American Journal of Humanities and Social Sciences Research (AJHSSR)
e-ISSN : 2378-703X
Volume-3, Issue-6, pp-63-68
www.ajhssr.com
Research Paper Open Access

Diagnostics And Identification Of Individual Types of Distortion of Mathematical Capacities

Alena Leščáková
Catholic University of Ruzomberok, Slovakia, external doctoral student

ABSTRACT: The aim of the paper is to briefly describe the problem of mathematical skills diagnostics, which is performed by a special teacher. We will characterize dyscalculia - a developmental disorder of mathematical abilities, its types and symptoms. We will describe the professional and methodological problem with which a special teacher in a school facility meets and present a record sheet that is a creative solution to the problem. It contains tasks that capture all areas and factors of mathematical abilities, making it easier to identify a particular type of dyscalculia. In conclusion, we explain the meaning and usefulness of the record sheet, which facilitates the diagnosis of mathematical abilities, shortens the time of investigation, and specifically identifies individual disruptions, and is the starting point for designing a reeducational program for dyscalculus according to its weakened mathematical capabilities.

KEY WORDS: *Diagnosis of mathematical abilities. Dyscalculia.Recording Sheet.*

I. INTRODUCTION

The overwhelming majority of primary school children learn to read and write in the usual way by using the methods they use, thus giving them a basis on which to build their education and life. In addition to this large group, we have a certain percentage of children in schools who, due to minor damage to some brain area, or to their uneven or insufficient development, have particular difficulties in mastering reading, writing, controlling mathematical operations.

Numbers significantly determine our daily lives, and we are not always aware of this. We use them not only in relation to counting and mathematics, but also in various situational contexts and semantic relationships. We mark them in order, sequence, determine the number of objects, or estimate the approximate amount, use them to indicate the order of magnitude.Use numbers to find out about time, as well as the duration of events and events, remember phone numbers, bus routes, street numbers and houses. In different coding we find numbers eg. as numerals, numbers in writing, as Arabic, rarer than Roman numerals, and in our imagination we use them - although we are not always aware of this, as the approximate locations or regions of a particular numeric continuum or numerical axis, which shows us the position, size, and the meaning of an abstract number.From the above it is clear that both visual-spatial mental processes as well as speech processing processes and written speech processing processes are basic functional systems of number usage.

Theoreticalbackground

Mathematical abilities are multifactoriallyconditioned, arise from the interplay of partial abilities and skills. Both internal and external factors participate in their formation. The internal factors include the child's health condition, as it significantly affects math performance. External influences, such as the family environment, the way of family education, the school environment, and the teacher's professionalism, who can help a child with difficulties in mathematics, also play an important role.

Basically, we can say that in Dyscalculia it is a disorder of mathematical abilities that affects number manipulation, numerical operations, mathematical concepts, geometry. Most often, it manifests itself by the fact that a child cannot understand the symbolic nature of a number and adheres disproportionately to concrete illustrative ideas; He has difficulty orienting himself on the numerical axis, and there are difficulties in solving verbal tasks.

The issue of dyscalculia in Slovakia was dealt with by J. Košč, who in 1984 formulated a definition of developmental dyscalculia as follows: "Developmental dyscalculia is a structural disorder of mathematical abilities that originates in a gene- or perinatal noxia-related disruption of those parts of the brain that are a direct anatomical-physiological substrate of age maturing math functions but which do not at the same time result in disorder of general mental abilities ".[2]-[3]- [4]

Michalová talks about dyscalculia as a specific failure of mathematical abilities in terms of inability to operate with numerical symbols. It manifests itself by problems in the orientation on the numerical axis, by the changes of numbers and numbers, by the inability to perform numerous operations, by disturbances in spatial and right-left orientation. A child cannot use eg. the terms smaller - larger, unable to sort objects, fails to link count - digit, still counts one, has difficulty reading and writing numbers.[3]

There are many types of dyscalculia, but it is still true that understanding arithmetic requires the ability to understand the language, the words we use to explain the task. Therefore, dyscalculia may also be associated with reading and comprehension problems of reading. The ability to read accurately and with understanding is required to understand the written arithmetic task. Solving the word problem is a problem for these children for a number of reasons: they cannot read the text of the word task with understanding, they do not understand the mathematical aspect of the task, if they have problems with writing, they cannot write a task entry or an example for calculation.

