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COGNITIVE DEVELOPMENT OF SCHOOL CHILDREN – OPERATIONAL THINKING IN THE NORM AND PATHOLOGY

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КОГНІТИВНИЙ РОЗВИТОК ШКОЛЯРІВ – ОПЕРАЦІЙНЕ МИСЛЕННЯ У НОРМІ Й ПАТОЛОГІЇ

У статті представлено результати дослідження зрілості мислення в групі дітей, які мають труднощі у читанні, і тих, хто вміє читати без будь-яких проблем. У дослідженні взяло участь шістдесят шість дітей (з нормою розвитку та з ризиком дислексії). Метою дослідження є оцінка зрілості мислення у дітей (вимірюється ефективність оперативного мислення). Нижчий рівень координації логічних структур мислення отримано в групі дітей з ризиком дислексії. Результати дослідження підтверджують відмінності в способі оперативного мислення між дітьми з ризиком дислексії і в нормі розвитку.

Ключові слова: діти, пізнання, оперативне мислення, читання, дислексія.

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КОГНИТИВНОЕ РАЗВИТИЕ ШКОЛЬНИКОВ – ОПЕРАЦИОННОЕ МЫШЛЕНИЕ В НОРМЕ И ПАТОЛОГИИ

В статье представлены результаты исследования зрелости мышления в группе детей, которые испытывают трудности в чтении, и тех, кто умеет читать без каких-либо проблем. В исследовании приняли участие шестьдесят шесть детей (с нормой развития и с риском дислексии). Целью исследования является оценка зрелости мышления у детей (измеряется эффективность оперативного мышления). Низкий уровень координации логических структур мышления получено в группе детей с риском дислексии. Результаты исследования подтверждают различия в способе оперативного мышления между детьми с риском дислексии и в норме развития.

Ключевые слова: дети, познания, оперативное мышление, чтение, дислексия.

Introduction

The aim of this study is to evaluate the maturity of thinking of children the indicator of which is the efficiency of operational thinking. It is one of the stages of the development of thinking which is shaped and perfected during the period from 6 – 7 to 11 – 12 years of age [1; 2]. The efficiency of operational thinking can be an important predictor of the level of reading skills.

Thinking of children developing properly usually bears the characteristics of operational thinking. However, in difficulties (developmental disorders) the development of this kind of thinking does not proceed properly. This article shows the regularities of the development of thinking in children in late childhood and discusses the maturity to learn to read. The analysis of the results of studies focused on comparing children with reading difficulties (risk of developmental dyslexia) with those who do not have such difficulties regarding their maturity of thought. The answer to the question is an important aspect: what changes in the development of operational reasoning are important for learning to read?

In the literature there are different views on intelligence, its nature and development, including the development of thinking. Due to the subject of the article one should focus primarily on the characteristics of changes in the development of thinking in children in the period from 6 – 7 to 11 – 12 years of age.

THINKING OF CHILDREN IN LATE CHILDHOOD

Taking into account the theory of J. Piaget [2], development is a directional process that takes place through different stages, and individual stages – associated with qualitative changes – are marked by further developmental achievements whose each stage is a necessary basis for further achievements, resulting from the integration of the earlier ones.

One such achievement is operational reasoning. It is a way of intellectual functioning which does not appear suddenly but is formed and matured according to the rhythm of development of the child. It is one of the stages of the development of thinking. It is formed and perfected in the stage of specific operations from 6 – 7 to 11 – 12 years of age [1; 2].

Reversibility is a fundamental feature of operating thinking. The appearance of the ability to think operationally occurs, according to Piaget, at the age of 6 – 7 years and its stabilization occurs at around 11 – 12 years of age. In this period the first mental operations occur. As a result of the formation of the concepts of constancy, thinking of the child becomes operational, that is, reversible. This means that thanks to the development of mental operation systems, functioning independently of the content on which they are performed, the child understands that for any transformation, there is the reverse transformation whose performance will cause the return to the starting point of the first transformation. This is possible thanks to the rule (which the child cannot

verbalize) that in the transformations performed on objects, or their systems, only some of their properties are subject to change while others (the so-called invariants) remain unchanged. This allows you to perform the reverse transformation [2].

If the child's thinking becomes reversible, she or he may go back to the starting point in their reasoning. Thanks to the reversibility of thinking, fast, smooth, and repeated change of direction of thinking that allows for coordinating various points of view (decentration) is possible.

