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# Cognitive development of the children with visual impairment and special educational treatment

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## Abstract

This research project is specifically focused on the evaluation of figurative and operational cognitive structures in relation with implemented special educational treatment at the children with visual impairments.

The sample was tested by battery U.D.N.80, (Piaget and Inhelder). The evaluated sample includes 71 children with visual impairments at special educational treatment, Belgrade, Serbia.

We conclude that there is inhomogeneous achievement of the tested children included in the sample. We can conclude about the necessity of implementation multimodal oriented approach, which focuses the role of special education, behavior modification and cognitive rehabilitation.

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*Keywords:* Cognition, development, children, visual impairments.

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## 1. Introduction

This paper focuses cognitive functioning of the children with visual impairment, who are included in the rehabilitation treatment that is standard for our region. The paper is based on the examination of the psychological cognitive structures such as elementary logical operations (Granrud, 1993; Yantis 2001; Karahoca, Karahoca & Yengin, 2010).

Many authors in this field have discussed the possibility that cognitive abilities develop in a different way in children with visual impairments than in children without visual impairments. The visual impairment imposes three general effects, all of which may have influence on cognitive development:

- range and variety of experiences
- ability to get about
- control of environment and self in relation to environment.

The child with visual impairments must build up concepts of the world based on other senses and experience while visual experience and information is extremely useful in building concepts for children with typical development. These various developmental disorders make the complete experience of the child with visual

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impairments more restricted because the nature of the concepts that individual acquires depends his range and quality of experiences. Therefore it may be expected that the concepts of the children with visual impairments are in some ways more restricted than those of sighted children (Tobin, 1972; Warren, 1984).

In defining the problem for the purpose of this research project and paper, when referring to the group of children with visual impairment, we understand that to mean three diagnostic categories of examinees, including: legally blind, totally blind and low vision, defined in accordance with the classifications of the World Health Organization (Maćešić-Petrović, Vučinić, Jablan & Eškirović, 2005). This descriptive study answers the question: how does the development of elementary logical operations manifest in the examined group of children? The paper is also aimed at establishing the existence of possible differences relating to the quality of development of elementary logical operations between the various diagnostic categories of children with visual impairment.

The general concept of this article is based on the Piaget model and its adapted methods of appraisal created by Inhelder, which are commonly implemented in our region, and that relate to the significance of the quality of cognitive function as one of the views of the existence of a developing individual. The paper examines and appraises the cognitive structures observed through elementary operation of classification, seriation, operation of correspondence, as well as through conservation of mass and the task of rotating pearls. The practical value of this paper can be seen through the fact that there is a very small number of papers which deal with this subject matter in our region. Therefore, the goal of our research is to enhance the understanding of developmental cognitive difficulties in children with visual impairment (Dimčović, 1992; Dimčović, Tobin, 1995; Maćešić-Petrović et al., 2005; Posner, Rothbart, 2006).

The research was carried out within the scope of a scientific-research project at the University of Belgrade, Faculty of Special Education and Rehabilitation, titled “The Phenomenology of disabilities and disorders in development” (101611), funded by the Ministry of Science and Environmental Protection, and managed by Prof. Dr. Slavica Golubović, who is a full-time professor at the University of Belgrade, Faculty of Special Education and Rehabilitation. The practical framework of this research project can be seen in the possibilities of adaptation the diagnostic procedures, based on the developmental needs of children.

## 2. Sample

The sample used in this project, was made up of 71 examinees, with average level of intellectual functioning, from the school for persons with visual impairment “Veljko Ramadanović” in Belgrade. Of that number, 29 examinees were female and 42 examinees were male. This number reflects their natural distribution within the scope of the examined categories, meaning that the sample included all children diagnosed as having a visual impairment. The sample includes examinees without neuropsychiatric and other combined impairments. In relation to education, the sample included children who are attending elementary school, grades 1 to 8. The examinees, were distributed into three groups, which are categorized in accordance with the level of visual impairment, and defined in accordance with the classifications of the World Health Organization: 1. legally blind examinees; 2. totally blind examinees and 3. examinees with low vision.

## 3. Method

In the evaluation of operational thought, the Piaget method was applied in evaluating the elementary logical structures, battery U.D.N. 80, whose author is Clair Meljak (1980). The tasks included elementary operation of classification, seriation, task by correspondence, as well as through conservation of mass and the task of rotating pearls. The methodological evaluation was implemented in accordance with the standard procedure, which was adapted to suit the capabilities and needs of the children with visual impairments, and in accordance with the model used by other authors who are active in this field (Eškirović, Vučinić, Jablan, Dimić, Ostojić, Đoković, et al., 2005).

The method of research is based upon a qualitative analyses of the achieved results and they will be presented both in the numerical values and in percents, as well as in terms of the degree and level of the cognitive development of the tested sample. The obtained results are presented in the tables. Analysis of results was conducted by various models of parametric and non-parametric statistics. For the purposes of the descriptive study the obtained data, were entered into a database using SPSS software for processing frequencies and percentages.