According to these symptoms, we divide the dyscalculia into other types as reported by several authors.

- Significantly low level of mathematical manipulation with real objects, estimation of number, comparison, sorting by criteria - **practical dyscalculia**
- Disturbance of verbal marking of quantity and number, operational features and mathematical actions at all; difficulties with verbal naming of numerical series, with the notion of four-four times - **verbal dyscalculia**
- Ability to readdigits, operationalcharacters, multisitenumbers, and zeros in themiddle - **lexicaldyscalculia**
- Disruptionoftheability to writeonlymathematicalsymbolism, inaccurate and incorrectlocationofdigits in space, primitivetracingofgeometricshapes, lowlevelofmathematicalsymbolism and analogouserrorsas in lexicalform, but in writing–**graphicaldyskalculia**
- Failure to perform mathematical operations; confusion, replacing complex operations with simpler, recourse to written calculations for examples of easy-to-handle spam; non-clarity of the meaning of the position value of the digits in the number, primitive counting over 10 and up to 100; strenuous manipulation of sub-bills - **operational dyscalculia**
- Failure to understand mathematical concepts and relationships between them;the most prominent is the failure in verbal problems, the clinging to the template solution of the tasks, the strenuous understanding of the essence of equivalent operations - **ideognosticdyskalculia.**[2]-[3]- [4]

II. METHODOLOGY

Accurate diagnosis of mathematical abilities is the starting point for choosing the most appropriate method for teaching mathematics at school. It serves to know the qualities of knowledge, personality, and generally intellectual assumptions and specific assumptions for mathematics.

The diagnosis of mathematical abilities serves not only to identify, name problems, but also to develop an individual workflow with a particular child in mathematics.

In the diagnosis of mathematical abilities, taking into account the nature of disorders and disruption of mathematical abilities, a teacher, psychologist, special pedagogue and social worker, eventually a doctor.

In the field of mathematical abilities, it is therefore based on the determination of general rational assumptions, where the criterion for determining the difficulties is to reach at least the lower limit of the below average intellect, then we observe the results achieved in mathematics - whether they are below the overall level of children's results in a given year (eg or more years).

The psychological examination is focused on the perception of mental processes and states, the level of attention, qualities of thinking, memory and its structure, on the area of emotional-will, characteristics of personality, on the level and above all the analysis of the intellect profile most often by means of intelligence tests.

When it is not possible to clarify the difficulties in mathematics with previous investigations, it is justified to look for the organic origin of mathematical abilities. This means applying an appropriate set of specific math tests and exams based on a battery of tests to screen and diagnose mathematical abilities in school-age children.

Mr.Novák, a leading mathematical diagnostics expert, recommends several steps in diagnosing mathematical skills:

Step 1 - detailed pedagogical diagnosis of the level and composition teachers of the school, in particular basic numerical abilities based on long-term observations of the pupil, comparing his / her current knowledge and skills with the curriculum in the given year, but also comparing them with the classmates' knowledge. Such an assessment also aims at addressing systematic, recurring errors or solutions.

Step 2 - Analysis of anamnestic findings from an interview with parents or pupils, data on child development in the earliest developmental stages, pre-school age, forms of home preparation, parents' views on their child's problems with math, child's interests. Although it may be purely subjective in nature, it is the view of parents and has an irreplaceable place in solving the benefits of mathematics.

Step 3 - Decidewhethermathproblems are primarily in theperceptionarea, e.g. hearing, vision, or speechdisorders, and thelike. In caseofsuch a positivefindingitisnecessary to providethecorrespondingcomplexspecialformsofeducation to such a child.
Step 4 - a detailed analysis of the level and structure of intellectual abilities and the emerging character traits. At this stage, assess whether problems in mathematics are primarily of a pedagogical, social, or psychological nature, or entirely different, presumably related to the conspicuousness of certain areas of the gray cortex (dysfunctional).
Step 5 - Applying special tests and trials to analyze qualitative and quantitative findings.
Step 6 - Formulation of diagnostic findings, advantages and deficits in the areas of general and special abilities, including traits.
Step 7 - formulateconclusions to users, indicatingthe type and type ofproblems, butalsothestrengths and benefitsofthechild, thenature, content and structureoftheproposedmeasures in thecontextofcurrentsocialstandards.[1]

