

Features of the development of ideas about the cyclicity of space-time processes in older preschool children

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Abstract

This article is dedicated to the opportunities of development of cyclic representations of preschool children. The ideas about the cyclicity of space-time processes belong to the group of social ideas and are generalized mental formations that reflect the space-time patterns that exist in culture (parts of the day and seasons) in the mind of the individual. These representations allow the child to find mutual transitions of opposites in the process of the changing of the seasons and parts of the day, as units of the development of the surrounding world, and to correlate them with each other (to see and understand the built-in cycles). An educational experiment is described where the children were suggested to solve some problems that required the application of dialectical mental actions. The evidence obtained as a result of this experiment lead to a conclusion that cyclic representations may be amplified through specifically designed educational program.

Keywords: cyclic representation, dialectical thinking, processes of development, preschool children.

I. INTRODUCTION

These days, the psycho-pedagogical research on the topic of developing the ability to navigate in time and space is a priority. This is due to the socio-economic and cultural need of our society for people who understand the sign-symbolic culture of the world around them. The understanding of space and time is the key means of reflecting the reality (N.N. Poddyakov, 1987). At preschool age, this comes down to the child beginning to navigate the diversity of the surrounding world, acquiring the ability to read a map and tell time with the help of a clock. Orientation in time and space is the most important skill involved in the social and mental aspects of a child's life.

The ideas of the cyclicity of space-time processes are a part of a group of space-time ideas. A number of Russian scientists (N.E. Veraksa, O.A. Shiyan, I.B. Shiyan, E.V. Bochkina, E.V. Romanova) have been engaged in researching them, as well as developments in ontogenesis. E.V. Bochkina believes that «the

ideas about the cyclicity of space-time processes belong to the group of social ideas and are generalized mental formations that reflect the space-time patterns that exist in culture (parts of the day and seasons) in the mind of the individual» [5]. These representations allow the child to find mutual transitions of opposites in the process of the changing of the seasons and parts of the day, as units of the development of the surrounding world, and to correlate them with each other (to see and understand the built-in cycles). The basis of the uniqueness of the formation of the ideas about the cyclicity of space-time processes is the mutual influence of the external (culture and educational tasks) and the internal (memory, thinking and imagination, as well as gender and age characteristics of the individual) components of these ideas.

N.E. Veraksa and E.V. Romanova state «that these ideas are unique due to their place in the system used for constructing an adequate picture of the world» [6]. N.E. Veraksa found that because of the ideas about the cyclicity of

space-time processes, «a person acquires the ability to see not only the initial and final stages of an event, but also a transitional moment which has the qualitative characteristics of both stages (for example: in the daily cycle, morning is a transitional stage between night and day» [6]. In the morning it is already dark like at night, but not yet light like in daytime). Relevant studies have confirmed that children are really immersed in the cyclical transformations of the world around them, they witness these transformations that happen to various objects and living beings. However, the understanding and ideas that children have regarding such transformations are fragmentary, they do not form a single structure as two-way transitions between the opposites.

2. Method

Our study took place from December 2013 to May 2020 in kindergarten #1602 in Moscow, the "Gramotei" children's development studio in Dedovsk and at the Scientific and Practical Center for Children's Psychoneurology in Moscow. The study participants were children aged from 5.6 to 6 years. They were divided into the experimental and control groups. In total, 618 people took part in the study: 408 girls and 210 boys.

To study the level of development of ideas about the cyclicity of space-time processes and the level of development of memory, thinking and imagination in children aged 5-6 years, we used the following methods: ideas about the cyclicity - the "Jars" method [1] (E.V. Bochkina), ideas about the cyclicity - the "Magic Ribbons" method [3] (E.V. Bochkina), imagination – the "Finishing Figures" method

(O.M. Dyachenko), spatial memory - "NEPSY-II" method (Sally Kemp), thinking - "Wexler's Test" (D. Wexler).

The initial diagnostics showed that the results of the examination of the experimental and control groups before the start of the experiment speak in favor of the absence of a significant difference between these groups.

For this experiment, a special series of situations was designed so that children could discover the cycles that exist in the world around them, coping with these situations and solving various cognitive and project problems. To do this, the children had to solve specially designed problems for anticipation (finishing stories), transformation (depicting the opposites), determining the relationships between opposites (day and night animals, etc.), identification and separation (seeing the similarities and differences in spring and autumn, mornings and evenings, etc.). According to the culturally-historical approach to the development of preschoolers, a visual model is the most adequate means of mental activity at this age (for example, creating a story about how day turns into night or about a snow bunny or a small flower). In this case, the children could focus on a visual model of the transition between the opposites, the transformation or the cycle.

