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CLINICAL APPLICATIONS OF THE MODIFIABILITY MODEL: FEUERSTEIN'S MEDIATED LEARNING EXPERIENCE AND THE INSTRUMENTAL ENRICHMENT BASIC PROGRAM

Doctoral Thesis

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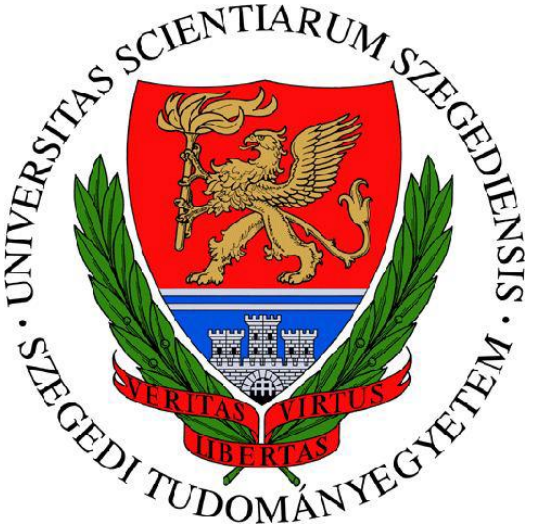

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

„It is time to change several of our time honored concepts – first of all, feeblemindedness is not incurable. Secondly, the feebleminded do not generally need to be segregated in institutions (Goddard, 1928, p. 225)".

This quote belongs to Henry Herbert Goddard, whose professional name merges into the „eugenics movement" in the beginning of the 20th century. One of his main endeavours was to prove the hereditary hypothesis, as the cause of intellectual disability. Due to his and his colleagues' serious professional mistakes, thousands of people with intellectual disabilitiy have been sterilized in very difficult circumstances and were confined to live in remote places in institutions in the countryside. Society felt that the „normal" needs to be protected from the „feebleminded" and their „bad genes" that carry the disease need to be stopped (Carlson, 2001; Spitz, 2009).

Goddard changed his views at the end of his life and acknowledged that intelligence could be improved, despite his earlier convictions, which considered human abilities innate and static. The eugenics movement is long over, yet *in the 21st century intellectual disability is still a major social, educational and health problem all over the world.*

European level of legislation has started to protect the rights of people with intellectual disability. The Salamanca Statement on Special Needs Education (1994); the UN Convention on the Rights of Persons with Disabilities, Article 24, Education, (2006); Protocol to the Convention for the Protection of Human Rights and Fundamental Freedoms (European Convention on Human Rights), Article 2 Right to Education (1953); European Social Charter (revised), Articles 15 and 17 (1996); Council of Europe Disability Action Plan 2006-2015 (Action Line 4, Education, and cross-cutting aspects); European Disability Strategy 2010-2020 (Area of Action 5, Education and training) all clearly state that every person with a disability have the right to equal opportunities and *high quality appropriate education* to maximize their potential; to participate in and contribute fully to an inclusive society and to choose and receive education in an inclusive environment.

At the same time, everyday practice of social approach, inclusion, and quality of education of people with intellectual developmental disorder still varies from country to country in Europe and unfortunately, it is *far not satisfactory.* Though 'inclusive education for all' is a basic human right, only a few percentage gains access to mainstream schools or work place, which leave them vulnerable to further social exclusion, according to a comprehensive research carried out in 10 European partner countries recently (EASPD Barometer Research, 2012). Also, only a few low-performing child can participate in intensive cognitive programs which aim at modifying their intelligence for a much more successful social integration.

Individuals with moderate level of intellectual disability, for instance, usually have access to special schools in Hungary -- especially in upper grades very seldom we find children with moderate mental deficits in mainstream, regular school settings. In Hungary „many institutions formally deal with inclusive education. There is a strong will to comply with legal documents but the real quality and the individual needs of pupils is barely taken into account. As we delve further into the school system, the implementation of inclusive education decreases. [...] The system is changing slowly. The tradition of special education is strong and changing attitudes is a big challenge. The whole education system has to provide answers and solutions to a multitude of challenges in the field of social inclusion" --- states the EASPD report concerning the assessment of given practice of inclusive education in Hungary (EASPD Barometer Research, 2012. p 92-93).

Naturally, individuals with retarded intellectual performance need special ways of instruction and contents structured and layered according to their individual thinking

patterns. A large number of research studies have been carried out in order to determine best ways of teaching academic subjects, reading and mathematics to children with cognitive impairments (Buckley & Bird, 2001; Buckley, 2002; Ghesquiére & Ruijssenaars, 2005; Browder & Spooner, 2011). Relatively little attention has been paid to the cognitive development of children with developmental disabilities, such as Down syndrome, other genetic syndromes, Pervasive Developmental Disorder or cerebral paresis. Research on the impact of cognitive acceleration programs on children with serious cognitive and learning problems is rather limited (Kozulin et al., 2010). Available research findings, however, prove that their intelligence can meaningfully be improved with cognitive and metacognitive programs (e.g. Sternberg, 1984; Klauer & Phye, 1994; 2008; Brooks & Haywood, 2003) and this type of cognitive activation is best to happen in inclusive settings (Lebeer et al, 2011; Booth & Ainscow 2002; Booth, 2011).

We are convinced that the final goal of any cognitive intervention should be the enhanced contribution of the affected individual to the society he/she lives in. The main goal is to equip the individual with abilities that will make him able not only to participate more in natural social discourses but also to create values that society will benefit from and appreciate. The *social model* of disability breaking with the former medical model of the previous centuries, do not seek the problems only and exclusively *within* the individual, but contextualizes their condition and prospects for *remedy into the social realm*.

Internationally, the estimated number of children with special educational needs (SEN) has increased in recent decades (*see Appendix 1* and *2*). Yet the education of teachers for learners with special educational needs is still dominated by the special school's perspective, especially in countries with a strong tradition of special education, and it is still a major challenge to find access to additional support in mainstream educational settings which would help a successful inclusion of students with intellectual disabilities without producing segregation, stigma and drop-outs.

Inclusive education is a must for children with intellectual disability, as this is the enriched environment where children with retarded performance are not exposed to pathologic behaviours (like in special schools); and since the main way of learning of our population is observation and imitation (Howie, 1969; Brown, Peace & Parsons, 2009), this is the path on which children with retarded performance may internalize normative ways of conversation, behaviour and levels of expectations, and their modifiability may reach its full potential. Proper inclusive programs are usually carried out with the help of well- qualified inclusive shadow teachers (Lebeer et. al., 2011).

It is very important to note, however, that those children with intellectual disability who do not bear *the prerequisites for learning*, whose attention span and focus is limited, whose cognitive functions have never been remediated – in other words, who remain closed systems – will not necessarily benefit from inclusion. Therefore, *cognitive activation must happen before or parallel with inclusive processes* (Lebeer et al., 2011). With our research we came to the very same conclusion. Only after an intensive remediational process were our participants able to benefit from natural, regular learning experiences.

It may have turned out from the afore mentioned statements that our educational philosophy towards children with intellectual disability is *active-modificational* versus the so called *passive-acceptant* approach, which permeates general educational attitude to children with intellectual impairments. We define active modificational approach the following way: „Whenever an individual's modifiability is not the major objective of intervention, a passive acceptant approach is reflected. Activities of passive acceptance nature may be highly resourceful and varied, and yet considered passive because they aim at adapting the environment to the present level of functioning of the individuals rather than at *enriching the*

individual's copying behaviour for a better quality of life" (Feuerstein, Rand & Feuerstein, 2006, p. 16).

As opposed to views that interpret the situation of children with intellectual disability as immutable condition, and experiencing the affective and cognitive needs of the children with low intellectual performance, we chose one from the internationally available socio-constructivist cognitive intervention programs and carried out a thorough intervention in a clinical laboratory for two years. We have ensured cognitive-affective rehabilitation for 15 children born with intellectual disability with other comorbid phenomena (autistic behaviors, obsessive-compulsive disorder /OCD/ and pervasive developmental disorder /PDD/). The cognitive activation lasted for 24 months in case of each individual with the intensity of 7-15 sessions per week.

Our thesis is structured into four main chapters. In the first theoretical part we give an overview about the concept of brain plasicity, especially related to learning experience. We think it is important in the understanding and evaluation of the research findings. Moreover, the concept of brain plasticity is a very important fundament of the intervention itself and on the level of psychological functions it is called 'Structural Cognitive Modifiability' or SCM. We outline the major principles from brain science necessary to be followed with care when cognitive intervention is given to the clinical population (to children with PDD, autism, genetic and other metabolic diseases, epilepsy and perinatal brain injury etc). We also highlight the possible links between the mirror neuron system and mediated learning experience (MLE) – the main mechanism behind social imitation and successful interiorisation of other's cognitive operations. We describe the nature and characteristics of intellectual disability; later we analyze the challenges of assessment of children with intellectual disability and the need for dynamic assessment of children with retarded performance organized in the ZPD. We also analyze, compare and classify different cognitive acceleration methods, programs and experiments and define where our chosen cognitive acceleration program is situated. We need to do this, since in the Hungarian educational environment even pure sensorial or motoric programs are claimed to be „cognitive" and even „metacognitive" – whereas real metacognitive programs or approaches to teaching children with special educational needs emphasize decontextualisation of abstract principles from the concrete experience and explicitely mediate transfer: the re-contextualisation of the generalized strategies into new contexts. They make children verbalize most mental operations they have just accomplished; and claim to lead children to higher self-regulation in terms of behaviour in general and while learning. We also discuss the heritage of Piaget and Vygotsky – how they conceptualized cognitive development of children, compared to Feuerstein. Then we discuss the main pillar of Feuerstein's theory, the concept of Structural Cognitive Modifiability. Later, we enlight the three interrelated systems: criteria of mediation; the deficient cognitive functions of the learner and the characteristics of the task analysed by the cognitive map.

In chapter two we explain the research problem and reflect on questions of methodology; this chapter details our applied intervention: general MLE, the Feuerstein Instrumental Enrichment Program (FIE-B) and Mediated Self-Talk. We outline the needed shifts in MLE when applied for retarded performers with different behavioural conditions. Also, we detail our blended assessment used for monitoring children for two years – dynamic assessment systems (LPAD-Basic and CAP) and static tests used in our experiment. In different subsections this chapter presents the case studies – the individual results and describes the results of descriptive statistical analysis and test-statistics.

Summary of the main results and conclusions are outlined in chapter three. Chapter four details possible pedagogical implications of the findings.

The main practical relevance of our research is a new approach to the remediation of thinking and language: *A Think-Aloud and Talk-Aloud Approach to Building Language: Overcoming Disability, Delay, and Deficiency* (Feuerstein, Feuerstein, Falik & Bohács 2013), which also builds on the plasticity of the brain providing students with language, self-talk strategies and thinking models that activate neural circuits to strengthen the language development and cognitive skills required for academic learning.

The wider theoretical context of the thesis is the international DAFFODIL project (Dynamic Assessment of Functioning of Children Oriented at Development and Inclusive Learning) in terms of describing and suggesting dynamic assessment systems for the evaluation of children with intellectual disability. The project has realized a multinational research including six European countries between 2008-2011 about present assessment preferences of children with intellectual disablity in Europe and possible gains of assessment with dynamic assessment systems. As one of the participants of the research group I systematically refer to the following publications in course of the theoretical part of the thesis: *Re-assessing the current assessment practice of children with special education needs in Europe* (Lebeer, Birta-Székely, Demeter, Bohács, Partanen, Sonnesyn, Candeias, & Dawson, 2011); *Tests and Instruments Currently Used in [Europe] in the Partner Countries* (Birta-Székely, Demeter, Lebeer, Partanen, Candeias, Rebocho, Rosário, Bohács, Dawson, Orban, & Sonnesyn, (2011); *Problematic Issues in Assessment* (Lebeer, Birta-Székely, Demeter, Bohács, Partanen, Sonnesyn, Candeias, & Dawson, 2011); *Organisation and Legislation of Special Needs Education in [Europe]* (Lebeer, Birta-Székely, Demeter, Bohács, Partanen, Sonnesyn, Candeias, & Dawson, 2011); *Critical Reflections and Suggestions for Change* (Lebeer, Birta-Székely, Demeter, Bohács, Partanen, Sonnesyn, Candeias, & Dawson, 2011). Our former articles issued in Hungarian Pedagogy also serve a basis for the theoretical part of my thesis: Feuerstein, R., Falik, L. & Bohács, K. (2010). A közvetített szolilokvia – a nyelv és a kommunikáció mediációja belső beszéden keresztül. *Magyar Pedagógia, (110)*2. 97-118. Bohács, K. (2010). A dinamikus értékelés. *Magyar Pedagógia, (110)*4. 311–328.

I use those results which have been presented in several national or international conferences. I refer to the question of clinical applications of dynamic assessment and later development of learning potential of 'non-gainer' children with autistic features, which I have presented in *The Jerusalem International Conference on Neuroplasticity and Cognitive Modifiability* in 2013 (Bohács, 2013a) or in the *11th Conference on Educational Assessment* in Szeged (Bohács, 2013b). Some of the results have been presented in the 2008 conference of *International Association for Cognitive Education and Psychology* (Bohács, 2008) and the 2009 *National Conference on Educational Sciences* [*Országos Neveléstudományi Konferencia*] (Bohács, 2009), in the *Assembly of the Hungarian Psychological Association* [*Magyar Pszichológiai Társaság Tudományos Nagygyűlése*] (Bohács, 2012) or in the *7th European Conference on Psychological Theory and Research on Mental Retardation and Cognitive Developmental Disabilities (PTRMR)* (Bohács, 2008).

I. THEORETICAL BACKGROUND

1. Learning Experience and Brain Plasicity

Cognitive education and neurosciences has started to converge in the past thirty years. A consideration of the relationship between the two fields is critically important, because the modifiability of the brain has long been denied by generations of scientists and educators (Horányi, 1961), and plasticity of the brain is still not well acknowledged and reflected in general practice or in educational attitude. There are exceptions, however, and we can be witnesses of new educational inventions where both theory and practice are based on what we know about the brain (e.g. Maryann Wolf's reading program, the RAVE-O (Wolf 2007), or Merzenich's Fast ForWord program to eliminate learning disabilities).

This chapter is a summary of the most relevant findings of the past decades concerning the plasticity of the human brain and its implications on learning processes. Since thousands of articles have been written about the brain and its ability to change since the 1960's, we cannot undertake the task to elaborate on each aspects of the findings. However, we can certainly present the history of neuroplasticity and reflect on its most relevant consequences on instruction of children with special needs.

Brain placticity is one of the most extraordinary discoveries of the 20th century. The terms *brain plasticity*, *neuroplasticity* or *neural-re-mapping* in the literature refer to the same phenomena: the brain's ability to re-organize itself in micro- and macro-levels, according to new experiences, learning or injury. Brain plasticity refers to the capacity of the nervous system to change its structure and its function over a lifetime, in reaction to environmental effects.

Although this phrase *'brain plasiticity'* is now commonly used in psychology and neuroscience, it is not easily defined and it is used to *refer to changes at many levels in the nervous system ranging from molecular events, such as changes in gene expression, to behaviour* (Kolb, Muhammad & Gibb, 2010). This is reflected in the following definition as well: „It is the brain's capacity to adapt its structure and functioning, as a response to learning or to damage, in fact, during an entire life time. New neural pathways and synapsys can be formed due to changes in environment, if new behaviour is imposed on the individual or even if brain injury happened (Lebeer, 2008)". In addition to genetic factors, the environment in which a person lives, as well as the actions that the person does, play a role in plasticity.

The concept of brain plasticity has been first mentioned by an American psychologist, William James in his book *The Principles of Psychology* in 1890, but his idea was largely neglected for the next fifty years. For many decades it has been a general consensus between neuroscientists that the brain is immutable and cannot 'remold' itself after the critical periods of early childhood. For example, Karl S. Lashley in 1950, surveyed the literature on possible neural changes after participants' learning and training, and concluded that there was no solid evidence to support any of the growth theories (Joja, 2013). The first researcher to use the term 'neural plasticity' was a Polish neuroscientist, Jerzy Konorski in 1948. Konorski suggested that neurons that had coincidental activation due to the closeness to the firing neuron would after some time create plastic changes in the brain (Konorski, 1948).

The Canadian psychologist, Donald O. Hebb can be considered „the father of neuropsychology", since he put forth the idea in the mid 1900's that "When an axon of cell A is near enough to excite cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased (Hebb, 1949)."

His postulate, which have been proved ever since by neuroimaging techniques and numerous experiments, is just mentioned today as the Hebb-paradigm: "neurons that fire

together wire together." This statement illustrates simply that the brain can form fresh pathways by having new unique patterns of neural cells firing together.

The next breakthrough in brain science happened in the sixties, when the effects of an 'enriched environment' were analysed. Rodent studies since the 1960's has highlighted that neurogenesis happens (development of new brain cells) in enriched environment. The comprehensive research of Mark R. Rosenzweig, Edward L. Bennet and Marian C. Diamond has shown that rodents raised in such environment have a larger cortex, more cellular connections and develop new brain cells in the hippocampus. There has been an increased thickness and higher weight of the cortex in Enriched Condition rats compared to that of Impoverished Condition rats. The researchers also noted that rats in the EC condition had developed significantly greater activity in the neurons in the cerebral cortex associated with transmission of acetylcholine, which is an important neurotransmitter for learning and memory (Diamond, 1967; Rosenzweig, Bennet & Diamond, 1972). From the 1990's such data are also available on humans.

For educators the question of what kind of *enriched environment* is needed for an enhanced development, comes naturally. By definition an enriched environment is "a combination of complex inanimate and social stimulation. In general, the 'enriched' animals are kept in larger cages and in larger groups with the opportunity for more complex social interaction. This definition implies that the relevance of single contributing factors cannot be easily isolated, but there are good reasons to assume that it is the interaction of factors that is an essential element of an enriched environment, not any single element that is hidden in the complexity" (Praag, Kempermann & Gage, 2000. p. 191). These experiments underline the importance of social contexts and interpersonal relations in which human intellect can best develop.

Acquisition of highly abstract information and brain plasticity came into the scope of attention of scientist in the past years. Just recently, scientists have also confirmed that brain structure is not determined solely by genetic factors or social contexts but is extensively modulated by experiences such as prolonged abstract training. Draganski and his associates from the University of Regensburg, Germany showed that learning and memorizing, especially the acquisition of great amount of highly abstract information changes the structures of the grey matter in some areas of the brain. They scanned the brains of German medical students 3 months before their medical exam and just right after the exam and compared their findings to brains of students who were not studying for exam in this examination period. Medical students' brains showed learning-induced changes in regions of the parietal cortex as well as in the posterior hippocampus. „During the learning period, the gray matter increased significantly in the posterior and lateral parietal cortex bilaterally" (Draganski, 2006 p. 1). These regions of the brain are known to be involved in memory retrieval and learning.

To sum up the accumulated knowledge on the brain in the past fifty decades, three occasions seem to be definitive when neuroplasticity occurs: a. At the beginning of human life: when the immature brain organizes itself. b. In case of brain injury: to compensate for lost functions or maximize remaining functions. c. Through adulthood: whenever something new is learned and memorized.

Three main forms of plasticity are described in the literature: *synaptic plasticity*, *neurogenesis* and *functional compensatory processing*. *Synaptic plasticity* means that the brain establishes neural pathways when humans engage in learning. Better inter-neuron communication happens (electrical signals travel more efficiently along the new pathway) when knowledge is acquired through repeated practice. *Neurogenesis* refers to the birth and proliferation of new neurons in the brain. The possibility of the birth of new neurons has been considered a heresy till the 1950's – and since then, especially in recent years the fact of

neurogenesis has been strongly established (Kolb, Muhammad & Gibb, 2010). Neurogenesis occurs when stem cells in the brain divide into two cells: a stem cell and a cell which will become a neuron -- fully equipped with axon and dentrites. Those new neurons will then migrate to even distant areas of the brain where they are needed and thus have the potential to allow the brain to replenish its supply of neurons. One possible example for epigenesis can be the results of Joseph LeDoux (2003). In his book titled '*Synaptic Self. How Our Brain Becomes Who We Are'* he is explaining the synaptic basis of the brain and the complicated relationship between genes and environment. LeDoux describes learning as a timeless process, running through all our lives. And finally, *functional compensatory plasticity* means the brain can use more areas in case of aging or after injury to compensate for lost function. A sub-group of aging individuals has been scientifically investigated and it was found that, when processing new information, higher performing older adults recruit the same brain regions as do the younger adults, but, also recruit additional brain regions that young and low performing older adults do not activate. Researchers have analysed this over-recruitment of brain regions in high performing older adults and have generally reached the conclusion that recruitment of additional cognitive resources reflects a compensatory strategy.

To conclude the manyfolded message of brain science for therapeutic interventions or for education, Kleim and Jones (2008) and later Feuerstein et al. (2013) have made a comprehensive review of research and have identified ten elements that research studies indicate as of utmost importance to promote neural plasticity. These are the following:

1. *The Activation Effect*: Specific brain functions must be activated and stimulated to develop and sustain behavioral functions.
2. *The Specificity Effect*: Interventions need to be specific to the particular cortical function that is the target for behavioral change. There is a relationship between the nature and type of intervention and the resulting plasticity and modifiability of functions. This requires assessment and the provision of varied activities and patterns of intervention.
3. *The Repetition Effect*: Repetition is required for the functional changes to be structurally implanted and manifested in behaviour – considerable amount of repetition. However, repetition alone is not sufficient, there must be variations in task structure to promote plasticity. Simply redoing activities without systematic variation in not enough – it will not create plasticity.
4. *The Intensity Effect*: The amount of time spent in practice and contact with the intervention modalities is critical in order to have the modifiability created become established in the neural structures. Cognitive modifiability requires intensity of exposure that typically go well beyond traditional and accepted patterns of 'therapeutic' application. This is why it is proposed as a part of daily living situations (for parents and care givers) rather than limited to therapeutic sessions or restricted instructional contacts.
5. *The Persistence Effect*: Different forms of neural plasticity take place at different times and pacing – requiring persistence in treatment planning and implementation over time. When immediate gains are not evident, one must not give up, but go forward with the intervention, knowing that acquisition occurs, often latently, but eventually materializing. We are often surprised by the changes that emerge after seemingly endless unproductive encounters. When they do emerge, rapid and significant changes happen.
6. *The Salience Effect*: The intervention must be meaningful – our mediatee always have to know what he/she will benefit from the intervention. He/she must be aware of his or her functioning, of its value, of the changes that are experienced and the importance of these changes.

7. *The Optimal Timing Effect*: We do not consider critical periods as a barrier to change, though it has been recognised that some kinds of change and propensities of change are age-related. Though it may be easier to induce changes in younger brains, the brains of adults and even the elderly are amenable to change. Research cautions us not to take the dimension of optimal timing as a reason to withhold or not to initiate interventions.
8. *The Novelty Effect:* Research has shown that learning experience must be new and challenging for it to stimulate neural plasticity. If all one does is repeat familiar tasks -- learning will be impeded. Challenge and novelty are required, linked to changes and variations in experience. The potential for capitalizing in novelty is endless. In a later discussion of this issue we present some of the important aspects of this element as reflected in MLE interventions (see *Section 3.3*) .
9. *The Spread of Effect*: Changes in functions resulting from a particular intervention can affect changes in other functions not directly targeted by the original intervention. This has been described as a *transference* effect, aided by the mirror neuron systems that have been discovered and tracked in neural anatomy. As initial MLE interventions are offered and are successful, language starts to develop, behaviors start to change, and aspects going beyond the language behavior alone become evident. Neurologically, it has been shown that activation in one part of the brain will generate activities in other parts, often without awareness or conscious intention.
10. *The Selection Effect*: There can be interference, whereby plasticity stimulated or experienced in one area may interfere with changes in other areas. This must be accounted for in the interventions selected, based on an analysis of the needed behavior changes and the tasks selected for the intervention.

According to present scientific results had mirror neurons had not exist, we would not be able to talk, feel and imitate. From our intervention program's point of view (MLE, FIE-Basic and MST) we have to shortly mention the mirror neuron system and their role in neural plasticity.

Mirror neurons are a class of neurons first discovered in the monkey premotor cortex that activate both when the monkey executes an action and when it observes the same action made by another peer. Studies have been designed for monkeys who observed activities where they clearly understood the the action (e.g placing food on a tray to be eaten behind a blind screen) – in such cases their mirror neurons discharged even though they could not observe the outcome of the action. These neurons enabled monkeys to understand actions performed by others (Fogassi & Ferrari, 2007, Ferrari et al., 2003).

Very similar mirror neurons have been discovered in humans – especially the Broca-area of the human brain proves to be rich in these. „…each time an individual sees an action done by another individual, neurons that represent that action are activated in the observer's premotor cortex…" – write Rizzolatti and Craighero (2004, p. 173). It became obvious that observed (and imitated) phenomena can have the same effect on the neuron as the acted-out behaviour. „The brain sees what the actor (mediator) is doing, than understands why the actor is doing this – so new research is showing that what is mirrored is not only the meaning of the actions (observed) but also the understanding of other's intentions" (Feuerstein, Feuerstein & Falik, 2010, p 137). In other words, when mediated learning experience happens, the exact intention of the mediator is transmitted (Fogassi et al., 2005), reciprocity in the mediatee is carefully checked (whether he/she has understood the mediator's intention and whether he/she has started to „mirror" the same goals of joint intentions) and the mediator's modelled behaviour is gently imposed on the mediatee's brain: we may call it *consolidated imitative activity*. Mirror neurons are the possible link between the mirror neuron system and mediated learning experience – the main mechanism behind social imitation and successful interiorisation of other's cognitive operations.

2. Description of Intellectual Disability

People and children with intellectual disability show an extreme level of heterogenity in terms of their condition. Not even two children having the same genetic anomaly (eg. Down-syndrome) can be treated as one „group" in terms of their level of intellectual functioning or educational needs, even if their measured IQ was the same. The penetrance and expressivity of the very same syndrome may be different – ending in totally different phenotypes, different atypical cognitive structure and behaviour. Research has shown that variable phenotypes can be caused by a number of factors, including the following:

- Modifier genes
- Environmental factors
- Allelic variation
- Complex genetic and environmental interactions (Lobo, 2008)

Heterogenity of symptoms observed in atypical cognition and behaviour is just one problem. Another challenge is their assessment in standardized circumstances (*Section 4*). The only study evaluating the effectiveness of FIE-Basic with clinical populations notes that Raven's Matrices used in the research showed higher results before the intervention then after it has been finished, due to the fact that not the same assessor had administered the tests in the beginning and in the end (Kozulin et al, 2010).

Classification of intellectual disability also raises several questions, as noted by Malhi: „Even though there are many descriptions of mental illness, few are clinically meaningful. In reality, mental illness is heterogeneous and ever changing, and perhaps by its very nature difficult to characterise" (Malhi, 2013 p. 7).

Due to these difficulties we can be witnesses of a slow change in the international classification of mental functioning turning away from the conventional classification of intellectual disabilities based on IQ scores (e.g. the older version of the Diagnostic and Statistical Manual of Mental Disorders (DSM – 4) differentiates between the following groups: Borderline Intellectual Functioning: IQ 71-84; Mild Intellectual Disability IQ 50-55 to approximately 70; Moderate Intellectual Disability: IQ 35-40 to 50-55; Severe Intellectual Disability IQ 20-25 to 35-40; Profound Intellectual Disability: IQ below 20 or 25) to more multidimensional forms of classification. These multidimensional forms are *levels of functioning* or *levels of need for support*.

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM) published by the American Psychiatric Association (APA) provides standard criteria and terminology for the classification of mental disorders – including intellectual disability as well. The DSM serves as a resource for clinicians, researchers, insurers, patients, as well as for legislation. The DSM-4 was used in the United States and to various degrees in Europe. The recent version, published on May 18, 2013 in San Francisco, is the DSM-5 (Fifth Edition).

As for terminology, already in the DSM-4 the term *"mental retardation"* has been replaced by *„intellectual disability"* as opposed to previous editions of the manuals. In addition to this, in the latest version of DSM, the parenthetical name *"intellectual developmental disorder"* has been included „to reflect on deficits in cognitive capacity beginning in the developmental period".

As for severity of problems, in DSM-4 intellectual disability was considered to be approximately two standard deviations or more below the population, which equals an IQ score of about 70 or below. However, the new DSM-5 *emphasizes the change for a more comprehensive assessment – consideration of adaptive functioning rather than IQ test scores*

alone. „By removing IQ test scores from the diagnostic criteria, but still including them in the text description of intellectual disability, DSM-5 ensures that they are not overemphasized as the defining factor of a person's overall ability, without adequately considering functioning levels (www.dsm5.org)." This may mean a significant advancement towards needs-based assessment and the implementation of individualised educational plans.

The new DSM-5 defines intellectual disability as the following: intellectual disability involves impairments of general mental abilities that impact adaptive functioning in three domains, or areas: 1. The *conceptual domain* includes skills in language, reading, writing, math, reasoning, knowledge, and memory. 2. The *social domain* refers to empathy, social judgment, interpersonal communication skills, the ability to make and retain friendships, and similar capacities. 3. The *practical domain* centers on self-management in areas such as personal care, job responsibilities, money management, recreation, and organizing school and work tasks.