In our professional practice for the diagnosis of mathematical abilities, we use Novák´s a set of specific tests for the assessment of mathematical abilities, which consists of 23 tasks, Calculia III, Numerical Triangle, Visual Differentiation Test.
Individual tests are focused on a particular area in which the pupil may be weakened, whether it is the disruption of spatial relationships, arithmetic totals, visual perception, attention, logical thinking, imagination - that is, the underlying processes that are essential to understanding mathematical relationships and contexts.
However, this information is of little importance to teachers, since most educators are interested in whether a pupil has acquired prefixed and numerical concepts, how to read and write numbers, whether he / she correctly orientates in a numerical series, or whether he / she correctly compares whether he / she has acquired basic mathematical operations as a census. subtraction, multiplication and division, as it solves verbal tasks.
However, entering all the tests during a single examination is very time-consuming, difficult and stressful for the client, the results are inaccurate and insufficient to determine the conclusion, so we have created a simple record sheet in our workplace that covers all areas of interest and factors of mathematical ability and through which we can identify a certain type of dyscalculia.
The record sheet fulfills the main goal for which it is intended - it diagnoses mathematical abilities, identifies individual types of dyscalculia and at the same time meets the requirements of special pedagogical diagnostics and pedagogical practice. It focuses on all specific mathematical abilities - it captures perceptual and verbal factors, lexical, spatial and graphical factors, operative factors, memory factors, factors of mathematical judgment, and can be used for pupils from the first half of primary school.
First and foremost, we were interested in the class that the pupil attends, as a specialist must, according to the grade, control the content of the subject matter in order to avoid testing what the pupil has not yet learned. He also watches whether the pupil repeated the year, or regularly attended school, whether he had many absences, as he had homework.
During the examination we always focused on those activities that are at the core of mathematics lessons and what tasks pupils often encounter. For pupils, the tasks were clear, seemingly simple, yet reasonably demanding, tracking every area of mathematical abilities and observing how the pupil works, calculating whether he or she is helping with the opinion of whether he or she needs help from an examiner, and assessing the extent to which he / she has developed mathematical skills. We were also surprised that pupils approached mathematical tasks without fear of failure because they were generally familiar with their tasks from school.
The examiner already judges during the completion of the individual parts of the record sheet whether additional tests are needed to confirm any difficulties he / she has noticed in each task. In such cases, the Visual Differentiation Test, Analogue, Numeric Triangle, Lateral Test, Calculia III, if necessary, Color Calculia is recommended.
Recording sheets are evaluated, along with other tests, the results of the entire special education examination are consulted on the results of the psychological examination, and a diagnosis is made as to whether it is developmental dyscalculia or just reduced mathematical abilities as a result of misunderstanding the curriculum taken over.

Results of diagnostics and identification of individual violations of mathematical abilities
When evaluating the above mentioned record sheets, we wanted to find out whether they affected all areas of mathematical abilities that we observe in the diagnosis and whether we can name and identify individual types of dyscalculia in order to be able to determine the exact diagnosis in the report from the diagnostic examination and propose to special educators in appropriate re-education program in schools.
Sample clients consisted of primary and secondary school pupils with learning difficulties. Some of them have already been diagnosed with developmental learning disorder, some have been diagnosed for the first time.

After processing the results and recording the achievements of the examined pupils, we found out that out of a sample of 90 pupils we can confirm the diagnosis of dyscalculia in 45 pupils. In no case is there any dyscalculia in isolation, but there is always another developmental learning disorder, especially dyslexia and dysortography.

In 13 pupils, learning disability was not confirmed, they did not weaken partial cognitive abilities that would lead to the diagnosis of learning disabilities. The causes of failure are different in this case - indifference to learning, negligent school attendance, no homework, lack of interest, while the child has the prerequisites to master the curriculum without significant difficulty.

In 32 diagnosed pupils, only the diagnosis of dyslexia, dysgrafia, dysortography, without the presence of serious disruptions of mathematical abilities was confirmed.

In the interpretation of the results, the following part of the paper will focus on the individual factors and areas of mathematical abilities in order to point out whether we are able to identify individual types of dyscalculia, respectively and what kinds of dyscalculia we encounter most often in our practice.

