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Cognitive Educational Transaction: Assessment and Mediation of Pupil's Cognitive Capacities

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Summary

Nowadays, a specific type of educational transaction whose aim is to know the cognitive determinants of the educational process has become the subject of basic and applied research. Research findings relating to the brain and mind indicate that if we can gain a better understanding of a pupil's cognitive apparatus, this may lead to more effective teaching of underperforming pupils. When considering the causes of a pupil's unsatisfactory school performance, it is important to consider which elements of thinking require activation during information processing, or task performance. Knowing the aspects of the pupil's motor and mental speed and their cognitive flexibility is the starting point for cognitive stimulus transactions. From this knowledge, subsequently generated transactions can be carried out in an individual intervention aimed at remedying possible cognitive deficiencies in underperforming pupils. In the paper we present the results of the pilot research (as a part of more complex experimental study[1]), whose intention is to assess the suitability and the selection of appropriate research tools in the diagnosis of pupils' motor speed. The diagnosis is an introduction to research on the assessment of the impact of the relationship between the pupil's

[1] The research is carried out as part of the project *Experimental verification of programs aimed at stimulation of executive functions of underperforming pupils* (*in the last year of elementary education*) – *the cognitive stimulation potential of Maths and Slovak language* under the supervision of prof. Iveta Kovalčíková.

motor speed and information processing speed on their success in learning. The subjects are pupils aged 8-10, gender-diverse. During the diagnosis the following tests were used: Mira Stambak's hatch tests, the "Looping" test, the rate of writing the word *domek* (house) by Elżbieta Grzegorzewska test, Rene Zazzo's Card Test, Oseretsky's test of motor speed development, test of cognitive functions, Trail Making Test (TMT) by Dean Delis, Edith Kaplan and Joel Kramer. The following factors have been taken into account: accuracy of the test, time needed to carry out the test, clarity of instructions, criteria for evaluation of test results and interest of pupils. After analysing the results, it was found out that the proper research would be conducted with the following tests: Looping, Hatching and Trail Making Test.

Keywords: mediation, cognitive stimulus transaction, cognitive process, motor speed, mental speed, cognitive flexibility.

Behavioral vs. Cognitive educational transaction

Not so long ago, it was thought in the area of pedagogy that man's behaviour is controlled and steered by their external environment. It would mean that human behaviour is a reaction that can be modified depending on the nature of a stimulus from the external environment. In this context, the role of psychology and partially pedagogy was the analysis of an individual's type of behaviour on the basis of an analysis of particular factors influencing a certain type of behaviour. This type of educational transaction is referred to in the literature as the Stimulus – Response Format. The basis of this transaction is an effort to focus on determining the nature of the relation between a given stimulus, i.e. behaviour preceding the occurrence of the stimulus, and reaction to this stimulus – behaviour. The research conducted on the basis of this behavioural paradigm concentrates on discovering the laws and rules that steer and predict one's behaviour or reaction to a stimulus. Behaviourism is a trend in psychology and philosophy which reduces human psyche to behaviour. In 1913, J.B. Watson set up a psychology school that became quite influential, especially in the United States (acc. to Ďurič Bratská, 1997). Experiments carried out in laboratories, above all on animals, constituted the basis for conclusions showing that in educational situations, in transactions in the educational context and beyond it, it is possible to control one's reactions to a given stimulus and to develop transactional stimulus-reaction relations. It is possible provided that we minimize external interference and exclude other uncontrolled stimuli. Over many decades it was believed that in educational behavioural transactions it is possible to shape, control and steer any behaviour. An ambiguous statement issued by Watson (1930), regarded as the father of radical behaviourism, illustrates ideological essence of these theories: "Give me a dozen infants, give me an opportunity to bring them up, and I guarantee you that if you pick up one of them at random, I shall prepare them to any type of specialist job – doctor, lawyer, artist, entrepreneur, regardless of their talent, predilections, race or parents' jobs" (Kovalčíková, 2001). The aforesaid point of departure had and still has an influence on educational concepts. One of the main rules that were

