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THE STIMULATION OF CREATIVE ACTIVITY IN DYSLEXIC ADULTS

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SUMMARY

A literature review concerning dyslexia, including several empirical studies and work of a more theoretical nature, suggests that there is a connection between creative activity and developmental dyslexia. The aim of our research was to test the hypothesis that such a correlation exists, and that creativity can be trained in dyslexic persons.

40 students in their first years of college study took part in the experiment: 20 dyslexic students diagnosed in school, and 20 non-dyslexic students selected for a control group, matched for age, sex, and field of study. All these subjects took part in an art therapy program carried out during a 3-week rehabilitation course organized by the Reintegration and Training Center of the Foundation for Persons with Brain Dysfunction. Classes were taught by a qualified art therapy teacher and a clinical psychologist. The participants were assessed with the use of the „Apple Picking” test, assessing creative skills, which was administered before and after art therapy.

There is a connection between developmental dyslexia and creativity in dyslexic persons, indicated by a higher level of general artistic talents, freedom of applying colors and the ability to match them, and the artistic level of drawing (in respect to realism and the number of details). We also found that the stimulation of creative activity with the use of art therapy gives better results in the case of dyslexic adults than in healthy controls.

There exists a significant correlation between creative abilities and developmental dyslexia. Our data also show that dyslexic students have greater possibilities to train these skills. The proposed creativity training results in technically better drawings by dyslexic students without features of pathology, though at the cost of some originality.

Key words: *dyslexia, creativity, art therapy*

INTRODUCTION

According to the diagnostic criteria of International Statistical Classification of Diseases and Related Health Problems ICD–10 developmental dyslexia belongs to the group of specific developmental disorders of scholastic skills (F.81). It's called "Specific reading disorder" (F.81.0). To the mentioned group apart from dyslexia belongs, not related to difficulties with learning to read, "Specific spelling disorder" (F.81.1) also called "dysorthographia" as well as "Specific disorder of arithmetical skills" (F81.2). The term "developmental" means that a person's result of the reading test is significantly lower than the result expected for the chronological age and IQ level. This disorder can be observed from the beginning of learning to read, that is in the earliest phase of education.

Essential criteria in diagnosis of the dyslexia are difficulties in a person's learning. However, teaching and environmental neglect are excluded as causes of dyslexia. Despite the fact that aetiology of dyslexia ICD–10 is described as unknown, suggesting as possible causes more than one type of biological dysfunctions, excluding neurological illnesses, brain injuries, sight or hearing impairment, the level of knowledge on the subject has changed since the last publishing of this version of classification (1992). Since then the biological character and genetic background of dyslexia has been proved. These days research on aetiology of dyslexia mainly focuses on genetic causes of dyslexia (Høien T., Lundberg I. (2000); Nicolson, Fawcett 2008). Many authors regard disturbances in neurotransmission processes on different levels of the central nervous system as the cause of dyslexia, as well as disorders of phonological processing (cf. Hatcher & Snowling, 2008).

In ICD-10 it is emphasized that in the initial period of learning the problems in acquiring letters may appear (knowledge and pace of naming letters/graphemes or giving their phonological equivalents – sounds/phonemes) as well as analyzing and categorizing speech sounds despite the lack of hearing impairments. Problems related to development of reading skills lie in:

- Omitting or replacing words by other ones, twisting them or adding either new ones or parts of them,
- Slow pace of reading,
- Mistakes and hesitations during reading, losing place in the text,
- Reordering words in sentences and letters in words.

Coexisting problems in understanding the text are: difficulties remembering what was read and drawing conclusions from the studied material or using rather general knowledge other than specific information from the text during answering questions that concern it (see ICD-10, 2000, p. 204). It sometimes happens that in late childhood and next developmental stages difficulties in acquiring spelling skills are greater than reading, the causes are which believed to be connected to insufficient phonological analysis.

Also, in the definition published in 1994 by Orton Dyslexia Society, which is located in the United States (Bogdanowicz, 1997), dyslexia was included in a broader category, that is, learning disabilities. This definition describes dyslexia as a specific language-based disorder of biological origin.

Dyslexia is manifested by varying difficulties with language communication, especially problems with reading and understanding a text as well as problems in writing and spelling. Similarly to ICD-10 the definition of this one emphasizes insufficient in relation to age phonological skills, leading to difficulties in single word decoding and other cognitive deficits, which result in school failure. Authors stress that these difficulties are not the result of a generalized developmental disability, or sensory impairment or inadequate teaching. While mental retardation excludes the dyslexia diagnosis, deficits in visual or auditory processing may appear in the dyslexics unless they are not the cause of the symptoms.