A. Tasks for naming, distinguishing and sorting individual geometric shapes and shapes

Only in 4 cases out of a sample of 45 dyscalculums did it have difficulty naming geometric shapes and shapes. They were mainly pupils of the 1st and 2nd grades of primary schools, they came from socially disadvantaged backgrounds, their mother tongue is different from standard ones, mostly they did not attend kindergarten. In naming the individual shapes and shapes they called them what the shape reminds them of, or they called it in their mother tongue, or they mistaken the names - cube-square. The greatest difficulty makes them naming a rectangle. Thus, we can conclude that pupils do not have sufficiently developed memory skills and visual resolution.

When sorting shapes and features by character, all pupils found at least one criterion and divided the subjects into two groups, sorting them by size, color, shape. Thus, the practice of object-oriented dyskalculia was not confirmed by anyone.

B. Tasks to verify orientation in numerical rows

Pupils should either speak numerical rows rising and falling in the field taken, or write missing numbers in the ascending and descending numerical rows. We have not noticed any significant difficulties in this area. Pupils are able to mechanically name numerical series rising and falling in the field of study, and they correctly fill in the missing numbers. Lower grade pupils have errors in adding numbers to decreasing numbers, but can be corrected when alerted, or downward numerical series are recorded as rising. Again, verbal dyscalculia was not confirmed by anyone.

C. Tasks for understanding the meaning of a number

In this part of the record sheet, pupils had 3-4 tasks, the fourth task was intended only for pupils of the 1st and 2nd grade of elementary school. In the first three tasks, pupils were to beat and draw a given number of subjects and then compare the numbers. In this task it is necessary to read the digits correctly, not to change the digits, to draw the correct numbers, to write the digits correctly, to write the comparison marks correctly. First trouble has already appeared. Pupils incorrectly read the numbers, drew the wrong number of subjects, wrongly compared.

We also found fast drawing and slow dictation of number or vice versa, slow drawing and fast dictation of numbers. Afterwards, the students concluded that they had already drawn a lot or few commas, started counting again, disappeared between the objects, skipped the commas, making mistakes and failing the task. When comparing numbers, it was often necessary to explain and show the signs of comparison, with which number the larger, smaller character is written. We have found that pupils have incorrectly compared comparison procedures, cannot track multiple digits if they start with the same digit, they mistake numbers. We assumed that only pupils in lower grades would have difficulty comparing numbers.

However, we were convinced that even pupils of 8th, 9th - class and also high school still have persistent difficulties in comparing numbers. Failure to compare and distinguish between larger and smaller numbers affects the subtraction of digits. We have confirmed the practicality of dyscalculia in numerical operations in 22 pupils.

The fourth task was to correctly show the number of fingers as directed. We gave this task to pupils of the first and second year of primary school. Nobody has failed in this area.

D. Tasks for finding verbal factors of mathematical abilities

This was followed by a task in which we watched whether the child had the ability to read and write numbers correctly, and whether he or she had acquired the position of the digits in the number. Difficulties in this task were already in the third year of the class, which was taught in the field up to 100, respectively up to 1,000 because it was already required to know how many zeros and numbers (numbers) have a number of 100, 1,000,

10,000, as the numbers are read correctly if some of them are omitted. Pupils who were diagnosed with dyslexia and dysgraphia, not only dyscalculia, could not do this.Mirrored readings, numeric digits, skipping digits, adding digits, and reading positions that were not in the number appeared. The same mistakes were made when writing numbers, the numbers were rough, inaccurate, unreadable, unfinished, written in mirror, wrong way. This observed area confirmed the presence of verbal, lexical and graphic dyscalculia.
The last two tasks were focused on the practical skills of manipulating numbers, as the child controls the basic mathematical operations of addition, subtraction, multiplication, and division, as they solve mathematical tasks.