MATURITY FOR LEARNING TO READ

Reading, which is a complex psycholinguistic process, involves decoding and understanding the content read. In the first place it requires the ability to recognize and express graphic symbols through which the language information has been encoded, i.e. it requires mastering the art of reading. According to D. Elkonin [3] it is the decoding process, i.e. the transition from the graphical representation to its initial oral form of sound. The essence and purpose of reading is comprehension of the reading material. Therefore, it is a very important element of the efficiency of reading. Decoding and comprehension are the two separate aspects of the reading process. The condition for interpreting the content is, among other things, mastering the technique of reading and the appropriate level of thinking.

Comprehension in reading is a thought process thanks to which we not only reconstructively go into the content given to us for acceptance but we also creatively process it. It is treated as «a process of actively constructing the representation of the text read in the mind of the recipient, involving interpreting the information received in accordance with the system of knowledge and the inclusion of such information into it» [4, p. 97]. The condition for creating the mental representation of the content is the ability to recognize and express graphic symbols, that is, mastering the techniques of reading, knowledge of sentence structure and text, and the general knowledge of the world relating both to the outside world and to oneself. What also plays an important role is the situational context and the expectations of the reader.

Maturity to learn to read is an integral part of the widely-understood school maturity.

There are many diverse views of educators and psychologists who spoke on the efficiency needed to achieve the so-called maturity for learning to read. Among them there are many Polish authors [5; 6; 7; 8].

Recent studies by G. Krasowicz-Kupis [8] indicate very important implications for readiness for learning to read and write not only concerning the normal development of speech and language but also the awareness of language and writing. The author assumes that reading and writing constitute:

1. language action (a form of communication based on language);
2. metalinguistic action based on:

a) awareness of relationship print – word;
b) awareness of relationship phone – letter;
c) awareness of language resources used in the formation of speech and its control;

3. metacognitive activity that requires conscious control of cognitive processes involved in reading, that is, comprehension;

4. pragmatic and metapragmatic activity requiring the skill of deliberate use of written texts and control of their applications from the point of view of personal and non-personal goals [8, p. 79].

In the above terms, among the components of maturity for reading and writing, Krasowicz-Kupis [8] distinguishes specific and non-specific components, i.e. relating to reading and writing (speech and language, linguistic awareness, awareness of writing) or to skills and school adaptation in the wider range (attitude and motivation, perceptive-motor skills and mental development). Thus, from the point of view of cognitive development, decentration and the concept of object constancy and its features are a prerequisite for the use of arbitrary alphabet characters which act symbolically in relation to other symbols like sounds of speech. In contrast, reversibility and understanding of transformation allow the use of elements of the alphabet, manipulating it – analysis and synthesis. Operational nature of thinking and its further development is conducive to the fact that language and writing become objects of manipulation and experimentation.

PROBLEMS OF RESEARCH

Achieving the appropriate operating level of reasoning by the child is undoubtedly of great importance when it comes to learning maths [9; 10] physics and chemistry. Studies show that there is a close link between the lack of operational thinking in children and their later failures in learning mathematics [9; 10].

Maturity to learn mathematics is related to the maturity to learn to read and write.

However, there is no clarity as to whether teaching of reading requires a certain level of cognitive development. Nor do we know whether the ability to use specific operations is necessary to acquire these skills or preoperative skills are enough. There are many indications that the good pace of development of the operating reasoning is extremely important not only for effective learning of mathematics, but also in learning other subjects, perhaps reading. It can be assumed that the delays in the operational development of reasoning may affect difficulties in this regard. The research presented in this article is an attempt to explain the above-mentioned problem.

It is, therefore, worth answering the question: what changes in the operational development of reasoning are important for learning to read? and do reading difficulties coexist with low levels of functioning of specific operations?

METHODS

The first part of the study was to isolate two groups: criterion and control group. For this purpose, the **Scale of Risk of Dyslexia** by Marta Bogdanowicz was used [11]. The SRD questionnaire contains twenty one statements on a variety of symptoms of risk of dyslexia. The survey covers six areas of development: small and big motor skills, visual functions, language functions (perception), language functions (expression), attention. The distinguished spheres of development correspond to the six subscales. Any statement in the scale represents one of the diagnosed dimensions. Overall assessment allows for determining whether the child belongs to a group of children at risk of dyslexia and what the degree of this risk is.

To evaluate the efficiency of operational thinking the **Diagnosis of Child's Intellectual Capabilities DCIC-2M** A. Matczak [12] was used and **Reading Tests For Six-Year Olds** G. Krasowicz-Kupis were used to assess the reading level [13].