As quoted definitions and international research show, the main deficit in cognitive processes that determines dyslexia are inadequate phonological processing abilities (Hatcher & Snowling, 2008; see Krasowicz 2008).

Moreover, according to Double Deficit Theory (Wolf & Bowers 1999; Wolf & O'Brien 2001) general disorders in phonological processing can coexist with the deficit in pace of naming pictures, symbols, colours, as a consequence of disorders of precise time integration of information coming from different modalities (Gaab 2007; Bednarek et al. 2006, 2008). They also accompany sensory-motor integration deficits (Bogdanowicz 1987, 1997) and dysfunctions of cerebellum that is responsible for automation of reading process (Fawcett, Nicolson, 2001, 2008). Indicated reasons for described dysfunctions, of biological nature, mainly genetically based, are: inverted asymmetry or symmetry of planum temporale (lateral sulcus), functional disconnection between a left gyrus angularis and parietal and temporal region, disturbances in development of lateralization and orientation of body scheme and space (Bednarek & Grabowska 2002). It's assumed that there are structural changes and disturbances in magnocellular subsystems' work in visual system (a magnocellular disruption of the lateral geniculate nucleus), auditory (a reduction of neurons in the medial geniculate nucleus) and motor (Livingstone, Rosen, Drislane & Galaburda 1991; Stein, 1991, Borkowska 2006). These theories don't necessarily compete and for this reason researchers who believe in the pluricausality of the dyslexia phenomenon regard them as complementing one another (Bogdanowicz 1983; Szczerbiński, 2007).

The general pathomechanism of dyslexia can be presented in the following way: the pluricausal causes of result in structural changes in the central nervous system. Its consequence is brain and cerebellum's malfunctioning. This leads to disharmonies (retardations, deficits) in psycho-motor development, and its consequences are specific learning disabilities in the form of developmental dyslexia.

Despite the fact that it has been a whole century since dyslexia was recognized, little scientific research concerning the relationship between this disorder and artistic activity has been carried out. Frequent reports from organisations supporting dyslexic people's creative activity (Art Dyslexia Trust, Davis Dyslexia Association International), remedial teachers, parents or psychologists about their outstandingly talented, creative dyslexic pupils induce the search for exceptional talents beyond the area affected by deficits like reading and writing (West, 1991; Rak, 2006; Bogdanowicz, 2008; Krasowicz-Kupis, 2008; Pąchalska et al. 2008).

Thomas West T.,G. (2001) in his famous book "In the Mind's Eye: Visual Thinkers, Gifted People with Learning Difficulties" and Marta Bogdanowicz (2008) in her publication "Portrays of not only famous people with dyslexia" present profiles of numerous creative people, including artists with dyslexia problem. In the literature concerning this subject we can find data concerning the frequency of the occurrence of dyslexia among university students including department of Arts (Wolff & Lundberg 2002). The research results indicate that students from Department of Arts suffer from more dyslexia symptoms. In addition, people with diagnosed dyslexia probably obtain better than average results in training artistic skills. This suggests that dyslexia coexists with artistic activity. The research carried out by these authors suggests that the frequency of dyslexia occurrence was significantly higher in the group consisting of people studying artistic subjects than other students. Moreover, phonological processing skills were significantly lower in the first group of students in comparison to the second one. Authors explain the obtained results by dyslexic students possible extraordinary creative talents. They also argue that the high level of difficulty during the process of enrolling in artistic studies excludes the possibility of choosing such a faculty solely by eliminating subjects which demand excellent linguistic skills (e.g. philological, humanistic) as well as deficits' compensation. In turn, work by Everatt'a, Steffert and Smythe'a (1999) proves dyslexic adults' greater creativity in performing tasks which demand applying original solutions, insight as well as innovative thinking styles. At the same time, there haven't been any reports showing dyslexic children's superiority in creativity over their peers. In addition, researchers haven't succeeded in proving that there is an assumed correlation between higher level of creative talents' development and visual-spatial gifts, as well as better functioning of right hemisphere, regarded as specialized in visual-spatial information processing and creative talents. On the other hand, recent research by Rak (2006) revealed a tendency to a higher level of creative predisposition in dyslexic youths, in comparison to their peers, but not to outstanding talent in this area. Greater creativity in people with dyslexia is often mentioned in literature reviews, dedicated to dyslexic people's strengths and talents, specific gifts and skills (Rostowski 1989; Wszeborowska-Lipińska, 1997; Reid & Kirk, 2001; McLoughlin et al. 2002). Summarizing, the mentioned scientific research and reports of theoretical character as well as prac-

tioners' experience clearly suggest that there is a significant correlation between creative talents and developmental dyslexia in adults. The aim of the research was to test the hypothesis about occurrence of such a link as well as checking if dyslexic people have bigger possibilities of training artistic skills.