referred to the learning situation was an expectation that the consequences of given behaviour define the possibility of this behaviour's occurrence. Positive consequences strengthen this behaviour and probably make it re-occur if the same stimulus is used. This rule was transformed into the A-B-C model of steering one's behaviour in educational transaction (Pou, 2008). In the aforesaid model, A can be interpreted as ANTECEDENTS represented by situations, events, environment organisation triggering, provoking a reaction, behaviour. B – BEHAVIOUR – is everything that an individual does, makes, says and that is possible to observe by other individuals. C expresses CONSEQUENCES — these are activities following the said behaviour. In this behaviour-oriented type of transaction or behavioural concept of learning, functional relations between a given type of behaviour – its antecedent/ cause and consequences – and environment where this behaviour occurred are subject to analysis. To eliminate a given undesirable type of behaviour (i.e. not doing one's homework) – with the help of the behavioural educational transaction – it is necessary to manipulate (1) antecedents' environmental and contextual circumstances and (2) reactions, consequences. After some time, when antecedents and consequences are manipulated systematically and in the right way, behaviour modification is expected. Critics of the behavioural approach to learning pointed to the fact that behaviourists focus too much on observation and measurable aspects of one's behaviour, external stimuli and environmental influence during the process of learning. What is more, the behavioural paradigm of learning is associated with little attention devoted to changeable factors, which are linked with an individual, and more precisely with the structure of their cognitive, affective or cultural features. An individual's internal, mental states, their attitudes, thoughts pertaining to a given situation are variables located between a stimulus and reaction, and in the opinion of critics of the behavioural approach they are insufficiently represented. The interpretation of the process of learning can be based on the belief that if an individual's mental states are not observable, they cannot play a crucial role in determining or explaining one's behaviour. However, in the last decades, due to technological development used in cognitive sciences, it is possible to observe the human brain in action, in the situation of learning. Cognitive science is an interdisciplinary branch of science which analyses the human mind and its processes. It explains cognitive features of the human brain with the help of both modern theoretical and experimental methods. It examines intelligence and behaviour, focuses on how information is presented, processed and transformed by an individual's nervous system. The aim of cognitive science is creating a formal explanation model and modeling out of cognitive activities. Cognitive science encompasses such disciplines as psychology, philosophy, neuroscience, linguistics and cognitive anthropology (Kovalčíková et al., 2016). Nowadays, it is clear that observable behaviour cannot be the only source of research and way to understand human thinking and learning. Before making an attempt to modify a pupil's undesirable behav-

iour, one should understand their thinking processes and way of thinking, which constitute the background of such behaviour. Behaviour is always the outcome of the work of the human mind in the context of an event or a situation, which is a result of how the external environment influence is organised. In the pupil's mind, in their thinking processes, there are many ways in which external reality can be cognitively reflected, and these ways have an impact on the external environment. By their nature, events, situations, teaching methods, school curriculum, learning organisation in educational transaction constitute external stimuli. These phenomena are internally represented in the pupil's mind, in their cognition by means of thinking, memorising, distinguishing, comparison and generalisation. These processes are the expression of human thinking-cognition. Mental phenomena taking place in the pupil's mind are expressed behaviourally. For example, the behaviour of a pupil whose mind insufficiently notices and evaluates/ processes information from a task makes him perceived as inattentive or the one that does not memorise, makes mistakes in the process of task solving. Instead of evaluating the pupil's achievements, or in other words, instead of responding to their undesirable behavioural reactions in the school environment, in the form of a grade or other type of evaluation or punishment, a better solution would be analysing their internal mental processes which are manifested in the pupil's external observable behaviour. Otherwise, it is important to ask a question: which of the pupil's internal resources has an impact on their suboptimal school performance? Next, we can ask a question: How can we research cognition if it is not visible? How can we discover the specificity of a given pupil's cognitive processes?