3. Results and discussion

Our experiment lasted 6.5 years. The experiment was repeated 13 times (each part lasted 6 months). 308 children were a part of the experimental group. 310 children were a part of the control group.

Table 1 *Descriptive statistics of the level of formation of the ideas about the cyclicity of space-time processes (N=618)*

| Mental processes | Experimental group (ascertaining stage) | | Experimental group (control stage) | | Control group (ascertaining stage) | | Control group (control stage) | |
|----------------------------------|---|------------|------------------------------------|------------|------------------------------------|------------|-------------------------------|------------|
| | Frequency | % | Frequency | % | Frequency | % | Frequency | % |
| Ideas about the cyclicity | 308 | 100 | 308 | 100 | 310 | 100 | 310 | 100 |
| <i>Low level</i> | <i>170</i> | <i>55</i> | <i>19</i> | <i>6</i> | <i>174</i> | <i>56</i> | <i>158</i> | <i>51</i> |

| | | | | | | | | |
|---------------------|----|----|-----|-----------|----|----|-----|----|
| <i>Medium level</i> | 92 | 30 | 37 | 12 | 90 | 29 | 121 | 39 |
| <i>High level</i> | 46 | 15 | 253 | 82 | 46 | 16 | 41 | 13 |

Values in bold are 60% or more.

Analyzing the results of the children in the experimental group, we see that after the formative stage of the experiment, 82% of the children in the experimental group have a high level of formation of the ideas about the cyclicity of space-time processes. At the ascertaining stage of the study, this indicator was demonstrated by 16% of children of older preschool age. A low level was detected in 6% of the children from the experimental group. In the control group, after the formative stage of the experiment, a high level of formation of ideas about the cyclicity of space-time processes was detected in 13% of children, a low level was detected in 51% of older preschoolers.

This data demonstrates that the children in the control group do not actualize and do not include the knowledge about time and space in their daily life. Because of that, they find it difficult to use it to solve our diagnostic problems.

After that, we carried out a comparative analysis of the obtained data in order to identify the differences between boys and girls in the formation of ideas about the cyclicity of space-time processes. In the experimental group, at the control and ascertaining stages of the experiment, positive dynamic was revealed in the level of formation of ideas about the cyclicity of space-time processes in general.

Girls of all ages, in the process of working with each set of cards, identified the point of transformation from one time period to another faster than boys (Fig. 1).

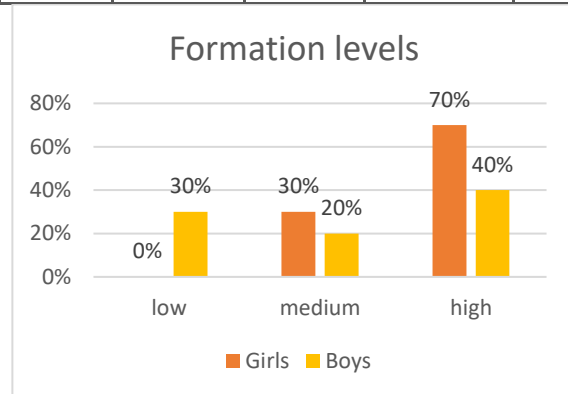


Fig. 1 *Distribution of levels of formation of ideas about the cyclicity of space-time processes by gender in the Russian sample*

During the analysis, it was found that the medium and high levels of formation in girls were significantly higher ($\varphi^*=1.61$, $p \leq 0.05$), and the low level of differentiation was significantly higher in boys ($\varphi^*=2.43$, $p \leq 0.001$). Girls were faster than boys in identifying the time stages and conditions for the transition from one state to another. The boys singled out the main external features of the object, not paying attention to the action being performed.

Correlation analysis (Fig. 2) of the Russian experimental sample showed that all three cognitive processes (memory, thinking and imagination) are involved in the process of creating the idea of the cyclicity of temporal processes. Children begin to separate the time periods, highlighting their main characteristics. The obtained data indicates that the higher the level of formation of ideas about the cyclicity of space-time processes, the higher the level of development of the main cognitive processes (imagination, thinking and memory).