MATERIAL AND METHODS

We tested 40 first- and second-year college students from Cracow colleges and universities. The experimental group numbered 20 students with developmental dyslexia diagnosed in school. In the control group there were 20 non-dyslexic students, selected as an experimental group with the use of method of matching pairs according to age, sex and the type of studies. This enabled exact equalizing the level of mentioned variables (age: $x_k = 22,1$; $SD_k = 3,98$; $x_M = 23,4$; $SD_M = 3,47$). All subjects took part in a art therapy programme, aiming in cognitive processes' activation with a special focus on stimulation of imagination (see Pąchalska 2008). The program was carried out during 3-week rehabilitation course organized by A Reintegration Training Centre of the Foundation for Persons with Brain Dysfunctions. The classes were taught by a qualified art therapy trainer and a clinical psychologist.

The following research methods were used: observation, analysis of pieces of work. The artistic level of analyzed work was measured by The Formal Elements of Art Therapy Scale (FEATS) (Gantt & Tabone, 1998) based on a thematic drawing. The subjects had a pencil and 12 coloured felt pens placed in front of them, according to standardized testing procedure. The instructions for making the thematic drawing were: "Draw a person picking an apple from a tree". The subjects had the possibility of drawing in colour, using for this purpose specific colour shades. The assessment was carried out twice: before the beginning of the course (assessment I) and after its end (assessment II).

Individual participants' drawings were assessed using Likert's 5-grade scale, and competent judge method. The competent judges were experts who deal on an everyday basis with analyzed problems: neuropsychologist, neurolinguist and a qualified art therapy teacher. The following drawings' characteristics were analyzed:

- prominence of colour,
- colour fit (to objects' shape),
- integration (holistic balance of composition),
- logic,
- realism,
- person (dimension and wholeness of a person),
- details of objects and environment,
- developmental level,
- space,

- line quality,
- implied energy
- implied energy (amount of energy used to make the drawing...')
- problem solving (is the method of picking apples effective?), (maybe it would be good to add here 'whether and how the person gets the apple from the tree?')
- rotation,
- perseveration (repetition of a graphic element or motor act of drawing)

RESULTS

Average results of assessed people obtained in individual categories of The Formal Elements of Art Therapy Scale (FEATS, Gantt, Tabone, 1998) during the first and second assessment in experimental and control group were presented in Figure 1.

Statistical analysis of the data shows that the average results obtained by the two groups both before and after therapy are significantly different. In assessment I dyslexic students gained better scores in Scale FEATS than non-dyslexic students ($x_E = 3,75$; $SD_E = 1,42$; $x_K = 2,81$; $SD_K = 1,38$). In assessment II an improvement in creating the thematic drawing was observed in all 14 scored scales in both groups, which indicates effectiveness of art therapy program that was applied. Dyslexic students' results are still significantly higher than these obtained by the control group.

Analyzing particular categories from Scale FEATS we observe that before the art therapy dyslexic students created drawings that indicated higher level of artistic talents, because they matched colours in a freer way and fitted them better to objects than students without dyslexia diagnosis. The dyslexics' drawings during assessment I contained more details and proved better

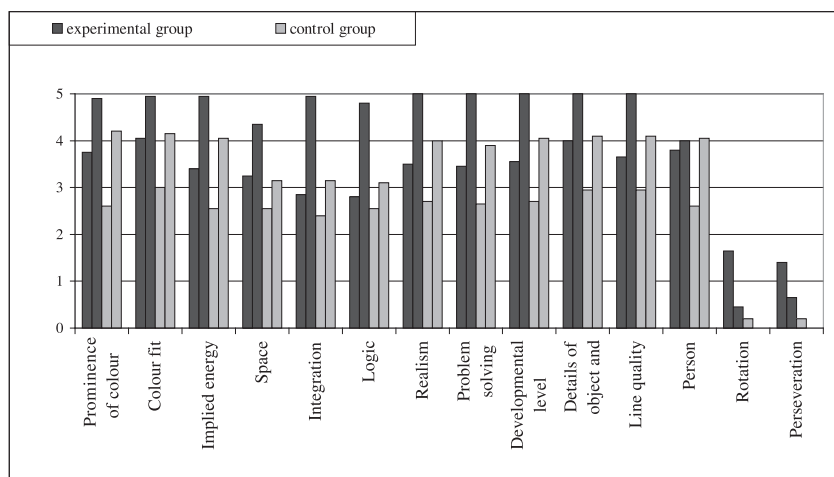


Fig. 1. Average results of assessed groups in particular scales

problem solving skills, presented objects were more realistic. However, it's worth noticing that the experimental group put more energy in completing the task. Rotations and perseverations were significantly more frequent in dyslexic students. Spatial neglect and unfinished lines were noticed in the case of some subjects. The drawings created by subjects from both groups had a similar level of elements' integration; they were also logical to the same extent in both groups as to the choice of elements for the task. The freedom of using the space and the line quality in dyslexic people's drawings either didn't significantly differ from the same aspects scored in the nondyslexics' work.