The diagnostic criteria of the American Association on Intellectual and Developmental Disabilities (AAIDD) are also based on DSM-4 (early onset, conceptual, social and practical domains), however classification of severity of the disability is multidimensional and *the individual's need for support* are of marked importance: temporal support (approximately equals APA's category of mild intellectual disability); partial support (approximately equals APA's moderate intellectual disability); extended support (approximately equals APA's severe intellectual disability); and pervasive support (approximately equals APA's profound intellectual disability) (Schalock et al, 2010).

The *International Statistical Classification of Diseases and Related Health Problems* (ICD), produced by the World Health Organization (WHO), is another commonly used manual which includes criteria for mental disorders. The 10th revision has been published in 2004. This is in fact the official diagnostic system for mental disorders in the US, but is used more widely in Europe and other parts of the world. The ICD is purely a medical paradigm of disability. In the Hungarian context classification of intellectual disability is based on the ICD, called BNO-10 --- and has been criticised because of its medical orientation since its use from 1993/1995 (BNO-10, 1998) (Lányiné, 1996).

3. Cognitive Acceleration Programs and Experiments

3.1 General Problems and Theoretical Grounds in Cognitive Acceleration

Hystorically, mainstream schools did not target the development of children's thinking processes in the past centuries. Until the 1970's, the main goal of formal schooling was to teach subject-contents – mainly because national curricula regulated the amount of lexical knowledge a given child had to know for further advancement. It was hypothesized that the structure of the different school subjects had enough effect on the development of the general abilities of students – and indeed, research on the development of human abilities showed that learning school subjects had positive effects on cognitive development. In other words, formal education *does* make a difference in cognitive functioning (Scribner and Cole, 1981 cited by Schwebel & Mahler, 1986). However, it also became obvious that for many students this effect is not enough – and drop-out or academically low-functioning students constitute a greater percentage of the general school population. Till the 1980's, the main concern of educators has been based on psychometric paradigms: What is the intelligence level of this child? – so the main concern was the measurement of intelligence in the form of an IQ score. This score was considered as a relatively constant, unchangeable condition of an individual's cognitive ability (an immutable state) – and the student was placed into a classroom where the level of teaching was at his level.

From the 1990's a different question has been addressed: How can we accelerate a child's general intellectual development, how can we facilitate his overall cognitive abilities? As Schwebel & Mahler (1986) formulated this, the change in focus was truly profound, since a fourth „r" has been added to the „3-r"-s: besides reading, writing and arithmethic, *reasoning* has been introduced to the curriculum as an important educational goal. In the spirit of this paradigm-shift, mirriads of educational programs have been developed in the past decades – some of them were very ambitious and large scale (the Venezuela programs namely CoRT, IE and the Intelligence Project; or Head Start in the USA), and some very marginal, nearly unknown (like Nyborg's Concept Teaching Method in Norway).

We have to note, however, that despite a movement into this direction, the long-time belief that intelligence is largely genetically determined still pervades the climate of schools and special education service providers. The active modification of human intelligence does not have neither theoretical, nor pragmatic tradition, since it does not happen easily that significant change takes place in fluid intelligence of children with intellectual disability. Another problem is that neither thinking-skills programs, nor even metacognitive skills approach is included in regular teacher training programs.

In this chapter we give a short overview of available cognitive acceleration programs from an international perspective – some of the programs are not present in the Hungarian context yet. Many of the programs we mention here are designed for children with learning disability (eg. dyslexia), some of them are deliberately for students with intellectual disability. There are, however, many programs or approaches on our list which have been designed for children with average intelligence (e.g. content-based infusion programs). Yet, we do not leave them out from our classification firstly because we are deeply convinced that any educational program or philosophy may contain some relevant hypothesis or element which may be used for the instruction and well-being of children with intellectual impairments. Secondly, we do not believe in segregative programs or approaches that treat the education of children with special needs differentiated from the education of mainstream populations. This approach may be alien in a country with a long history of segregated special education – but has become a general attitude in countries with outstanding inclusive experience in the era of „school for all" (like Norway, Israel and United Kingdom). Some of the programs we mention may have been applied in case of students with intellectual disabilities, but there are not enough data about their effectiveness.

3.2 Classification According to the Program's Relation to Content

When planning interventions either for students with general intelligence or with retarded cognitive performance, there is a variety of options we can choose from. As we have already stated, the approaches described here may be a mode for instruction of special populations as well or may inspire experts in the field of special education. In the following section we will classify acceleration programs – we will detail those which are deliberately designed for individuals with cognitive delays or deficits. We will just list those programs which are for the mainstream population.

One possible way of classifying thinking-skills programs is *along the line of their relationship to content knowledge*. Many programs give *instruction in cognitive strategies, independent of content* (*„content-free" programs*). These programs are „independent of content" in the sense that these are taught without reference or even with deliberate avoidance of subjects, such as literature, mathematics or biology. These give a greater emphasize to general abilities and abstraction than practical aspects of learning and believe in the possibility of wide transfer (Csapó, 2003). Examples for this type of programs are: De Bono's

CoRT program, Lipman's Phylosophy for Children, Feuerstein's Instrumental Enrichment program (Level 1 and Level 2), Klauer's Inductive Reasoning Program and the Activating Children's Thinking Skills program from Northern Ireland.
Other programs accelerate *cognitive development through a mode that is integrated into the regular school curriculum (*also titled as *„content-based or infusion" programs*). These programs assume that the possibility of transfer is certainly not automatic and narrow, therefore the development of abilities is linked to the transmission of the academic subject. Transmission of content knowledge is integrated with the development of abilities. One example of this may be Adey's CASE program (Cognitive Acceleration through Science Education). The programs we have just mentioned in *Section 2.2* are suitable for children with average intelligence having minor learning disabilities or for children with mild intellectual disability.

3.3 Classification According to the Program's Accentuated Mode on Skills or Dispositions or Knowledge

When we try to classify the existing cognitive educational programs, besides the afore mentioned dichotonomous model (content-free and content based/infusion programs), Harpaz (2007) offers us another possible conceptual mapping of the field. According to his view, there are three main approaches in cognitive education since the 1970's: the s*kills approach*; the *dispositions approach*; and the *understanding approach*. He believes that a fine thinker actually bears all the three qualities of human thinking, since "After all, what makes a person into 'a good thinker' (or 'intelligent,' 'smart', 'reasonable," etc.) if not techniques, strategies, tools - in short, thinking skills; in addition to attitudes, character traits, inclinations - in short, thinking dispositions; and in addition to education: knowledge, expertise in the thought-about topic - in short, understanding? A good thinker is one who possesses skills, dispositions and understanding" (Harpaz 2007 p. 4. and p. 26) (*Figure 3*).

1. Figure: Theoretical Model for Analyzing Cognitive Intervention Programs (Based on Harpaz, 2007.)

Harpaz states that the first group can be called as 'the skills approach' programs. The *skills approach* puts an emphasis on developing basic and higher order thinking skills in the students. Basic skills (neutral skills) like *classification, grading, comparison* are the milestones for the development of higher order skills of *decision-making, problem solving,* and *concept formation*. They are also a basis for specially developed skills (the so called normative skills) like *breaking conventional thinking patterns, devising problems, exposing basic premises, discovery of biases,* etc. This approach advances critical thinking and creativity. The skills approach claims that in the era of explosion of knowledge it is not realistic to teach/transmit knowledge anymore, but we have to equip our students with good thinking skills, i.e. *thinking tools* or mental operations like *identification, focusing, classification, grading, discrimination, comparision, selection, generalization, summation, choosing, arriving at conclusion, solving problems, decision,* etc. The *principal metaphor* of intelligence of the programs or theories belonging to the skills approach is the *toolbox*. The mind is conceived as a kit of thinking tools – and skilled thinking is achieved by the efficient use of these thinking tools. However, a critique of the skills approach must be formulated:

when such a cognitive program appears in the classroom in educational reality, there is a danger that the cognitive skills approach is *tamed* into direct teaching of abstract skills. Another critique that we can formulate is that teaching skills is effective only when it corresponds to the inner disposition of students and may easily degenerate into rote learning when such connection is missing.

According to Harpaz certain cognitive acceleration programs can be grouped into the second, so called *dispositions approach category*. The *dispositions approach* states that the foundational element of good thinking is 'thinking dispositions', values and motivation beyond thinking. The main *metaphor* of the dispositions approach is *deep currents* sweeping our intellectual behavior. The dispositions approach grew out of the criticism of the skills approach, as thinking dispositions were viewed as 'energy suppliers' for thinking skills, a link connecting skills and action. (Students may have good thinking skills, but no motivation or disposition to implement them.) Criticism of this approach is: one danger can be in everyday practice is that dispositions approach programs may become *preaching* rather than cultivation in school life.

The third, so called *knowledge understanding approach* rejects the dichotomy between teaching knowledge and teaching thinking, between teaching *what* to think and teaching *how* to think; it acknowledges an internal connection between knowledge and thinking, between the "what" and the "how" (*Table 1*). One possible danger can be: understanding approach becomes *lecturing* rather than construction.

1. Table: The Approaches to Teaching Thinking (Adapted from Harpaz, 2007, pp 22-23.)

Approaches / Characteristics	**The Skills Approach**	**The Dispositions Approach**	**The Understanding Approach**
The foundational element of good thinking	Skills are thinking tools – in order to cope in life, we have to use them efficiently, quickly, and precisely	Dispositions are motivation for good thinking which is formed by reasonable choiches	Understanding is the ability to locate a concept in a context of other concepts, to implement concepts in new contexts and *perform thinking processes with knowledge*
Examples of foundational elements	Neutral skills (identify, focus, classify, grade, discriminate, compare, select, generalize, summarize, ask, choose, assume, conclude, solve (problems), decide, etc.); Normative skills (breaking conventional thinking patterns, devising problems, exposing basic premises, discovery of biases)	Disposition to think	Reflective understanding
Patterns of teaching	The pattern of impartation	The pattern of cultivation	The pattern of construction
Ideologies of the "good thinker"	Efficient thinker	Wise thinker	Learned thinker
Concept of metacognition	Metacognition is skill	Metacognition is disposition	Metacognition is understanding
Concept of Intelligence	Intelligence is constituted of skills	Intelligence is constituted of dispositions	Intelligence is constituted of understandings
Metaphors for thinking	Toolbox	Deep currents	Net
Examples of theories, programs and ideas	De Bono – CoRT; Ennis - Taxonomy of critical chinking; Beyer - Direct teaching of thinking; Perkins - Thinking frames; Perkins and Swartz - Graphic organizers; Swartz and Parks – Infusion; Sternberg - Intelligence implied; Treffinger, Isaksen and Dorval - Creative problem polving; Johnson and Blair - Informal logic; Chaffee - thinking critically; Whimbey and Lochhead - Problem solving; Feuerstein. - Instrumental Enrichment; Lipman - Philosophy for Children	Perkins - Dispositions theory of thinking; Tishman - Thinking dispositions; Costa - Habits of mind; Baron -Theory of rationality; Langer – Mindfulness; Barrel – Thoughtfulness; Facione - Critical thinking dispositions; Passmore - Critical thinking as a character trait; Siegel - The spirit of the critical thinker; Sternberg - Successful intelligence; Golman - Emotional Intelligence; Lipman - Philosophy for Children; (*Feuerstein - Instrumental Enrichment)*	Perkins - Understanding performances; Gardner - Understanding in the disciplines; Wiske - Teaching for understanding; Wiggins and McTighe - Understanding by design; Paul - Critical thinking in the strong sense; McPeck - The reflective critical thinker; Brown - Community of learners; Smith - Understanding as good thinking; Brooks and Brooks - Constructivist instruction; Lipman - Philosophy for Children; Harpaz - Community of Thinking; (*Feuerstein – Instrumental Enrichment)*

Harpaz emphasizes that the many theories and programs of teaching thinking do not fall into the different approaches like „billiard balls into their pockets" -- several simultaneously fall into two or three approaches (e.g. Lipman's "Philosophy for Children"

situated in the above table in three columns). But even in these eclectic „theories-programs" one dominant approach is usually reflected.

We find Harpaz's classification experiment interesting; at the same time we have to note that many cognitive intervention programs *do not separate* cognitive aspects from the affective, implicitly referring back to the ideas of Piaget who said, neither in case of children, nor in case of adults: "can we find a behavior or a state which is purely cognitive without affect, nor a purely affective state without a cognitive element involved. There is no such thing as a purely cognitive state" (Piaget, 1962, p. 130 cited by Schwebel, 1986.). Therefore, Feuerstein's Instrumental Enrichment Programs (Level 1, Level 2 and FIE-Basic) has to be placed into all three categories – they are 'skills approach' as they remediate deficient cognitive functions and mental operations; they are 'dispositions approach' as in the instructional pillar (Mediated Learning Experience) affective-emotive triggers are included, like *mediation of meaning* which links action with inner drive, and explains what benefits will be gained with the action; or *mediation of feeling of competence* which enhances intrinsic motivation. And they are 'understanding approach', since they perform thinking processes with vast knowledge, as transfer activities are crucial part of each IE sessions.

3.4 Classification According to Specified Population of Students: Programs for Pre-Schoolers; or for Adolescence with Developmental Disorders

3.4.1 *Cognitive Programs for Pre-Schoolers; or for Older Children with Developmental Disorders in Sensorially Accentuated Mode*

Many intervention programs are designed for pre-schoolers with specially formulated, manipulative materials that invite children to engage in learning activities. These programs may title themselves as „cognitive" but actually they are more *sensorial, practical* and mean *repeated work* with concrete materials that captivate the child's attention. They are certainly not elaborated metacognitive, abstract, thinking-skills programs, but connect one or more mental operations (like sorting, pairing, comparing or sequencing) with deliberate motoric actions. They may target the general kindergarden population with preventive aims and/or claim to be useful for children with developmental disorders. Some of them are deliberately designed for the population with developmental disorders or to overcome pathologies of neurogen etiology. A non-exhaustive list of these programs is the following: the *Montessori program*, the *Sindelar program*, or a program titled *'Every Child Can Learn'*. In the Hungarian educational climate cognitive rehabilitation and acceleration, or the treatment of learning disabilities happens mainly with programs which are motoric or senso-motoric in nature (TSMT) (Lakatos, 2001 and 2003), 'Alapozó terápia' (Marton-Dévényi, 2002). We will detail just the first three programs.

Maria Montessori's educational philosophy, her child-size tools, tactile-visual toys which inherently include cognitive operations, her sensorially rich learning environment are well-known all over the world. The „Montessori principles" proved to be feasible in organisation of inclusive settings for average, disadvantaged or lower-functioning children as well. Therefore we do not elaborate on her philosophy and program in detail. (For further analysis of her theory, see Montessori, 2011; Mede 2010; Németh 1992.) As the roots of Montessori education are coming from observation and education of handicapped children, it is very natural that Montessori environment provides these children with great stimulation and support. We note, however, that students with intellectual disabilities will not become active, autonomous learners engaging themselves in self-directed activities even in a well-prepared environment without human mediation of cognitive structures, rules and systematic learning of transfer.

The Austrian clinical psychologist and psychotherapist *Brigitte Sindelar* has developed her method of diagnosis and treatment of learning disabilities (dyslexia, dyscalculia, attention deficit dysorder, concentration problems and behaviour difficulties) in the 1970's. Her program outspokenly aims to develop the senso-motor system (Sedlak & Sindelar, 1993; Zsoldos, 2009). The therapy program includes a series of exercises, focusing on visual differentiation, background-shape visual differentiation, auditory differentiation, background-shape auditory differentiation, visual memory, auditory memory, inter-modality, sequence and space orientation. The therapy requires a daily practice, for about ten minutes of one of the dysfunctional basic capacities, which involves active cooperation between parents and specialists in the Sindelar method. Repetition of one or maximum three certain basic capacities are embedded into tasks in growing complexity. According to her theory, the anomalies in the more complex abilities of reading or mathematics are caused by basic functional disorders – like when a tree's ramage is underdeveloped because of problems in its roots. Her theory emphasizes that for proper functioning a synergy of the partial abilities is needed. The program is based on Affolter's three dimensional perception developing model (Affolter, 1972). The program claims to be effective in case of learning disabilities (dyslexia and dyscalculia) and individuals with mild mental intellectual disabilities have been reported to benefit from the program. No scientific evaluation of the Sindelar program is available.

The *'Every Child Can Learn'* approach is claimed to be „functional learning" by the authors in the sense that they imitate early normal child development (Stroh, Robinson & Proctor, 2008). It is an approach developed by George Stroh and his staff at High Wick Hospital School and underpinned by the early learning philosophy of a neurologist, Geoffrey Waldon. Each „lesson" is a *simulation of the normally-developing child playing freely.* Waldon's theory of child development is Piagetian in the sense that according to his convictions 'meaning derives from movement', more precisely from effortful movement and that the earliest learning is derived from the infant's earliest movements. Waldon differentiated between general understanding which the infant learns on its own without adult guidance and is derived from effortful curiosity. So, according to him, the vulnerable child needs the adult's support to learn through the lesson, what the ordinary child learns through solitary play (Solomon, Holland & Middleton, 2012). In their 'purposeful doing' approach in motoric modality (adult sitting behind the child and holding his/her hands while he/she is working on a placing board) they create the motoric abilities of placing, piling and banging with cubes. Into the motoric ability they infuse the mental abilities of pairing, matching, sorting and sequencing according to different criteria. The number of repetition of each action may be even a few hundred each day, in one or two hours. As children gradually learn to act and later think according to these basic operations, the role of the adult is fading. The program claims to be effective with children with serious developmental delays and autism in any age. Parents are actively involved in the learning process.

3.4.2 *Real Thinking Skill Cognitive Programs for Pre-Schoolers; or Older Children with Developmental Disorders*

We consider the following programs real 'thinking skills programs', as operations will be completed not (only) by 'doing', but in an internalized way *on the level of mental representations*. Most of the following programs either explicitly or implicitly try to remediate deficient cognitive functions, develop task-intrinsic motivation and develop representational thought. They want to enhance learning effectiveness and readiness for school learning explicitly. They represent metacognitive approach to early education. These real thinking-skills programs are the following: Nyborg's Concept Teaching Method, Haywood's Bright Start Program and Feuerstein's Instrumental Enrichment Basic. We will

detail the first two programs here – description of the FIE-Basic program will happen in *Chapter 5*.

Concept Teaching Method of the Norwegian pedagogue, Magne Nyborg represents a systematic approach of teaching concepts and conceptual systems integrated with oral language skills to a generalised and transferable way to children, from kindergarten onwards (Hansen, Hem and Sønnesyn, 2002). Nyborg's theory and empirical work includes a) the PSI-model (Person-Situation-Interaction) which means that the learning individual is in dynamic interaction with his environment; b) the BCS-model (Basic Conceptual Systems) consisting of twenty-one basic categories. These are the following: colour, shape, position, change (eg. In size or position or colour etc.), size, place, direction, number, sound/phoneme, surface attributes, surface pattern, substance (eg. glass, leather, wood etc.), attributes of substance (eg. hard, soft, elastic etc.), weight, speed, time, tempreture, use or function, smell, taste, value (Hansen, 2001); c) and the CTM (Concept Teaching Model). He takes over his students in three phases of the learning experience: Selective Association (the SA-phase), Selective Discrimination (the SD-phase) and Selective Generalisation (the SG-phase). According to Nyborg's postulate, analytic coding (very precise analysis of the different and characterising features of objects) helps learners to overcome their perceptual weaknesses (Sønnesyn & Hem, 1996). Later in time, the ideas from Concept Teaching have been taken over to teaching reading for children with cognitive disorders. We give a short example of analytic coding applied in the teaching/learning of letters. For example, the analysis of the letter L by means of (names for) Basic Conceptual Systems is the following (possible answer): This letter consists of (the number of) two parts. They both have straight-lined shape. One is in vertical position; the other in horizontal position. The vertical one is placed on the left-hand side of the other; and the horizontal one is placed at the lower end of the vertical line. The letter is used as a symbol for the phoneme /L/ and is articulated "el" (Nyborg et al., 1997).

According to our view by giving refined abstract labels and criteria of comparision for kindergarten children for analysis, Nyborg not only helped them to become verbally and perceptually conscious, but created the prerequisites for learning. Concept Teaching Method claims to be appropriate for typically developing children in pre-school settings, and at the early years of elementary school; and older children with general learning disorders of learning, combined with lower performance. Pupils with learning disorders – when having performed such precise analysis with the help of the teacher, as just demonstrated – learn the letters and what they symbolise faster than otherwise, and that they learn to read and write sooner and better than in situations when Basic Conceptual Systems are not used as tools in such teaching/learning. Nyborg's approach has enabled many children with mild to severe retardation to be included in mainstream education (Lebeer, 2002).

However, compared to FIE-basic, Nyborg's system is partial (analytic coding), while Feuerstein tries to cover all the cognitive functions and mental operations that a pre-school child should be able to do.

Bright Start is another explicit cognitive and metacognitive curriculum for young children between 3 and 6 years of age. It has successfully been used with some children presenting mild and moderate intellectual disabilities up to about 8 or 9 years of age. Its theoretical framework is based on Feuerstein's Mediated Learning Experience theory (as way of interaction) and the concept of Structural Cognitive Modifiability; Piaget's stages concepts of cognitive development; Vygotsky's social-historical approach; Haywood's transactional perspective on human ability; and Gibson's research on children's perception of distinction features of stimuli (Brooks and Haywood, 2003). Developed originally for use with normally developing children who were at high risk of school failure (children from poor, culturally different, and ethnic minority families in the United States), *Bright Start* has been used

successfully with children who have mild to severe handicapping conditions, including intellectual developmental disorder, emotional disturbance, learning disabilities, autism, pervasive developmental disorders, neurological impairments, sensory impairments (in vision and hearing), cerebral palsy, and orthopedic handicaps. The program's aim is to enhance and accelerate the development of basic cognitive functions, especially those functions characteristic of the cognitive developmental stage of concrete operations. The Bright Start program consists of seven cognitive units, namely, 1. Self-regulation or self-control (children learn to bring their behavior under control of external stimuli, then internalize control; understand role of rules; temporal summation, later learn to use their self-control in a social context). 2. Number concepts (basic number concepts - amounts, numbers, ordinal relations, and conservation of number). 3. Comparison (introduces the concept that we can identify similarities and differences in a systematic way. Compare on single and multiple dimensions and in face of irrelevant variations; develop spontaneous comparative behavior.) 4. Role-Taking (develops the ability to take different perspectives, first on the physical, and then on the social level. Children learn to consider other people's feelings and view-points.) 5. Classification (develops the function of classifying across three dimensions - color, size, shape - and evolves into representational classification (classifying without pictures). 6. Sequence and pattern (children learn to identify items within classes according to their serial position. The lessons focus on number and pattern progression and finding patterns in groups of stimuli). For the effectiveness of the program see Brooks and Haywood, 2003.

Compared with FIE-Basic, Bright Start does not emphasize the importance of using concrete content to lead children to more abstract levels of thinking. The FIE-Basic program is not a content-free program, since it deliberately and systematically mediates content, however it leads the young or delayed learner to abstract thinking and metacognitive awareness.

3.4.3 *Acceleration Programs for Pre-Schoolers; or for Older Children with Developmental Disorders in Accentuated in Socio-Cultural Mode*

The *Tools of the Mind Program* (Bodrova & Leong, 2007) represents the Vygotskian socio-constructive approach to early childhood education. It is not a cognitive curriculum per se. The *Tools of the Mind* program covers all developmental domains -- cognitive, social-emotional, language, physical, creative arts, and approaches to learning. Though the program emphasizes the development of underlying skills, such as paying attention, remembering on purpose, logic, reasoning, and symbolic representation, as well as the development of literacy, mathematics, and science concepts and skills – but does so via the socio-cultural context. Developing executive function (i.e. inhibitory, effortful self-control, working memory and cognitive flexibility) is an explicit aim of the program. Its theoretical basis is a Neo-Vygotskian approach to child development (Karpov, 2003; Kozulin, Gindis, Ageyev & Miller, 2003) (*Table 2*). In each developmental period there is one activity that plays the leading role propelling the child's cognitive and emotional development. The periods alternate between those where leading activity has an emotional-interpersonal focus and the periods with cognitive-instrumental focus (Kozulin, 2013).

2. Table: Leading Activities According to the Neo-Vygotskyan Model of Child Development (Kozulin, 2013)

Focus / Age (years)	Emotional-interpersonal focus	Cognitive focus
0-1	Emotional interaction with caregivers	
2-3		Object-centered joint activity
3-6	Socio-dramatic play	
6-12		Formal learning

A child's play between the ages of 4 and 10 moves between two poles of a single continuum: from an explicit imaginary situation with implicit rules (pretense play) to an implicit imaginary situation with explicit rules (games with rules). In pretense play the child becomes capable of going beyond the confines of the here-and-now situation and learns to assign meanings to objects and situations in a deliberately artificial way. Play as a form of social activity prepares the child for an acceptance of certain roles, e.g. a role of a student. Such an acceptance and the realization of its volitional nature directs the child toward a "dynamic position". The quasi-natural undifferentiated self-identity of the child gives way to realization that one can play different roles that require different attitudes and performances. By assuming different roles and observing how other children are assuming the same roles, the child develops a more sophisticated "theory of the mind" that allows him or her to interpret beliefs, actions, and concepts held by other people (Dolya, 2007). School readiness can be defined whether or not the child has acquired the use of symbolic tools, whether has already developed perceptual standards and self-regulation (executive functions). Activities in the program include role play, acquisition and internalization of symbolic tools and use of the private speech for self-regulation. For the effectiveness of the program see Diamond et al., 2007.

3.4.4 *Ecological Programs Enhancing Cognitive Development of a Specific Age Group through Sensitizing Caregivers or Creating Parent-School Partnership*

Change in human life-style due to external economic crisis or breakdown of the extended family structure, and the growing rate of divorce and singleparent families has affected child-rearing practices in the most dramatic ways. Transmission of knowledge from the older generations on how to grow children seems old-fashioned or even non-applicable in an era of modern technology, internet and computer technology. However, the cognitive-affective 'nutrition' a child gets from his caretakers due to this disrupted continuity may not be enough for an undiminished development through the school years (Klein, Wieder & Greenspan, 1987). Therefore Pnina S. Klein created the so called *MISC (Mediational Intervention for Sensitizing Caregivers,* later titled *More Intelligent and Sensitive Child) program* in Israel (Klein, 1992). It aims to develop a fine quality of interaction between the young child and his/her caretakers and to utilize its long-term effects on child development. The program is based on Feuerstein's Mediated Learning Experience and cognitive functions model, and can be considered an intervention program which accelerates child development through the caregiver. The interactions are individually tailored to each child, based on former analysis of videotaped parent-child interactions. The adult-child interaction is optimised in a developmentally appropriate manner, taking into consideration ethnocultural and ecological variables as well. MISC is designed for children with developmental disabilities, children from low-income families and gifted children. Research has demonstrated that enhancing the quality of parental mediation vastly improves the child's cognitive performance, as well as social and emotional behavior. Empirical evidence

suggests that these experiences may consequently promote the cognitive and emotional development of young children (Klein & Alony, 1993; Klein, 1996; Tzuriel, 1999).
The *Cognitive Enrichment Network Educational Program* (COGNET) (later the name of the program changes to Cognitive Enrichment Advantage Program or CEA) created by Katherine H. Greenberg in the United States for at-risk or underachieving students from age 4 till 12 in regular or special education is based on Feuerstein's Mediated Learning Experience. It is a comprehensive school-wide approach to cognitive education designed to enable children to achieve greater school success by establishing a school-based community of learners. It has three components: the classroom, parent-school partnership, and community-school network. Parent-school partnership means that family members and school staff work together closely to meet learner success. The classroom is turned into a laboratory of learning. A two-year commitment at minimum is needed for COGNET/CEA use. Self-, peer and supervisory monitoring and evaluation is also included in the program. It has been used in several cultural, linguistic and socio-economic settings throughout the United States and Canada with students of diverse ethnic background. On effectiveness of the COGNET on academic achievement and teacher behavior see Greenberg, 2005. The program fits Bronfenberger's model on ecological development of intelligence.

3.4.5 *Infused Subject Specific Programs for Students with Learning Disabilities – Correction of Reading, Writing and Mathematical Abilities*

In this category we find programs which try to correct basic curricular abilities of reading, writing and arithmetic. In other words, these programs are to prevent or correct dyslexia, dyscalculia or dysgraphia. These remedial programs are: Kumon's maths program, Wolf's Rave-O, or Meixner's dyslexia program in Hungary. Since the scope of our thesis is general human intelligence, we cannot detail these approaches targeting more crystallized abilities.

By classifying approaches to teaching thinking, we have placed our applied intervention program (MLE, FIE-Basic and MST) into a wider context and showed its relevance among other approaches or methods in the treatment of children with intellectual disabilities.

Sternberg outlines important parameters when we may assume a cognitive intervention program when applied sytematically will be successful (Sternberg, 1984). The first one is that the program must have both a *psychological theory* of the intellectual processes it seeks to train and an *educational theory* of the way it is going to teach those processes. „The program must highlight what mental processes will be trained, *how these processes work together* in problem solving and how these processes will be taught to individuals so as to achieve durability and transfer. Innumerable programs seek to train intelligence. One can immediately rule out large numbers of the low-value programs by investigating whether they have any theoretical basis (Sternberg, 1984, p 47)".