Mediated learning and cognitive structural modifiability

Nowadays, a specific type of educational transaction whose aim is to get to know the cognitive determinants of the educational process has become the subject of basic and applied research. Research findings relating to the brain and mind indicate that if we can gain a better understanding of a pupil's cognitive apparatus, this may lead to more effective teaching of low-performing pupils. When considering the causes of a pupil's unsatisfactory school performance, it is important to consider which elements of thinking require activation during information processing, or task performance. According to Lebeer (2006), cognitive processes are not only the product of the physiological maturation of the brain but also of cognitive stimulation during socialization. In the literature targeted cognitive stimulation is referred to as mediation or mediated learning (Kozulin & Rand, 2000; Feuerstein, R., Feuerstein, R.S., Falik & Rand, 2006; Pou, 2006). Mediated learning reperesents a type of cognitive educational transaction. In this transaction, i.e. through mediation children learn 'what', 'why' and 'how'. In

other words, in mediated learning the adult draws attention to the stimulus (the *what*) that attention is focused on, attributes meaning to it (the *why*), and teaches the relevant approaches and strategies (the *how*) (Pou, 2006). Cognitive educational transaction, also known as the cognitive mediation model builds on two primary theoretical sources: (1) *The Theory of Structural Cognitive Modifiability and Mediated Learning Experience* (MLE) (Feuerstein, R., Feuerstein, R.S., Falik & Rand, 2006); and (2) *The MiCOSA Model* – Mediation in the Classroom: An Open Systems Approach (Robinson-Zanartu, Doerr, & Portman, 2015). Feuerstein and his colleagues (Feuerstein et al., 2006a; Feuerstein et al. 2006b) formed a working structure – a list of most frequently occurring pupils‘ defects in information processing. The categorisation criterion in this context, emphasising an artificial and expressive framework structure, was in this case identifying and determinig the main stages of mental actions that can be registered while solving a given task.

In this context, Kozulin (1998), for example, differentiated between *direct learning* and *mediated learning*. In direct learning, the child interacts with the environment. These interactions may take the form of observed learning, learning through trial and error, or learning through conditioning. In mediated learning transaction, the adult (parent or other bearer of cultural experience) takes on the role of mediator and stands between the child and the environment; in other words, the adult mediates the cultural experience. Mediation is targeted (Kozulin, 1998), i.e. the mediator intentionally filters and focuses on environmental stimuli, selecting, classifying, and organising their sequencing, and regulating their intensity, frequency, and order. The mediator and the child create relations between the stimuli that rediscover past experience and anticipate future experience. This can be referred to as systematic mediation in the child’s zone of proximal development. Through mediation the child is led to perceive stimuli which were previously perceived randomly and unintentionally in a completely different way. The child learns to focus their attention, observe, differentiate, compare, classify, and intervene. Subsequently, the child will interact differently with the surrounding environment and their contact with the environment will take on a new quality. It is no longer passive “observation”, but active perception of the experience (Kozulin, 1998; Feuerstein, R., Hoffman, M., Rand, Jensen, Tzuriel & Hoffman. D., 1986). During mediation, the pupil learns to implement active, productive, and representative thinking required for institutionalized learning. According to Feuerstein, R., Feuerstein, R.S., Falikand Rand (2006) and Feuerstein, R., Jackson and Lewis (1998), and Falik (2000) mediation is based on the premise of *Structural Cognitive Modifiability* (*SCM*). It assumes that individuals are capable of qualitatively changing their level of thinking and behavior in response to a systematic, planned, repeated, and stimuli-variable intervention.[2] Kozulin

[2] The potential for modifiability could be assessed with the use of dynamic testing and influenced by structurally situated educational contexts.