E. Tasks to verifytheability to add, subtract, multiply, divide
In thelower-yearrecordsheets, theexampleswererecorded in rows, and in theuppergradestheywerealsorecorded in rows and beloweachother, so we watched the control of both the written addition and subtraction. Lowergradershavesolvedexamplesof spam, butmanyhavebeenusingfingers. Whatwassurprisingforus, eventhesecondgradepupils, evenhighschoolstudents, countedsomesimpleexampleswiththeirfingers.
The greatest difficulty has arisen in the case of baseline transitions - be it addition or subtraction. When reading up to 20 and up to 100 pupils do not master basic procedures and do not remember simple subtotals. The results are only guessing and I do not understand why they are being notified of an error. Though they are pointing with their fingers, they cannot show a two-digit number, they pull their fingers out differently, rewrite their fingers, lose in the examples, then slip to write the same result to all the examples. They don't even respond to help and explanation, giving an opinion, just don't understand what to do.
Likewise, they do not have written addition and subtraction procedures, starting to count from left to right, from hundreds to units, regardless of the baseline transition. When subtracting, they do not realize the lower number above the higher, when they have to borrow a dozen, they cannot ask, they do not understand even after explanation. If we ask how such examples count on mathematics lessons, we get the answer that they count everything using a calculator. All pupils from sample 45 were confirmed to have operative dyscalculia.
Examples of multiplication and division were determined for pupils from the 4th year, in the lower years we studied only the control of the multiplication table, in the higher years we also mastered the written multiplication of multiple digits with a single-digit, sometimes double-digit number.
Since the seventh grade and higher (also high school students), we have also tried to divide multiple digits by a single-digit number, whether the pupils also control this rather demanding procedure. Proper control of the multiplication table depends on good memory capabilities and understanding of the multiplication and division principle. Already when looking at a simple multiplication table, the pupils sighed and troubled, many drew a number of subjects, counting single multiples on their fingers one by one.
They all gave up on division, they do not know the principle, nor did they try to envisage these simple examples after explanation. Again, we found that the school, as a compensatory aid, provides a calculator that makes it easy to calculate, but it does not allow you to learn the sequence of steps in solving individual examples of multiplication and division.
All grade 4 pupils with diagnosed dyscalculia had difficulty in multiplication and division. Again, in these cases, operative dyscalculia and reduced memory, spatial and reasoning factors of mathematical abilities have been confirmed.

F. Tasks for Solving Word Problems Based on Understanding Assignment
Solving word problems depends on the level of reading and understanding of the text. If a child has dyslexia, has severe difficulty in composing words and understanding the task, we cannot expect a quick and memory-based solution of word tasks. If dyslexia was diagnosed and we found that he was unable to read alone and was unable to read comprehension, we were able to read the two types of verbal tasks, and we tried to understand and achieve a verbal task.
We also encountered a surprising performance when the child was unable to read a simple word on its own, but after reading the assignment, it spoke out the right answer. Only in two cases did we find that the child had ideognosticdyskalculia - one sophomore and one seventh failed in this area, not even multiple readings, explanation of the assignment, writing an example, everything done with mistakes.

III. DISCUSSION AND CONCLUSION

If we compare pupils' examinations with our record sheet, and using Novak's Set of Specific Examinations, we must state that our record sheet is simple, corresponds to the child's investigated age category and math content, and notes all areas of mathematical abilities and their weaknesses and disruptions.
At the same time, it allows us to precisely identify the kind of dyscalculia, which is a huge benefit to a special educator - diagnosis, because it specifically defines the diagnosis; an appropriate therapeutic program for a group of pupils with the same type of dyscalculia. Novak´s The set of specific tests is complicated, cannot be used for all ages, has the same types of examples for all grades, individual tests are elaborated lengthy, complicated, often misunderstood and fail.

Based on the practical experience of diagnosing with our suggested sheet, we can say that the work of a special educator has become more efficient, the processing and evaluation of the results has been made, the type of dyscalculia goes, and based on the diagnosis, recommendations for reeducational exercises to work with dyscalculics precisely targeted to the most weakened areas of mathematics.

REFERENCES

[1] NOVÁK, Josef. Examination of mathematical abilities in children. Bratislava: Psychodiagnostika, a.s. 1998.
[2] POKORNÁ, Věra. Theory, diagnostics and correction of specific learning disorders. Prague: Portál, 1997. ISBN 80-7178-135-5
[3] ZELINKOVÁ, Olga. Learning Disabilities: Specific developmental disorders of reading, writing and other school skills. Prague: Portál, 2003. ISBN 80-7178-800-7
[4] ZELINKOVÁ, O. Pedagogical diagnostics and individual educational program. Prague: Portál, 2001. ISBN 80-7178-544-X.

Author:
PaedDr. Alena Leščáková
Catholic University of Ruzomberok, Slovakia, external doctoral student
e-mail: alenalescakova@gmail.com