A second criteria is that in order to achieve durable and transferable learning, the program *explicitely has to teach mental processes* used in task performance and *self-management strategies* to use these components in new tasks (*metacomponents*). „Many early attempts at process training did not work because investigators assumed that just teaching the processes necessary for task performance would result in improved performance on intellectual tasks. The problem was that students often *did not learn when to use the processes* or *how to implement them in tasks* differing even slightly from the ones on which they have been trained (Sternberg 1984, p 47)".

The program should target the *motivational* and *intellectual* needs of the students *at the same time*. „A program which do not target the intrinsic motivation of students is bound not to succeed, even if the cognitive component is remarkable (Sternberg 1984, p 47)".

As a next criteria, the program must be sensitive to *individual differences* – a program which fails to be amenable and elastic enough for all students will fail to engage large number of children.

And finally, the program should have a *well-tested curriculum for teacher/therapist training* – a program may fail to realize its potentials if the therapists/teachers are insufficiently or improperly trained, *since they will work with their whole personality*.

We chose Feuerstein's Mediated Learning Experience, Instrumental Enrichment Basic Program and Mediated Self-talk approach for our intervention, as his theory and applied systems definitely fit all the afore mentioned five criteria outlined by Sternberg.

3.5 Role of Metacognition and Self-Regulation in the Acceleration of Children with Intellectual Disability

In 1976 Flavell stated that "metacognition refers to one's knowledge concerning one's own cognitive processes and products of anything related to them, e.g., the learning-relevant properties of information or data (Flavell, 1976, p. 232)." Twenty years later, Nelson's famous article titled '*Consciousness and metacognition*' in the American Psychology presented illustrative findings about the importance of metacognitive monitoring and metacognitive control (Nelson, 1996).

Based on the two most distinguished experts' words, one possible definition of metacognition can be the following: metacognition is *the awareness of* and *the ability to control one's own cognitive activities*. Also, it is not less important *to be able to attribute mental states* (beliefs, intentions, emotions) to the self and others (Theory of Mind) (Butterworth et al., 1991).

Thousands of articles have been published about the field of metacognition since 1976. As Csaba Csíkos notes, one of the challenges when someone wants to sythetize these studies is that the terminology of metacognition is rather complex, more precisely, too many aspects of metacognition exist (metamemory, metaknowledge, theory of mind, self-regulated learning etc). Interpretation of the field is especially difficult, when some of the authors change their scope of view while still using the same terminology (Csíkos, 2007).

Metacognition, and cognitive, emotive, motoric *self-regulation* during problem-solving activities are extremely relevant processes *in the education of persons with intellectual disabilities*, as this population have limitations in goal-oriented behaviour, undeveloped or partial strategy-use-abilities and strategy-transfer in the different domains. „Mentally retarded subjects display a more limited repertoire of metacomponents than regular students (DeStefano & Gordon, 1986, p 179). Research in the 1970's mainly focused on various strategy-use to improve memory performance of regular and atypical learners – most part of this work has been directed towards rehearsal strategies (Belmont & Butterfield, 1969; Champoine & Brown, 1977; Ellis, 1978; Brown, Bransford, Ferrara & Champione, 1983, cited by Bebko & Luhaorg, 1998). Differences between children with intellectual disabilities and mainstream age-equvivalent peers have been attributed to poorly established or partially developed strategies of children with intellectual disabilities (Belmont & Michell, 1987). Memory studies with children with Down-syndrome in the 1980's have also shown that they have poor memory performance compared to mainstream mental-age-equvivalent peers especially on tasks that require linguistic strategies such as digit span recall or auditory sequencing memory (MacKenzie & Hulme, 1987; Marcell & Armstrong, 1982). Low performance on these tasks has been characterized by a lack of strategy use especially in linguistic modality (MacKenzie & Hulme, 1987; Gibson, 1991, cited by Bebko & Luhaorg, 1998).

As Vaidya states, students with intellectual disabilities often find learning a difficult and painful process. „Learning becomes difficult when there are memory problems, difficulties in following directions, sustaining attention, trouble with the visual or auditory perception of information, or visual-coordination problems resulting in an inability to perform paper and pencil tasks. Children with intellectual disabilities are often overwhelmed, disorganized and frustrated (Vaidya, 1999, p 3)".

We assume we can enhance our learners' performance with cognitive and metacognitive strategies and endure frustrations of learners with intellectual disability. Metacognitive strategies are executive in nature (Barkley, 2012). They are often referred to as self-regulatory strategies. When these strategies are integrated into content area learning, the learning outcomes are successful (Scruggs and Mastropieri, 1993, cited by Vaidyia, 1999). Self-talk strategies to control negative affect and anxiety ('I do not think of that last question, I will move on to the next question') have been considered successful strategies by researchers to ensure emotive control while problem-solving (Hill & Wigfield, 1984 cited by Boekaerts, Pintrich & Zeidner, 2005). Bandura in his book titled '*Self-Efficacy: The Exercise of Control'* also strengthened that strategies may include attempts to control self-efficacy through the *use of positive self-talk* (e.g. 'I know I can do this task') (Bandura, 1997).

Many of Feuerstein's Mediated Learning Experience criteria ensure that learners with retarded performance will *successfully internalize metacognitive knowledge* about their own thinking and *self-regulation* (e.g. mediation of goal-seeking, goal-setting and goal-achieving behaviour; mediation of an awareness of the human being as a changing entity mediation of control of behaviour). (*See Section 5.3*). One of the instruments of the FIE-Basic program (titled 'Emotions') explicitely teaches human emotions. Based on certain cues it ensures that the delayed learner with intellectual disability will recognize the different emotive states when experiencing them by himself or noticing when others feel the same way (self-reflection and Theory of Mind). Mediated self-talk (MST) contains self-talk strategies to stay calm even if the task or challenge is difficult.

FIE-Basic does teach content as opposed to FIE Standard. But Feuerstein emphasizes *the acquisition of content* must always be *directed and oriented by the mediational approach* (Feuerstein & Feuerstein, 2006) – which inherently involves cognitive and metacognitive facilitation. In his program the explicite transmission of cognitive and metacognitive elements are bound together (*see Chapter 5.3*).

3.6 Specific FIE Research Studies

Outcome effects of Feuerstein's Instrumental Enrichment *Standard* have been examined by specific research studies on variables of particular relevance to the target groups to which FIE Standard program have been addressed. FIE-Standard is designed as a content-free program for students from 9-14 mental age (Feuerstein et al., 2006). Studies have examined the effects of FIE-Standard in the following areas: low-achieving students in regular schools (Ruiz, 1985; Alvarez et al., 1992); culturally different immigrant and minority students (August-Rothman & Zinn, 1986; Kozulin & Lurie, 1994; Kozulin, Kaufman & Lurie, 1997; Kozulin 2005); gifted students (Mulcahy et al., 1994); and students of regular education in Brazil (Tinoco Melo & Varela, 2005).

Program implementation studies concerning *learning disabled students* involved special education students whose condition could be best described as *culturally different* or *culturally deprived*. Beasley (1984) studied deficient cognitive functions of learning disabled students before and after FIE Standard intervention. The results showed that learning disabled students who received FIE intervention showed significant improvement in terms of

cognitive functions. Particularly significant improvement was observed in the *need for logical evidence* (cited by Feuerstein et al., 2006).
In another study Shayer and Beasley confirmed students' relative improvement in standard and mediated performance on the Raven test. The experimental group (students who received FIE) and the control group (students who did not) were pre- and post-tested with the Raven test both under mediated learning conditions and standard conditions. Pre- and post-tests were one year apart. (The results were expressed in mental age units.) The difference for the experimental group between standard pre- and post-test was 1,9 years, while for the control group it was 1;0 year. The difference for the experimental group between the mediated pre- and post-test was 1,7 years. The same for the control group was 0,2 years. The conclusion was that the experimental group not only improved its performance under standard conditions but significantly improved to benefit from human assistance (Shayer & Beasley, 1987, cited by Feuerstein et al., 2006). There have been applications with regular Instrumental Enrichment with school aged children with DCD and ASD which have shown a potentially positive effect on cognitive as well as behaviour functioning (Schnitzer, Andries, & Lebeer, 2007).

There are only two studies exploring the effectiveness of *FIE-Basic program with preschool children* with *regular intelligence.*

In the Alaskan study FIE-Basic was given to about 200 preschool and kindergarten children for 1 year in differing intensity (40-60 hours altogether) (Ben-Hur & Feuerstein, 2011). In the absence of control groups the gains were analyzed in terms of the differential performance between age equivalent scores (available from most school readiness measures) and the children's chronological age in months. In some of the program sites data from the Developmental Indicators for the Assessment of Learning (DIAL-3) and the Peabody Picture Vocabulary (PPVT 3rd edition) indicated that 40-60 FIE-Basic lessons over 7 months were effective enough to yield an average gain that is equivalent to 25 months of normal growth. In another site where children got 60 lesson hours of FIE-Basic, the mean age equivalent pretest performance was 5 months above the mean chronological age; the mean age equivalent performance at the posttest was 15,7 months above the mean chronological age at that time. At another community where approximately 80% of the students typically performed academically below the national norms, it was possible to obtain PPVT performance data for the whole group of 25 third-grade student cohort who had previously received the FIE-Basic intervention at the preschool, and for 49 students who had not participated in the program. The average performance of the children who had previously received a year of FIE-Basic exceeded the national PPVT norm for third grade. 90% of these children performed at or above the norm for third grade, compared to only 40% of their peers. The Alaskan study notes that different school readiness screening devices (DIAL-3, STAR Early Literacy and BRIGANCE K&1 Screen-II.) indicate that the largest gains were in *concept development* and *reasoning*.

The other study concerning FIE-basic was conducted in Chile with *socially disadvantaged children* with regular intelligence as young as 3-4 years. As a result of cognitive acceleration, the experimental group showed significant improvements over the control group in the following domains: Vocabulary comprehension/Vocabulary expression and Vocabulary control; Knowledge of oneself and Knowledge of environment. The experimental group received the IE-Basic program for seven months (for a total of 48 hours) (Salas et al. 2010). The study notes that some of the cognitive functions that would be involved in the improvement of vocabulary and knowledge by the characteristics of the items used to measure these variables would include better *attention skills, less distraction, increase in the verbal units used, diminished trial-and-error approach to problem solving*

and use of sequential steps in complex problem-solving processes, generalization abilities from the concrete to the abstract level.

We have only one study applying FIE-Basic in the *clinical population*. This third study on the effects of FIE-Basic was conducted with children with intellectual disability (genetic disorders, autism, DCD, CP) in five countries. The experimental group received FIE-Basic for 30-45 weeks (for a total of 27-90 hours) and the control group received general sensory-motor therapy or occupational therapy. Significant gain has been shown by Raven Colored Matrices and WISC-R measures in the experimental group; effect sizes were small-to-medium by the experimental group over the control group (Kozulin et al., 2010).

We have to mention studies concerning a widely used pre-school program similar to FIE-Basic, namely the *Bright Start Program* (the program uses Feuerstein's MLE as a way of instruction and concepts from 'Comparision' and 'Categorisation' IE Standard instruments, see *Chapter 3.4.2*). Brooks and Haywood note when summarizing the studies dealing with the effectiveness of Bright Start that all available research „reveal positive and durable effects on IQ, intrinsic motivation, ability to function academically in 'mainstream' classes, cognitive development itself, and subsequent school achievement. When systematically applied by teachers who have been trained in its methods, this program of cognitive/metacognitive early education has demonstrated positive effects on IQ, although that is not the most important criterion variable. Rather than believing that the program results in increased intelligence, the authors' interpretation of the IQ data is that cognitive early education helps children to gain access to the intelligence that they already have and to apply their intelligence more effectively and efficiently to new learning. There are also indications that this program can help to 'level the playing field' in such a way that children with disabilities can be educated well in regular classes; i.e., *it can help to avoid unnecessary and inappropriate special education placement*. This has not been studied as extensively as have some other criterion variables, and requires further empirical study (Brooks & Haywood, 2003, p 43-44)." The authors demonstrated a significant increase in children's self-regulation, role taking, learning of letter/shape concepts, as well as in operations like comparison and classification with the Bright Start. A group of children with intellectual impairment showed a rise of 12.15 IQ points, corresponding to the effect size of 0.81, while a group of 'at risk' children gained 8.92 IQ points. 'At risk' children who received non-cognitive enrichment activities gained only 1.09 IQ points (Haywood, Brooks & Burns, 1986).

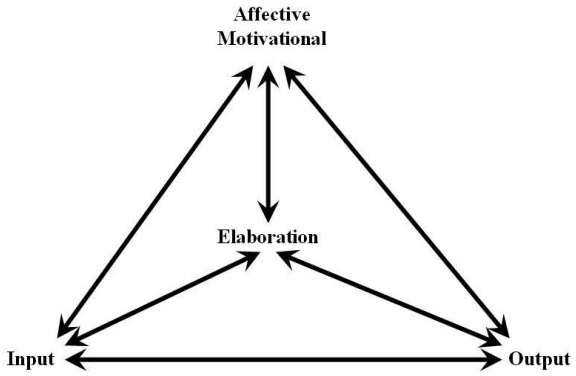
4. Problems with Assessment of Students with Intellectual Disabilities

Assessment of students with retarded performance raises several theoretical and pragmatic questions. These questions have been formulated concerning psychometric test practice paradigm for disadvantaged students (i.e. children with intellectual disabilities, children suffering from cultural deprivation or low socio-economic conditions) since the 1920's (Buckingham, 1921; for an overview see Guthke & Wingerfeld 1992; Feuerstein et al, 1979, 1980; Haywood & Lidz, 2007; Nisbett, 2009). The challenges and main points of criticism against psychometric evaluations of abilities of intellectually disabled children are summarized in the following:

1. *Normative, psychometric tests are not able to distinguish between different clinical groups.* Availability of tests of neuropsychology is very limited at the same time, especially in the Hungarian context. Also, intelligence tests based on conventional IQ deviations do not represent so low IQ rates that characterize moderate and severe intellectual disability. These tests are not totally suitable for the examination of these populations (Lányiné, 2012).

Possibly, with tests that allow more dynamic interactions, cognitive structures and their interrelatedness in the low-performing individual can be explored more precisely.

2. *There is a need for assessment systems which penetrate deeper, much more into the 'latent intelligence' of the low-performing individual which may be hindered by physiological and affective-emotive factors.* This point can be highlighted with one of our striking personal experience, when a six year old child with intellectual disabilities has been assessed by two authorities in the very same week: in the first case he has been evaluated as having an IQ of 60, however, as having an IQ of 70 in the second occasion. (One of the examinations was his screening in one of the National Committees of Learning Abilities, and the other assessment has been carried out by a state-run center for pedagogical services. The same standardised test has been used – it was just the assessors who were different experts, both of them psychologists by profession.)
Obviously, we have to carefully analyse the underlying causes of such cases, why these rates were outside the confidence-interval of the test (Lányiné, 2012. pp. 80-81). Our explanation of the case was -- having known the child for three years, whose fluctuating cognitive functioning greatly depended on his sensitive metabolic system, and he could perform very differently in subsequent days during the week -- that physiological, social, emotional, cognitive aspects are all closely interwoven in the young or older low-performing child (*Figure 1.*) Under standardized circumstances (when interferences are avoided, different types of questioning or feedback are not allowed for the sake of reliability, when greater intentionality in the interaction is forbidden), objective „measurement" of cognitive abilities is not possible.



2. Figure: Relationships Between the Three Phases of the Mental Act in Case of the Lower Functioning Child (Resource: Feuerstein, Klein & Tannenbaum, 1999, p. 77).

In other words, we have to organize our assessment in the Zone of Proximal Development of the child to really know if the failure on a certain task is due to lack of /or insufficient development of a cognitive skill, lack of knowledge/experience, lack of attention/concentration or merely lack of willingness or due to disinterest. If the answer is formulated eventually by the child with the help of a more experienced adult (hints, modeling or just mediation of focus) we know that the child will be able to reach independent-problem solving soon in that type of cognitive tasks.

3. For educational purposes -- when the question is how to advance lower functioning children -- norm-referenced results hardly give any useful information. Static tests do not give information of learning processes, learning strategies or learning potential of the individual. The present paradigm of testing does not make it possible to see the real

interconnectedness of thinking structures. Therefore, they are not suitable to design a molar, individualized intervention plan (Sternberg, 1984; Sternberg & Grigorenko, 2000; Feuerstein, 1979). Conventional assessment does not make explicit the child's learning strategies and methods, or his/her particular strengths and weaknesses in learning and problem-solving behaviours. The latter are termed 'cognitive functions' by Feuerstein (2006) and are also described by Dockrell and McShane (1993) in relation to learning difficulties.

4. *Static ways of interpretation of test results may create negative self-fulfilling prophecies* as described and researched by Rosenthal and Jackobson in the *Pygmalion-effect* (Rosenthal & Jackobson, 1968; Zanna, 1975). If the report of a child with intellectual deficits is only a list of deficiencies, it may cause extreme fear, feelings of short-coming, hopelessness and guilt in parents or caretakers – doubling their trauma (Mintzker, 1999; Lebeer, et al., 2011). The same negative feelings and self-perception is transmitted later to the child. For this reason Feuerstein has been especially reluctant to produce test materials for the pre-school aged population or for children below the age of 9. He opposed the medical testing paradigm: unlike in case of cancer or any purely medical condition, it is a big dilemma in case of intellectual delay if early detection is a „blessing or a curse". It may disturb the bonding with the mother, especially in the early years, and "the early detected minimal signs of differential development may lead to a state of alienation, stimuli deprivation, which is often compensated for by a reaction formation on the part of the parents." (Feuerstein, 1997 p. 7). The same concern has been expressed by Judith Mearig when exploring how to assess kindergarten and school-aged children with developmental disorders: "…If the child perceives incompetence early in learning and begins to anticipate failure, premature closure of effort to succeed will likely occur when subsequent tasks are initially perceived as difficult…The child will not even absorb all crucial information… Under fear of failure, nonintellectual factors disintegrate first and block effective functioning… (Mearig, 1987)".

5. *Reports based on psychometric testing paradigms and IQ-based categorisation make minimalistic recommendations for further advancement of students with special needs.* This may lead to a deprivation of adequate educational programming and cognitive stimulation. Lebeer and his colleagues have examined the current testing habits and actual diagnosing instruments used in six European countries in 2011. Their results has indicated that reports are comprised of usually lists of deficiencies and do not offer detailed solutions and concrete educational suggestions which could enhance further development of the low-performing individual (Lebeer, Candeias & Grácio 2011).

6. *The predictive validity of static psychometric tests is low.* Opponents of psychometric testing argue that standardized IQ tests underestimate the cognitive ability of children from low socio-economic settings, from minority groups, and children having learning difficulties. This have already been formulated by Claparède in 1919 and later by Zazzo, that tests do not adequately predict adaptability and educability (Zazzo, 1974, cited by Lebeer et al, 2011). The correlation between intelligence and school achievement may seem rather strong (0,71) but the point is that 50% of the variance is not explained (Tzuriel, 1992). Deutsch and Reynolds argue that psychometric assessment seeks to measure the intelligence of individuals by means of their performance on a set of tasks at a given point in time and to predict future performance from such measurement. Its basis and purpose is the quantification of differences between individuals of similar ages. Socio-cultural variables, however, which may affect this performance - for example the way in which a parent's or teacher's contribution to a child's cognitive development may have influenced it - are not considered to be of fundamental importance. Tzuriel (2013) also claims, a growing body of theory and

research in the last three decades supports the *crucial role of active parental* and *peer mediation* in enhancing children's cognitive development (Tzuriel quotes Belsky, Goode & Most, 1980; Berk & Spuhl, 1995; Bornstein & Tamis-LeMonda, 1990; Bradley & Caldwell, 1984; Clarke-Stewart, 1993; Cristofaro & Tamis-LeMonda, 2012).

5. *Psychometric functioning tests are based on a highly medical- biological, individualistic, impairment-based view on functioning.* This underlying philosophy, however, is far from the *cultural model of disability*, which underpins the UN Convention of the Rights of People with Disability, the ICF (International Classification of Functioning, Disability and Health) model of disability of the WHO, and the Inclusive Education movement as is being advocated by associations of people with disability – claim Lebeer et al. The *social model of disability* sees the degree of disability as a result of complex interactions between a child's bodily or functional impairments and the barriers to learning and functioning which exist in the external world. "Barriers that obstruct development can be attitudes, physical problems, norms, rules, habits or personal circumstances. However, no trace of this thinking can be found in the testing paradigm" (Lebeer et al. 2011, p. 77). In this study it has been revealed that in current ways of assessment very little use has been made of instruments looking at contextual aspects of functioning, such as the family and school, with the exception of Scandinavian countries (Sweden and Norway).

4.1 Dynamic Assessment of Children with Retarded Performance

For these (non-exhaustive) reasons, a new testing paradigm has evolved in the 1970's, namely *dynamic assessment procedures* or DA. The philosophy of DA originates from the social constructivist theories of Vygotsky, the Zone of Proximal Development, respectively. The concept of Zone of Proximal Development explained by him is the following: „Having found that the mental age of two children was, let us say, eight, we gave each of them harder problems than he could manage on his own and provided some slight assistance: the first step in a solution, a leading question, or some other form of help. We discovered that one child could, in cooperation, solve problems designed for twelve-year-olds, while the other could not go beyond problems intended for nine-year-olds. The discrepancy between a child's actual mental age and the level he reaches in solving problems with assistance indicates the zone of his proximal development" (Vygotsky, 1986, p. 187).

Vygotsky has never operationalised an assessment system in his lifetime (Vygotsky 1978, 1983 and 1986). His research into the development of cognitive functions revealed that „this process is not a matter of innate abilities growing into a mature state but that it is the emergence of new ways of thinking, acting, and being that result from an individual's engagement in activities where he or she is supported by cultural artifacts and by interactions with others". In this way, the social environment „is not merely the stage on which development plays out, it is in fact the driving force of development". As a consequence of this, „observing individuals' independent performance reveals, at best, the results of past development. If one wishes to understand the processes of development, to intervene to help individuals overcome difficulties and to support their ongoing development, then mere observation of solo performance is insufficient"— writes Poehner about the importance of blending mediation into the assessment procedure (Poehner, 2008, p. 1).

The first version of dynamic test batteries -- the „forefather" of DA is the *Learning Propensity Assessment Device* of Feuerstein, which has been created in the 1950's (Feuerstein and Richelle, 1957, 1963) irrespectively of Vygotsky's ideas, but in response to the needs of post-war refugee children whose learning experiences had been disrupted by the Holocaust, wartime trauma and cultural deprivation (Bohács, 2010). Feuerstein's work

remained an isolated example of a non-psychometric approach till the 1970's – writes Deutsch (2009), when Budoff has come out with his learning potential procedure (Budoff & Corman, 1976) in the United States.

By *definition*, Dynamic Assessment (DA) should make it possible to evaluate the person's learning potential/propensity, not just his or her actual knowledge and skills. DA refers to an an assessment where an active teaching process of a child's perception, learning, thinking and problem solving takes place. The process is aimed at modifying an individual's cognitive functioning and observing subsequent changes in learning and problem solving patterns *within the testing situation* (Tzuriel, 2001, Lifshitz et al., 2011). Unlike other assessments, where examiners seek to document an individual's existing repertoire of cognitive abilities and make no attempt to change, guide, or improve the individual's performance, the main goal of DA is to assess changes in performance. The changes are taken as indications of learning potential, that is, future development that will be realised *provided that a cognitive intervention is applied* (Tzuriel, 2011).

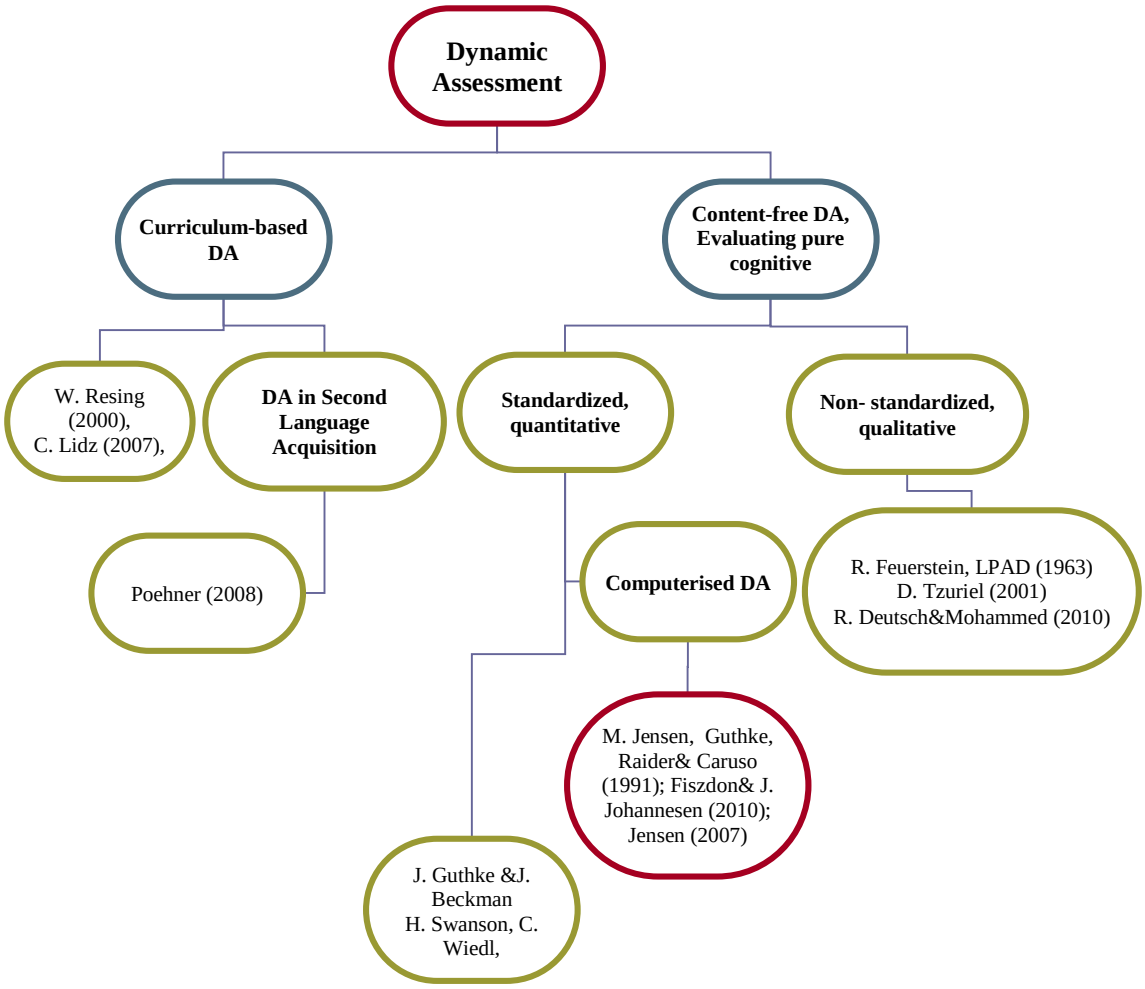
Today DA means very heterogenous assessment systems – it is not just one or two test batteries but a whole differential paradigm (Bohács, 2010). Under the terms of „*learning test*" or „*interactive assessment*" we mainly find content-free assessment systems evaluating pure cognitive structures, most of them are qualitative and non-standardised. However, there has been curriculum based DA systems developed as well, usually for the mainstream population (e.g. Haywood & Lidz, 2007; Resing, 2000; Aalsvoort, Ruijssenaars & Resing, 2002).

Only a few standardised DA systems has been created in the last 40 years, with such objectivity, reliability and validity as defined by classic psychometric standards. Standardized dynamic assessment tests with high validity and reliability for the assessment of intellectually disabled children are the following: Block Design Learning Potential Test (BDLPT; Budoff, 1987); Hessels Analogical Reasoning Test (HART, Hessels, 2009); Analogical Reasoning Test (ARLT, Hessels-Schlatter, 2002). Test batteries of Tzuriel (2001) can be applied both qualitative and quantitative ways (Tzuriel's Cognitive Modifiability Battery). Certain standardized psychometric tests are used in a dynamic way in speech therapy (Dockrell, 2001; Hasson & Joffe, 2007). Further standardized dynamic tests for the assessment of adolescence with learning disabilities are the Adaptive Computerized Intelligence Learning Test (ACIL; Beckmann, 2001); Raven Kurzzeit Lerntest (RKL; Frohriep, 1978; Guthke, 1992, 1995); Learning Potential Test for Inductive Reasoning (LIR; Resing, 2000). The *Cognitive Abilities Profile* of Deutsch and Mohammed (2009 and 2010) is a qualitative dynamic assessment test indicating how much of the assisted guidance could have been internalized by the intellectually disabled child over the course of years of intervention.