(1998), however, emphasised that this does not mean that a child who does not have the opportunity to participate in mediated learning interactions/transactions, or access adequate mediation by adults, will have limited access to higher thought processes or display an irreversible level of development. Cognitive psychologists (De Bono, 1976; Haywood, 1977, 2004; Sternberg, 1990, 2013) have stated that structural cognitive modifiability is a phenomenon which can be observed over one's lifetime. According to Sternberg and Grigorenko (2002), the real problem is not whether cognitive modifiability is possible or not, but rather how we can cognitively modify a person's capabilities best. In education this means ascertaining how the person should be taught. Providing a low-performing child with a task to perform in a specific way presents the educator with an opportunity to target and correct a wide spectrum of deficit cognitive functions. In the teaching environment and pupil–mediator relationship, mediation provides the teacher with an opportunity to (1) diagnose the quality of the pupil's cognitive apparatus (2) understand the reasons for their inadequate school performance, and (3) create a remedial programme to improve their deficient cognitive processes. Cognitive processes are considered to be a "mixture" of natural capabilities (overlapping with intelligence), motives, habits and attitudes towards learning and processing information. Clinical studies and observations indicate that if the exact mental "source" of cognition is identified, then this information can be used to link diagnostics with mediation. If we want to understand and discover the source of the cognitive deficit and the potential for cognitive change, we must first analyse the task the child is attempting to perform. This can be done by conducting a cognitive analysis that produces a cognitive map of the task (Feuerstein, R.S., 2000; Burden, 2000). The cognitive map summarizes the cognitive requirements essential for successful task completion. The structural elements of the task are aligned with these requirements. The map compares these cognitive requirements with the individual's cognitive capacity to perform that task. The relationship between the cognitive requirements and the pupil's cognitive capacity may be sufficient to facilitate learning and task performance or may lead to an inadequate, deficient performance. According to Feuerstein, R., Feuerstein, R.S., Falikand Rand (2006) the cognitive map is based on seven elements. These relate to the requirements for task performance:

1. Content of the mental act (domain-general or domain-specific).
2. Task modality (task mode or language).
3. Phase of mental act (the main thinking stage).
4. Cognitive operations, functions present during task performance.
5. Level of task complexity.
6. Level of task abstraction.
7. Level of efficiency (rapidity, level of precision, effort required).

In *Cognitive processes and phase of mental act,* Feuerstein, R., Feuerstein, R.S., Falikand Rand (2006) describe the working structure of the most frequently

occurring cognitive deficiencies in pupils. For heuristic and functional purposes, the cognitive functions are divided into the phases of mental act that can be registered during task performance. R. Feuerstein and others (Tzuriel, 2001; Pou, 2006) have identified the following three phases in the mental act: *1. the input phase*, during which the perception, collection, and gathering of information occurs; *2. the elaboration phase*, during which the information is processed; and *3. the output phase*, the expression and communication of stimuli processed during the elaboration phase. The mental activities an individual uses to perform a task require: 1. mastery, control of the task's dimensions, 2. adequate engagement of the cognitive functions required to manage the task. Clearly a child who already wrestles with many cognitive deficiencies in the initial phase of the task will not be capable of progressing during the elaboration phase of the task. Educators teaching the curriculum to pupils with unidentified deficient cognitive functions may be unable to help them achieve their learning objectives. Information regarding a pupil's cognitive performance that takes into consideration (1) the cognitive phase of task performance and (2) the cognitive processes activated during these mental sequences could be used as the basis for a cognitive mediation programme accounting for that pupil's educational needs. It is important to stress that the phases of the mental act are dynamic, criss-cross in complicated ways and represent the act of thinking in its entirety. They are artificially divided into the three phases for the purposes of (1) investigating, identifying, and explaining elements of thinking and (2) designing mediation programmes. The specialist literature contains a number of theories that identify the cognitive processes active during the mental act. For instance, the theories by R. Feuerstein and C. Robinson et al., divide the mental act into the three phases previously mentioned. Feuerstein, R., Feuerstein, R.S., and Falikand Rand (2006) refer to the cognitive processes represented by each phase of the mental act as (*deficient*) *cognitive functions.* Feuerstein and Feuerstein define these as cognitive manifestations that can be observed during task performance that may be deficient. Feuerstein suggests that negative connotations – deficient cognitive functions – automatically point to a possible diagnosis of cognitive problems associated with task performance. In the mediation process, the mediator/teacher explains to the pupil which cognitive processes "act" while tasks are being solved. We obtain information from the pupil on what they think about, how they think, what they think about their own thinking process. The information obtained lets the teacher discover which elements of the pupil's mental act might be considered insufficient, "deficit", poorly developed. This specific way of teaching is analysed in the light of cognitive educational transaction. Two phases can be recognised in cognitive educational transaction. If the mediator declares that cognitive operations contribute to poor outcomes whose processes lower the quality of pupils' learning, they can commence systematic and planned intervention. Cognitive intervention presents in

this way cognitive stimulation which focuses on eliminating problems linked with the pupil's cognitive condition.