- The following variables were processed in statistical analysis procedures:

- The results of the chronological age
- The gender distribution
- Intelligence quotient measured for assessing intellectual abilities for children with visual impairments
- Socio-economic conditions of the children's family
- School achievement
- The level of visual impairment, defined in accordance with the classifications of the World Health Organization: 1. legally blind examinees; 2. totally blind examinees and 3. examinees with low vision.

These results will not be presented in this study because of space and numerical limitations of the article.

#### 4. Results

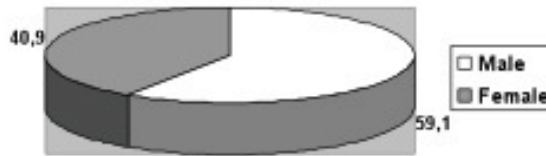


Figure 1. The gender distribution of the sample

The gender distribution of the examinee, shows the participation of 59.1 % examinees who were male, and 40.9% examinees in the sample who were female, which is the result of the natural distribution of examined children in accordance to their gender.

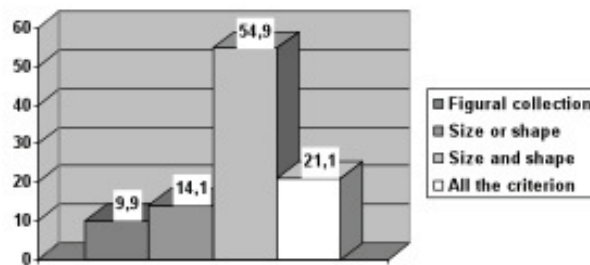


Figure 2. Operation of classification

According to the obtained results, we can conclude that the largest number of examined children, precisely 54.9% of the sample, was able to solve the task of classification according to the criteria of size and shape, whereas in fulfilling one of the given criterion the success rate was 14.1%. That number equals 9.9% when dealing with figural collections, whereas the success rate for the classification task, expressed through the classification of given models by all given criterion is equal to 21.1%. These results show a significant limitation in cognitive functioning in children with visual impairment, which are evident in the fact that without good quality development and accordable differentiation capability in visual and tactile perception, there is no harmonious cognitive functioning.

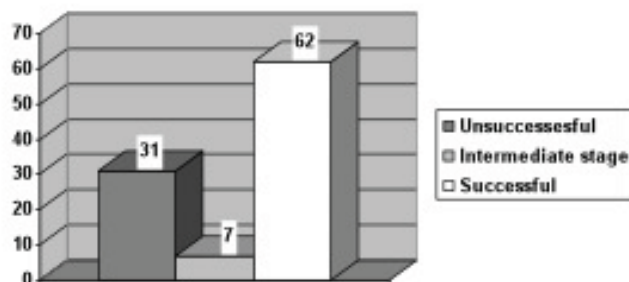


Figure 3. Operation of seriation

This part of the battery that evaluates operational thought is completed successfully by 62% of the examinees with visual impairment. In the intermediate state 7% of the sample is present, whereas 31% of the children did not master the operation of seriation. We can conclude that the visual and tactile-kinesthetic development result are important at this level of mental operation functions, which was established in our earlier research within this field.

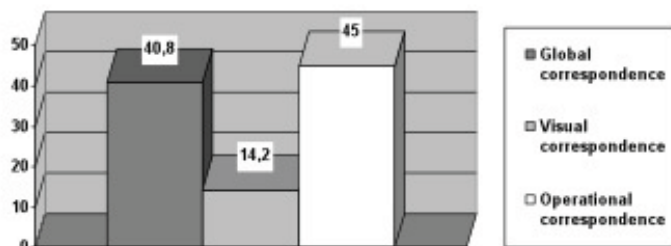


Figure 4. Operation of Correspondence

In this part of our research we noted a high percentage of examinees at the level of operational correspondence (45%), as well as a high level of examinees at the level of global correspondence. Visual correspondence is dominant in 14.2% of the examinees. Taking into consideration the procedure of evaluating visual capabilities of children who are visually impaired, we note that a significant limitation factor in development is played by the conceptual elements derived from experience, that act as a basis for the development of operational thought that examined in this part of our research.

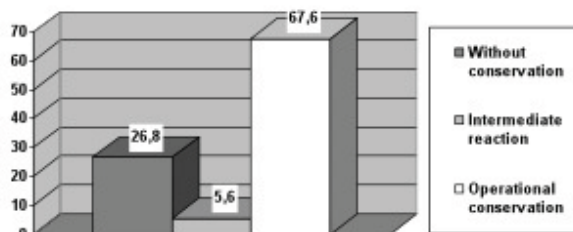


Figure 5. Operation of conservation of mass

The operation of conservation of mass is developed in 67.6% of the children with visual impairments in our sample. Intermediate level are present in 5.6% of the examinees, whereas 26.8% of the sample did not complete the tested operations. Based on these results it can be concluded that difficulties in visual functioning determine the cognitive development of these children in a specific way, in such a way that a certain number of children develop these operations with difficulty in relation to the type of developmental problem, in addition to which other significant factors, such as the level of intellectual functioning, should be controlled in our future evaluations.