With the appearance of computer-based assessment procedures DA systems has advanced as well, and some dynamic assessment procedures have been adapted to computer-assisted dynamic tests (e.g. Fiszdon & Johannesen 2010; Jensen, 2003, 2007; Guthke, Räder, Caruso & Schmidt, 1991). Funke writes about how to assess „complex cognition" by computers in a dynamic way (Funke, 2010).

We have to note, however, that computer assisted dynamic assessment procedures resemble to adaptive tests, where the next item given by the computer is matched to the level of the previous, successfully solved test item – since under these conditions the greatly flexible human mediator is not present.

The complexity of present dynamic assessment systems and procedures make it possible to choose from standardized quantitaive or non-standardized quantitative DA systems (*Figure 2).*



3. Figure: Classification of Dynamic Assessment Systems (Resource: Bohács, 2010 p. 314).

What unites all these approaches is that they rely on the test-teach-test paradigm: a typical DA procedure involves three phases, *a pre-test, teaching/learning phase, and post-test*. Pretest is the identification of the source of difficulties and strengths; it is the initial assessment of the subject's knowledge and of current conditions which help or hinder his/her learning processes. Interaction takes place in the teaching or learning phase. It means learning strategies, principles and concepts are given to the individual to see if he/she can cope with the task; it means teaching the subject cognitive tools in order to cope with the difficulties.

Posttest means the assessment of the knowledge following intervention; also definition of favorable conditions for future learning; appraisal of changing manifested as a result of learning cognitive strategies.

What distinguishes between different DA models is the nature of "teaching" that occurs between pre- and post-tests (Campione, 1996; Haywood & Lids, 2007; Lidz & Elliott, 2000).

Some DA models use a series of *graduated prompts* (Carlson & Wiedl, 1980; Campione et al., 1984) where the assessor intervenes first at a minimal level and then with increasing teaching support, if it is required, in order to ensure success on the tasks of the test. Here, the stages and content of the intervention are predetermined and still retain some characteristics of standardisation allowing for responses of different children to be compared. Deutsch and Reynolds (2000) give examples of recent European DA models using this approach: Guthke & Wingerfeld (1992), Guthke (1995) and Paour (1992 b).

A different model within the DA approach is when the teaching phase is ensured by *Mediated Learning*, which is exemplified in the DA models of Feuerstein (1979), Haywood (Haywood et al., 1992), Lidz (1991) Tzuriel (1997) and Kahn (1992).

In these models, intervention during the assessment is not standardised at all and is totally responsive to the individual needs of the child. The Mediated Learning models are sometimes described as *'clinical' DA intervention*, because they are highly responsive to individual need and lead to diagnostic and prescriptive insights which are uniquely relevant to a particular child. The assessor mediates cognitive strategies to the child rather than teaching the child better task performance on a specific test item. Analysis is of (i) the child's use of 'intellective' skills, (e.g. their ability to make comparisons, to conserve, and to generate and test hypotheses), as well as non-'intellective' aspects such as habits, attitudes and degree of motivation (ii) the component cognitive demands of each assessment task; and (iii) the content of the assessor's mediation.

The modality in which the task is presented, (for example verbal, visual, numerical, pictorial) the level of complexity, the task content, and the specific cognitive skills required for successful performance, are the assessor's analytical tools which are deliberately manipulated in response to the behaviour of the child in the test situation. All the child's responses are noted, and the insights gained can result in useful recommendations for teachers and parents. Remediative procedures (cognitive acceleration) usually happens in the same paradigm as that of the teaching phase.

Criticism of dynamic assessment systems usually address the following points:

DA takes more time to administer than static testing – indeed, we have assessed children for 26 hours sometimes to explore their cognitive functioning. DA requires more skill, better training, more experience and greater effort than static testing (Dockrell, 2001). Tzuriel (2013) notes that this is the exact phenomena why DA cannot be so popular – most DA systems are taught in expensive international courses. The extent to which cognitive modifiability is generalized across domains (ie. analogical, numerical) needs further investigation. Validation of DA is more complex than validation of static testing because it has a broader scope of goals (Missiuana & Samuels, 1988).

5. Overview of Feuerstein's Theory and Applied Systems

5.1 Piaget, Vygotsky and Feuerstein – about the Modifiability of Intelligence

Both Vygotsky and Feuerstein developed their theories under strong influence of Piaget (Preissen & Kozulin, 1992). However, both of them were dissatisfied with certain aspects of the Piagetian approach, namely with the fact that Piaget left the role of *social environment* out of account from his constructivist theory (Piaget, 1963). Piaget considered human intelligence a *construction* – however, according to his views, the evolvement of the building blocks are driven by biological aspects of the individual (Piaget, 1971). Piaget believed that adult intervention would not result in acceleration of cognitive development, since development was determined by maturation of the brain, therefore could not be accelerated by adult intervention. Environmental experience is important – but the processes are universal, i.e. similar in all cultures and the sequence in which this construction takes place is the same. If the child is not ready to proceed to the next stage, no amount of stimulation will make this learning occur more rapidly (Paour, 1992a). Piaget used the following concepts to describe the process children develop by while they construct and acquire knowledge with active involvement with their environment: *assimilation* i.e. the process of incorporating a new object or event into an existing scheme or way of dealing with the world; *accommodation*, i.e. where the individual adjusts their existing scheme when the scheme does

not fit to a new object; *adaptation*, i. e. the individual uses prior knowledge to acquire new knowledge. He also emphasized the importance of *equilibrium* – the process that allows each individual to develop cognitively while maintaining a state of stability that serves to regulate behaviour (Piaget, 1985).

Feuerstein, as a student of Piaget in Geneva between 1950-1954, when developing his developmental theory, not only keeps the Piagetian ideas on representational thought (schemata-theory), but further analyzes and describes possible mental operations and cognitive functions that the brain may perform (Inhelder & Piaget, 1964; Feuerstein et al., 2006). However, he denies his master's ideas on stage development and their compulsory sequential order; denies direct learning as the only way of acquiring knowledge; and emphasizes the role of indirect, mediated learning made by other humans and the importance of cognitive acceleration if necessary: „...we view the possibility to intervene in the growth of the physical, neuronal, cognitive and social spheres as necessary, and ready targets for the development, prevention or acceleration of the pace and content of that development. This is not consonant with the attitudes /.../ of Piaget. Piaget's influence has created a position very much against the kind of systematic intervention we advocate in developmental psychology. He was generally against any kind of active involvement in interventions to learn, so as to enhance intelligence. It is not that he was against offering the individual a structure, but he did not see value in building or activating structures to develop intelligence" (Feuerstein & Feuerstein 2006. p. 9).

Vygotsky maintained that cognitive development was a process of internalising ideas, which are experienced as a result of interactions with the social/cultural world in which language was a critical factor. Vygotsky claimed that higher mental cognitive functions are the results of mediated activities. He suggested three classes of mediators: material tools; psychological tools; and other human beings (older peers or adults) (Vygotsky, 1978; 1986; Kozulin, 1990). Since human senses and physical abilities are restricted, compared to those of animals, humans have developed material tools to ensure their dominance and survival in nature. The use of material tools has induced new demands on human mental processes, even though they target nature. Also, material tools do not solely exist – they require their collective use, and interpersonal communication between humans – so they require the existence of psychological tools (for example language; or the clock to measure time etc.). Psychological tools target and mediate human's own psychological processes – to remember; to formulate ideas etc. As for human mediators, Kozulin writes, a human individual as a mediator appears first and foremost as a carrier of signs, symbols and meanings (Preissen & Kozulin, 1992). The child will listen to, then internalize these constructs – „one may say that only through the other do we become ourselves, this rule applies to each psychological function as well as to the personality as a whole (Vygotsky, 1983, p. 144, cited by Preissen & Kozulin, 1992)".

Zone of Actual Development was the term used by Vygotsky to describe the limit that the child can achieve in terms of learning without adult support. *Zone of Proximal Development* (ZPD) has been defined as a difference in the child's achievement in assisted versus unassisted performance – assisted performance means that the child can achieve in terms of learning with support from an adult or more knowledgeable older child (Vygotsky, 1986). Proximal in this context means 'what might come next' in the learning process. ZPD allows for guided practice as the child becomes a collaborator in the learning process alongside a more knowledgeable person. ZPD was based on the belief that learning and development influence each other. Kozulin argues that while the hierarchy of concept formation has been explored in considerable detail by Vygotsky, „the corresponding study of communicative situations was not elaborated beyond a general counterposition of classroom instruction and spontaneous everyday learning. This left considerable lacunae or

missing parts in Vygotsy's theory of mediation. These lacunae, ulimately, have been addressed by the work /.../ of Reuven Feuerstein" (Preissen & Kozulin, 1992, p. 15).

Feuerstein has not known Vygotsky – he developed his theories in collaboration with the neopiagetian school (e.g. André Rey). He named interactions as having a mediational value only and exclusively which had high quality – that is which corresponded to the first three universal criteria of MLE interactions, namely the criteria of intentionality and reciprocity, meaning and transfer (see *Section 3.3*).

„We differ from Vygotsky in our emphasis on the critical importance of the human being as the mediator, acting in an intentional and volitional manner, and do not view material/psychological objects (as in Vygotsky's conception of „psychological tools") as having the same mediational potential. Second, we consider Mediated Learning Experience as producing structures and potentials that substantially change the concept of the ZPD. Therefore we have replaced the notion of potential by that of 'propensity' to convey the open, unrestricted change that is possible with the application of Structural Cognitive Modifiability"— claims Feuerstein (Feuerstein, Feuerstein, Falik & Rand, 2006, p. 13).

5.2 The Concept of Structural Cognitive Modifiability

The main pillar of Feuerstein's theoretical and applied systems is the *theory of structural cognitive modifiability* (SCM). In line with modern brain placticity research in the 21th century (see *Chapter 1*), this model has viewed the human organism as open, adaptive and amenable for change since already the 1950's (!). According to this, intelligence is viewed as a propensity of the organism to modify itself *when confronted with the need to do so*. It involves the capacity of the individual to be modified by learning and the ability to use whatever modification has occurred for future adjustments (Feuerstein, Feuerstein & Falik, 2010). In SCM intelligence is defined as a changeable state rather than an immutable trait. Following Piaget, in this model *cognition* plays a central role in human modifiability – since many behavioral and emotional conditions may become modified through cognitive intervention. Mediated Learning Experience is a proximal factor of human modifiability, which can moderate the influence of such distal factors as genetic predisposition, organic impairment, or educational deprivation.

Feuerstein describes *structural changes* according to four parameters (Feuerstein, Feuerstein & Falik, 2010):

**Permanence*: To what extent is the change preserved over time. If a structural change has occured, the learner will be able to solve the problem the next day and long after that by using the strategies and mental operations which have bben acquired.

**Resistance*: How resistant is the change to changed conditions and environments. If we change the data in a problem or increase its complexity, the learner should be able to resist the changed elements of the new situation.

**Flexibility/Adaptability*: To what extent it is included, beyond the initial situation, in other areas of learning responses and events.

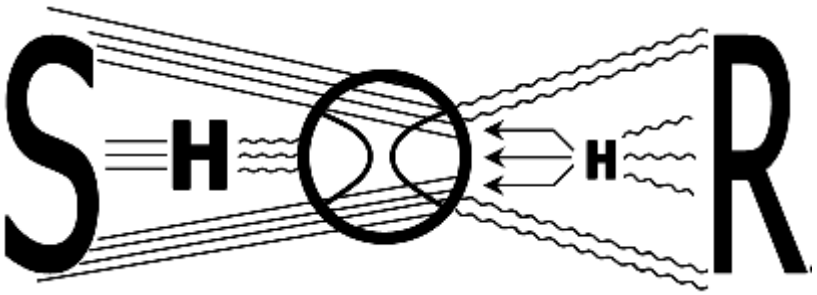
**Generalizability*: The generalizability of a change is an important aspect of SCM: a change when produced in one area tends to significantly affect other areas of the individual's functioning. „Modifiablity is also recognizable by the fact that the rhythm and amplitude of the change itself undergo important transformations. Thus, a change that initially required a very strong effort and a long-term investment is transformed in regard to the rapidity, quality

and ease with which it is produced, and multiplies itself at later stages (Feuerstein, Rand & Feuerstein, 2006. p 47).”

The theoretical apparatus of SCM includes criteria of Mediated Learning Experience, the list of Deficient Cognitive Functions, and the Cognitive Map. The principles of SCM are realized in such applied systems as Learning Potential Assessment Device and Instrumental Enrichment.

5.3 Criteria of Mediated Learning Experience

Mediated Learning Experience (MLE) represents a way of looking at the quality of interactions – and it is not specifically related to content (Kaniel et al, 1999). Mediated Learning means that a more experienced human interposes himself between the stimuli and the child (organism) and changes the stimuli according to his own intentions and makes sure not only the content, but the cognitive aspects and the values he wants to pass, will certainly penetrate the individual. He acts so while bearing in mind the needs of the individual (the mediatee’s former knowledge, undeveloped cognitive functions, lack of needs or certain values he will need in his/her future). The priming of a human mediator may change the direct learning model of Piaget into that of mediated learning (*Figure 4*).



4. Figure: The Model of Mediated Learning (Resource: Feuerstein et al 2010 p. 28.)

The human mediator, indicated by the "H" in the diagram, intervenes in the learning process by placing him or herself between the learner and the stimulus and between the learner and his response. The mediator selects, changes, amplifies and interprets both the stimuli that come to the learner and the learner’s responses. The absence of the necessary type and amount of MLE leads to the underdevelopment of the child’s cognitive functions and direct learning strategies. Feuerstein’s postulatum is that massive infusion of mediated learning may improve the situation of cognitive deficiency and turn the child into an independent and self-regulating learner.

Mediated Learning has existed since generations or individuals passed their own culture to their offsprings. This has always been the way a group or nation guarantees and extends its psychological-spiritual existence beyond their biological entity. So MLE may be apparent in different environments, different contexts and different cultures.

The role of MLE is pivotal in *cultural transmission*. In the process of cultural transmission there are two, interrelated phenomena: a certain generation passes not only the content of their heritage, but also their thinking processes, strategies and values.

Feuerstein defined 12 criteria of MLE – 3 universal and 9 situational parameters – which can be be the characteristics of natural adult-child interactions. These are the following:

Universal parameters:

1. Intentionality and reciprocity
2. Transcendence
3. Mediation of meaning

Situational Parameters:

4. Mediation of feeling of competence
5. Mediation of regulation and control of behaviour
6. Mediation of sharing behaviour
7. Mediation of individuation and psychological differentation
8. Mediation of goal-seeking, goal-setting and goal-achieving behaviour
9. Mediation for challenge: the search for novelty and complexity
10. Mediation of an awareness of the human being as a changing entity
11. Mediation of the search for an optimistic alternative
12. Mediation of the feeling of belonging

(These criteria will be detailed later in this chapter.) Feuerstein argues that an interaction or teaching has mediational value *only and exclusively* if the first three criteria, namely the universal parameters can be clearly pointed out in the flow of interaction (Feuerstein, Feuerstein, Falik & Rand, 2006).

In different cultures, in different religions and even in different families children get different quantity of mediated learning experience. However, the same quality or quantity of MLE is not enough for every child because of their own psychological characteristics they are born with, or due to some external reasons. One of Feuerstein's postulations, namely 'the more properly the learning experience is mediated by an adult, the greater will be the individual's cognitive modifiability', is one hypothetic question of this thesis. In other words, the more MLE an individual gets, the more he/she will be able to learn from direct learning experince, and the more he/she will be able to adapt himself to the changing environment in the future. According to Feuerstein, MLE processes create structural cognitive changes (*structural cognitive modifiability* or SCM) in the individual. The MLE-SCM theory emphasizes that though *direct learning* is a crucial phenomenon in human's life, in certain cases direct contact with the stimuli of the world is not enough so that effective learning takes place. Those students or children who are *culturally deprived* (due to some external reasons, like poverty or alienation from the ancestors; or some internal reasons like genetic or organic deficits) are not able to benefit from direct exposure to stimuli (Camp, Swift & Swift, 1982).

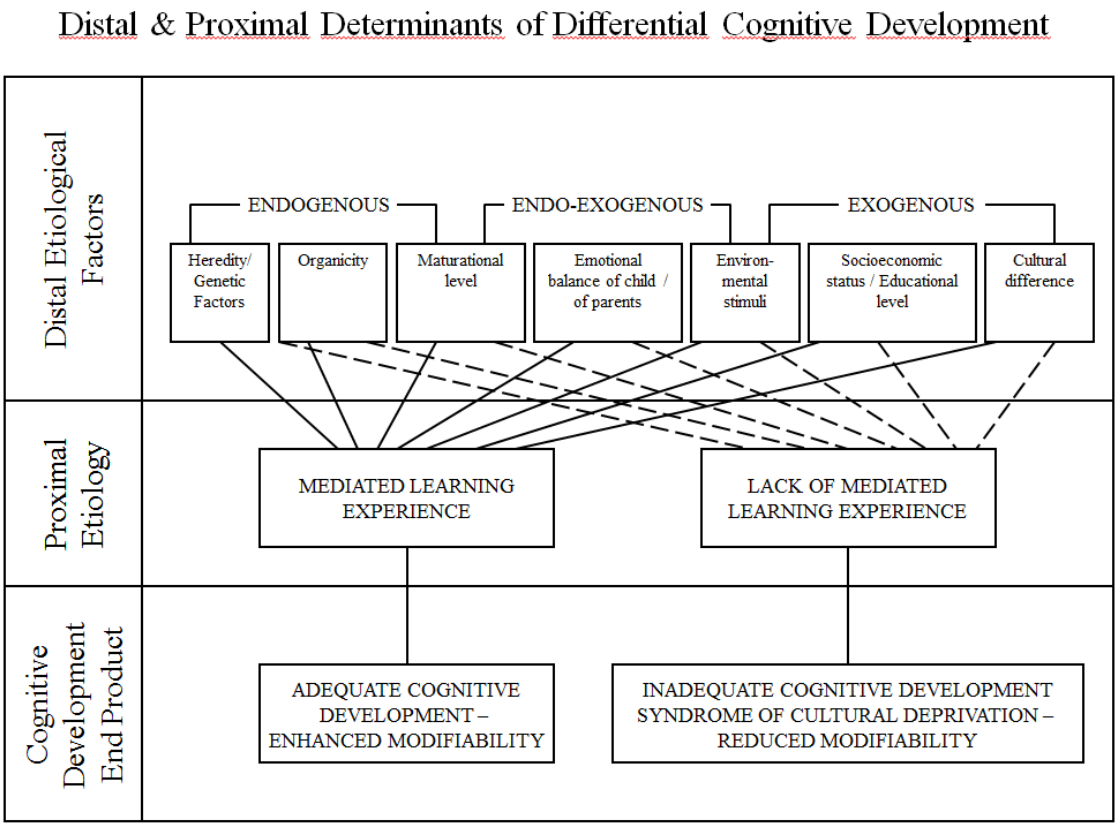
We attempt to explain the concepts of *structural cognitive modifiability*, *cultural difference* and *cultural deprivation* with some historical data (Feuerstein, Falik & Bohács, 2010). The theory of MLE has been elaborated between 1950-1963 by Reuven Feuerstein, André Rey and the Piagetian school of thought. Between 1950 -1954 Feuerstein spent 3-4 days of the week in Geneva as a student of Piaget, and 2-3 days in the post-Holocaust camps in France (children of the Soa were treated and nurtured in these camps after the Holocaust -- brought to the camp sites by the Youth Aliyah movement -- till they were prepared for their emigration to Israel). Those children who survived the Holocaust showed a remarkable difference in their cognitive and learning behaviour compared to the average children of Geneva. Even though their cognitive performance was more or less the same on Piagetian cognitive tasks, two types of groups seemed to be formulated among the post-Holocaust children and adults: the culturally different and the culturally deprived. Some of these children and young adults of very different origin were equipped with learning capacities – even their original culture was different, they showed a good capacity to be modified by direct exposure to stimuli, without any help (mediation). These *culturally different* children

grabbed every stimuli in the new culture to turn into new strategies to learn. Their own original culture (Polish, Hungarian or Russian) has equipped them by learning capacities.

However, the other type of children, the *culturally deprived* could not benefit anything from new, direct-exposure-type of learning alone. A very thorough explanation was needed on part of the examiner, '*which could not be easily found in the classical conventional approaches to testing and nurturing intelligence*' (Feuerstein & Feuerstein 1999, p. 4). In other words, the culturally deprived has not been exposed to enough mediated learning experience beforehand due to some external or internal obstacles. Feuerstein's concept of cultural deprivation has later been supported with brain science, when scientists realized that not only the brain produces and forms culture, but also culture imposed on the brain will alter it and contribute to neural re-mapping. Research on neuroplasticity has shown that any long-term activity that has ever created a map in the brain will change the brain and the mind, and whenever we meet a new culture, the former maps will change themselves according to the demands of the new culture (Doidge, 2007).

Discussions between Feuerstein and Rey and the Piagetian group later led to the theory of MLE, SCM, and a new way of looking at „testing" the learning potential of an individual (which became the Learning Propensity Assessment Device (or LPAD) – one of the forefathers of dynamic assessment (DA) (Bohács, 2010).

Sometimes it is the environment which does not supply sufficient mediation (for example due to emotional imbalance of parents or very low socioeconomic status), sometimes internal barriers prevent other children to receive mediation (maybe due to genetic deficiencies or autism or acquired deficiencies, ie. lack of oxygen while birth) (*Figure 5*). However, according to Feuerstein's postulatum if we succeed to match the intensity of MLE and that of the stimuli to the type of barrier, a substantial change occurs.



5. Figure: Distal and Proximal Factors of Differential Cognitive Development (Feuerstein et al. 2006 p. 70)

In the following we elaborate on the twelve parameters of Mediated Learning Experience identified by Feuerstein and his colleagues (Feuerstein, Feuerstein & Falik 2010). However we also try to link the criteria to other developmental psychology theory – and where possible, show some links with latest research results in the field of metacognition, mastery motivation, self-regulated learning and transfer.

MLE theory operates in the cognitive domain, yet at certain points it creates a link between cognition, emotion and motivation. MLE is a primary mechanism to achieve Structural Cognitive Modifiability and the components of MLE will ensure the establishment, restoration and/or rehabilitation of *cognitive functions* (Feuerstein, Feuerstein, Falik & Rand, 2006).

Universal Parameters of MLE:

Intentionality and Reciprocity

The Feuerstein et al. conceptualization of intentionality is that a more experienced human who interposes himself between the mediatee and the stimuli, willfully and explicitly conveys his or her intention: he/she not only wants the mediatee to focus on the stimuli (*content*) but also to participate in the joint thinking processes (*process*) (Feuerstein, Feuerstein, Falik & Rand, 2006). The mediator changes some of the characteristics of the stimuli – its saliency, pace, and frequency or redundancy of exposure according to the needs of the mediatee.

„MLE is clearly not accidental; it is a conscious, intentioned act..." -- writes Klein and Feuerstein earlier (Klein & Feuerstein, 1985). This clear and strong intention is designed to create a reciprocity in the mediatee. Reciprocity indicates that an interaction has occured. Reciprocity can be verbal or non-verbal on part of the mediatee – it can be a positive or negative answer as well. The characteristics of the answer will influence the next criteria of MLE that the mediator will choose.

Transcendence

The mediator ensures during the flow of interaction that the learning experience does not remain in the visible, concrete domain, but after a generalisation phase either/both the content or the thinking operation is placed into another context. An example for content-transfer may be when a 4 year-old child remembers -- while manipulating a small turkey animal at the table – where he/she has already seen a turkey last time in his/her life (eg. at grandmother's house in the garden last summer). An other example for the thinking process of transfer is when a 7 years-old can define, after finishing a task requiring a lot of comparative thinking, when we compared a lot in daily life or in which certain school subjects comparative thinking was emphasised.

This transfer effect ensures that the stimuli or thinking operation is removed from the „here and now" experience and as an internalized mental representation it is placed in an other place and time. The ability to act over increasingly large distances of time, space and levels of abstraction is a main characteristic of human development – state Feuerstein and his associates (Feuerstein, Feuerstein & Falik, 2010). This parameter of MLE ensures that the objects of learning do not stay in an isolated condition and the mediatee will not see the world in an episodic way, but relationships are created between certain phenomena of the world. Transcendence ensures that the learning goes beyond direct and immediate experience.

Molnár notes that researchers differentiate between *horizontal* and *vertical transfer* in the literature (Molnár, 2006). Horizontal transfer means transmission between two different tasks having the same level (e.g. roller-skating and ice-skating). Vertical transfer means transmission between tasks which are embedded into each other (e.g. in order to seriate we have to be able to compare). Transfer abilities can be classified according to their level of

abstraction and level of automatisation: Perkins and Salomon differentiate between „low road" and „high road transfer" (cited by Molnár, 2006). Low road transfer means less abstraction from the concrete, and more automatised processes (when we associate compare we do not notice that we are transferring according to a certain criteria). High road transfer means more abstraction and less automatised processes, which require conscious effort and high level of learning. Jensen and Singer have evaluated the effects of FIE-Standard on a group of 13-17 year old special education students having borderline intelligence (average baseline IQ was 76). The study revealed that those students who received one year or less FIE outperformed the control group at a statistically significant level in near transfer, but not in far transfer. Those students who had more than one year of FIE, outperformed the control group in both categories (Jensen & Singer, 1987).

Mediation of Meaning

Mediation of meaning is the third criteria of MLE interactions. This component is the affective-energetic dimension answering the questions: *why* or *what for*. If children understand what they themselves can benefit from a certain action, or phase of learning, they are more willing to do it.

There are two ways to create meaning in the student – the mediator makes it explicit why the certain object of learning or action is important for himself/herself. His or her need and positive or even enthusiastic behaviour is accepted by and assimilated in the mediatee. The importance of expressing the adult's appreciation or affect toward objects, concepts or values expressed by verbal or non-verbal ways is especially high in case of smaller or low-functioning children – e.g. exaggerated opening of the mouth and the eyes or a high scream or sigh of surprise.

Another way to create meaning is when we construct possible reasons why the learning experience is beneficial for the learner. Ultimately, most learners create their own meanings for learning. „The 'meanings' mediated at a given time by the adult may long be forgotten, or may become transformed by the individual by virtue of his personality or the changes in the culture in which he lives, but the need and orientation to search for the meaning becomes a permanent condition of his existence" (Feuerstein & Feuerstein, 1999, pp. 26-27).

Literature makes a strong distinction between the different reasons or goals that give rise to an action. The most basic distinction is between *intrinsic motivation* -- which refers to doing something because it is inherently interesting or enjoyable, and *extrinsic motivation* -- which refers to doing something because it leads to a separable outcome. According to research, external rewards tend to undermine intrinsic motivation (Lepper, Greene & Nisbett, 1973).

We view Feuerstein's approach as a possible way of successfully linking the two driving forces of actions and making children internalize outside goals and becoming more aware of their own potential interests and find more self-determined goals. The Self-Determination Theory (SDT) of Deci and Ryan emphasize the same, the importance of fostering *internalization and integration* of values and behavioral regulations in all educational programs (Deci & Ryan, 1985; Deci et al, 1994). „Internalization is the process of taking in a value or regulation, and integration is the process by which individuals more fully transform the regulation into their own so that it will emanate from their sense of self. Thought of as a continuum, the concept of internalization describes how one's motivation for behavior can range from amotivation or unwillingness, to passive compliance, to active personal commitment (Deci & Ryan, 2000, p. 60)."

Krisztián Józsa notes that from the 1990's a paradigm-shift has taken place in the field of interpreting human motivation and the former dichotonomous view of „intrinsic-extrinsic" has been replaced by a model which looks at the different human motifs as a *multicomponent*

system. This system needs to reach an optimal level in order to be able to successfully adapt the learner to a learning environment (Józsa, 2002; 2007a).

Personality and motivational systems of children with intellectual disability has been infrequently examined by researchers in the past. „People with MR (mental retardation) tend to have diminished cognitive abilities as well as less intrinsic motivation and self-determination than matched individuals without MR, and these motivational deficiencies exacerbate the cognitive deficits resulting in negative consequences for life circumstances, academic performance and psychological well-being and subsequent development of motivation" – states Deci (2004, p. 49). However, there were no significant differences found in mastery motivation between typically developing infants and infants with Down syndrome between 18 and 24 months (Glenn et al., 2011). Hauser-Cram's view is that any decreased levels of motivation in children with disabilities occurs *later than the sensori motor period* (Hauser-Cram's, 1996). Józsa and Fazekasné studied achievement motivation of children with learning disabilities. They found that achievement motifs of children with learning disabilities improve during the school years, while this tendency is just the opposite in case of regular learners (Józsa & Fazekasné, 2007).

Gilmore and Cuskelly in their longitudinal study have examined achievement motivation of toddlers and adolescents with Down-syndrome and found that early mastery motivation is significant for later achievement -- which has important implications for the focus of early interventions in the field (Gilmore & Cuskelly, 2009).

Other researchers indicate that students with mild-to-moderate mental retardation are more likely than other students to casually *attribute poor performance* to their insufficient ability and are less likely to view success as a result of their ability (Butkowsky&Willows, 1980, Weisz, 1999, cited by Deci, 2004). This attributional pattern is maladaptive and may lead to a cycle of fear of failure and the formation of learned helplessness (Licht, 1983, cited by Deci, 2004).