DCIC-2M designed to test children aged 6 – 10 is used to assess the intellectual capacity based on efficiency of operations of **addition and logical multiplication**. Efficiency of addition and logical multiplication – as basic operations of concrete thinking – is a diagnostic indicator of intellectual capacities. Material for mental operations: logical addition and multiplication is included in subtests: a) Classes (C) (classification) – score 0-3 p. (max. 114 p.); b) Relations (R) (arrangement) – score 0-3 p. (max. 114 p.). Test tasks of varying degrees of difficulty consist of complementing structures (complementing the missing element of a logical structure) which bear the characteristics of **Classes** or **Relations**. Tasks are closed: the subject has a choice of potential solutions (in the version for individual tests we ask about the reasons of the choice). These tasks: *Supplementation, Analogies, Multiplication* due to the material used are pictorial, verbal, figural and numeral. They are summarized in two test booklets (Classes and Relations).

Class is a structure whose elements share the same properties. **Addition of classes** – means combining their ranges, which leads to the absorption of narrower classes by the wider ones or formation of parent classes with a higher level of generality, e.g. a picture of a dog matches a group of other pets. **Multiplication of classes** is about isolating the common range of classes, which results in the creation of narrower classes, subordinate to the classes multiplied e.g. *mouse and hedgehog are animals; ship and boat are objects floating in water – fish matches mouse and hedgehog because it is an animal and ship and boat because it floats in water*. Operations on classes – **quantification of inclusion** – means understanding that a narrower class must contain fewer components.

Relation is a structure based on differences between the elements other than the wider class whose part it is. **Addition of relations** is the combination of relations of the same kind, leading to the formation of a series of, for

example, words: *year, month, week* match word *day*. **Multiplication of relations** means placing elements in at least two different arrangements e.g. one has to find a picture that would be a good complement of both pairs: truck and chassis (wheel is part of the chassis), and rocket and aircraft. However, *Operations on relations* is **understanding of their transitive nature**.

Respondents in the test DCIC-2M have to select one of several responses. A child making a choice can give a correct answer or commit one of the possible errors (Type I, Type II, Type III) receiving less than 3 points.

Type I errors are the partially correct solutions. A child creates simple classes and series (elementary logical addition), shows no logical multiplication skills. He or she manifests a deficit in the recognition of relations between classes or classifying relations. His or her reasoning is carried out by analogy. This type of errors can result from inattention or impulsiveness of the child. Type II errors are a way of organizing information typical of preoperative thinking. The resulting structures are not classes or relationships, they are figurative collections (perceptual or imaginary associations). However, Type III errors are random choices, where you can see the obvious lack of connection with elements of the supplemented system, a complete misunderstanding of the task; they are an attempt to guess the answer.

The method used to assess the level of reading skills by children is Reading Tests For Six-Year Olds G. Krasowicz-Kupis [13]. What is contained here are the basic samples for assessing reading in all aspects (*speed, accuracy, comprehension*): recognizing letters, reading the text, reading words, reading comprehension.

CHARACTERISTICS OF RESPONDENTS

The study group consisted of 60 children of 6 years of age attending kindergartens in Lublin. The whole group of children was divided, based on the SRD M. Bogdanowicz test, into two groups: criterion group which included children at risk of dyslexia and control group consisting of children without the risk of dyslexia.

ANALYSIS OF RESEARCH RESULTS

Analysing the results obtained by the children examined in Test DCIC-2 A. Matczak [12], one can conclude that children subject to risks of difficulties in reading achieve worse results in the test of operational thinking, both in the ability to create classes and detect relationships. Tasks of Classes are a bit easier than Relations in both test groups. **Children not burdened** with the risk of dyslexia mastered the elementary skill of logical addition but were worse at logical multiplication. Logical multiplication is more difficult for both groups than logical addition. **In children burdened with reading difficulties** one can observe a lower level of coordination of structures of logical thinking: low levels of reasoning by analogy, low level of logical addition and multiplica-

tion, domination of figurative collections based on direct, perceptually or imaginatively recognized relations, characteristics of preoperative thinking. The differences between average scores in Test DCIC-2 indicate that the average number of points obtained in individual subtests (Classes, Relations) and combination of Classes + Relations in the group of children at risk of dyslexia is significantly lower compared to the average number of points awarded to a group of children without the risk of dyslexia.

CONCLUSIONS

The efficiency of operational thinking may be an indicator of the level of reading skills. Research has shown that learning to read requires a certain level of cognitive development. It can be assumed that the delays in the operational development of reasoning may affect difficulties in this regard.

Not all children of 6 years of age manifest fully formed characteristics of thinking essential for reading: decentration, reversibility, understanding transformations, abstraction, generalization, comparison, classification (creating and naming classes) and the operations on words based on the ability to describe the relationship. The lack of these features of concrete thinking adversely affects the shaping of the concepts necessary for the mastery of the language system – it may contribute to difficulties in reading and hinder the start at school.

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