Three-week art therapy resulted in significant growth of integration of particular objects and their suitability for the task in dyslexic students' drawings. In nondyslexic subjects improvement was smaller. Besides, after the therapy in both students' groups the level of energy input significantly increased as well as the effectiveness of presented problem solving. Moreover, subjects drew objects which were more recognizable and their drawings presented a higher level of creativity development. With regard to the rest of aspects of the FEATS scale: freedom of using and matching colours, making use of space, details of objects and environment, line quality, dimension and wholeness of a person, scores of students from both groups were also significantly higher after completing the art therapy than before its starting. As a result of therapy, the frequency of appearing rotations and perseverations in drawings has decreased in both assessing groups. 2 examples of drawings – one by a participant with developmental dyslexia diagnosis (Fig. 2) and one by a matching non-dyslexic participant (Fig. 3) – are presented below.

A qualitative analysis of selected drawings created during the assessment confirms the statistical data. After having taken part in proposed art therapy classes, clear improvement in performed tasks can be noticed. Drawn lines



Fig. 2. Drawings created during the experiment by one of the students from the experimental group [with diagnosed dyslexia]: before therapy (on the left) and after therapy (on the right)

are more distinct, drawings show bigger implied energy input. What draws attention is a transition from gray to a sharp contrast of black and white in a dyslexic person's work as well as introducing a full range of colours in a drawing of a person without dyslexia. The drawings created in the assessment II are more realistic and logical in joining different fragments of the composition; they also show a better use of space. It's worth underlining that a dyslexic person's drawings, in experts' opinions, represent significantly higher artistic

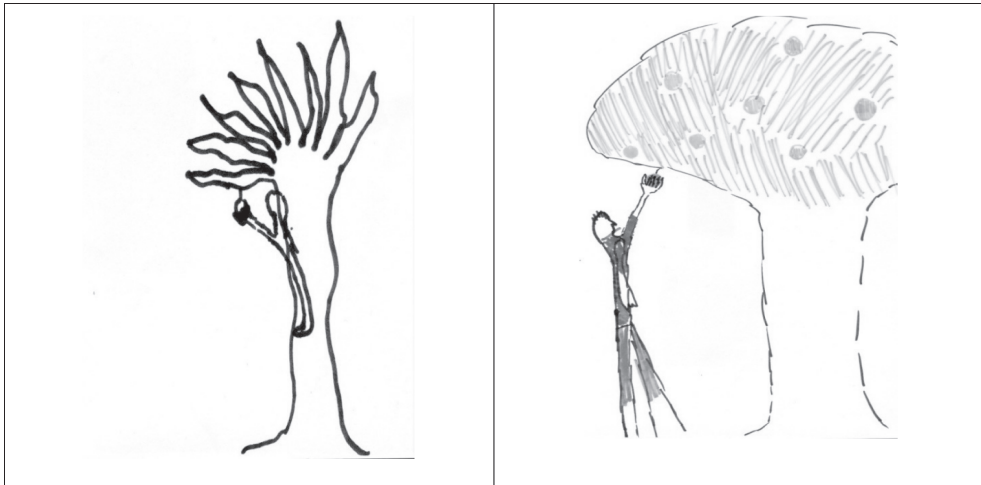


Fig. 3. Drawings created during the experiment by one of the students from the control group [with diagnosed dyslexia]: before therapy (on the left) and after therapy (on the right)



Fig. 4. Drawings created during 3-week period of rehabilitation by one of the students from the experimental group [with diagnosed dyslexia]: during the second week of the course (on the left) and towards the end of the course (on the right) [Ownership: A Reintegration Training Centre of the Foundation for the Persons with Brain Dysfunctions]

