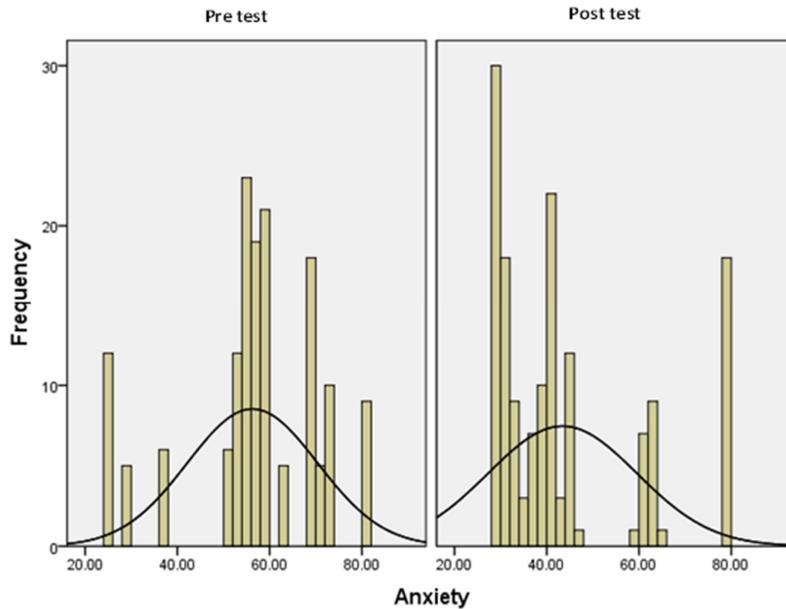


Fig. 4: distribution of anxiety score in post experimental group

Table 1: comparison of motivation before and after designed exercise by game.

p	t	standard deviation	average	numbers	Variables
0.0001	8.27	10.45	95.22	151	Pre-experimental motivation
		17.52	110.22	151	Post-experimental motivation

According to Table 1, because significant level of paired t-test is lower than 0.05 ($p= 0.0001$), H0 is rejected. So we can say that the amount of motivation in post-experimental is higher than pre-experimental group.

Fig. 5 shows motivation before and after designed exercises in game.

4.5. Second hypothesis test

Child-centered methods have effects on positive attitude to math anxiety among 3-6 years-old children

H0. Child-centered methods do not have effects on positive attitude to math among 3-6 years-old children.

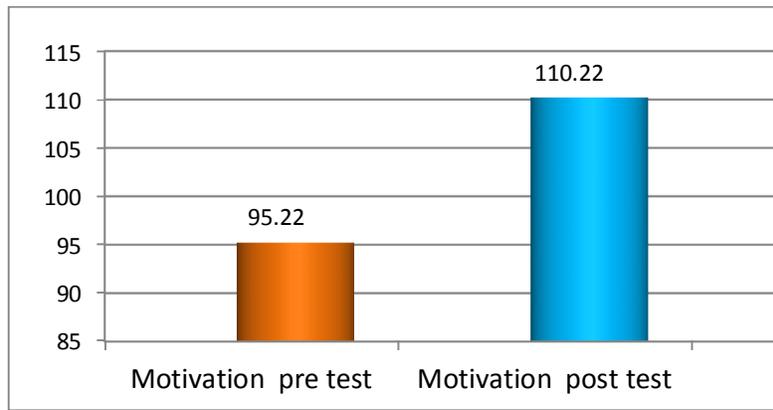


Fig. 5: amount of motivation before and after test (game and entertainment)

Table 2: comparison of attitude before and after designed exercises

p	t	standard deviation	average	numbers	Variables
0.0001	12.95	17.09	53.03	151	Pre-experimental attitude
		12.82	75.62	151	Post-experimental attitude

According to the table, because significant level of paired t-test is lower than 0.05 ($p= 0.0001$), H_0 is rejected. So we can say that attitude in post-

experimental group is significantly higher than pre-experimental group. Diagram 5 shows the attitude before and after designed exercises in game.

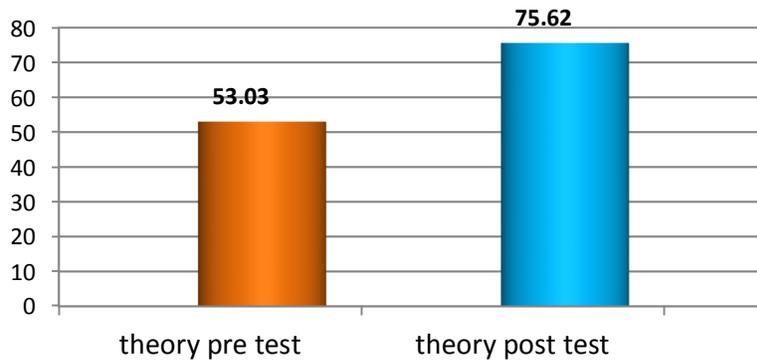


Fig. 6: amount of motivation before and after tes

4.6. Third hypothesis test

Child-centered methods have effects on decreasing math anxiety among 3-6 years-old children.

H_0 . Child-centered methods do have effects on decreasing math anxiety among 3-6 years-old children.