In the next part of the paper we analyse the pilot study results, which were part of more comprehensive research. The research was focused on experimental verification of the type of cognitive educational transaction focused on cognitive determinants of the educational process. Knowing the pupil's aspects of motor and mental pace and cognitive flexibility, it was the starting point for creating cognitive stimulus transactions. The aim of individual intervention transactions was to remedy possible cognitive causes of reduced school performance in low-performing pupils.

Analysis of the pilot study

Taking into account the subject and the aim of a given study, the researcher should determine the aim of this type of activity and how its results can be helpful afterwards. In the presented concept, **the aim of the study is a pedagogical diagnosis of cognitive processes, especially the relation between the pupil's motor speed and information processing speed**.

The main aim of the study:

1. **The evaluation of the influence the relation between the pupil's motor speed and information processing speed has on their school achievements.**

The following detailed aims were defined:

1. Analyse pupils' motor speed depending on their information processing speed.
2. Diagnose operational functions of the surveyed pupils as far as slowing down and cognitive flexibility are concerned.
3. Analyse learning results of the surveyed pupils.
4. Get familiar with the teachers' evaluation in relation to the surveyed pupils' learning results.
5. Analyse the level of the pupils' self-esteem and motivation.

The aforesaid aims made it possible to form the main problem:

1. **Is there a relation between the pupil's motor speed and their information processing speed that has an impact on their learning results?**

The following detailed problems were defined:

1. What is the relation between the pupil's motor speed and their information processing speed?
2. What is the state of operational functions of the pupils surveyed as far as slowing down and cognitive flexibility are concerned?
3. What are these pupils' learning results?
4. What is the teachers' evaluation in relation to the surveyed pupils' learning results?

5. What is the level of the pupils' self-esteem and motivation?

The study adopts a working hypothesis **assuming that there is a relation between the pupil's motor speed and their information processing speed that has an impact on their learning results**.

Research sample

The pilot research was conducted in the period of time from September to October 2018 among 11 pupils of the 2nd – 4th grade of primary school in Sosnowiec. Within the framework of the research the pupil's motor speed was measured The aim of that pilot research was a qualitative analysis of contextual and methodological aspects of the research in order to choose appropriate research tools and evaluate their usefulness. The following criteria shall be taken into account: test accuracy, time needed to run the test, instruction clarity, evaluation criteria and pupils' interest. The pupils were of different genders (6 boys and 5 girls) and age (4 eight-year olds, 3 nine-year olds and 4 ten-year olds). These were pupils with special educational needs mainly deriving from their specific difficulties in learning (risk of dyslexia), including attention deficit disorder, optic and aural perception, central aural processing, deficits in the area of graphomotor skills. The research was conducted in the paper form during two thirty-minute meetings.

In the main stage of the research, our aim should be enlarging the research sample, identifying and determining a number of subjects in the research in order to conduct a statistical analysis. All applied tests should show the same level of graphomotor pace. If a given test diverges from the data registered in other tests, it should be removed in the main research.

Method

The research was conducted with the use of the following tests:

— Mira Stambak's hatch test,
— The "Looping" test
— The test by Elżbieta Grzegorzewska: the pace of writing the work *domek* (house)
— Rene Zazzo's Card Test,
— Oseretsky's *Test* of *Motor Speed Development*,
— Trail Making Test (TMT).

The first test was Mira Stambak's hatch test. The test examines hands' graphomotor skills. The measure of these skills is the number of lines drawn in subsequent squares (1 cm × 1 cm) during one minute.