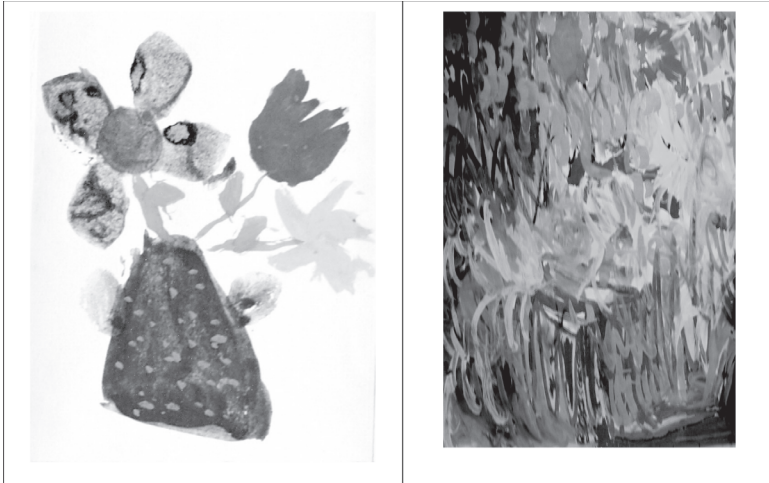


Fig. 5. Drawings created during 3-week rehabilitation course by one of the students from the control group [without diagnosed dyslexia]: during the second week of the course (on the left) and towards the end of the course (on the right) [Ownership: Centrum Reintegracyjno-Szkoleniowe of the Foundation for the Persons with Brain Dysfunctions]

level than simple drafts made by a person from control group. The majority of drawings created by dyslexic people are distinguished by their artistic plan, a number of details and realism as well as the attempt of a perspective depiction of the presented scene.

It's also worth pointing out that drawings created during the experiment in assessment II, after completing the art therapy classes, in both groups, although in general are better technically, lose in experts' opinion some degree of their originality.

However, analysis of all pieces of art (drafts, drawings and paintings created by the subjects during 3-week rehabilitation course allows to say that in general an interesting transfer as to creative skills has been noticed, which proves an evolution of the quality of work made. Above 2 examples of pictures are presented – one by a student with diagnosed dyslexia (Fig. 4) and one by a matching non-dyslexic student (Fig. 5).

DISCUSSION

The carried out research confirms that there is a significant correlation between creative gifts and developmental dyslexia; the drawings created by students with diagnosed dyslexia, although contain some features of pathology (e.g. perseverations, less often rotations and spatial neglect and unfinished lines), show a higher level of general artistic talents, more freedom of applying and the ability of matching colours, greater realism and a number of details in drawing.

Dyslexic students in assessment I obtained better results in Scale FEATS than students without dyslexia features. However, in their drawings there are

some abnormalities, which can be interpreted as symptoms of disorder: the most often perseverations were observed, less frequently rotations, spatial neglect and unfinished lines. The mentioned disorders' symptoms, of course, don't appear in non-dyslexic students' drawings.

As a result of applied art therapy, carried out in order to improve drawing skills, in assessment II an improvement of created thematic drawing was observed in both tested groups in all analyzed aspects of the scale. This fact indicates effectiveness of creative activity stimulation with a special focus on imagination. Dyslexic students' results are still significantly higher than these obtained by the control group. It was stated that the proposed program gives better results in people with diagnosed dyslexia than in people from the control group, especially in the aspect of the drawings' realism and holistic balance of its elements.

The results of presented research suggest that teaching additional art therapy classes, stimulation of creativity and artistic gifts, especially among children and youths interested in art, could well complete a remedial teaching program. The possibility of expressing oneself through art could have a positive effect on dyslexic people's self-esteem and self-concept, as well as their attitude towards possessed talents and gifts.

How to explain obtained results from the neuropsychological point of view?

Dysfunctions and therapeutic progress in patients with dyslexia can be analyzed in different theoretical contexts. Executive Function Theory seems to be especially useful (Executive Function – EF). This concept was introduced to the analysis of EF in the S→R cycle („stimulus-response”) in a previous study [Pąchalska et al. 2000].

The concept of “creativity” – can be understood in various ways. On one hand – from the perspective of evolutionary biology creativity lies in a human's extraordinary gifts of adaptation, which stems from his significantly higher intelligence in comparison to animals. Creativity understood in this way means that a person isn't limited in every situation to these behaviours and solutions which are dictated by his instinct (that is responses/reflexes) or the process of learning (conditioned responses). Thus this creativity isn't limited to searching for solutions to solve completely new problems. It is also manifested by the fact that a creative person is not always satisfied with every tested solution to a given problem, but always thinks: „Can it be done even better?”. It isn't difficult to notice that such a definition of creativity has a lot in common with the notion of intelligence. However, there isn't enough space in this article to solve an old argument in psychology: is intelligence itself always linked to creativity, or can exist authentic intelligence which is more uncreative than creative (the most common in Poland methods of assessing students suggest that our educational system is based on uncreative intelligence).