Józsa and Fazekasné emphasize the role of the social environment in the development of mastery motivation of learners with learning disabilities (Józsa & Fazekasné, 2007). Pintrinch and Blazevski also stress that the response, reaction, behaviour, expectation and affect of teachers, parents and caregivers are crucial to avoid learned helplessness belief systems in mentally retarded students (Pintrinch & Blazevski, 2004). The same has been strengthened by Zsuzsa Mesterházi (1998). *Autonomy-supportive teaching and parenting techniques* (e.g. willingness to offer choice) versus controlling teaching/parenting style has been evidenced to positively correlate with children's growing intrinsic motivation (Grolnic & Ryan, 1989).

Situational Parameters of MLE:

The nine situational parameters do not serve themselves as conditions for an interaction to be MLE – however certain behavioural or cognitive-emotive characteristics of the mediatee or certain life-situation may give reason that these parameters are applied. Research from the field of developmental psychology also underlies why these criteria are valid ways of instruction.

Mediation of Feeling of Competence

The feeling of competence does not necessarily correlates with concrete achievements – students with moderate school results may feel competent, versus, very high-functioning individuals may evaluate themselves rather incompetent students. Literature is replete with evidence that the child's *perception* of his achievement and himself is a stronger predictor of achievement motivation than his/her real achievement itself (Weiner, 1974; 1980 and 1986; Bandura, 1977; Covington, 1984; Covington & Dray 2002). Mediation of this parameter means firstly, to create situations and tasks for the mediatee where he can experience

competence, and this competence needs to be verbally expressed and elaborated. „If the child perceives incompetence early in learning and begins to anticipate failure, premature closure of effort to succeed will likely occur when subsequent tasks are initially perceived as difficult. The child will not even absorb all crucial information... Under fear of failure, nonintellectual factors disintergrate first and block effective functioning…" – states Judy Mearig when highlighting that physiological, social, emotional, cognitive aspects all closely interwoven in the young child or a lower functioning individual (Mearig, 1987).

Secondly, it means to appreciate and even enlarge those areas of skills where real competence exists, but may not be accepted as part of the self-concept yet. Based on clinical experience we may formulate that in many cases the lack of certain very basic skills (ie. deficient cognitive functions) cause that the individual experiences failure in many of his/her endeavours. When successful remediation of the deficite functions happens, the low self-esteem changes. The mediator has to be careful that the complexity of the task will not exceed the capacities of the learner.

Mediation of Regulation and Control of Behaviour

'Response inhibition', 'self-control', 'mental set-shifting' and 'behavioural or cognitive inhibition' are well known concepts in cognitive psychology, usually discussed as elements under the umbrella of executive functioning (Barkley, 2012). Regulation and control of behaviour means the successful inhibition of dysfunctional and unwanted learning behaviours, and the initiation of certain behaviours which are socially appropriate or required by the task. Self-regulated learning requires self-monitoring while working on a difficult problem (see *Section 3.5*).

Literature dealing with this component of MLE is rather dualistic. There are those who interpret this criteria in the context of 'behaviours while learning' (Deutsch & Mohammed, 2010) -- and there are those who apply this criteria in a wider context, i.e. regulation of the child's behaviour in *all real life situations*, from family life to all kinds of social adaptations (Feuerstein & Feuerstein, 1999).

This element of human interactions is the most important between teachers and students, parents and their children from a *quantitative* point of view, according to Feuerstein. Even in the communication of authorities and citizens it has a greater importance – calling attention to dangers or warnings what we are not supposed to do. However, teachers or authorities do not necessarily *mediate* what they want us to do – and their *imperatives without meaning* (explanation or reasoning) usually serve as pure 'whip' without forming our behaviour into an internalized, metacognitive source of self-reflection from within. „The teacher whose concern is most centered on the 'product' of his student encourages very little cognitive control of behaviour. (Feuerstein & Feuerstein, 1999)."

We find evidence for this criteria of MLE in literature: some authors have found negative correlation between parenting styles (i.e. the mother's authoritarian commands while giving low guidance) and the children's intelligence scores, achievement motivation and academic school results (Camp, Swift & Swift 1982, cited by Lidz, 1999); Baldwin, Cole & Baldwin, 1982; Chien, Tsay & Chang, 1992).

Neither the inhibition of improper behaviours, nor the initiation of behaviours that are blocked or insufficiently present are easy or well-regulated processes in most children with cognitive impairments. The interplay between excitation and inhibition has an important role in human behaviour. Understanding the relationships between these two opposing forces has advanced significantly during the recent years, mainly due to the growing use of in-vivo intracellular recording techniques. The neural control in synaptic inhibition are highlighted for example by the works of Idan Segev (Gidon & Segev, 2012). Social behaviour dysfunction (e.g. autism) is explained by a hypothesis that there is elevation in the ratio of cortical cellular excitation to inhibition (cellular E/I balance) (Yizhar et al. 2011). Regulation

and control of behaviour requires the assessment of the situation on part of the individual and making a decision how and when to react. Children with cognitive impairments most often react to stimuli immediately after the registration of them, in an impulsive and haphazard way. The mediator's role is to make the mediatee postpone his reaction in time and stay away from the stimuli while mobilizing cognitive functions in order that a well set decision is made about the way and intensity of responding. This parameter of MLE is close to the concept of *metacognition* (Nelson, 1996) and *self-regulated learning* (Flavell, 1987) (see *Section 4.5*).

Mediation of sharing behaviour

The need to share either a toy, or a feeling or a thought on part of the child is discussed as a basic need at a very early stage of development in the Feuerstein literature. Sharing has crucial importance not only in the development of cognitive processes, but also in the development of the total personality. „The mediation of sharing behaviour and the mediation of individuation and psychological differentiation are seemingly opposite, antagonistic type of needs. Sharing behaviour reflects the need of the individual to go out of his own self in the direction of participating with others, and to make others participate with him (Feuerstein & Feuerstein, 1999 p. 72)." When infants start to point at each objects they see, trying to share what they experience with their caretakers, we see a very vell characterised form of sharing behaviour. The development of age-appropriate joint attention and shared gaze are very important in language development (word meaning, word comprehension and production). The mediation of sharing behaviour is the basis of any social learning – children of mothers who are unable to successfully establish regular joint attention with their child rate lower on scales of social competence (Nowakowski, Tasker & Schmidt 2009). In children with developmental disorders the need to share may be very underdeveloped due to obvious neural or biological reasons. Mediation of this criteria of MLE may happen explicitly with modelling (the parents model sharing a sachet of candies with others) or pointing („*Look! What a beautiful cherry tree! Lets try its fruits!*"); or an implicit way by the exaggerated animation of intentionality („*What beautiful tyres Lighting McQueen has!*) Also, parents and therapists can create a habit in the child by sharing his/her toys or candies with peers together; it is also important to mediate emotional envolvement into other's life.

Mediation of individuation and psychological differentation

This criteria of MLE means that the unique characteristics of the individual are explicitely expressed by parents/therapists in comparision with others. We may create a list in what aspects our mediatee differs from others. It is a basic human right to express ourselves a special way that is unique. „What appears on initial reflection to be paradoxical -- sharing as against individualization – is not contradictory, but rather complementary in the human being. Today an adaptive person has to be activated by these two components together – that is to say, you have to be yourself while being a partner to others /…/ Children whose confidence level is fortified through a process of mediation display a far better ability to perceive themselves as separate and independent entities, possessing emotional ties that continue way beyond the separation that is anchored in space and time. On the other hand, children who have not been fortified by means of a mediational interaction react in panic to separations from their parents home and other familial attachments because it is difficult for them to imagine themselves as living without the psychical presence of these attachments (Feuerstein, Feuerstein & Falik, 2010, p. 54)." This component of MLE is rather culture-bound: psychological differentation is particularily stressed in Western cultures as opposed to Asian culture, for example.

Mediation of goal-seeking, goal-setting and goal-achieving behaviour

This criteria of MLE targets many cognitive functions and operations: planning behaviour, orientation in time and space, widening of the mental field; mental operations of

sequencing and hypothetical thinking; and in a general way, abstract thinking. The presence of a desired or possible goal in the mediatee's mind means representational, abstract thinking. Children with special needs are so often without goals – or if they formulate goals, their goal achieving behaviour is poorly developed. Mediators may help to set even distant goals for their mediatee, and clarify and sequence the steps of actions to achieve them. The fact that the concrete plans will lead to the desired condition only in the future gives a transcendent value to this component of MLE.

Mediation for challenge: the search for novelty and complexity

The propensity to face and successfully adapt to novel and complex problems rather than giving up the efforts is of crucial importance, especially in a world of constant change where knowledge and technological development muliply themselves every year. The mediation of challenging behaviour must be represented as goal in all the programs that seek to increase the adaptability of the individual to the changes and complexities of our world (Feuerstein, Feuerstein & Falik, 2010). Literature has proved that parents of special needs children develop negative coping strategies to deal with their child's behaviour. One strategy is overprotection: avoiding their children from physically or socially challenging situations (Rutter, 1977; Naidoo, 1984; Sharlin & Polansky, 1971). Mediation for challenge must include that the mediator enables the child to overcome his/her anxiety and insecure feelings related to the unfamiliar.

Mediation of an awareness of the human being as a changing entity

This criteria is possibly the less frequent in quantity in the interactions between mediators and mediatee's, however this parameter of MLE would ensure that the mediatee gets constant feedback on his/her autoplasticity to change. Also it creates self-reflective thinking in the learner. Therefore, the mediator should constantly work to create in the person the feeling that he/she is being modifiable (Feuerstein, Feuerstein, Falik & Rand, 2006). Educators have to break with the passive-acceptant approach that views intelligence and the affective-emotional aspects of the personality constant and unaffected traits. From this criteria's aspect, an active-modificational approach means that educators and parents search signs of change over time and reflect them to the individual i.e. „I see you are changing! Yesterday you could'nt control your impulsivity, today you could beautifully wait and consider all the data before responding!"

Mediation of the search for an optimistic alternative

It is one of the characteristics of children with special needs that when trying one possible strategy in solving the actual problem and when failure is experienced, they don't present flexible thinking – and emotially they block at the first instant. Not to block even when a mistake has been made or when a task seems to be difficult, is a basis for cognitive growth. „The child whose first response is 'It is impossible' stops looking for the components of the task which may help him solve the problem. The mediation of an optimistic alternative starts at an early stage in the child's development making the child anticipate positive outcomes (Feuerstein & Feuerstein, 1999, p. 72)."

Mediation of the feeling of belonging

Alienation is a general phenomena in the past decades after nuclear families became the basis of modern societies and „the insulation of the nuclear family from the larger societal units" is experienced (Feuerstein et al, 2006, p. 104). The cognitive deficits resulting from this insulation besides the affective-emotional ones are multiple: since his/her field of experience is narrowed, the child's readiness to enlarge his views beyond the immediacy of his own experiential field (Feuerstein & Feuerstein, 1999).

5.4 The Deficient or Emerging Cognitive Functions

In Feuerstein's theory cognitive functions serve as basis for more complex mental operations. Functions are universal (every healthy individual bears them regardless of their culture) and they are relevant to each mental transaction regardless of content. According to Piaget, the functions are developed naturally during the child's life in response to his experiences due to brain maturity. However, according to Feuerstein, exposure to stimuli is not sufficient; there is a need for mediated learning experience.

With these functions we take in information, elaborate them and later present the 'results' to our audience. For instance, in order to make proper *seriation* with cubes according to their size, certain pre-requisite minor mental tools (cognitive functions) are needed, respectively: clear perception of the data (a cognitive function in the input phase); collection of all the relevant information (not to include irrelevant forms like globes – input phase); the ability to work with more than two sources of information at once (a cognitive function at the input phase); and constant comparision according to the chosen criteria (size) (a cognitive function at the elaboration phase); inferential-hypothetical thinking (elaboration phase); strategies for hypothesis testing (elaboration phase); non-egocentric communicational modalities (to be able to express the seria).

Feuerstein formulated *a list of cognitive functions* based on his clinical observations with hundreds of Holocaust survivers and later immigrant students from Africa. „Normative functions are the result of available, appropriate mediation and one of the main causes of deficient functions is in the lack of mediation or inadequate mediation, responding to the particular needs and experiences of the learner (Feuerstein, Feuerstein, Falik & Rand, 2006, p. 141). All mediators are expected to understand the interrelated dimensions of criteria of mediated learning experience and cognitive functions – we would like to emphasize this is the cornerstone of Feuerstein's theory and applied systems, together with the Cognitive Map (this latter one will help us in task-analysis).

Impaired cognitive functions in the *input level* include those impairments which distort the gathering of data concerning its quality or quantity when the individual faces a given problem, an object or an experience. Feuerstein defines eight deficient functions in the input phase. These are the following:

1. Blurred and sweeping perception
2. Unplanned, impulsive and unsystematic exploratory behaviour
3. Lack of or impaired, receptive verbal tools which affect discrimination (eg. objects, events, relationships, etc. do not have appropriate labels)
4. Lack of or impaired spatial orientation; the lack of stable systems of reference impairs the establishment of topological and Euclidean organization of time and space
5. Lack of or impaired time concepts
6. Lack of or impaired conservation of constancies (size, shape, quantity and orientation) across variation in these factors
7. Lack of or deficient need for precision and accuracy in data gathering
8. Lack of capacity for considering two or more sources of information at once; this is reflected in dealing with data in a piecemeal fashion, rather than as a unit of organized facts

Impaired cognitive functions affecting the *elaboration level* include those factors which impede the efficient use of available data and existing cues. Feuerstein defines 12 deficient functions in the elaboration phase. These are the following:

1. Inadequacy in the perception of the existence and definition of an actual problem
2. Inability to select relevant vs. non-relevant cues in defining a problem

3. Lack of spontaneous comparative behavior or limitation of its application by a restricted need system
4. Narrowness of the psychic field
5. Episodic grasp of reality
6. Lack of, or impaired need for pursuing logical evidence
7. Lack of, or impaired internalization
8. Lack of, or impaired inferential-hypothetical thinking
9. Lack of, or impaired strategies for hypothesis testing
10. Lack of, or impaired ability to define the framework necessary for problem-solving behavior
11. Lack of, or impaired planning behavior
12. Non-elaboration of certain cognitive categories because the verbal concepts are not a part of the individual's verbal inventory on a receptive level, or they are not mobilized at the expressive level

Impaired cognitive functions on the *output level* are those factors that lead to an inadequate communication of final solutions. We emphasize that even adequately percieved data and perfect elaboration can be represented in a haphazard or incorrect solution if difficulties exist at this level. Feuerstein and his associates define 8 possible deficient functions in the output level:

1. Egocentric communicational modalities
2. Difficulties in projecting virtual relationships
3. Blocking
4. Trial and error responses
5. Lack of or impaired tools for communicating adequately elaborated responses
6. Lack of or impaired need for precision and accuracy in communicating one's responses
7. Deficiency of visual transport
8. Impulsive, acting-out behavior

Further definition and analysis of the deficient cognitive functions is presented in the literature (Feuerstein, Feuerstein, Falik & Rand, 2006; Feuerstein, Feuerstein & Falik, 2010). Feuerstein and his colleagues emphasize that the separation of the mental act into three levels is a mean to bring some order into the array of impaired cognitive functions. However, there is interaction between the levels. The analysis of a learner's cognitive abilities in terms of cognitive functions is of utmost importance for molar remediation – and special dynamic assessment tools (eg. the Learning Propensity Assessment Device – Standard and Basic) are designed for this purpose (Bohács, 2010).

In case of young children Feuerstein speaks about "developing" or *emerging functions*, and considers five fundamental stages of growth that are present during early stages of development, namely:

1. Cognitive functions have not yet developed; therefore have not become materialized in the various environments in which they must operate.
2. Cognitive functions that have developed but not yet reflected spontaneously; they do not manifest themselves in an open, available or observable way.
3. Cognitive functions that are impaired or have some deficiency or inadequacy in one or more of the three phases of the mental act (input, elaboration and output).
4. Cognitive functions which have been developed, but due to lack of sufficient experience, they are fragile or not applied in an appropriate way, they may not be addressed by the nature of MLE offered to the learner in the environment.
5. Cognitive functions that appear in adjusted manner, in an appropriate way (Feuerstein & Feuerstein, 2006).

We foster the learning ability while handling functions at any age with the assumption that age is not a barrier. However, in a younger age with widening the sphere of mediation (ensuring proper mediation of the different functions in widening contexts) nurturing and correction of certain functions require less effort and time then in adolescence, for instance, when negative feelings (low self-esteem or helplessness) have evolved.

The inherent possible relationships between mediated learning instructions and effected cognitive functions can be manyfolded. The interrelatedness of criteria of mediation and cognitive functions highly depends on the intentionality of the mediator – which cognitive or behavioural elements he or she emphasized according to the needs of his/her learner (*Table 3.* introduces a few possible options). He/she may transmit mediated recall short-term or mediated recall long-term (cognitive elements) or he/she may transmit mediation of positive anticipatiation of future (cognitive and emotional attitude.)

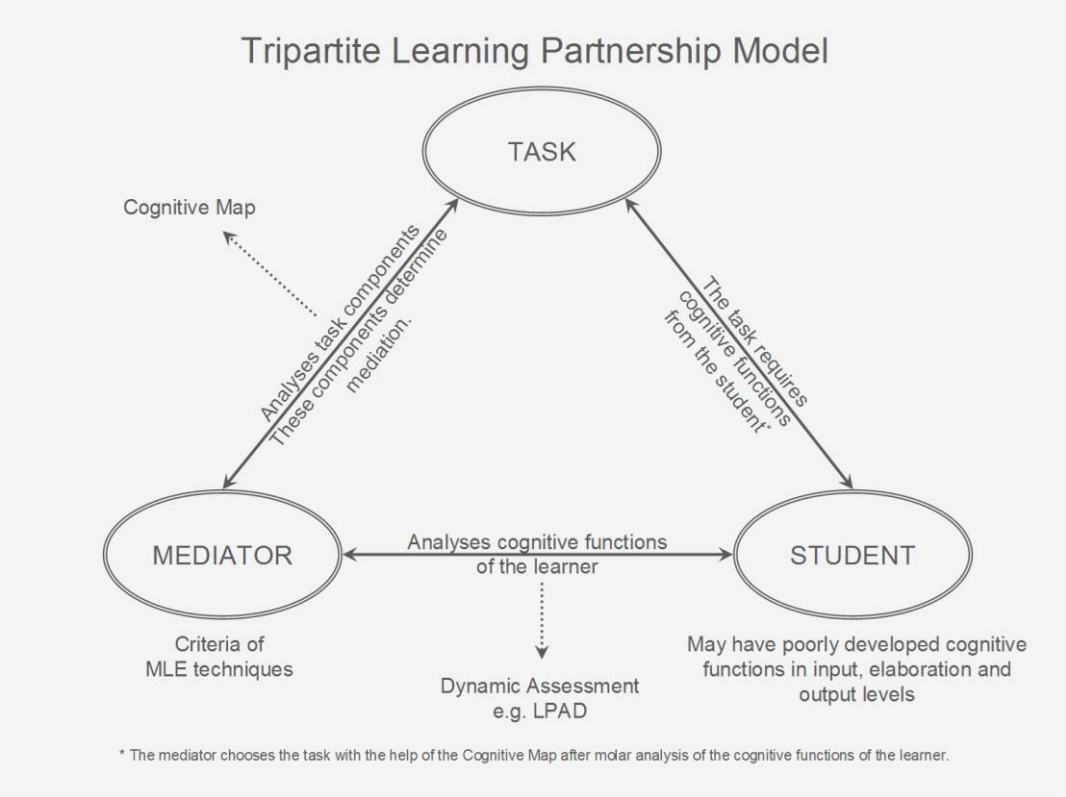
3. Table: Relationship between Parameters of Mediated Learning and Effected Cognitive Functions

Criteria of Mediation	**Cognitive Functions Effected or Remediated**
Intentionality	Clear perception, deeper and longer focus versus blurred and sweeping perception; Perception of the existence and and definition of an actual problem versus lack of perception of a problem; Proper absorbtion and internalisation of stimuli instead of trial and error responses; Clear visual transport instead of deficiency in visual transport;
Mediation of Meaning	Need for pursuing logical evidence versus lack of need for persuing logical evidence
Mediation of Transcendence	Well-developed orientation in space versus lack of or impaired spatial orientation; Adequate time concepts versus lack of or impaired temporal concepts; Wide psychic field versus narrow psychic field; Perception and understanding relationships versus episodic grasp of reality;
Mediation of Feeling of Competence	Brave communication instead of blocking
Mediation of Regulation of Control of Behaviour	Systematic exploratory behaviour versus impulsive, unplanned and unsystematic exploratory behaviour; Thinking things through before responding instead of trial and error responses
Mediation of Sharing Behaviour	Non-egocentric communicational modalities; ability for projecting virtual relationships
Mediation of Individuation and Psychological Differentiation	Internalization versus lack of or impaired internalization
Mediation of Goal Seeking, Goal Setting and Goal Achieving Behaviour	Planning Behaviour versus lack of or impaired planning behaviour
Mediation of Challenge: The search for Novelty and Complexity	Using more than two sources of information at once
Mediation of an Awareness of the Human Being as a Changing Entity	Conservationof constancies versus lack of or impaired conservation of constancies
Mediation of the Search for an Optimistic Alternative	Open communication versus blocking
Mediation of Feeling of Belonging	Wider mental field instead of narrow field; Recognising and understanding relationships instead of episodic grasp of reality

5.5 The Cognitive Map – Dimensions of the Task

According to MLE theory, it is necessary to analyze the characteristics of the task to which the individual is required to respond. This analysis is very important, since it will enlight what cognitive functions are precisely mobilized by the task and what cognitive performance is required from the learner. The components of the task interact with the cognitive functions in the formulation and production of responses of the learner, which may be adequate, appropriate, and facilitative of learning and problem solving, or may combine to generate failing, inadequate, and inefficient performance (Feuerstein, Falik & Feuerstein, 2010). The analysis is done with the help of the *cognitive map.*

Particularly in case of students with learning disability, the cognitive elements of the task must correspond with the needs of the learner and MLE techniques generated by the mediator on a molar level – this will ensure that the therapy is maximally individualized and will be successful. The interrelated dimensions between the mediator, the student and the task ensure that an intervention will be optimal. This is the Learning Partnership Model (Figure 6).



6. Figure: The Learning Partnership Model (Adapted from Deutsch, Mohammed, 2010 p. 10)

The Cognitive Map includes seven parameters by which a task can be analyzed: content, modality, phase, operation, level of complexity, level of abstraction, and level of efficiency. Tasks thus require mastery of elements that in turn require adequate cognitive functions for efficient thinking to occur in a process-oriented approach (Feuerstein, Falik & Feuerstein, 2006). The manipulation of these parameters becomes highly important in the examiner-subject interaction in the formation and validation of hypotheses regarding the loci of the subject's difficulties. The seven parameters are as follows:

The universe of content around which the mental act is centered: The competence with which subjects deal with a specific content is directly related to each subject's experiential, cultural, and educational background. Certain content may be quite unfamiliar to a subject,

and thus may require such an intensive investment for its mastery that it is no longer useful for providing information about the cognitive functions and operations it involves, the real target of the assessment. Manipulation of the content in both assessment and intervention will become a source of insight for change.

The modality or language in which the mental act is expressed: The modality, which may be verbal, pictorial, numerical, figural, symbolic, graphic, or any combination of these and other codes, will affect subjects' performance. The parameter of modality is important due to the fact that the elaborative capacities revealed by subjects on any single modality may not reflect reliably of their capacity if the task were presented in another modality. For example, a subject may be able to complete a mathematical operation successfully when the problem is presented in numbers and signs and fail when the same problem is presented in a verbal modality.

The phase of the mental act: The mental act can be broadly divided into three phases: *input, elaboration* and *output*. Although there is an interrelationship among the three phases, a greater or lesser emphasis may be placed on one or another of them by the requirements of a particular mental act. The isolation of the phase (and of the strengths and/or deficiencies of the cognitive functions it contains) helps to locate the sources of inadequate responses and to determine the nature and extent of mediation the examiner must provide.

The cognitive operations required by the mental act: A mental act is analyzed according to the rules or operations by which information is organized, transformed, manipulated, understood and acted upon to generate new information. Operations may be relatively simple (e.g., identification or comparison) or complex (e.g., analogical thinking, transitive thinking, or logical multiplication).

Level of complexity: A mental act is analyzed according to the number of units of information upon which it centers, in conjunction with the degree of novelty or familiarity of the information to the subject.

Level of abstraction: The conceptual or cognitive distance between a given mental act and the object or event upon which it operates defines the level of abstraction. For example, the mental act involved in sorting by producing relationships among objects through perception and motor performance (i.e., concrete – abstract) represents a lower level of abstraction than does a mental act involving an analysis of the relationships among relationships (i.e., abstract – abstract).

The level of efficiency with which a mental act is performed: The level of efficiency of a mental act can be measured objectively by the rapidity and precision with which it is performed, and by the subjective criterion of the experienced amount of effort invested in the performance of the task. The level of efficiency is a function of the degree of crystallization of the mental act and the recency of its acquisition. Processes that are recently acquired and not yet automatized are more vulnerable and less resistant to a variety of interfering factors. Lack of efficiency may be due to difficulties in one or more of any of the other six parameters, as well as to a host of physical, environmental, affective and motivational factors which may be transient and fleeting or more pervasive. This parameter is not to be confounded with the question of the subject's capacity, although in conventional psychometric procedures there is very frequently confusion between the two.

The Cognitive Map is used extensively during dynamic assessment. It plays a critical role in the construction of materials and in their selection and manipulation during the assessment, in the mediated learning interventions, and in the interpretation of subjects' performances.

4. Development of Children's Human Figure Drawing

„Drawing is self-recognition as well, realisation that I am not part of the homogenous cosmos anymore... but I have differentiated myself... I am: me" – writes the foreword to Maria Feuer's book (Feuer, 2000. p 60), one of the most distinguished compilation and research about children's drawings in Hungarian literature.

This statement seems to be well-defined especially in case of children with intellectual disability who usually have difficulties with body-image, self-awareness, motoric abilities and psychological differentiantion of themselves from others. In case of these children the first drawing of the self or of a beloved caretaker is very valuable since it represents a remarkable breakthrough in mental development: the maturation of the central nervous system and the complex development of different psycho-motor, cognitive and verbal abilities. Our cognitive intervention has brought about unexpected changes in the human figure drawing of the participants. Therefore we devote some time to review the most important findings about development of human figure drawings of children – both with typical and atypical development.

Researchers have started to study children's drawings more than a hundred years ago. In 1885 *Ebenezeer Cook* hypothised that studying children's graphic communication would reveal facts about their psyhological development. In 1887 Corrado Ricci was the first author to synthetise children's drawings in his book titled ''L'arte dei Bambini' (cited by Feuer, 2000). Since the 1900's researchers have examined children's drawings from many aspects. Developmental psychology has been monitoring children's graphic communication from cronological developmental aspects; clinical psychology has been interpreting children's human figure or family drawings as possible projecting mechanisms (Machover, 1949; Levy, 1958; Vass, 2006; Leibowitz, 1999; Kárpáti, 1995); psychotherapy has been using thematic and spontaneous drawings as a way of healing (Jakab & Hárdi, 1992). Visual pedagogy proclaims the importance of visual education of teenagers. Andrea Kárpáti has pioneering research about the effects of visual education in Hungary (Kárpáti, 1995; 2001).

Developmental psychological studies have established a *series of stages of development* in children's human figure drawing. These stages can be witnessed in the artworks of normally developing children. The stages share many characteristics which are differently defined in terms of cronological onset by different researchers -- like Piaget (1937); Lowenfeld (1947); Read (1956); Hurwitz & Day (1991).

Jean Piaget has identified *six main periods* in drawing development – closely related to the mental developmental phases. Stage I: scribble stage, lack of imitation (1-2 years). Stage II: scribble stage with episodic imitation (2-3 years). Stage III: stage of systematic imitation, stage of simple forms (3-4 years). Stage IV: stage of complex forms, stage of imitation of patterns not necessarily present on own body (4-5 years); Stage V: precise imitation of patterns not present on own body (5-7 years); Stage VI: realistic stage, delayed imitation, precise reflection of reality (7-9 years) (Piaget, 1978).

Lowenfeld argues that there are *five clearly defined stages of artistic development*. The first stage of self-expression is the *scribbling stage* (2-4 years). Children at this age are occupied with the *physical activity* of drawing. There are no connections made between the marks and real objects during most of the scribble stage. However, towards the end of this stage children may begin to give their waves and scribbles certain names. This stage is mostly about the enjoyment of making marks on a piece of paper.