The "Looping" test is a sub-test in "The set of methods diagnosing reasons of pupils' school failure" ("Bateria metod diagnozy przyczyn niepowodzeń szkolnych u uczniów") (Bogdanowicz et al., 2008). It evaluates hands' motor skills (in an exercised activity), hand dominance and eye-hand coordination. A given pupil draws little loops within two line rulings during one minute. Comparing the test results with the calculated results, we obtain the result for motor skills in question.

The next test consists in checking the pace of writing the work *domek* (house) with the test by Elżbieta Grzegorzewska (Hanisz et al., 2001). The task is to write the word *domek* as many times as possible during one minute. The measure of manual skills is the number of letters written during set time. The results are assigned to the standard ten scale.

Rene Zazzo's Card Test (1974) tests eye-hand coordination, hand dexterity and dominance. A subject is to put cards on the table in front of them, one after another, as fast as they can. The test is repeated three times. Comparing a better result obtained by a given child with the median and the spread, we can determine dexterity in years.

The next test is Oseretsky's *Test* of *Motor Speed Development* (according to A**.** Barański,1963), whose aim is to test general motor skills. The test is intended for children and teenagers aged 4–16. Six exercises on Oseretsky's scale illustrate different aspects of neuromuscular coordination, thus their use makes it possible to evaluate basic mechanisms of motor intelligence and mobility: hand static coordination, hand dynamic coordination, dynamic coordination of the whole body, movement speed, simultaneous movements, movement precision. The range of the tests from category 4 of motor behaviour was used to test motor speed. Oseretsky recommended a thee-stage evaluation system for test performance. For the lack of an attempt "–", for good performance "+", for partially good performance "+/–". The "+" mark would have the value of one month for tasks till 10 years, and two months for tasks above this age. Once the test is performed and its results calculated, one can obtain the value corresponding to the motor development age (MDA) as well as, like in case of development tests, one's motor development quotient (MDQ) if we divide MDA by one's age (A).

Trail Making Test (TMT) (Delis-Kaplan, 2001) – a test analysing deficits in the area of cognitive functions. It is one test from the set of D-KEFS tests serving to measure operational functions in children and adults aged 8–89. It was developed by Dean Delis, Edith Kaplan and Joel Kramer, and published in 2001. The whole set contains nine tests which can be used separately. A sub-test checking motor speed was chosen for the pilot research. This test consists of an A3 sheet of paper with 32 points joined by dotted lines. The task is to join these points following these lines in the shortest time possible. The speed is evaluated by means of time needed to finish each attempt correctly.

Pilot research results

Hatch test

During the first meeting with the pupils, they were asked to complete Mira Stambak's hatch test. A given pupil got an instruction to draw vertical lines in squares as fast as they could, during one minute. The pupil could hold a pencil in a chosen hand and draw lines from left to right or from right to left. After one minute, the pupil has to change hands and repeat the test. Two attempts for each hand interchangeably are performed. Comparing a better result obtained by the child with the median and the spread, we can determine dexterity in years. The test instructions were comprehensible for the pupils and suitable for the test content. The pupils were willing to complete the test, but only with their dominant hand. At the attempt with the other hand, some pupils' willingness dropped, whereas some other respondents were amused. Three tested pupils asked for a sheet of paper to rehearse writing with their non-dominant hand. The atmosphere among the children completing the test was generally positive. Analysing test results, it can be stated that there was no case in which motor skills exceeded a given respondent's age. In two cases out of eleven, the children's motor skills corresponded to their developmental age. In nine cases it was lowered by two years (7 pupils) or one year (2 pupils).

Rene Zazzo's Card Test

During that meeting, the pupils were also tested with the help of Rene Zazzo's Card Test. A given pupil had to put cards one after another on the table, as fast as they could. The cards could be picked up with an index and middle finger, one had to be careful not to pick up two cards at the same time and not to drop them. The test was repeated twice. The best result compared with the median and the spread determined motor skills in years. The test required demonstration from the researcher's side as the pupils found it difficult to understand its instructions. Each pupil happened to drop cards. The attempt had to be repeated. The fact that the test checking the pace of card putting was repeated three times discouraged some subjects. However, when a given child saw the researcher put their results down, it stirred their interest and they were willing to improve their speed.