On the other hand, the creativity is usually associated with art – music, painting, sculpture, poetry, dance etc., but what counts most are two qualities: originality and high esthetical values. However, in the reality the meaning of the mentioned characteristics in the contemporary art is sometimes the object of controversy. From the perspective of an average person the most important question is if he or she likes the particular piece of art. A big role in creating such opinions often play emotions: work of art seems creative especially when it expresses an emotional state – affect, mood – which audience know from their own experience, yet rarely can express it (see: Kinsbourne 2000; Pačalska 2008).

Of course we tend to judge differently art created by average people, including children, and differently so called “great art”. We appreciate extraordinary art work of such figures as Rembrandt, Da Vinci, Michelangelo, Mozart, Shakespeare and other great artists also because in their pieces of work they could express important issues as perfectly that we cannot imagine that they could be presented in a different way. We also appreciate originality, but the most important role play esthetical values. A great creator always attempts more or less consciously to create something, which will be the best, unique and which will be compared with next pieces of art in the future.

Already in ancient times there was controversy whether a great artist’s talents are inborn, yet demand a lot of effort and discipline in order to develop them, or are a gift understood as a divine inspiration. In any case, a great artist differently sees (hears or even feels) than an average person. Either he or she sees something, which is not seen by the others or they look at the same objects – differently. Traditionally in famous artists’ biographies this unique way of perceiving the world, which we believe that is mainly responsible for their creativity, apart from their possible manual or verbal talents, is underlined (West, 1991). Pure skills as to using a paintbrush, musical instrument, voice or pen is not sufficient to make a great painter, musician or a poet, if he or she lacks this “spark” of inspiration, and this seems nearly the same as the original way - „uniqueness” of perceiving the world (West, 1991).

Within the confines of one scientific work it is hard to expect that we will develop or defend a general theory of creativity, which would include all the problems which have been mentioned so far. However, we have several important observations with regard to the obtained results concerning dyslexic students.

Firstly: a person with dyslexia has not got just „impairment” according to WHO, but also “disability” or even “handicap”. As the basic problem concerns written language, coding and decoding information in the process of language communication, with the use of symbols which letters are, it is necessary to admit that a dyslexic student must work harder than his peers without this problem in order to obtain good marks at school. Already in 1900 and 1917 J. Hinshelwood in his monographs argued that this is related with atypical development of brain structure (Bogdanowicz 1983) and cerebellum, as R.

Nicolson and A.Fawcett proved (2001, 2008), as well as with their incorrect functioning. More precisely: such a student all the time has to solve the problems with other students deal almost without an effort. Therefore the mere fact that such a student completed school with grades that enable him entering university, proves his or her extraordinary intelligence, which is expressed in the process of problems solving. Therefore we can suppose that assessed students with dyslexia already went through a strict but effective process of selection. Thus in this case we deal with “high functioning” people with dyslexia.

Secondly: problems characteristic for dyslexia have a diachronic character, which indicates a leading (but not exclusive) role of a left hemisphere in controlling incorrectly developing functions. Whereas if the right hemisphere was formed without analogical disorders, a person with dyslexia compensates no existing “diachronic” talents by recruiting other “synchronic” neurons (which are located in the right hemisphere), we shouldn't be surprised at a higher level of artistic creativity in this population.

Thirdly: some authors believe that a dyslexic person has got a distinct “world vision”. If we consider this specific distinctness to be pathological, it's hard to characterise it as „creative” at the same time. On the other hand it's worth reminding in this context that many people who are outstandingly artistically talented show symptoms of psychological disorders or even peculiar intellectual limitations in other life domains apart from chosen art discipline. There is a thin line between a genius and madness, also for this reason the same “distinct” world vision, which is a crucial component of a great genius's creativity, can also result in the fact that the same person may have even serious problems with adaptation to everyday life. We don't at all mean that among the assessed students there may be some undiscovered Picasso. However, once again the obtained data may be not as paradoxical, as it may seem at the first sight.

People with dyslexia obtained better results than the others because already in the assessment I they had higher cognitive abilities in the area of creative activity which may mean higher level of artistic talents. In the assessment II after the therapy there was some improvement observed in the both groups, but to greater extent in dyslexic people than people without dyslexia. The fact that both groups obtained better results as a consequence of art therapy was also connected with putting more energy in creating a piece of art. It was observed that few students from the group with diagnosed dyslexia manifested many difficulties in the aspect of space organisation in their drawings, which can be probably connected to the influence of dyslexia subtypes (see Willmes-von-Hinckeldey et al. 2008) on the very process of creating. In these people's drawings there were present the elements typical for persons with parietal and temporal damage (unfinished lines), but also for persons with frontal lobe damage (perseverations) (see also Pąchalska et al. 2008).