In the so called *preschematic stage* (4-7 year-old) children are beginning to see connections between the shapes that they draw and the physical world around them. These are the first *representational attempts*. Circles and lines may be described as 'people' or 'objects' that are physically present in the child's life. In this stage children first make the connection to

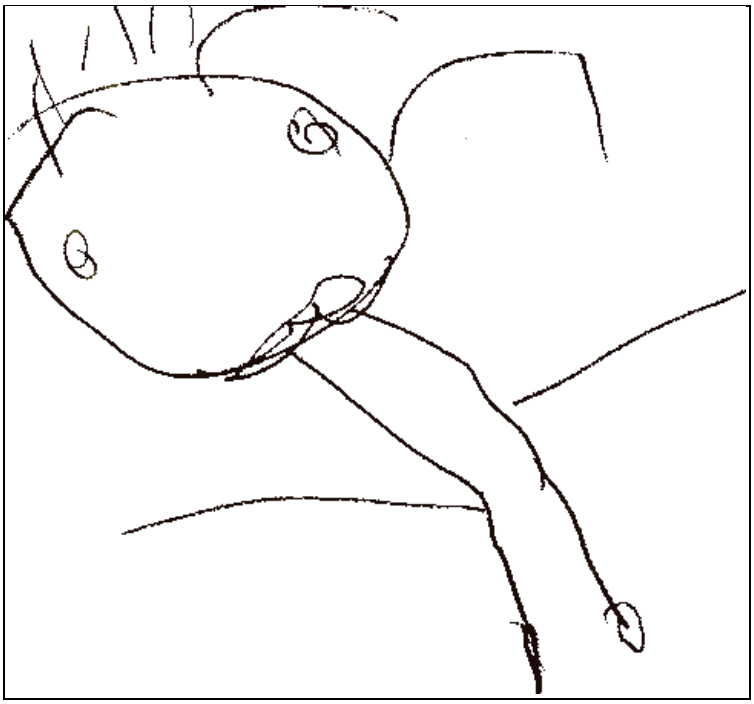
communicating through their drawings – the drawing becomes a symbol of an object or a person. The preschematic stage starts when the first *circular images* with lines appear which seem to depict a human or animal figure. During this stage the schema, the visual idea is developed. The size of the drawings show what the child perceives as most important about the subject. There is little understanding of space - objects are placed in a haphazard way throughout the picture. Space is not understood, color is used emotionally.
Achievement of a form concept is reached in the *schematic stage* (between 7 - 9 years). Shapes and objects are easily definable by the outer observer as well. Exaggeration of figures (humans may be taller than a house, flowers are bigger than humans, some family members are large and some are small) reflect that the child has strong feelings about a subject. Sometimes the objects appear to be drawn upside down. Another distinguishing phenomenon of this stage is called "X-ray drawing", meaning the picture shows inside and outside, as if the subject was cut open. The child uses colours in a realistic way and controls space well on the paper.
The *era of realism (or the gang age)* lasts from 9 till 11 years. This is a period of self-awareness even being extremely self critical from the child's point of view. Realism is not meant to be real in the photographic sense but having an experience with a particular object. In this stage the child becomes aware of a lack of ability to show objects the way they appear in the surrounding environment. The human is shown precisely according to her/his sex, as girl, boy, woman, man -- clearly defined with a feeling for details often resulting in a stiffness of representation. Perspective may be another characteristic of this stage. There is an awareness of the space between the base line and sky line. Overlapping of objects, types of point perspective and use of small to large objects are evident in this stage, proportionally. It may happen that objects no longer stand on a base line exclusively, but three dimensional space is reflected on the drawing. Three dimensional effects may be achieved along with shading or use of fine colour combinations.
The *pseudo-naturalistic stage* is the *stage of reasoning*, between 11 -13 years. The use of value and light is now apparent in drawings. Children at this stage of artistic development are very critical of their own success. Success is determined by the level of realism achieved in the drawing. Frustration is a common occurrence. It is exceptionally important to encourage students at this stage – writes Lowenfeld (1947). We analyse the drawing development of our participants in the empirical part according to Lowenfeld's stages.

There is a hot debate in the literature about the *intellectual evaluations of children based on their human figure drawing* (HFD). We have HFD assessment tests since 1926, when Florence Goodenough has constructed the first test for the 'Measurement of Intelligence by Drawings' (Goodenough, 1926). Harris and later Koppitz have modified Goodenough's scale and extended it (Harris, 1963; Koppitz, 1968). Lanz has created an easel age scale which can be used with children between 4-9 years for their intellectual assessment (Lanz, 1955).

It has been revealed that till the age of 10 (pre-puberty) children's drawings develop parallel with their intelligence, the drawing quotients correlate with IQ scores. Some exceptions are possible, but such cases have other diagnostic relevance. *Watz* has revealed that the Goodenough and Harris 'Draw-a-man" test for instance significantly correlates with the WISC-R as well as the Stanford-Binet test (Watz, 1996). Others do not confirm such correlations (Feuer, 1990).

Drawings of people with intellectual disability has been examined in the past to less extent (Vass, 2006; Jankovichné, 1963). It has been revealed that children having moderate intellectual disability substantially lag behind with their drawings compared to their typically

developing peers (*Figure 7*). Their artwork reveals the lack of consolidated structures and lack of systhesis of the parts (Vass, 2006 p. 54).



7. Figure: Human Figure Drawing of a 13 Year-Old Girl with Moderate Intellectual Disability (IQ=49)

According to Kietzman's research, scores of the human figures in the drawings of moderately mentally retarded adolescents (12-14 years old) are substantially lower than the scores of the drawings of 7-year-old children of normal intelligence (Kietzman, 1983). László Nagy writes that drawings of children with intellectual disability „reaveal at first glimpse that something is not all right. Human figures of retarded performers are usually chaotic and dysharmonic. The most important characteristic of such drawings is that they lack relations, some of them are overtly detailed and some may be bizarre. If more drawings are available, we may realize some stereotypes in the human figures (the figures are depicted the same way) (Nagy, 1905, p. 585).

It has been strengthened however, that with the improvement of intelligence the general quality of the drawings also improve (Aylaian & Meltzer, 1962; Hárdi, 1983 cited by Vass, 2006).

II. THE EMPIRICAL RESEARCH

1 Aims and Hypothetical Questions of the Research

Our aim was not to prove the effectiveness of FIE-Basic program per se, our experiment was much more *exploratory*: we wanted to see what kind of changes we can elicite in the cognitive-behavioural condition of our participants and how far we can take them with our intervention.

The staff carrying out the intervention for two years consisted of highly qualified special teachers who have earned international diplomas in the theory of Mediated Learning and Instrumental Enrichment programs and had minimum five years of experience in cognitive activation of children with special needs. Two of them supervising the dynamic assessment procedures of our participants, and monitored their development in every six months have international diplomas in assessment with DA systems.

The research site was a clinical center in Budapest (Foundation for Mediated Learning). The novelty of our research is that in Hungary a metacognitive thinking skills program has never been applied with students with intellectual disabilities. The program we chose (Feuerstein's theory and applied systems) is not well-known in our country – especially his program for younger children or for children with lower cognitive performance (the FIE-Basic program). Also, we followed a novel approach to monitoring the condition of our participants with dynamic assessment besides normative tests – which let us clearly see possible molar developments not necessarily indicated by regular testing procedures. This is absolutely not common in Hungary either.

We emphasize that Feuerstein's programs are theory-driven instructional programs, and the understanding of his educational philosophy is far more important than his instruments. For this reason, and since the pragmatic aspects of how to use his applied systems can only be learned in interpersonal ways, on part of the writer of the thesis a one and a half year period of studying his theory and applied systems has been carried out in Israel. Otherwise, due to partial understanding of the philosophy and incomplete application of the complex materials, not always valid conclusions are drawn nationally and internationally (Pap-Szigeti, 2009; Blagg, 1991). Pap-Szigeti claims that there is no theoretical model behind the tools of Instrumental Enrichment. Feuerstein has built a compact theory of intelligence. The order in which IE instruments are applied is usually defined by dynamic assessment procedures and derived from the individual needs of each student. As Narrol and Gibblon also state, (Feuerstein evolved) „a lengthy list of cognitive deficits and skills, a complicated teaching technique, and hundreds of pages of remedial material" (Narrol & Giblon 2001, p. 13), which demand considerable investment before application.
The main questions of our experiment are the following:

Hypothetical Question 1
We have evidence from international research studies that MLE and FIE-Basic have a positive effect on children with *regular intelligence* or children in the *socially disadvantaged population* (Ben-Hur & Feuerstein, 2011; Salas et al., 2010, see *Chapter 3.6*). Is this possible to elicit changes in the development of fluid intelligence of children with moderate and mild intellectual disability as well?
Hypothetical Question 2
Is it possible to elicite changes in the participants' *conceptual development*, *receptive/expressive language* and *communication*? Based on Ben-Hur's and Feuerstein's study (Ben-Hur & Feuerstein, 2011, see *Chapter 3.6*) we expect that the program will positively influence not only regular children's conceptual development but also those who have intellectual disability.

Hypothetical Question 3
Is this possible to enhance the logic, *reasoning abilities* of children having moderate and mild intellectual disability? Based on Beasley we hypothized that our intervention will bring about changes in reasoning abilities of children in our atypical group as well (Beasley, 1984, see *Chapter 3.6*).
Hypothetical Question 4
The study of Alas et al. note that one of the effects of FIE-Basic on socially disadvantaged children was that their self-regulation have improved and the experimental group became less distracted (Alas et al, 2010). Is this possible to develop these children to metacognitive awareness, *self-regulation* and internalized psychological control while learning? Based on Alas and the several criteria of MLE (see *Chapter 5.3*) we expect that there will be growth in children's self-regulation while treating stimuli.
Hypothetical Question 5
Will the elicited changes generalize to other areas that we cannot prognose? Based on one of Feuerstein's criterion about SCM (the generalizability of a change) we prognose that the induced changes will affect other areas of the individual's functioning (Feuerstein, Rand & Feuerstein, 2006. p 47) (see *Chapter 5.2*).

1.1 Participants

Participants of our study (N=15) are randomly chosen individuals from all parts of the country and from all socio-economic backgrounds. They have mild to moderate intellectual developmental disorder with very different etiology (genetic syndromes, cerebral paresis, perinatal brain injury and/or metabolic diseases). As we have noted earlier, they presented very different, heterogenious atypical cognitive-emotive behaviours. Besides their atypical cognitive development, severe comorbid behavioural and motoric phenomena could be experienced (*Table 4*). Nine of them presented autistic features (auditory or tactile sensitivity), obsessive behaviour, severe ADHD and/or motoric dysfunctioning (dyspraxia, ataxia and hemiphlegia). All of them had problems with speech comprehension and expressive language. Four of them arrived for intervention with very restricted language abilities – holographic one-word or two-word sentences or fragmented speech. Four of them (Cases 3, 9, 11 and 13) were non-verbal children upon arrival. All the school-aged children (aged 7 or above) attended segregative special schools in their residence cities. Case 13 and Case 14 attended inclusive kindergartens with mainstream peers.

4. Table: Original Diagnosis, Medical Condition, Age, Socio-economic Status and Residence of Participants of the Study

	Original Diagnosis	Age (Years)	Etiology	Comorbidity	Motoricity	SES and residence
Case 1	Moderate intellectual disability ; IQ 44	Age Pre - Post 8;0 – 10;0	Unknown X-linked genetic syndrome with Marfanoid habitus	Autistic features (tactile and auditory sensitivity; obsessive-compulsive behaviour); ADHD	Severe dyspraxia; occulomotor dysfunction; hypotonic muscle tone	Medium; Budapest
Case 2	Moderate intellectual disability; IQ 53	Age Pre - Post 5;5 – 7;6	Unknown	Autistic features, later diagnosed as Asperger-syndrome; ADHD	Poor fine motor skills	Medium, Érd
Case 3	Moderate intellectual disability; FQ 44	Age Pre - Post 5;7 – 7;7	Perinatal brain injury	Motoric aphasia; dyspraxia	Incoordinated gross and fine motor skills; hypotonic muscle tone	Medium, Pécs
Case 4	Moderate intellectual disability; IQ 43	Age Pre - Post 12;7 – 14;7	Fragile X-syndrome	Autistic features (tactile sensitivity) and phonic ticks;ADHD	Good motor skills; convergence insufficiency	High, Pécs
Case 5	Moderate intellectual disability; F71	Age Pre - Post 7;5 – 9;5	Congenital myoclonic epilepsy, Dravet-syndrome	Obsessive-compulsive behaviour	Ataxia	Low, Budapest
Case 6	Average/Mild borderline intellectual disability; IQ 80	Age Pre - Post 6;6 – 8;6	Unknown	Autistic features; ADHD	Dyspraxia; hypotonic muscle tone	Medium, Budapest
Case 7	Mild intellectual disability; F 70, F 90.8	Age Pre - Post 5;2 – 7;2	Unknown	Severe ADHD	Dyspraxia	Low, Bicske
Case 8	Moderate intellectual disability F71, IQ 55	Age Pre - Post 14;8 – 16;8	Stroke at birth	None	Paraphlegia; severe epilepsy	Low, Budapest
Case 9	Moderate intellectual disability F71, FQ 43	Age Pre - Post 6;8 – 8;8	Unknown genetic syndrome, Joubert syndrome suspected	Severe speech disability, central speech disorder	Extreme hypotonic muscle tone; poor balance and coordination	High, Budapest
Case 10	Severe Autism with borderline intellectual disability (normalcy/mild) F 84.0	Age Pre – Post 10;11– 12;11	Unknown	None	Poor fine motor skills	Medium, Budapest
Case 11	Severe Autism with borderline intellectual disability (moderate/severe) F 71, F 72, F 84	Age Pre - Post 6;3 – 8;3	Unknown	No speech production	Poor gross motor coordination, poor fine motor skills	Low, Abony
Case 12	Moderate intellectual disability F 71, G9110, G 4010	Age Pre - Post 7;8 – 9;8	Postinfectious hydrocephalus internus	Severe ADHD	Hemiphlegia	High, Székesfehérvár
Case 13	Moderate intellectual disability FQ 54	Age Pre - Post 2;8 – 4;8	Down-syndrome (Trisomy 21)	Slower speech development	Poor gross and fine motor skills, hypotonic muscle tone	Low, Békéscsaba
Case 14	Mild intellectual disability F 84.90, F 70.0	Age Pre - Post 4;8 – 6;8	Hypoxia, hypovolemia	ADHD	Poor gross motor coordination, poor fine motor skills	Medium, Budapest
Case 15	Mild Intellectual disability, F 70	Age Pre - Post 7,0 – 9;0	Mosaic Down-syndrome (Trisomy 21)	ADHD	Poor fine motor skills	Low, Budapest

1.2 Methodology

We chose a qualitative method of *multiple embedded case studies* (Szokolszky, 2004), since we felt many of the refined and molar components of cognitive development would be lost during statistical analysis. Furthermore, in case of our population we speak of children with partially impaired perceptual and thinking performance and in such instances longitudinal case studies are highly suggested: „Case studies can be strong methodological procedures, given their rigorous application, and can become a probe of theory under certain circumstances. Extensive analysis of individual cases have always had an outstanding role in neuropsychology, and with the chiselled psychological theory of the last decades their importance is growing" (Szokolszky, 2004, p. 498). Szokolszky notes that in the field of cognitive psychology when *complex markings of impaired and unimpaired cognitive functions* are examined, case studies are the most tangible ways of hypothesis testing. Based on our preliminary theoretical hypothesis we can prognose certain changes, and the patterns gained from the individual cases may support or discharge our hypothesis (Szokolszky, 2004).

However, we had quantifying endeavours. „Flexibility of the qualitative studies is not a reason to avoid systematic and consequent handling of data. Summarizing all the data in tables and the endeavour to quanitfy the results helps to maintain the validity of the research (Szokolszky, 2004, p 411)". Therefore we used *descriptive statistics* and *test-statistics* (Paired-samples T-test and Wilcoxon signed-rank test) to enhance the reliability and validity of our work. The first part of the empirical research desribes the development of the individual cases, and the second part presents aggregated data and test-probes.

According to Yin, when case studies are conducted we have to differentiate between *holistic* or *embedded* research designs, depending on units of analysis (Yin, 2003). Holistic designs include a single unit of analysis -- this is usually chosen when the aim is to study the global nature of the phenomenon or when no logical sub-units can be pointed. Embedded designs include multiple units of analysis -- such studies may include main and smaller units on different levels. Our scope of interest definitely was the development of the participants in attention, memory, receptive/expressive language, cognitive operations, metacognition and behaviours while learning – so multiple units of analysis had been monitored for a longer period of time.

The researcher may study one single case or more cases, therefore single-case studies or multiple-case studies are differentiated in terms of complexity. Our research is viewed as *multiple embedded case studies*, since in our longitudinal study fifteen participants were followed and their development analyzed for a longer period of time (24 months). Therefore in our longitudinal research the real development can be seen which would not necessarily have been explored by statistical analysis. Our participants all had mild to moderate cognitive delays (mental retardation) with very different etiology (genetic syndromes, cerebral paresis, perinatal brain injury or metabolic diseases) (*see Chapter 1.1*).

Our intervention program was FIE-Basic, and MST (Mediated Self-talk) within the framework of Mediated Learning Experience as for way of interaction. The time of acceleration was 24 months in each cases. The intervention sessions were one-to-one, with large intensity (7-15 sessions per week) – this way deficient cognitive functions of the individuals could be targeted with greater precision than in group settings.

According to Yin our research is viewed as a series of experiment where the cases can be interpreted as the repetition of the same intervention program and this "replication logic" is supposed to reveal support for theoretically similar results, or contrasting results for predictable reasons (Yin, 2003). Internal validity of our findings is strengthened by "triangulation", we asked multiple observers (caregivers and schoolteachers) to provide data

on the same phenomena in a survey (Cognitive Abilities Profile) -- development of the participants in attention, memory, receptive/expressive language, cognitive operations, metacognition and behaviours while learning). (Triangulation means searching converging findings from different sources. This process increases construct validity.)

Also, normative tests had been administered by an external evaluator (a clinical psychologist) to enhance the reliability of our work.

„Case studies can be multi-faceted ways of conducting explorative types of research, constructing inductive theory, checking theoretical hypothesis and program evaluation. The potential power of case studies have been revealed lately in this latter form of application" – claims Szokolszky. „This qualitative analysis was used for example by Zigler and Muenchow in 1992 to evaluate the Head-Start program in the United States" (Szokolszky, 2004, p. 507 and p. 499). Disadvantage of case study designs are their *demand on time* and *resources*, their complexity and difficulties caused by the vast amount of data.

1.3 The Applied Intervention: General MLE, Mediated Self-Talk and the Feuerstein Instrumental Enrichment Basic Program (FIE-B)

Depending on the condition of children participating in our experiment, we applied three types of intervention as complementary programs to each other – they are all clearly derived from Feuerstein's theory.

The first one, *Feuerstein's Instrumental Enrichment Basic Program* has been designed for the pre-school population (children between 4 and 9), or for the older individual with lower cognitive performance. The program is designed for a 3-year-long intervention, or a 2-year-long acceleration for older or higher functioning children (Feuerstein & Feuerstein, 2003).

The problem was that not every child or older adolescent had bared even those basic conceptual-linguistic abilities that the program requires, or many of them had not been used to joint learning activities (when approached, they may have presented temper tantrums, blocking or other ways of resistance to learning). In many cases their serious attention deficit has not led them to benefit from FIE-Basic in the beginning (with an attention lasting for 1,5 minutes not much can be accomplished).

In these cases as a preliminary intervention, a general, *introductory MLE-phase* has been given with *cognitive games, puzzles and specially formulated tools* (e.g. colorful picture cards of objects for categorization – items belonging to the class of food, animals, furniture, jewelry, clothing, dairy products, profession, vehicles etc. to enhance basic vocabulary acquisition and categorization; three stripes of Velcro on a board to sequence 3 item stories drawn on cards, to stick on the Velcro what comes first, second and third etc. to enhance the ability to sequence in space and time). The aim was in this *introductory phase* to bring the learner to the habit of learning, to create intrinsic motivation to explore for the joy of learning and to attend to different stimuli for a longer period of time (to reach increased attention span). Mediation of basic concepts, adaptive behaviours, and skills related to *primary cognitive behaviours* have been done along the following topics as content:

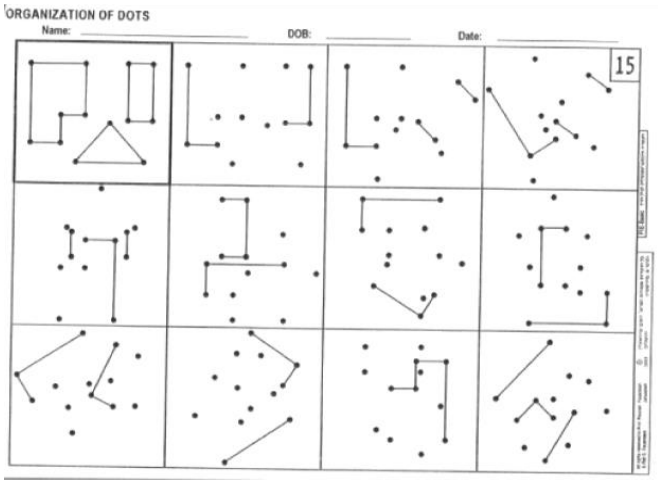
a. Basic Concepts: color, shape, size, orientation in space and related concepts, number and quantity, time, cause and effect relationships, feelings and moods, the human body (body parts and their functions).

b. Adaptive Behaviours: (basic skills related to daily living – with directed parental involvement in home settings) motor skills (fine and gross motor), dressing, personal grooming and physical self-care, eating and table manners, orientation in environment, independence and helping in home activities, general knowledge about the immediately experienced world.

c. Primary Cognitive Behaviours: attending to stimuli, focusing, imitative behaviours, symbolic play, question and answer responses, initiatory/adaptive play (Feuerstein, Mintzker&Feuerstein, 2006).

When the child has been considered ready for *FIE-Basic*, the instruments of the program have been applied – depending on individual needs, in what order.

1. *Organisation of Dots – Basic*: The learner is mediated to identify a geometric shape (diagonal lines, square, triangle or rectangle) presented as a model in an amorphous cloud of dots: the child creates order and meaning initially perceived disconnected, amorphous infomation. The child learns to overcome difficulties caused by the rotation of the figures and the proximity of the dots. The instrument promotes analytic perception of shapes, conservation of form and size, planning, need for precision and restraint of impulsivity. This instrument is aimed at developing children's cognitive functions in a figural and visual–motor modality (Kozulin et al, 2010, Feuerstein, Feuerstein &Falik, 2009).



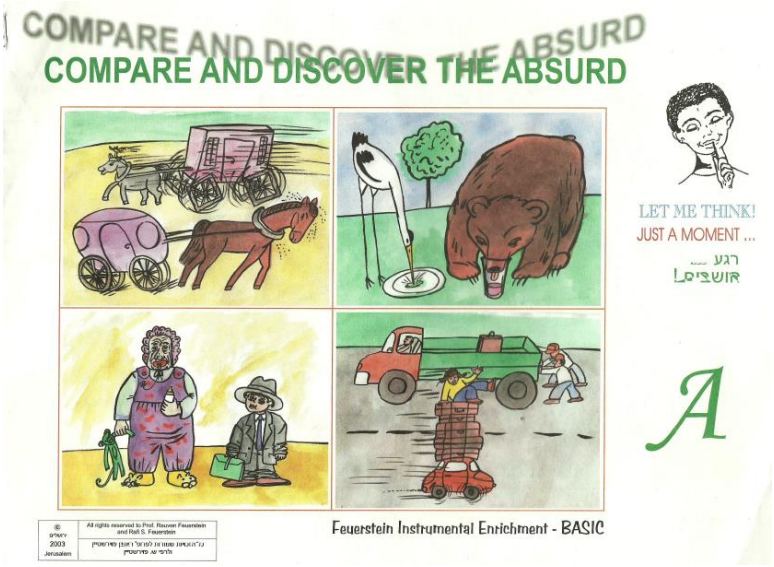
8. Figure: Sample: FIE-Basic Organisation of Dots

2. *Orientation in Space – Basic*: This tool is aimed at developing spatial concepts and orientation in pictorial space representing everyday life situations. This requires scanning the pictorial information, identifying the relative position of objects and events, and the development of a conceptual and operational vocabulary. The learner is required to follow verbal directions of increasing complexity to orient the search (scanning, exploration and focusing) – the learner thus experiences the need to systematically scan the total scene, look for the identified object and identify relationships between two or more objects. (Kozulin et al, 2010, Feuerstein, Feuerstein &Falik, 2009).

3. *From Unit to Group*: The tasks include counting and grouping simple visual stimuli such as dots, triangles, circles, squares, etc. The instrument promotes systematic exploration of data, systematic following of rules, and consideration of several sources of information, comparison, categorization, inferential thinking and deductive reasoning. The aim of the instrument is to lead the learner to systematic counting, summative processes of organization, multiplication and division. (Kozulin et al, 2010, Feuerstein, Feuerstein &Falik, 2009)

4. *Identifying Emotions*: The tool targets children's ability to decode behavioural and social cues that stand for emotional states. At the top of each page there is a stimulus photograph showing certain emotional states and four pictures showing different life situations. Children are first mediated to look at the top photograph and label the emotion, and then to analyze each one of the ''stories'' depicted in four illustrations in terms of relevant emotional states of the characters involved. The search for cognitive reasons for the evolvement of the emotion requires systematic gradation of possible causes – therefore develops hypothetical

thinking. The instrument strengthens the relationship between emotional states and their cognitive correlates (Kozulin et al, 2010, Feuerstein, Feuerstein &Falik, 2009).
5. *From Empathy to Action*: This tool presents a starting situation (eg. and old lady carrying two heavy bags and a boy looking at the lady) then four alternative possible reactions (eg. the boy pushing the old lady from the back; the boy doing nothing, the lady passing; the boy offering help to the lady and taking over the loads etc.). The four alternative situations are meant to help the learner find the best response to the expressed emotional situation: „What should I do when I see such a situation?". The tool triggers observation and analysis of a social sceen, generalisation of the feelings and possible outcomes through verbal labelling, hypothetical thinking and drawing logical conclusions (Feuerstein, Feuerstein &Falik, 2009).
6. *Compare and Discover the Absurd*: The instrument uses absurd or incongruous situations in a cartoon modality in order to develop the children's ability to use selected criteria as a basis for comparison and to develop a system of sub- and super-ordinate concepts. Both more basic (size, shape, direction, quantity) as well as more complex (age, function) criteria are used. The instrument is aimed at developing higher cognitive functions, expressive language, and coordination of pictorial analysis with verbal responses (Feuerstein, Feuerstein &Falik, 2009).



9. Figure: Sample: FIE-Basic Compare and Find the Absurd

7. *Tri-Channel Attentional Learning*: This instrument is comprised of a box open on the two sides (for the hands to be placed into the box); 25 convex and cocave wooden geometrical shapes (eg. pentagon, circle with embedded triangle etc.); and a booklet with the two-dimensional drawing of the wooden shapes. The learner is asked to touch the shape placed into the box totally blind, analyse its characteristics in a successive manner, draw it on a sheet of paper and then find the exact shape among many other complex figures in the booklet. The tri-channel aspect of the instrument refers to the successive haptic (tactile) modality; the graphic modality (drawing) and ultimately using the visual channel to recognise the model that has been perceived in a tactile way. The tool with proper mediation aims to correct attention deficits, perceptual impulsivity and lack of precision in using two or more sources of information at the same time.
8. *Know and Identify*: The tools's format is pictorial and written verbal and focuses of different characteristics of objects (relevant attributes and differentiated features). The aim is to develop comparative behaviour, create categories and strengthen the learner's content knowledge (Feuerstein, Feuerstein & Falik, 2009).

9. *Think and Learn to Prevent Violence*: This social/emotional instrument presents situations of conflict in pictorial modality with suggested possible outcome resolutions. The learner must consider, choose and then predict the outcome of his/her choices. The tool requires deductive and inductive reasoning, understanding of consequences of appropriate/inappropriate behavioural actions. The tool is an important follow up to *Identifying Emotions* and *From Empathy to Action*.
10. *Learning to Ask Questions for Reading Comprehension*: The instrument presents stories in a pictorial and verbal modality in a narrative manner and asks the learner to formulate questions based on contextual details and the logical continuation of the narrative that is presented. The learner has to infer outcomes, generate sentences and create summative titles based on the sometimes unfinished narrative (Feuerstein, Feuerstein & Falik, 2009).
11. *Compare and Discover the Absurd* – Level 2. This instrument follows *Compare and Discover the Absurd 1* tool, it extends thinking and organizational strategies through the use of a series of questions. It is a highly verbal and abstactly structured instrument (Feuerstein, Feuerstein & Falik, 2009).

While Instrumental Enrichment Standard has been designed as a „content-free" intervention for the enhancement of learning abilities, *FIE-Basic targets the exposure to content* as one of its goals – but from that content systematic „working" concepts are developed. In FIE-Basic content is considered important to open the young child or older child with delayed development to a greater number of mental operations, and „particularly the need to question" (Feuerstein, Feuerstein & Falik, 2009). In the long run, however, *process* is much more emphasized: teaching the learner how to think, providing differentiated and repeated practice in the activities of thinking.