Domek

The last test used during the meeting was the one checking the pace of writing the word *domek* (house) by E. Grzegorzewska. The pupils' task was to write the aforesaid word as many times as possible during one minute. The researcher checks the number of letters and assigns them to the standard ten scale. The instructions were fully comprehensible, supplementary hints were not needed. The pupils were willing to work. The author of the test divided the pupils according

to the grades they represented, regardless of their age. However, among the pupils tested there were those who were in two different grades, being the same age. It poses a difficulty while presenting test results as they may be wrongly interpreted. Analysing the results of this test the following data were obtained: five out of eleven pupils got the results below the average, four of them enjoyed an average result, and two of them a high score.

Looping

During the second meeting, the looping test was used. The pupils had to draw little loops within two line rulings during one minute, holding their pencils in the chosen hand. When the time was over, the pupils held the pencils in the other hand and completed the task once again. The test required drawing little loops appropriately. The pupils willingly performed the test, they did not need any supplementary hints. After the set time, they passed the pencil into the other hand. At this moment, most of them asked if they could rehearse drawing with their non-dominant hand. Next, they began the task. The results of the test showed that six out of eleven respondents obtained a low score, four of them – an average score, and one of them – a high score.

Oseretsky's test

The next test pertaining to movement speed was conducted with the help of Oseretsky's test, performing exercises from the 4th category of motor behaviours. The test takes into account its participants' age. Once it is conducted and its results are calculated, one can obtain the value corresponding to the motor development age (MDA) as well as, like in case of development tests, one's motor development quotient (MDQ) if we divide MDA by one's age (A). The test tasks turned out to be quite difficult for the tested pupils. It is disturbing that each respondent performed the task below their developmental age. In some cases the differences reached four years.

Trail Making Test (TMT)

Trail Making Test (TMT) was the last one used within the framework of the pilot research. Each pupil had to join the points as fast as possible, following dotted lines. Initially, there was a trial version, next the test version took a form of an A3 paper sheet. The pupils were willing to take the trial test. Once the main test card was opened, the children uttered sounds of delight and willingly set to the assigned task. Joining the points did not prove difficult to them, however they had to work actively with the other hand, holding the paper in the right place on the desk.

Performing all six test of the pupils' motor speed rendered the following results (Table 1).

Table 1
The distribution of results pertaining to motor speed in particular attempts

	Pupil's name	Pupil's age (in years)	Haich test	Cards	*Domek*	Looping	Oseretsky	TMT
1.	Aron	8	**2 ↓**	**2 ↓**	**AVERAGE**	**LOW**	**2 ↓**	**10**
2.	Hania	8	**1 ↓**	**2 ↓**	**BELOW AVERAGE**	**LOW**	**2 ↓**	**12**
3.	Maja	8	**--- 0**	**2 ↓**	**BELOW AVERAGE**	**AVERAGE**	**2 ↓**	**13**
4.	Tymek	8	**2 ↓**	**2 ↓**	**BELOW AVERAGE**	**LOW**	**2 ↓**	**12**
5.	Amelia	9	**2 ↓**	**2 ↓**	**AVERAGE**	**LOW**	**3 ↓**	**6**
6.	Lara	9	**2 ↓**	**3 ↓**	**BELOW AVERAGE**	**LOW**	**3 ↓**	**2**
7.	Marta	9	**1 ↓**	**2 ↓**	**BELOW AVERAGE**	**LOW**	**2 ↓**	**10**
8.	Antek	10	**2 ↓**	**3 ↓**	**AVERAGE**	**AVERAGE**	**4 ↓**	**7**
9.	Konrad	10	**-- 0**	**3 ↓**	**HIGH**	**HIGH**	**2 ↓**	**12**
10.	Szymon	10	**2 ↓**	**4 ↓**	**AVERAGE**	**AVERAGE**	**3 ↓**	**9**
11.	Wiktor	10	**2 ↓**	**4 ↓**	**HIGH**	**AVERAGE**	**2 ↓**	**12**

Legend:
* the difference between the subject's age and their skills measured in years, where:
↓ means lowered skills in comparison to the subject's age,
--- means skills corresponding to the subject's age.