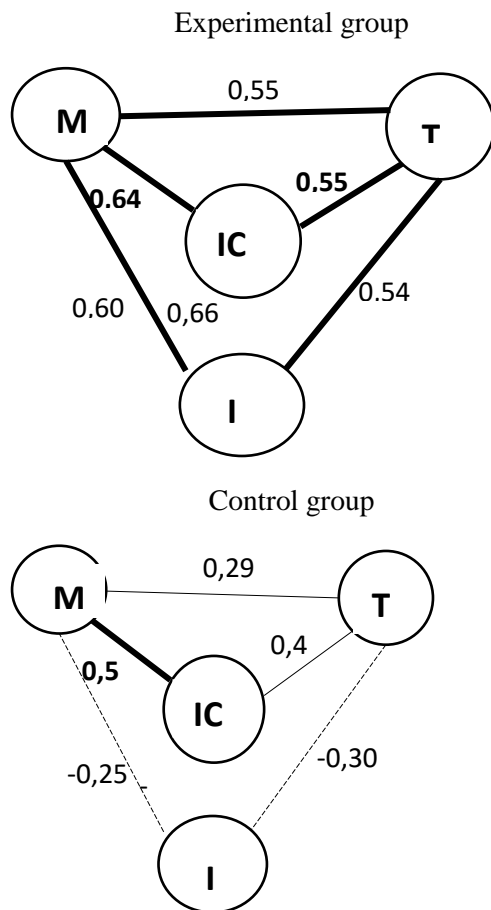


Fig. 1 Correlation pleiade of content categories of the ideas about the cyclicity of time processes in the experimental and control groups

Note: Categories of analysis: I - imagination, M - memory, IC - ideas about the cyclicity, T - thinking. A solid line indicates a direct relationship, a dotted line indicates a reverse relationship; Significant relationships are highlighted (in bold).

$p \leq 0.05$ if $r_s = 0.68$, $p \leq 0.01$ if $r_s = 0.72$

In the control group, the relationship was found only between the categories of memory and ideas about cyclicity. In other categories no changes in relationships have been found.

4. Conclusion

It was found that the intervention led to certain qualitative changes in the understanding of cyclicity among the participants: children showed a much more frequent presence of thought structures related to defining the

relations between opposites in time and space structures. These structures include not only the transformation from one opposite to another, but also the reverse transformation, as well as the corresponding transition point (medium) between them.

This data confirmed the assumption that the development of understanding of cyclicity is a part of the zone of proximal development of preschoolers and can be enhanced with the help of a specially designed educational program.

We assume that the ability to detect and understand developmental processes in the surrounding world would help a child to take an active position in relation to the world around them and give the child an opportunity to change it, i.e. contribute to the development of creative thinking. This may be an area for further research.

References

- [1] Bochkina E. V. Methods of research of cyclic representations in preschool children on the material of the author's methodology "Jars" / E. V. Bochkina // Procedures and methods of experimental psychological research. – Moscow: Institute of Psychology of the Russian Academy of Sciences, 2016. – pp. 572-575. – EDN WZBQSH. [In Russian].
- [2] Bochkina E. V. Positional learning as a way to overcome egocentrism in preschool age / E. V. Bochkina // International Journal of Experimental Education. – 2014. – No. 6-1. – PP. 55-57. – EDN SBZPUZ. [In Russian].
- [3] Bochkina, E. V. Ways to study ideas about the cyclicity of spatiotemporal processes in preschool children on the material of the "Magic ribbons" method / E. V. Bochkina // Psychology. Historical and critical reviews and modern research. – 2019. – Vol. 8. – No. 1-1. – pp. 287-295. – DOI 10.25799/AR.2019.43.1.076. – EDN LILYBJ. [in Russian].
- [4] Romanova E.V., The development of preschoolers' representations of the cyclicity of events: abstract from the thesis for psychology doctorate degree: 19.00.07: M., 2000. [In Russian].

- [5] Shiyan, O. A. Development of cyclic representations of senior preschoolers / O. A. Shiyan, I. B. Shiyan, E. V. Bochkina // *Procedia - Social and Behavioral Sciences* (see in the books). – 2016. – Vol. 233. – P. 274-279. – EDN JZWBAB.
- [6] Veraksa, N. E. Structural Approach to Dialectic Cognition / N. E. Veraksa // *Psychology in Russia: State of the Art*. – 2010. – Vol. 3. – P. 227-239. – EDN OIOZZX.
- [7] Fleiwell J. Genetic psychology of Jean Piaget with the foreword by Jean Piaget. M., 1967. [In Russian].