Feuerstein defines four levels of mediational distances: zero level of mediation (the required answer is formulated by the mediator, the mediator produces the response for the student); low distance (the mediator asks the student to produce response which is identical to that which has been demonstrated (modelling behaviour); high level of distance occurs when the mediator asks the student to produce a response which is opposite of that which has been modelled (this requires the student to understand a rule or relationship in order to reverse it) (Feuerstein et al, 2006). We have always tried to work at the highest level of distance, at an internalized, representational level. Therefore we consider FIE-Basic *a thinking skills program* for the young or delayed learner which emphasizes highly verbal and abstract thinking. The FIE-Basic is definitely not a perceptually oriented program – even though it has instruments for visuo-motor and perceptuo-motor dispositions. The strong and high level of abstraction usually does not characterise other interventional approaches to intellectual developmental disabilities. Also, many of the tools mediate self-regulation while learning, empathy and strategy-use – with the aim of creating metacognitive awareness in the young learner. The program is claimed to generate intrinsic motivation throughout the whole set of instruments in order to maintain and augment self-regulatory functions. Some of the tasks evoke the children's needs to correct incongruent, absurd situations which create cognitive disequilibrium in the learner. The incongruent, funny episodes help to maintain attention and curiousity. The tasks are pictorial, cartoon-like drawings, reflecting the rich visual world of our era (Ben-Hur & Feuerstein, 2011).

As a third, complementary way of intervention we have applied *Mediated Self-Talk* in some of the cases (especially with Case 1, 2, 3, 4, 11, 12 and 13) when the participant's linguistic abilities have been very low upon arrival or the individual had been too closed to be approached in other direct ways. MST is an intentional mediated interaction undertaken by the mediator to share his/her inner language aloud, but without the expectation that the child will respond. This interaction is characterised by the criteria of MLE (*See Section 3.3, Universal Characteristics of MLE*), but Reciprocity is expected to be delayed – weeks or

months later. This is the act of the adult verbalizing his/her *inner language* to develop language awareness, acquisition and development. However, MST has several built-in necessary attributes:

- it is usually related to concurrent activities that the child observes or experiences
- it contains specially constructed grammar and syntax that is missing from the child's linguistic repertoire
- it has qualities of embellishment, exaggeration and repetition
- it systematically works on transfer since it orients the listener to the past and future experiences.

Further analysis of private speech organizing human behaviour and description of MST procedures are illustrated by Feuerstein, Feuerstein, Falik & Bohács (2013).

1.3.1 Needed Shifts in MLE when Applied for Retarded Performers

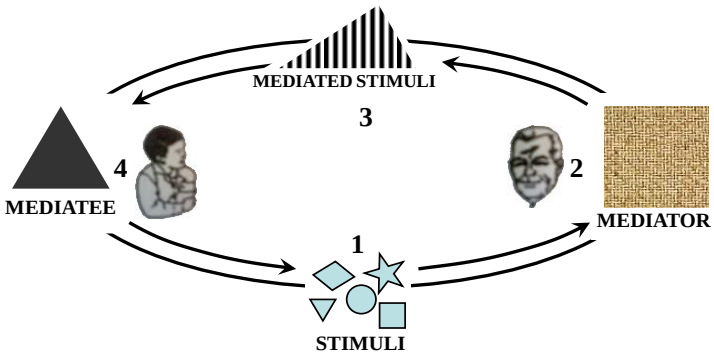
In this section we give educational applications of MLE for children with low intellectual performance, Pervasive Developmental Disorders (PDD) and autistic features – how we mediated the tools of FIE- Basic program to the population of our research. Our points presented here are enlightened with examples for each criteria so that the underpinnings and practical applications of MLE for the special needs population will be understood clearly.

The reason for this is that there are shifts in the ways we mediate to lower functioning individuals than to individuals with higher mental functioning – and there is a very contradictory phenomena in the literature: though Mediated Learning Experience is associated with cognitive rehabilitation, most writings on Mediated Learning Experience describe MLE criteria and processes targeted to the greater population of children with either average intelligence or with minor learning disabilities. So based on clinical experience we would like to refine some of the criteria to lower functioning children and indicate where some shifts or special attention are needed when we instruct low-functioning children with moderate mental retardation or even below.

Intentionality/Reciprocity: When a moderate level of intellectual delay is indicated, according to clinical experience, the main deficits present themselves in the input level: cognitive functions related to perceptual sensory systems (eyes, ears or the tactile system) are rather underdeveloped, depriving the individual from the successful collection and registration of data. Unmediated stimuli may be meaningless – especially for perceptually weak children. The intensity of stimuli experienced in a direct way is usually not strong enough that it will be absorbed by the child. Its redundancy is not appropriate either.

a) Therefore a human mediator has to be determined to really ensure that the so called „mediational loop" will be closed when we instruct low-functioning children. Otherwise the stimuli will not reach their elaboration.

The Mediational Loop



10. Figure: The Mediational Loop (Adapted from Feuerstein, Feuerstein & Falik, 2010, p. 42.)

The process of MLE can be likened to a mediational loop: there exists a group of geometric forms (Stimuli, 1) from which the mediator (2) chooses one to be focused on. He chooses one stimulus (in our example it is a triangle, 3) and by separating it from the rest of group, by enlarging it, changing its colour and size and making it more salient by exaggerating its characteristics, it is presented to the mediatee in order to facilitate its reception (*Figure 8*). The mediational loop is closed only if the message regarding the stimulus passes from the mediator to the mediatee is absorbed, registered and leads to a process of generalization, conservation of the object and ultimately abstract thinking. (Feuerstein, Feuerstein & Falik, 2010). When the mediator explains his/her intentions to the child – why he/she choses this stimulus and not the other, why he/she enlights this certain characteristics of the stimulus and not the other, why he/she compares it to a certain object and not the other – the child will learn abstract criteria of analysis of stimuli which he/she can use in other contexts (in other words, the child will learn to mediate to herself/himself) when the mediator is no longer present. This way a metacognitive, self-perpetuating learning is taught, which proved to be possible with many of our participants in our research.

b) In case of clinical population a much stronger intentionality is needed on part of the mediator to make sure that the mediatee registered the stimulus or data. Also a greater deal of sensitivity on part of the mediator to read non-verbal signs of his/her clients for reciprocity, which would indicate that the successful understanding of abstract principles of analysis have happened.

c) A third very important aspect of mediating to lower functioning children is that special emphasise has to be put on mediation of attention, focusing and exploratory behaviour as they are very problematic in this population and they serve as the prerequisites for any mental activity. The mediator may model how to gather the data in a systematic fashion (for example from left to right, from top to bottom).

d) A fourth important shift compared to general mediation is *perseverence in intentionality*: the mediator has to initiate and continue mediation, even if there is no response from the child. In that case, the mediator would be required either to repeat their action or to postpone their mediation and modify their approach in a way that will increase the child's attention and evoke a more appropriate response. In other words, mediation for intentionality is about not giving up our efforts to elicite the required response. Thus, it is of utmost importance for the mediator to become flexible – if the stimuli is not registered in the short run, creative and

successful alternative communication is needed to reach our client, mainly by questioning from different points of view.

Mediation of Transcendence: Though our goal is to take our mediatee to the level of transfer, we have to head forward very slowly. Without crystallized structures children do not have neither contents, nor cognitive functions to be discovered in different contexts. So repetition with alterations is important: the child should be presented with the same stimuli but with slight changes. Firstly, this improves their mastery and permits mediation for competence. Secondly, repetition allows the mediation of different concepts related to the very same tasks.

Example: When the child works on the same puzzle task, repetition is done in a slightly different way: after doing the puzzle on a perceptual level (finding the pieces by looking at the picture on the model), second time a cognitive strategy is chosen: sorting the pieces into two groups. One group has one or more straight lines (these will give the frame of the puzzle); the other group have only curved lines. The same task is given – however the second option makes it possible to teach concepts of „straight", „curved", „lines, „frame" etc.

Mediation of Meaning: In order to ensure the energetic, affectional-motivational aspect of our interaction, we have to clarify during the initial assessment (by parental interviews) what topics, objects or sounds the child loves. This is of utmost importance when we give mediation of transcendence as well: especially in the beginning of our intervention, bridging activities are done in the domain of the child's favourites.

Mediation of Control of Behaviour: Communication proves to be best if we speak slowly, and articulate words with careful mouth movements, and use short sentences with simple words. Children with learning disabilities usually receive more negative than positive feedback. They receive so many "nos" during their everyday life that this makes them think they are bad. As a consequence, they believe that whatever they will do they will never please their caregivers. This could make them be more oppositional. Moreover, when receiving a "no" the child does not know what s/he should be expected to do. As a consequence the often perceived phenomena is that they have strong fear of failure. In many cases their very low self-esteem and frustration following incorrect responses can actually provoke problem behavior such as tantrums, aggression, and self-injury – or total lack of cooperation (not wanting to start a page or play with a cognitive game). Therefore *we emphasize the importance of the combination of MLE with errorless learning* at this point, especially in the first six months of our cognitive intervention till the child's self-esteem is strengthened. At the same time we do not wish to follow in our approach any methods based on behaviourist paradigms – as they are conditioning children as animals are trained (dog training for instance).

Errorless learning means we prevent the learner from reinforcing errant behavior, which may occur with repeated mistakes (Mueller, Palkovic & Maynard, 2007). Errorless learning refers to a variety of discrimination learning techniques that eliminate or minimize responding to incorrect choices. After introducing a task, either we apply zero mediation in the beginning of the therapeutic process (we immediately tell the correct answer) so the child does not have any opportunity to make a mistake; or if a mistake has been made our feedback is „nearly" or we kindly thank the answer and repeate our request again.

Example:

*Mediator: *Please, give me a black triangle!*

*Mediatee: *Mediatee hands over a black triangle.*

*Mediator: *Bravo! Excellent! Thank you!*

*Mediator: *„Please, give me the big green circle!"*

*Mediatee: *Mediatee hands over a small yellow circle. (Obviously a mistake has been made.)*
*Mediator: *„Very good, nearly! Thank you very much! Now please give me the big green circle!"*

According to research, errors "stick" in memory because of emotionality. This may be because errors are associated with embarrassment or anger or other strong emotions that "drive in" the incorrect response and make that response more likely the next time. We noticed that significant anxiety can result in increased errors especially in children with low working-memory capacities. If a failure has been reflected back by the mediator, a complete blocking was experienced and the total termination of cooperation on part of the child. The combination of MLE with errorless learning reduced incorrect responding and decreased behaviours associated with task avoidance or frustrations which arrived when a task seemed to be too difficult. When we address general behaviour problems or behaviours while learning, the mediator should target only few behaviours and work only on them, thus keeping the level of conflict low. The mediator always have to stay calm, even if he/she meets with very serious oppositonal behavior or temper tantrums. Modification of behaviour happens with nonverbal signs and questions – creating cognitive conflict in the child and then reinforcement of adequate or proper behaviour. They always should smile rather than looking concerned, because special needs children tend to rely on the nonverbal rather than the verbal communication. The experiments of Gump and Kulik (Gump & Kulik, 1997) has proven the phenomena of behavioral mimicry, in terms of facial expression and emotional contagion.

1.4 Data Collection Instruments and Procedures

We have used both dynamic assessment systems and static tests for the evaluation of our clinical population in our research as pre- and post-tests. Dynamic testing requires international training – our two assessors had qualifications in the field. Raven test and TROG test has been administered by an external evaluator (a clinical psychologist). We note she spent about 5 sessions with each child to avoid emotive difficulties in children with intellectual disabilities while being tested. Due to the limited number of our participants we could ensure that always the same person would administer the tests to eliminate difficulties mentioned by the authors of one of the studies about the applications of FIE-Basic with low-functioning children. Post-test results were sometimes lower than pre-test ones, since not the same assessor administered the tests (Kozulin et al, 2011). First we are going to describe the data collection instruments, then we elaborate on data collection procedures.

1.4.1 Dynamic Assessment Systems Used

The following DA systems were used in our experiment: *Feuerstein's LPAD-Basic* (pre- and post-test) and *Cognitive Abilities Profile* (CAP) of Deutsch and Mohammed (2010) (as for baseline assessment and monitoring development in every 6 months). Since the CAP made it possible to monitor our participants' development while giving cognitive acceleration, the real development of the participants could be revealed and described for outside observers as well in terms of independent problem-solving (how the child becomes more and more independent as his/her strategic thinking develops .
With the DA systems we applied as pre-test, a new possible dimension of our later cognitive intervention has opened up due to the refined taxonomies of cognitive factors and precise localisation of molar deficiencies. This alternative and complementary way of assessment of children has clearly highlighted the „wholes" in the child's cognitive structures, in other words which cognitive functions need to be remediated in order to ensure that the child could

carry out higher mental operations. (Feuerstein's master, Piaget proposed that maturational processes of the brain let the child to reach a new stage in his/her development. According to Piaget, the functions are developed naturally during the child's life in response to his/her experiences (brain maturity). Feuerstein opposed the generic epistemological model of development and suggested and described a new taxonomy of cognitive development. According to Feuerstein exposure to stimuli is not sufficient. There is a need for mediated learning experience.

Strengths in the cognitive-emotive structures made it possible for us to create transfer from the stronger abilities to the weaker ones.

One of the novelties of our research is that DA has been used as *outcome measure* in order to see the effectiveness of our intervention. This is not very frequent in studies exploring the effectiveness of a cognitive program. „The logical argument is that if the declared objective of the intervention is teaching children how to learn and to benefit from mediation, then the criterion outcome measure should be assessed by DA, which aims precisely to reveal the ability to benefit from teaching. DA measures do not simply target the same abilities that cognitive education programmes intend to develop. In other words, it is not a matter of merely tracking improvement in individuals' performance of discrete tasks. Rather DA's focus on cognitive modifiability entails learning how to solve problems across domains, including but not limited to those addressed in cognitive education programmes. Given this affinity, it is surprising that many studies that endeavour to evaluate the effects of cognitive education programmes do not employ DA in their outcome measures" – as Tzuriel points out the importance of this methodological approach (Tzuriel 2011, p. 113) . The same has been suggested earlier by Sternberg and Grigorenko (2002).

Another important reason behind our preferance to use dynamic tests as outcome measures is that the learning curve of lower-functioning children often presents a degenerative trend with progressing age. „In addition, in several tasks" in normative tests „from one year to another, the level of difficulty of the tasks increases". „Therefore, zero gain scores might represent real improvement" – as Kozulin et al. point it out (Kozulin et al, 2010).

However, we did not reject static tests either, for three reasons. Firstly, we wanted to know if the hypothesized development of our clinical population can be finally evaluated at the end of the intervention compared to normative groups. (Their level of functioning did not always made this possible in the baseline phase – many of our participants simply was not on the level to solve normative tests.) Second, in our Hungarian context the interpretation of DA results may be alien. Third, to elevate reliability of our work, we wanted to ensure that an external evaluator (a clinical psychologist) would carry out the administration most of these tests.

Since DA systems are not known in our country, we shortly introduce the two applied dynamic assessment systems and later overview the normative tests having had administered.

Feuerstein's LPAD-Basic

The battery of LPAD-Standard instruments was born in the 1950's, after the Second World War. These instruments can be used from the age of 6 years and upwards, even with low performing adults. Some of the instruments are quite challenging, even for a "regular" functioning adult. In order to respond to a growing need of lower functioning individuals and younger children, an LPAD-Basic battery has been developed (Feuerstein & Feuerstein, 2006). This may be used in case of individuals with a "mental age" of 4-7 years, including low functioning adolescents and adults. For children who are lower functioning than a mental age of 4, the LPAD-Basic battery is not suitable, but the LPAD paradigm and modifiability profile can be used with more concrete play or assessment materials in a dynamic way. *Lids*' assessment scales can be one example of such possibility (Lidz, 1991, 1987).

LPAD-B aims at assessing the examinee's openness to the process of mediation (propensity for modifiability). Principles of assessment are based on the SCM theory (see Chapter 4.1). It aims at understanding the examinee's processes of thinking and learning underlying performance by the analysis of emerging cognitive functions and affective factors. Also determines the most appropriate mediation processes necessary for the examinee. LPAD-Basic by its clinical and qualitative nature, shapes the test situation to encourage response, in other words creates a readiness to respond to the mediation process.

The theoretical rational behind the LPAD-Basic is that an active approach must be adopted rather then wait for natural stages of growth to detect risks and preventing them from materializing. The immutability is substituted by the concept of modifiability. Provided constructive steps are the following: i. isolating the target behaviour, ii. ensuring massive intervention; iii. pushing the child beyond the expected norm. Possible human targets of LPAD-Basic can be young children requiring the development /acceleration of content and concept learning; those at risk requiring prevention of dysfunction or delay (populations at risk); or finally those requiring restoration/ remediation of lost functions (e.g. adults with TBI) (Feuerstein & Feuerstein, 2006).

Instruments of the LPAD-Basic:

1. Instruments focusing on visual-motor and perceptual organization

Complex Figure Drawing:

This test assesses the child's ability to organize, copy and recall a complex figure made up of geometric shapes (different sized rectangles and diamonds within each other). There are a number of variations that require mediation. The test helps the examiner to appraise the individual's level of precision and graphic performance as well as the way he/she organizes visual memory. Structurally, the Complex Figure-Basic instrument is based on Rey's Complex Figure Drawing Test design, but with major alterations. The following stages are followed during the dynamic testing procedure: Stage 1—Pre-test stage, copy D. Stage 2—Drawing from Memory D. Stage 3. Intervention on A. Stage 4. Post-test, to Follow Task D Copy. Stage 5. Post-test, Recall on Task D. (For Complex Figure 'A' see *Appendix 5*.)

Spatial Orientation

This instrument tests orientation in space and demands familiarity with and active use of concepts such as *above, below, next to, in front of, behind* and *right/left,* etc. The child is given a picture of familiar sorroundings (a room, a street) showing an assortement of objects and circles in two colours (black and white) and different sizes. The object of the test is to assess the ability to use spatial concepts, follow instructions and refer to a number of criteria simultaneously such as: „*Show me the little black circle behind the car*". (One page from the Spatial Orientation Test can be seen in *Appendix 6*.)

Mazes

The Mazes instrument -- sometimes called „Labyrinth" in the literature – is a test of motor planning and visuo-motor coordination. The child is asked to plan a route methodically and trace a path through the maze whilst abiding by rules explained to him/her (no touching the „walls" of the labyrinth, no lifting up the pencil, no entry into blind allies). The test is composed of 5 training pages followed by 14 mazes arranged in ascending order of complexity. The series of tasks are graded and require visual tracking and the ability to exercise motor control while drawing a line from a starting point to an end point. The tasks become progressively more complex, starting with simple progressive movement, gradually incorporating the need to change direction (motor control), plan for correct and incorrect routes toward the end point (anticipating the effects of choosing an alternative pathway), moving in directions that are contrary to the perception of location of the end point

(reversibility of movement), and highly complex juxtapositions of space, barriers and movement through space. (One page from the Mazes Test can be seen in *Appendix 7*.)

Human Figure Drawing

The LPAD adaptation of the HFD consists of a pre-test phase in which the subject is asked to draw a human figure; then a mediation phase (where modification of the body image happens, where it is necessary); a post-mediation test phase and one or more additional post-tests. In our experiment HFD has never been used like this – children never been "taught" how to draw a human figure, but HFD development happened as a consequence of the intervention program (mainly due to visuo-motor development elicited by the instrument called Organization of Dots).

2. Instruments focusing on memory, with learning components

Visual Transport

By using visual transport skills, the child must indicate the location of an object in a set of spatial relations that appear in the model. The task appears in ascending order of difficulty and complexity. (One page from the Visual Transport Test can be seen in *Appendix 8*.)

Associative Recall

The child has to remember the names of ten items with the help of associative links between the items and the reduced clues and symbols that represent them (e.g. a computer when a printed page or passage is presented).

3. *Instruments involving higher cognitive processes and mental operations*

Concept Formation by Inclusion

The child is required to form concepts by using processes of comparison, generalization, assignment of criteria, hypothesis and verification, and finally by forming groups with suitably defined categories.

Concept Formation by Elimination

The examinee is asked to eliminate one picture out of 5 pictures which does not belong; later, to eliminate two items out of the 6 which do not belong. This test examines the subject's ability to form a concept on the definition of the different item which has no relation to the target item(s). The subject is requested to identify common elements whilst disregarding irrelevant cues. The test is based on the child's general knowledge and demands the ability to compare, hypothesize and verify. (One sample page from the Concept Formation by Elimination Test can be seen in *Appendix 9*.)

Test of Inferential Thinking

The child is shown pictures of different situations and she is expected to answer questions that relate to the situations by using inferential thinking, for example the question asked in relation to two children fighting is " Who are the children who have to be separated? Show them to me." (One page from the Inferential Thinking Test can be seen in *Appendix 10*.)

Part-Whole and Functional Part-Whole

The Part-Whole requires the child to find the missing part in each of the four pictures given, whilst relating to shape, colour, direction, number etc. (One page from the Part-Whole Test can be seen in *Appendix 11*.)

Sequencing of Concepts: Progressions

The instrument 'Progressions' consists of 12 tasks, one problem per page, five simply drawn pictures presented in a vertical orientation. The pictures can be placed in serial order according to a principle which must be deduced (e.g. the birth of a chick). (One page from the Progressions Test can be seen in *Appendix 12*.)

Sequencing of Concepts: Picture Sequencing

The sets of the cards are not presented to the examinee in a sequential order, but rather determined by the examiner's assessment of the number of the number of sources of information the examinee can handle successfully and the complexity/abstraction of the story depicted in the sequence of the cards. Mediational strategies are described in Feuerstein & Feuerstein, 2006. (One page from the Picture Sequencing Test can be seen in *Appendix 13*.)

Absurdities

Absurdities are 10 cartoon-like drawings, each of them presenting an incongruity – a silly, funny, or functionally incorrect situation (like a man with moustache wearing a kitchen pan instead of a hat). The modality is pictorial with verbal logico-deductive components. This is a test assessing conceptual development and some of the pictures also enable the examiner to assess the individual's sense of humour and social awareness. The task is that the individual scan and analyze the picture and identify the incongruity, also later to find a solution which would eliminate the incongruity. The main objective of the instrument is to give the examiner insight into the conceptual processes of the examinee – if he/she has the ability to compare a depicted object (stimulus) with an internalized model of the object. (One sample page from the Absurdities Test can be seen in *Appendix 14*.)

Feuerstein uses partly existing tests, which are well known and are norm-referenced e.g. Rey-Osterrieth's Complex Figure test (widely used in neuropsychological testing); but do it in a 3 or 5-phase way. Sometimes he adapts existing tests, such as the Rey's verbal memory test, which is also widely used in neuropsychology; but Feuerstein changed the words and added a 16th, in order to allow the child to use categorization as a mnemonic technique.

The kind of test chosen depends on the child's level, motivation, difficulties. There is a logic in the choice of tests, in as much as diffent domains are covered, different modalities, operations, functions, degrees of abstraction and complexity. These are called "parameters of the cognitive map".

In contrast to "classic" diagnostic psychometric reports, LPAD reports conclusions are formulated in terms of observed changes. Since its purpose is not to give a diagnosis of deficient functions, but an evidence-based outlook on modifiability, the conclusions have to made accordingly. That does not mean that problems in (cognitive or affective) functioning are denied. The observed impairments are noted, but also the observed changes as a response to mediated learning intervention, the kind and intensity of needed mediation. It is this information which will have to be translated into recommendations for teachers and parents. Recommendations are given in a number of areas:

1. teaching academic subjects and skills (reading, writing, maths, etc.)
2. how to raise general cognitive functioning
3. how to raise the level of motivation (or affective/motivational processes)
4. how to regulate behaviour, if necessary
5. what kind of support is needed and when
6. what to do in the child's educative environment, in order to set up an active modifying environment, i.e. where all the people who are involved in caretaking or teaching, take up consciously an active role so as to raise the child cognitive's functioning.

Necessarily, LPAD reports will be longer than classic psychometric diagnostic reports, because they simply contain much more information. This means that it is of particular importance the way in which they are communicated. Time should be taken to communicate the results and their implications with parents and the concerned child, with teachers, with the team parents-child-teachers-support staff. Implementing an active modifying environment and educational intervention plan is based on the report.

The testing procedure of LPAD-Basic slightly differed from the usual way: the mediation phase is usually blended into the testing procedure, if the mediatee fails with a task, the level of mediation is lowered (that is, immediate help is given). For research purposes, in order to have scores about the number of items the mediate could do without any help, first we let our participants to go as far as they could alone (It is indicated as "Independently" in the individual tables of the cases or in *Appendix 15*). Then, we gave mediation and those scores present the zone of proximal development of the child (indicated as "With mediation" scores). Assessment with LPAD-Basic lasted from 16 to 20 hours in each cases.

Cognitive Abilities Profile (CAP)

CAP is a special tool on the palette of DA. CAP is a tool designed for observing the cognitive functioning of the learner (thinking processes in problem solving activities) and for consultation. It is not a concrete set of test batteries planned for dynamic assessments, but a *refined molar taxonomy of cognitive functions* and mental operations (intellective factors of thinking) *together with affective factors* (attitudinal and emotional variables). As we have pointed out earlier, these are much more intervowen in the low-performing child than in his mainstream peers, these are 'interdependent and transactional' – as argued by Deutsch & Mohammed (2010, p 1).

CAP is a *reliable dynamic instrument for use in long-term follow-up* – as cognitive functioning may change as a result of intervention. This tool ensured us that triangulation of our research is reached (Yin, 2003) – in the scores obtained not only the therapists' observations of the child's development or functioning is reflected who actually worked with the children, but those of the parents and classroom teachers as well. Both parents of each child has filled out the CAP as a survey with the help of the profiler (the writer of the thesis). Also, chief classroom teachers of our participants have been interviewed by CAP as a survey in every 6 months during the 24 months period.

CAP let therapists monitor changes in response to the cognitive intervention. The profile has been completed as a collaborative process between the therapists – but interrater-reliability has been insured by the fact that it was the same person (the profiler) who actually scored the test. Interrater-reliability is a crucial problem for researchers when it is the clinical population who are examined. Kozulin et al. when examining the effects of FIE-Basic on clinical populations with standardized psychometric tests pointed out that children sometimes gained less scores in the post-tests than in the pre-tests. „...the tester in pre- and post-tests were different. Normally, given the standardized nature of the WISC and Raven, this should not have mattered. The static nature of psychometric tests, however, has been known to disadvantage students with special educational needs, who are highly influenced by the context and person doing the testing" (Kozulin at al. 2010 p. 8.).

The CAP has been inspired by Feuerstein's taxonomy of cognitive functions, as described in the LPAD (Feuerstein, Feuerstein & Falik, 2008) – but this was not considered exhaustive, so many new or more refined functions we find in the CAP. Feuerstein's information processing model of the mental act (Input, Elaboration and Output) is kept in the CAP. Cognitive abilities analysis is derived from Luria (Luria, 1973, 1980) – grouping the cognitive-emotive functions into functional domains. CAP observes the child in the following functional domains: *Attention; Perception; Memory; Language; Logical Reasoning; Strategic Thinking; Metacognition; and Behaviours Affecting Learning*. Levels of ability or response are interpreted in the following way – letting the observer to analyse to what extent human mediation has been internalized (the aim is to produce independent learners who can directly analyze and process stimuli and adapt their behaviours to all situations in life):

N Not applicable/Not observed; 1. Is not able even with help/support; or does not respond 2. Only able with help/support, not independent; or some response is given 3. Sometimes able to do independently (not consistently); or inconsistence response 4. Consistently and independently able/responsive.

Due to copyright reasons we are able to give only one example of one of the CAP functional domains and cognitive taxonomy (*Table 5*).

5. Table: Cognitive Abilities Profile. The Cognitive Abilities of the Learner (BP: Baseline, R1: Review 1; R2: Review 2 etc.)

ATTENTION (AA)

Cognitive Ability		**Assessment Question**	**Profile Scores**				**Evidence**
			BP	**R1**	**R2**	**R3**	
AA1	Regulation of attention	How well can the learner regulate their attention so that they are focused on the task?					
AA2	Selective attention	How well can the learner filter out distractions?					
AA3	Shifting attention	How well can the learner shift their attention from one stimulus to another?					
AA4	Sustained attention	How well can the learner sustain attention over time?					
Total score							
Number of scored							
Average score							

1.4.2 Static Tests Used in Our Experiment

1. *Peabody Passive Vocabulary Test*:
A multiple-choice test, suitable for children from 2;6 to 8 years of age (the Hungarian version till the age of 10;11 years). It has been designed to measure the respondent's receptive vocabulary, generally interpreted as *verbal intelligence*. Administration of the test requires no reading by the respondent: the examiner reads aloud a series of stimulus words, and in each case the respondent selects a picture corresponding to the word from a set of four alternatives, the words being arranged within the test in ascending order of difficulty (Dunn & Dunn, 1997). Dunn and his colleagues have screened different populations of children with special needs with the PPVT -- children with motor disabilities, children having mild-to-moderate intellectual disability and deaf students as well. Concurrent validity of PPVT has been established using comparisons with other vocabulary tests. For example, the correlation of PPVT scores with the Stanford-Binet Vocabulary Subtest ranges between 0.68 and 0.76. The reliability of the PPVT was measured in two ways, the split-half and the test-retest. For the former, the reliability ranges from 0.60 to 0.80. For the latter, the range is from 0.70 to 0.90. The Hungarian version of the test includes 150 test items (Csányi, 1974).
2. *(Gardner) Expressive One-Word Picture Vocabulary Test*:

The purpose of the EOWPVT-R or Gardner Picture Vocabulary Test is to obtain an *estimate of a child's verbal intelligence* by means of the child's acquired one-word expressive picture vocabulary. It tests an individual's ability to name, with one word, objects, actions, and concepts when presented with illustrations. The EOWPVT-R is intended for children aged 2 years to 11 years 11 months (Gardner, 1990). The English version has a high degree of reliability for internal consistency, ranging from 0.93 to 0.97 for the various age groups, with a median of 0.95 across all ages. The test-retest correlation for raw scores is 0.98 and 0.97 for standard scores. The validity data support this test as an instrument for assessing vocabulary abilities across a wide range of ages. The English version has 100 test items. The Hungarian adaptation includes 79 test items (Csányi, 1990).