Table 3: comparison of anxiety before and after designed exercise in game

p	t	standard deviation	average	numbers	Variables
0.0001	-6.99	14.12	56.26	151	Pre-experimental anxiety
		16.14	43.41	151	Post-experimental anxiety

According to Table 3 and Table 4. Because significant level of paired t-test is lower than 0.05 ($p= 0.0001$), H_0 is rejected. So we can say that anxiety in post-experimental level is significantly

lower than post-test. Diagram 6 shows anxiety before and after designed exercises in game.

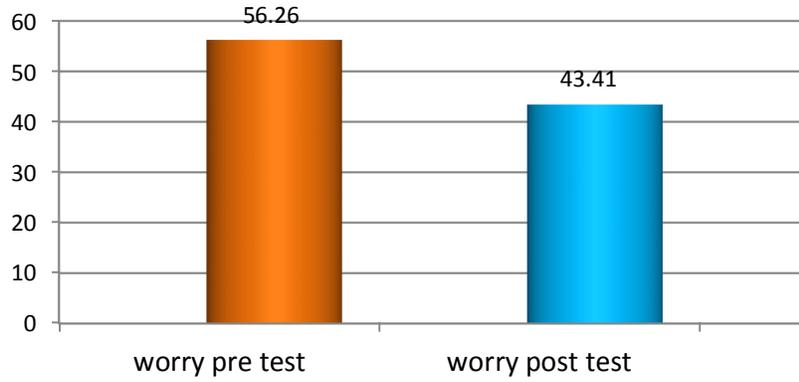


Fig. 7: anxiety before and after test

4.7. Fourth hypothesis test

Child-centered methods have effects on increasing interest to math among 3-6 years-old children.

H0. Child-centered methods do not have effects on increasing interest to math among 3-6 years-old children.

According to the Table 4, because significant level of paired sample t-test is lower than 0.05 ($p= 0.002$), H0 is rejected. Therefore, we can say that interest in post-experimental group is significantly higher than pre-experimental. Diagram 7 shows interest in math before and after designed exercises in game.

Table 4: comparison of interest to math before and after designed exercises

p	t	standard deviation	average	numbers	Variables
0.002	3.164	6.62	21.00	151	Pre-experimental interest
		6.20	23.29	151	Post-experimental interest

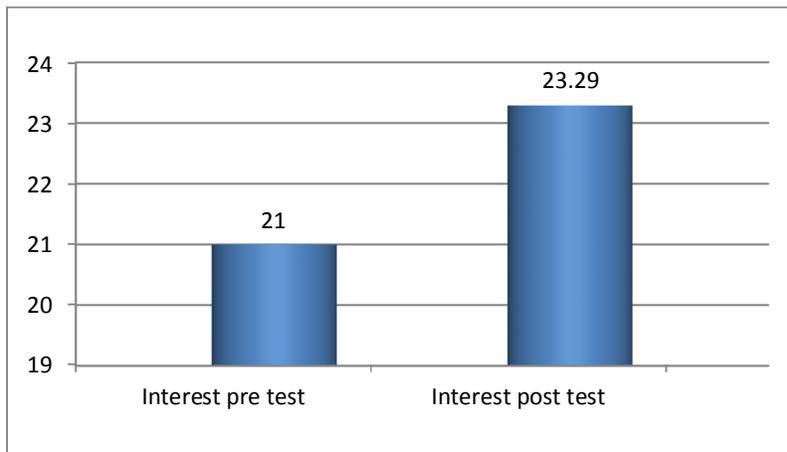


Fig. 8: interest before and after test

5. Discussion and conclusion

The results of this study show that:

1. Child-centered method and providing an environment that child can learn by his experiences had significant effects on increasing motivation in learning math concepts. Both training is creation of environment that child's cognitive structure can emerge and change. Piaget believes that cognitive structures develop when

children build it according to their own learning experiences. Therefore, learning should be spontaneous and environment should be rich of sense experiences. Mathematics is not such as other course that student learn from showing and telling. It should be associated with appropriateness of cognitive, emotional and mental growth of people (Kolaienejad, 1385). Kok craft believes that math should be taught in an applicable and enjoyable part for children.

2. Open training methods and appealing and learning methods in math in an interactive environment with minimum guidance cause creation of positive attitude to math among children.
3. These open methods cause children find good attitude to math and learning is done spontaneously (Broomz, et. al, 1383). Therefore, children need more learning opportunities by direct experiences to formal teaching. So it is better to provide facilities for children to the best results of learning.
4. Child-centered methods (according to designed exercises in game and entertainment) have significant effects on reducing math anxiety among five-year-old children in nursery. Children when belong to math enjoy from engaging in activities requiring learning and treat it as an interesting and cute course, and less likely to math anxiety and feeling of restlessness and confusion in this relation.
5. As predicted, increase of motivation in mathematic course cause to increase educational motivation and increase of interest to reading skill.

References

- Inam A, Saad N and Abd Ghani S (2012). A metacognitive Approach to solving Algebra problems. *International journal of independent research and studies*, 1(4), 162-173
- Mousavi S, Radmehr F and Alamolhodaei H (2012). The role of mathematical homework and prior knowledge on the relationship between students mathematical performance, cognitive style and working memory capacity. *Electronic journal of research in education psychology*, 10 (3).
- Verschaffel L, Greer B and De Corte E (2000). *Making Sense of Word Problems*, Taylor & Francis Nicolaou.