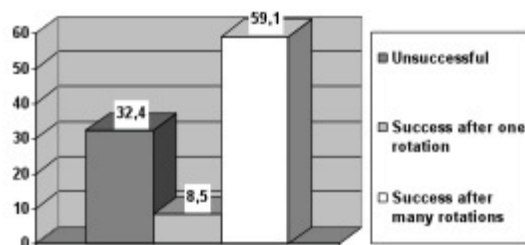


Figure 6. Operation of rotation of the pearls

More than half of the examinees in the sample group (59.1%) foresees the sequence after a number of rotations, the sequence is foreseen by 8.5 % of the sample group after one rotation, whereas 32.4% of the sample group is unsuccessful in this task. This points out a problem in the development of cognitive operations in children who have visual disturbances and impairments as a significant branch of developmental disorders and the therapeutic approach to these types of children.

## 5. Conclusion

According to the results obtained in our evaluations project, we can define the formation of elementary logical operations in the sample group of children with visual impairment, as inhomogeneous. In evaluating the operation of classification, possible conclusions on the specific developmental characteristics as the cause of specifically formed tactile-kinesthetic and visual experiences, as the basis of formation of experiential content tied to the capability of classifying objects in accordance with various criteria of conceptual level of thought.

Limitations in the visual tactile-kinesthetic experience lead to limitations in the formation of concept of operation of seriation, which was also emphasized in our earlier evaluations within this branch, and relating to the population of children with intellectual disabilities (Mačesić-Petrović, Jablan, Vučinić & Eškirović 2005).

When considering the results obtained in the evaluation of the operation of correspondence, the situation becomes more complex, because taking into consideration the evaluation procedure for the visual capabilities of totally blind children, there is a significant limitation factor, that is set in the formation of experiential concepts in this cognitive field, which can also point to the significance of a properly evaluation procedure, as well as material adapted to the sensory experience and needs of a blind child (Mačesić-Petrović, Vučinić, Jablan & Eškirović 2005).

In relation to the development of the cognitive operation of conservation of mass, it can be noted that most of the tested children develop these operations, as expected for their age group. However, there is a 26.8% of tested sample who does not develop them as appropriate. These results point to the disorders in the visual functioning which either enable for the operation of conservation of mass to be developed despite the type of visual disturbance or are interfered with or are hindered, in which case other significant factors should be controlled relating to the research problem, such as the level of general intellectual functioning which can represent the subject of our future investigations (Granrud, 1993; Yantis, 2001). The problem may also reflect the difficulties of the visual attention and attention problems, which generally may be in relation with voluntary attention (Posner, 2006).

Difficulties in the cognitive functioning in children with visual impairments are seen in the experiment which includes the rotation of pearls, can be seen in less than half the examinees, 32.4% to be precise; whereas more than half of the sample group in this evaluation had successfully completed the given tests in this field. This also shows the problems in the development of cognitive operations in children with visual impairments, as a significant branch

of developmental disorders indicative for the examined branch of cognitive functions (Dimčović, Tobin, 1992, 1995; Granrud, 1993; Yantis 2001).

Some of the similar studies suggest the conclusion that blind children show a slower course of cognitive development as represented by conservation of weight, substance and volume. One possibility is that lags in the development of operations such as conservations may be a result of carryover lags from sensorimotor period. The other possibility is that the experience of the blind children during the operations period is restricted in significant ways that hamper the development of operational thought.

In addition, though, it seems quite likely that the continued restrictedness of the school-age blind children's experience produces a continued depressing effect on the acquisition of conservation abilities (Warren, 1984).

Other authors refer similar data and conclude about significance of cognitive style in performance on the Piaget tasks. They refer individual differences in certain cognitive characteristics, aside from IQ, which are collectively called cognitive style. Age at onset was not specified. They conclude about the importance of vision in the development of an articulated cognitive style. For example, the children without visual impairments performed best on the some tasks of the Piaget test, while the partially sighted children was worse than the sighted children but significantly better than the totally blind children (Warren, 1984).

On the basis of these researches, however, the determinants of cognitive style in the population of blind are not all clear. As noted earlier, there have been individual differences reported in the totally blind and it would seem important to determine the factors involved in producing the differences. Degree of residual vision is clearly implicated in the performance on the implemented tasks. It seems clear that experiential factors, mentioned earlier, are important and adequate research will require concomitant attention to early visual history and residual vision characteristics (Tobin, 1972; Dimčović, 1992; Dimčović, Tobin, 1995).

At the end we can conclude about the importance of training on Piaget-type cognitive tasks. Training on Piaget-type cognitive skills and computer treatment improved performance on those skills. However, improvement also occurred on the IQ test. The training on conservation tasks apparently generalized to a cognitive test, which is not designed specifically to evaluate those tasks. This result suggests that there is a more generalized cognitive effects of the training on Piaget - type tasks at the whole cognitive functioning of the children with visual impairments (Warren, 1984; Karahoca, Karahoca & Yengin, 2010).

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