Such a big improvement as was observed in people with diagnosed dyslexia in assessment II can be explained on the basis of the model of distribution of mental and cognitive resources (see Mc Neil 1998).

Art therapy aimed at activation of all cognitive processes with a special focus on stimulation of imagination results in a bigger plasticity of brain and creating new functional connections (also see Wolff & Lundberg 2002; Kaczmarek 2003). This fact, in turn, is conducive to greater stabilization of brain system in people with dyslexia and consequently to decreasing of general phonological processing disorders, which coexist with the deficit in the area of precise time integration of information coming from different modalities according to Double Deficit Theory (Wolf & O'Brien, 2001, Gaab et al. 2007). In this way cognitive resources increase, (see Pachalska 2008) and consequently more energy which is necessary for creative tasks is released. All listed here factors result in improvement of creative executive functions in the cycle S→R.

Top layer of this model is time, which can be understood in an objective sense, as an object of physicists' interest or as a subjective one – as a rule regulating the way, in which we experience our life. Objective time (external) Has a linear route which results in the fact that presence all the time forms a mobile line between the past and the future, while under the regime of subjective time, despite the fact that there are the same three dimensions, presence has its real parameters, and doesn't make up just a unidimensional boundary. Thus this specific brain clock mediates between the past, presence and the future in interaction of three short lasting, current cognitive functions, among which the first – short term memory – has got retrospective character, the second – imagination – prospective character (see Fig. 6), and the third – attention – defines, which time period at the given moment is subjective

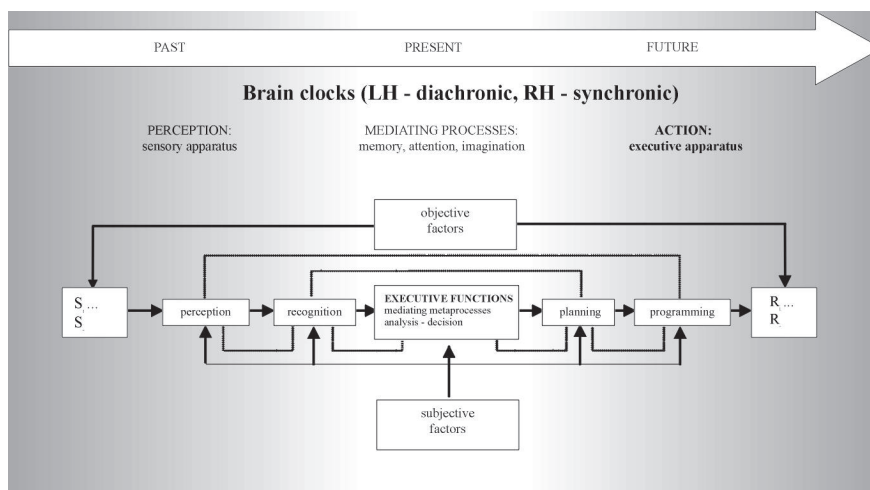


Fig. 6. Executive functions in the cycle S→R. Source: Pachalska et al. 2000

presence. Thus these are intermediary processes, which are located in the middle of the second layer of the model between perception and action.

The process, thanks to which brain processes information received from sense organs, is perception. This is contrary to appearances information precisely about the past, about what was a moment ago before light rays and acoustic waves reached our eyes and ears from the source. On the other hand an action is oriented towards the future, because this comes out from the need of making a change, to make the future different from the past. Between the perception and action there is “a window of consciousness”, which we experience as presence. Here, as was mentioned before, current internuncial processes play the key role (Pąchalska et al. 2000). The necessary conditions for an effective action, based on control, we have to effectiveness consider an imagination, because we have to imagine a target, we’re aiming at, a concentration span, because the realisation of the aim requires consistent, careful and oriented towards this aim action as well as memory, because we have to remember, what aim we have got and what plan we formulated to realize it. If this triad of processes becomes unsteady or disintegrated because of brain damage or emotional disorders we have to do with disorders of executive functions.

The third layer of the model constitutes a specification of well known behavioural cycle S→R. Any number of stimuli reaches brain from the external environment (with the use of sense organs) and internal (with the use of kinesiography and proprioception processes), among which only some in a given moment become an object of perception surpassing the threshold of synaptic fragility. What happens next (simplifying the matters to some extent) is the process of recognizing, within the confines of recently received impressions become perceptions – „mental representations” and are compared to one’s own resources stored in memory and classified to the right categories with lesser or greater accuracy. They reach the consciousness in the form of mental representations (this also concerns words) at the moment, when we become conscious of something present in the environment or in our own body. Then we consciously analyze this more or less coherent and organized information, and next we make the decision, if it is necessary or not to react. This process called by Fuster (2000) “a peak of a perception-action cycle” constitutes exactly a key moment in executive functioning and transition from thinking to an action depends on it.