Source: own research.

Conclusions

— Analysing the distribution of test results pertaining to motor speed, they were quite convergent in the majority of trials. Exceptions are Rene Zazzo's Card Test and Oseretsky's test. Poor results in these tests were quite apart from the results of the remaining tests. The most convergent test results for particular pupils were obtained with the help of the "Looping" test, the Hatch test and the Trail Making Test, which constitutes construct validity.
— All the tests had instructions suitable for expected actions undertaken by the respondents. Some required supplementary explanations (Rene Zazzo's Card Test)
— Most of the time, the used research tools evoked the pupils' positive attitude towards the tasks. Only Rene Zazzo's Card Test repeated three times made some pupils fatigued and impatient.

— The tools used for result analysis were clear and researcher-friendly. Only the test checking the pace of writing the word *domek* (house) by E. Grzegorzewska posed difficulties. The author divided respondents into grades, regardless of their age, which was problematic while processing and interpreting test results. The respondents were the same age but attended different grades of primary school.
— The conducted tests aimed at verifying and choosing suitable tests for the research covering a bigger population of pupils aged 8–10. Due to the tests' accuracy, time needed to administer a given test, instruction clarity, clearness and easiness of processing ready test results, pupils' interest, the research shall be conducted with the help of the following tests: Looping test, Hatch test and Trail Making Test.

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Transakcja poznawczo-edukacyjna: ocena i mediacja możliwości poznawczych ucznia

Streszczenie

W obecnym czasie szczególny rodzaj transakcji edukacyjnej, której celem jest poznanie poznawczych uwarunkowań procesu edukacyjnego, stał się przedmiotem badań podstawowych i stosowanych. Wyniki badań dotyczące mózgu i umysłu wskazują, że jeśli uda nam się lepiej zrozumieć aparat poznawczy ucznia, może to prowadzić do bardziej efektywnego nauczania uczniów słabszych. Analizując przyczyny niezadowalającego wyniku szkolnego ucznia, należy rozważyć, które elementy myślenia wymagają aktywacji podczas przetwarzania informacji lub wykonania zadania. Znajomość aspektów prędkości motorycznej i umysłowej ucznia oraz ich elastyczności poznawczej jest punktem wyjścia do transakcji bodźców poznawczych. Na podstawie tej wiedzy następnie wygenerowane transakcje mogą być przeprowadzane w ramach indywidualnej interwencji, mającej na celu zaradzenie ewentualnym brakom poznawczym słabszych uczniów W pracy przedstawiamy wyniki badań pilotażowych (w ramach bardziej złożonych badań eksperymentalnych), których celem jest ocena przydatności i wybór odpowiednich narzędzi badawczych w diagnozie prędkości motorycznej uczniów. Diagnoza stanowi wstęp do badań nad oceną wpływu zależności między prędkością motoryczną ucznia a prędkością przetwarzania informacji na ich sukces w nauce. Badani to uczniowie w wieku 8–10 lat, zróżnicowani pod względem płci. Podczas diagnozy zastosowano następujące testy: testy kreskowania Miry Stambak, test „zapętlenia", tempo pisania słowa *domek* według testu Elżbiety Grzegorzewskiej, test karty Rene Zazzo, test rozwoju prędkości motorycznej Oseretsky'ego, test funkcji poznawczych, Trail Making Test (TMT) autorstwa Dean Delis, Edith Kaplan i Joel Kramer. Pod uwagę wzięto następujące czynniki: dokładność testu, czas potrzebny na przeprowadzenie testu, jasność instrukcji, kryteria oceny wyników testu oraz zainteresowanie uczniów. Po przeanalizowaniu wyników ustalono, że odpowiednie badania zostaną przeprowadzone przy użyciu następujących testów: test zapętlenia, kreskowanie i Trail Making Test.

Słowa kluczowe: mediacja, transakcja bodźca poznawczego, proces poznawczy, prędkość motoryczna, prędkość mentalna, elastyczność poznawcza.