The course of this process from the very beginning depends on many factors, which can be classified as:

- *external which we rate among*: environmental conditions, demands and limitations etc. These factors determine generating external stimuli.
- *internal* that is physical and a human’s psychological resources, among other things physical strength, intelligence (including general knowledge concerning certain subject), cognitive effectiveness, personality and emotional-motivational factors. These factors determine and next generate in-

ternal stimuli. Besides a positive motivation and attitude is necessary because nobody makes plans and attempts to realize them, when they don't expect desirable results or don't believe in their own abilities. That is why a word „emotion” comes from Latin *e+motio*, that is a movement on the outside.

Every decision to react or not to a current situation in principle constitutes a plan of action, a picture of a situation changed by our future, intentional action. It is usually a conscious process, but it can become automatic to a certain degree. However, it rarely happens that moving, e.g. while writing, we make a conscious mental effort. That rather our fully conscious brain gives an order “Write!”, and the process of setting in motion all the nerves and muscles (in the precise order, in the right direction and moment) goes on without the integration of our consciousness, busy creating a content of a written text. The reason for this state of matters is that practically we have got ready programs for all acquired activities, which are the direct reason for our specific behaviour and contain our responses ($R_1, R_2, R_3...R_n$) to stimuli ($S_1, S_2, S_3...S_n$). These responses influence the environment more or less effectively altering it and at the same time changing the stimuli. Of course the earlier automatic programs of action become active, the easier this action will be. Observed in many people with dyslexia disorders can be connected to a damage of the mental resources, which are responsible for programming an action, which results in excessive work load of conscious controlling which leads to inhibition and disintegration of process of action, in this case – creation. Redistribution of resources (especially in the area of imagination) as a consequence of sensory-motor integration causes improvement in action effectiveness, that is the quality of artistic work (see McNeil 1998; Pąchalska 2008).

Using the language of microgenetic theory, this phenomenon is consistent with the process of sculpting a symptom, because it is not only processes of neoteny and heterochrony that influence the functioning of a person with various brain dysfunctions, but also parcellation of mental and cognitive resources. Subtraction and addition of these resources result in the fact that intra- and- interhemispherical integration does or does not take place at the right time, so that the person's perception and action improve (see Brown & Pąchalska 2003; Pąchalska 2008), which gives the best results in the area of the drawings' realism and holistic balance of their elements. It is probable that described effects were obtained thanks to the improvement of visual memory (Lipowska et al. 2008), selectivity of attention (Borkowska 2006) and sensory-motor integration (Bogdanowicz 1997). In other words the improvement of the quality of work of art could be the result of stabilization of brain systems (Pąchalska 2008)

Have the drawings by dyslexic people not lost their originality because of the influence of the art therapy teachers?

In the experts' opinion – yes. The drawings created in assessment II, after art therapy, gained technical perfection and did not show characteristics of pathology, but in many cases lost the quality of being original. They were

stripped of the features of primary understatement and primitivism which characterize, for example, the work by the famous Polish artist known as Nikifor. And what was responsible for this characteristic originality thanks to which an art recipient, using his or her imagination could add his or her own meaning to a picture and complete it in the process of his or her own perception was this understatement and primitivism of drawings, and even, appearing in some work, perseverations, rotations or unfinished lines observed in the assessment I, before the art therapy. Not necessarily realistic but still – beautiful.

The described change could be connected to the fact that art therapy teachers tried their best to make drawings containing perseverations, rotations or unfinished lines – more realistic. What comes to mind is a philosophical remark that some features which we try to get rid of, may not only make our existence easier, but also are the reason for our success. Instead of changing them, we should learn to profit from them. In life the greatest benefit gain people who create things which are original. Like never before success is a consequence of innovative ideas, which is associated with creativity.

CONCLUSIONS

The results of the assessment that was carried out indicate:

- a significant correlation between creative abilities and developmental dyslexia; the drawings created by students with diagnosed dyslexia, although contain the features of pathology (e.g. perseverations, more rarely rotations, spatial neglect and unfinished lines), are characterized by a higher level of general artistic talents, freedom of applying and the ability of matching colours, realism and a number of details.
- greater possibilities of training of artistic skills in dyslexic people. The stimulation of creative activity with the use of art therapy gives better results in their case than in people without such a diagnosis, especially in the area of drawings' realism and holistic balance of their elements.

The drawings produced in the assessment II, after the end of the art therapy by both groups although are in general technically better and don't show the features of pathology, at the same time, according to experts, lose some originality.

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