3. *TROG -- The Test for Reception of Grammar*:

The test assesses the child's understanding of a range of *grammatical structures.* It is appropriate for children aged 4;0 to 13;0 years (Bishop, 1983). The author of the test has examined its validity comparing its raw scores to those of the PPVT. In the British standardisation sample concurrent validity has been 0,77 between the two tests. The test is highly recommended for the assessment of the clinical population – children and adolescents with William-syndome, Down-syndrome, aphasia or acquired language disorders (Lukács, 2005). There are four pictures on a page and the client has to point at the one matching the sentence or phrase he/she hears. There are 18 blocks in the test, each having 4 items (72 items all).

4. *Screening Test of Language Development* or *PPL*:

A screening test for detecting possible language development disorders. Intended for children aged between 4;0 and 8;0. The test has been used for monitoring language development of children Williams-syndrome and Down-syndrome *(*Pléh, Palotás & Lőrik, 2002). The test has 42 test items. We have administered the test in only such cases where morphological development of the child has been markedly low.

5. *Raven's Coloured Progressive Matrices* or *CPM*: Raven's CPM usefully provide an assessment of non-verbal ability, and is designed for young children ages 5:0-11:0 years (Raven, 1938). The CPM contains three sets (A, AB, B), each having 12 items, altogether 36 items. The association with other cognitive tests is moderate to substantial (.33 and .54). The alpha coefficients ranged between 0.81- 0.91 with a median of 0.88. The test has been administered by an external evaluator (clinical psychologist).

6. *DIFER, Test Battery for Diagnostic Assessment of 4-9 Year-Old Children*: József Nagy has extensively researched the abilities of preschool and early primary school children with regular intelligence since the 1970's in Hungary. His conclusion is that the marked differences in the abilities of preschool aged children will be deepened by the school-years. Children's results in the 1st grade highly correlate (0, 86) with their achievements in the 8th grade (Nagy, 1974, p. 40 cited by Nagy, 2009). He and his colleagues at Szeged University Institute of Educational Sciences have completed a preventive diagnostic system for children of 4-7 years, the so called PREFER, which has been widely used in Hungarian kindergartens since the 1980's with at-risk children as well (Nagy, 1986; Józsa & Zentai, 2007). The extended version of PREFER, the so called *DIFER, a Test Battery for Diagnostic Assessment of 4-8 Year-Old Children* has been issued in 2004 (Nagy, Józsa, Vidákovich & Fazekasné, 2004). The criterion-oriented test measures *basic abilities essential for school learning* in the following seven domains:

--*Copying parts of letters*. Coordination of handmovements are essential for later development of ortography.

--*Phoneme awareness* (e.g. difference between two sounds, later two words). Phoneme awareness is crucial for proper perception of human speech. It is also the basis for the decoding phase of reading.

--*Vocabulary for relations*. Clear decoding of relations between different pieces of information in linguistic modality is contingent upon the development of vocabulary for relations. Speech comprehension is well-developed if the listener can analyze relationship between concepts (Nagy, 2009).
--*Basic numeracy* (e.g. counting, mathematical operations with sticks, recognising numbers, recognising digits). Some elements of basic numeracy are the following: counting, inverse operations, addition, substraction, recognising quantity and numbers etc. Basic numeracy is the basis for later mathematics education (Józsa, 2007b).
--*Hypothetical thinking* (e.g. If… then…) and *Relationships based on experience* (If only…; Not only if…) are critical aspects of thinking.
--S*ocial skills.* Basic social motifs and skills are responsible for children's successful integration into school life. Moral sense is crucial for interpersonal relations.

Performance in the different domains will clearly indicate which basic ability needs to be developed. The test differentiates between five possible performance levels: preparatory level; beginner; advanced level; final level and optimal level (Nagy, Józsa, Vidákovich & Fazekasné, 2004). Critical basic skills need to be at the optimal level for appropriate school maturity.

Fazekasné Fenyvesi Margit and Krisztián Józsa have successfully administered the test for children with mild intellectual disability -- given a longer administration time. The seven domains have been suggested to be differentiated for different sessions in case of this population (Fazekasné & Józsa, 2006a; 2006b; Józsa, 2011). Radványi, Fazekasné & Radicsné have tried some of the domains of the test to be blended into the Heidelberg Competence Inventory with children with moderate intellectual disability in integrated school settings where children with mild and moderate intellectual disability have studied together (Radványi, Fazekasné & Radicsné, 2012). Positive experience have been indicated by DIFER in case of this population as well.

DIFER test has two versions ('short DIFER' and the regular one) (Nagy, Józsa, Vidákovich & Fazekasné, 2004). We have used the *longer version* of DIFER in our research with the exception of 'Social skills', since this part's complexity and the level of abstraction proved to exceed the skills and moral values of children with (moderate) intellectual disability.

As for the testing procedure we note that administration of the diagnostic test system happened slightly differently than the regular testing procedure described in the manual, but totally in line with the recommendations given for children with learning disabilities (Józsa, 2011). We administered the different domains of the test in different therapy sessions, and usually after 3-4 test items we kept a break. If the child seemed to be down we postponed the administration of the test for the next day.
We *repeated* the instructions till their registration happened by the learner. In order to avoid attention problems and blurred and sweeping perception, we instructed the child with *greater animation* than usual in testing situations. We ensured that the child would be motivated to register the task and carry out the mental operation(s) by showing the prospects of a much easier activity later. If he/she gave a proper answer we accepted it – if not, we did not give further help but moved to the next item.
Where serious symptoms of attention deficite (AD) has been detected, we *covered the distracting brackets* on the page with a white sheet of paper so that the child could concentrate on the actual item.
Due to these reasons testing time was much longer than in case of mainstream populations.
7. *Goodenough-Harris Drawing Test (GHDT) for the Assessment of Human Figure Development:* The 'Draw-a-Man-Test' was introduced by Goodenough (1926) to assess children's mental development. Later the test was revised and renamed by Machover (1949)

as Draw-A-Person Test (DAP). Its goal was redefined to assess psychological maturity in 1961. The scoring was sufficiently reliable and correlated well with intelligence test scores (Goodenough, 1926). Fabry and Bertinetti (1990) found substantial and significant correlations between the number of details in DAP test results and WISC–R (Wechsler, 1989) Performance IQ (.69), Verbal IQ (.45), and General IQ (.62), respectively, in 6- to 10-year-old children with behavioral and emotional problems (Laak, et al. 2005). The Hungarian quantitative scoring system version of the Goodenough-scale analyzes fourteen different aspects of the drawings (such as specific body parts and clothing) for four various criteria: detail (17 items), complexity (12 items), proportion (6 items) and motoric coordination (13 items). In all, there are 48 scoring items for each drawing.

Paralell with the general developmental aspects, children's human figure drawings have other special characteristics and may reveal the *personality* and *character* of the creator. Therefore we can evaluate children's drawings as projecting mechanism. I use Maria Feuer's books to analize children's drawings from this point of view (Feuer 2000; 2006).

Testing procedure was the ususal: after the instruction 'Please, draw a person. As beautifully as you can' the child started to work. We usually used markers instead of pencils as many children had problems with low pressure.

However in most cases children's drawings were spontaneous drawings which means their actual mood and cognitive state has been revealed in the drawing.

2 Detailed Case Studies – Description of Individual Results

In this section we present our case studies. Summary of Static Pre-test and Post-test results are shown in *Table 6*. Pre- and Post-test results gained by dynamic assessment systems are presented in the individual case studies or in *Appendix 15*.

6. Table: Summary of Static Pre- and Post-test Results

	Medical Condition and Original Diagnosis	**Raven Pre-Post**	**Pea-body Pre-Post**	**Gard-ner Pre-Post**	**TROG Pre-Post (mental age)**	**Gooden ough Pre-Post (Drawi ng Quotien t)**	**DIFER (mean) % Pre-Post**
Case 1 Age Pre - Post 8 – 10	**Moderate intellectual disability (Unknown X-linked genetic syndrome with Marfanoid habitus)**	**10 – 18 Percentile <5 -- 5**	**12 -- 113**	**19 -- 72**	**--**	**Categor y 'A' – 61**	**Not possible to administer – 62,8**
Case 2 Age Pre - Post 5;5 – 7;6	**Mild intellectual disability with autistic features**	**14 – 27 Percentile 5 -- 85**	**18 -- 63**	**17-- 50**	**--**	**68 -- 90**	**23, 6 -- 81,3**
Case 3 Age Pre - Post 5;7 – 7;7	**Moderate intellectual disability with motoric aphasia; perinatal brain injury**	**7 – 15 Percentile <5 -- 25**	**12 -- 83**	**0 -- 69**	**--**	**Categor y 'A' -- 105**	**Not possible to administer – 57,1**
Case 4 Age Pre - Post 12;7 – 14;7	**Moderate intellectual disability with genetic etiology (Fragile X-syndrome)**	**14 – 20 Percentile <5 -- 5**	**101 -- 131**	**30 -- 77**	**--**	**38 -- 60**	**Not possible to administer – 77,1**

Case 5 Age Pre - Post 7;5 – 9;5	**Moderate intellectual disability with epilepsy (Dravet-syndrome)**	**14 – 20 Percentile <5 – 10/25**	**64-92**	**36 -- 72**	**--**	**52 -- 81**	**31,6 -- 81**
Case 6 Age Pre - Post 6;6 – 8;6	**Average/Mild borderline intellectual disability**	**15 – 28 Percentile 25/50– 75/90**	**54 -- 101**	**35 -- 68**	**4;0 – 7;0**	**76 -- 110**	**40,1 – 62,6**
Case 7 Age Pre - Post 5;2 – 7;2	**Mild intellectual disability with autistic features**	**13 – 20 Percentile 10 – 50/75**	**42 -- 83**	**27-57**	**3;5 – 6;0**	**88 -- 98**	**56 – 67**
Case 8 Age Pre - Post 14;8 – 16;8	**Moderate intellectual disability and paraplegia; severe epilepsy**	**14 – 21 Percentile <5 -- <5**	**68 -- 141**	**42 -- 76**	**3;5 – 7;5**	**41 -- 48**	**31 -- 78**
Case 9 Age Pre - Post 6;8 – 8;8	**Moderate intellectual disability, severe speech disability**	**0 – 24 Percentile 0 -- 50**	**1-13**	**0 -- 5**	**Non-verbal child**	**60 -- 78**	**Non-verbal child**
Case 10 Age Pre - Post 10;11– 12;11	**Autism**	**23—36 Percentile 10 -- 95**	**21 – 32**	**9 -- 36**	**0 – 3;0**	**69 -- 83**	**0 -- 52**
Case 11 Age Pre - Post 6;3– 8;3	**Severe autism and Moderate/Severe intellectual disability**	Not possible to administer	Not possible to administer	**0 -- 3**	Not possible to administer	**Category 'A' -- Category 'A'**	Not possible to administer
Case 12 Age Pre - Post 7;8 – 9;8	**Moderate intellectual disability (Cerebral Paresis)**	**0 – 4 Percentile 0 - <5**	**13 -- 48**	**8 -- 28**	**0 – 3;5**	**Category 'A' – 52**	Not possible to administer
Case13 Age Pre - Post 2;8 – 4;8	**Moderate intellectual disability with genetic etiology (Down-syndrome)**	Not possible to administer	**8 -- 56**	**0 -- 19**	Not possible to administer	**Category 'A' – 102**	Not possible to administer
Case 14 Age Pre - Post 4;8 – 6;8	**PDD with borderline normalcy/mild intellectual disability**	**0-14 Percentile 0 - 25**	**14 -- 60**	**8 -- 38**	**<2;0 – 5;0**	**Category 'A' – 98**	**0 -- 41**
Case 15 Age Pre - Post 7;0 – 9;0	**Borderline between normalcy/mild intellectual disability**	**13 – 28 Percentile 10 – 50/75**	**108 -- 132**	**55 -- 71**	**7;0 – 10;0**	**90 -- 120**	**47,6 -- 81,1**

2.1 Case Study: Participant Nr 1

Baseline Information and History of Standard Testing

The Budapest Binet test has been administered to our participant at the age of 4;6 by the 'Number 4 National Expert and Rehabilitation Committee' in Budapest. His measured IQ score was 44. Our participant has been exposed to several intensive therapies till the age of 7;6 without any relevant effects on development.

SON test (Snijders-Oomen Nonverbal Test) at the age of 7;5 has still indicated serious psycho-motor developmental delay, lack of eye-hand coordination, "no spontaneous human figure drawing, only scribbled circles" and non-relevant improvement only in gross motor development and speech. Measured IQ score has been still 43. His BNO code was: F 71. His

medical condition and diagnosis included moderate mental retardation with genetic etiology (unknown X-linked syndrome) with Marfanoid habitus and unknown metabolic disease.

Dynamic Assessment (Pre-test)

Our participant has been assessed by Feuerstein's LPAD-Basic for 16 hours in Jerusalem by the International Center for the Enhancement of Learning Potential in 2007. His modifiability in conceptual and linguistic areas has been considered relevant – but experts indicated strong resistance and fear of failure in the child's affective behavior. Especially if the little boy had to do higher mental tasks, he would feel threatened, and immediately terminate the work if he sensed he may not be „enough" to carry out something or the task was considered too high. Therefore „errorless learning" has been suggested as a way of teaching besides MLE.
It was very difficult to make him sit still at a table and make him cooperate. It took about four weeks for his assessors to make him pay attention for 5-10 minutes without temper tantrums.
The postulated deficit cognitive functions were extreme impulsivity, lack of conservation of constancies (size and shape), lack of planning, lack of orientation in space, difficulties in visual transport and projecting virtual relations. His report included a great deal of occulomotor dysfunction – his eye movements did not separate from the movements of the head; he had convergence insufficiency and problems with binocular vision. Goodenough Human Figure Drawing Test showed category "A" before intervention.

Our participant did not like if he was stopped to do dangerous activities (like approaching a plug with his fingers) – whenever he was said 'no', he would hit her mother or father. His report included that his bonding with the mother was rather symbiotic and he showed a great deal of learned helplessness.

Detailed Description of Intervention

After his assessment in Jerusalem, his cognitive intervention procedure has been carried out in Budapest. Our participant has been exposed to MLE interventions for 24 months, between the years of 2007 April – 2009 April. Type of intervention was one-to one sessions and the intensity was 15 sessions per week. His age was 8;6 at the start of the acceleration period.

The child has been exposed to general mediated learning experience for 3 hours a day. Instrumental Enrichment Basic – Organisation of Dots tool has been applied by a therapist in 4 sessions per week. Besides the tool, thorough mediation of shapes and size has been given in verbal modality in the therapy sessions – with a lot of transfer to daily life on shapes. His treatment included Compare and Find the Absurd; Identifying Emotions, altogether for 6 hours per week. He has been mediated adaptive behaviours and primary cognitive behaviours (attending to stimuli, focusing, imitative behaviours, symbolic play, question and answer responses, initiatory/adaptive play) for 5 hours per week.
Our participant has given lots of trial and error responses when asked to label the persons or objects on a page divided into four parts (eg. The tool 'Identifying Emotions' or the PPVT or Gardner's expressive vocabulary test). A 'butterfly' would be labelled as 'ladybird' or an 'ostrich' as a 'bird'. He had very poor vocabulary – he would use single words in a holographic sense ('car' meaning 'lets go'). Higher mental categories like 'vegetables' or 'dairy products' or 'musical instruments' were missing from his conceptual development. Therefore our staff has put a lot of emphasis on making him recognize, label and categorize objects very precisely and systematically on the concrete level first. Then more abstract working concepts (categories of fruits, professions, jewellery etc.) has been mediated to him. Also, criteria of comparison had been systematically transmitted to him (what it means to compare according to height, colour or shape). We made him systematically observe objects

and label their characteristics precisely. Then he was made carefully remember where he has seen such object before or what the object may resemble (transfer).

Effects of the intervention have been visible from the 4th week. He started to attend stimuli and started to enjoy labelling the world around him. By the end of the 3rd month he was able to work for 4-5 sessions actively with 15 minute breaks. From the 4th month his vocabulary has increased to such an extent that he started to formulate 'why' questions (e.g. '*Why do cats like milk to drink? Why do people get on the trains?*') He became very demanding in terms of interactions – after 3-4 session per day he would want to continue learning. His behaviour started to normalise – whenever he felt frustrated instead of screaming or lying on the floor he would verbalize his problems: '*This task is too difficult. Help me!' 'This task is too boring. I don't like it.*' He learned to recognize and label his feelings and regulated his emotions much easier.

His parents indicated that his questions have become more and more abstract at about the 6th month of the intervention: '*What happens in the banks, father, I do not understand*? *Why do people take their money there*?' '*Why do you love me, daddy? Please, give me reasons.*' '*I don't understand, what will happen with the fire after it has burnt? Where does it disappear?' 'How can doctors heal people, mother*?'

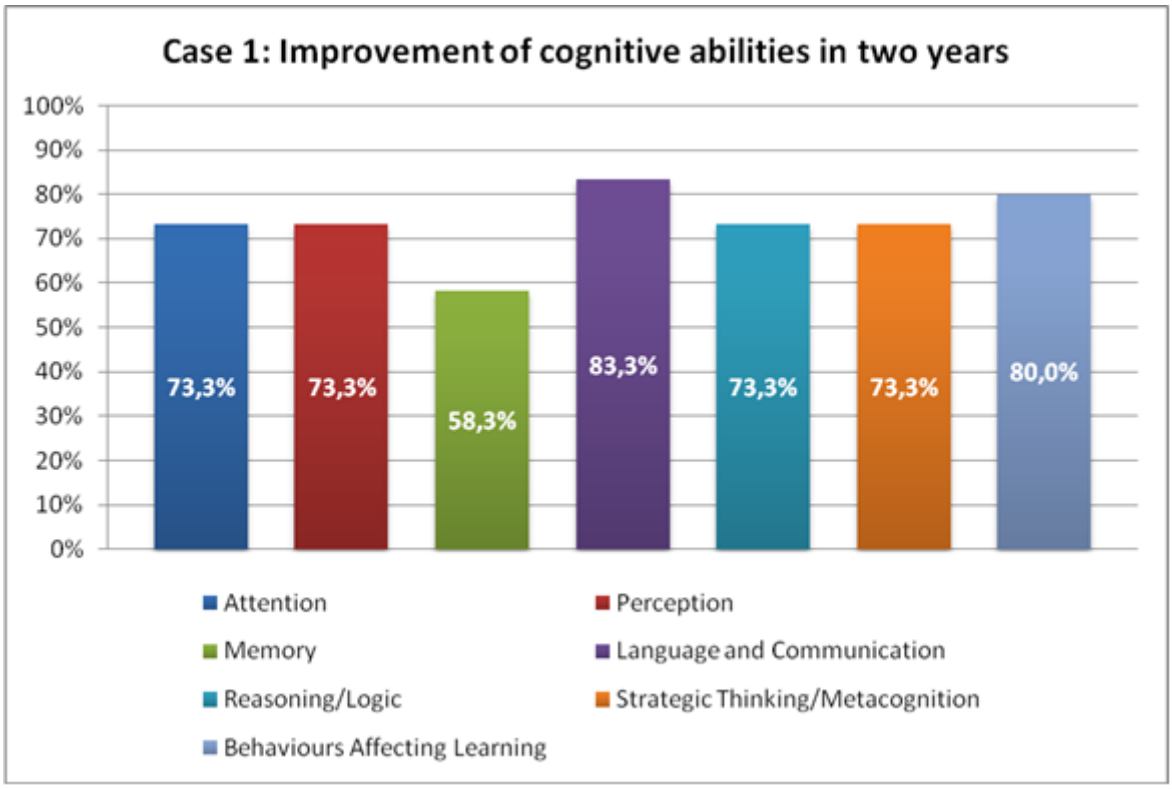
Our participant started to treat objects according to their real function and became interested in cause and effect processes. He developed a constant comparative behaviour by the end of the first year and his episodic world-view has changed. Though he still had serious problems with spatial and time orientation, he was not afraid from novel situations or problems anymore. He would immediately indicate if he has seen an anomaly or something strange in his environment. He warned his therapist one day: '*Klaudia, I see a problem outside. It is daylight and the neighbour has left the lights on! They should switch it off!*'. His perception started to develop due to internalized cognitive and metacognitive strategies.

Case 1 has become more able to benefit from human mediation if we compare the pre-test and the post-test phases of LPAD-Basic assessments (*Table 7*).

7. Table: LPAD-Basic Assessment Results (Case 1)

	Maximum scores possible	**Pre-Test**		**Post-Test**	
		Independently	**With mediation**	**Independently**	**With mediation**
Spatial Orientation	62	62/10	62/15	62/44	62/55
Mazes	16	16/0	16/1	16/5	16/7
Visual transport	16	16/0	16/4	16/5	16/12
Concept Formation with Inclusion	40	40/0	40/2	40/1	40/40
Concept Formation with Elimination	30	30/2	30/4	30/20	30/30
Test of Inferential Thinking	6 and 10	6/4 and 10/2	6/4 and 10/3	6/6 and 10/8	6/6 and 10/10
Part-Whole	22	22/7	22/11	22/17	22/22
Functional Part - Whole	16	16/2	16/8	16/15	16/16
Progressions	12	12/3	12/8	12/9	12/12
Picture Sequence	18	18/2	18/2	18/12	18/18
Absurdities	10	10/0	10/0	10/7	10/10

According to Cognitve Abilities Profile his improvement has been most dynamic in in language and communication (83,3% points), behaviours affecting learning (80% points), strategic thinking (73,3% points) and perception (73,3% points) according to Cognitive Abilities Profile (*Figure 11*).



11. Figure: Improvement of cognitive abilities in two years in percentage points (Case 1)

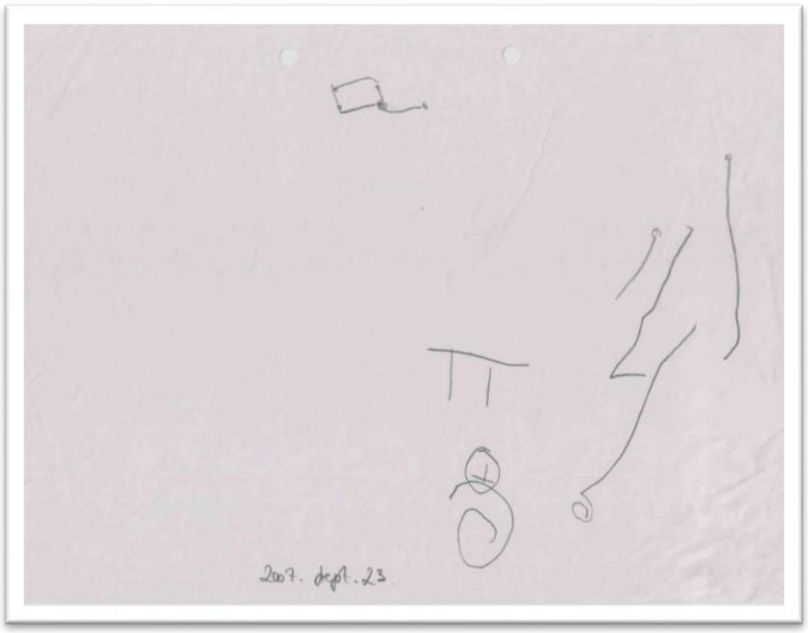
Static test results have indicated the same: his language development has been the most striking. His mental age has changed from 2;6 to 10;0 years according to Peabody Passive Vocabulary Test. The boy's expressive vocabulary has been normalised within 24 months, according to Gardner Expressive Vocabulary Test. His Raven test scores have changed from 10 raw scores to 18.

It was not possible to administer the DIFER test for the 8 year-old child due to impulsivity and resistance at the start of the intervention. 23 months later in the domains of Phoneme awareness and Relationships based on experience he reached optimal and final levels. In all the other domains he was still at preparatory or beginner level (*Appendix 15*).

Human Figure Drawing Development (Case 1)

12. Figure: Case 1. Pre-test Human Figure Drawing, April 2007. Raw Score: 1. DQ: Category A.

The level of the drawing is in the pre-schematic stage, when the first circular form appears. Compared to the child's chronological age, this is rather delayed. The reason that it is not drawn by pencil is that the child's weak muscle strength and eye-hand coordination would not ensure enough success to leave marks on the paper. The name of the child and his age has been written by his Israeli therapist from the opposite side of the paper.



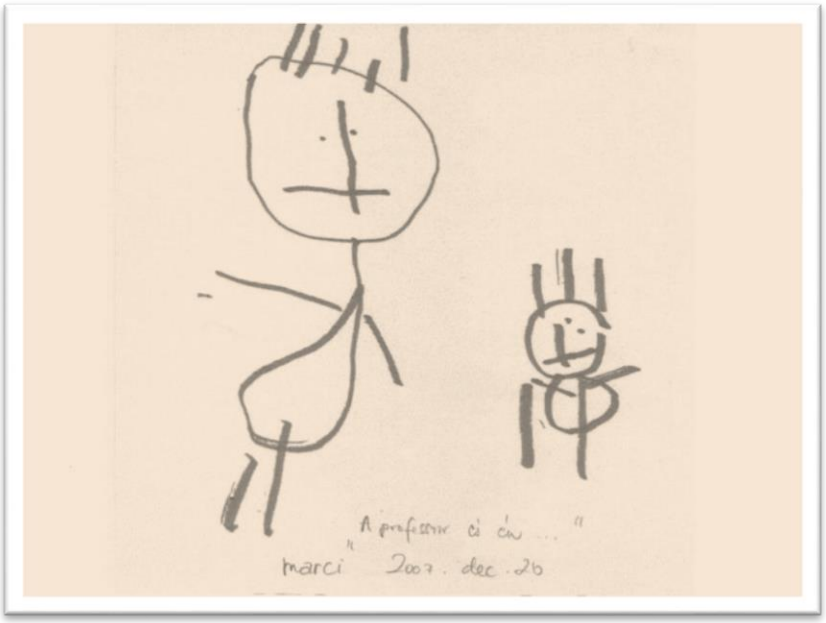
13. Figure: Case 1. Spontaneous Human Figure Drawing, after a session in the presence of his father. The title of the drawing: „It is me". September 2007. DQ: 47

In the 3rd month of the intervention, the child started to show a tendency to make relationships between episodic data. Obviously he started to integrate his visual and visuo-

motor skills. The effects of 'Organisation of Dots' tool are visable in the drawing: one square form can be seen and a few dots. The first vertical and horizontal lines comprise the visual organisation of the child on the right hand side of the picture. According to Feuer, the first vertical lines indicate the first differentiating tendencies in the child's life. Symbolically this is 'the first action of creation, differentiation between good and bad, darkness and light. The first steps to self-awareness'. (Feuer, 2006, p 28).

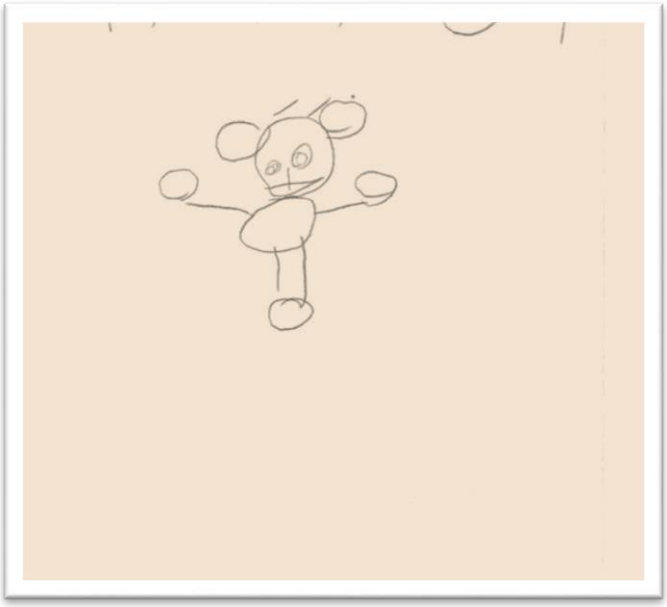
14. Figure: Case 1. Spontaneous Human Figure Drawing. Title given by the child: „A Man with a Sun" and „Paul with Football". October 2007. DQ: 55

The fact that he continues to give titles to his drawings indicates that he started to realize the world can be represented on paper. Two items appear in the drawing (a man and his football) which indicate the widening of his psychic field. Later during the day he draws a man and a sun – meaning he started to crystallize his new skill. The drawing still indicates visual problems (the legs do not touch the body) and problems with spatial orientation on the page.



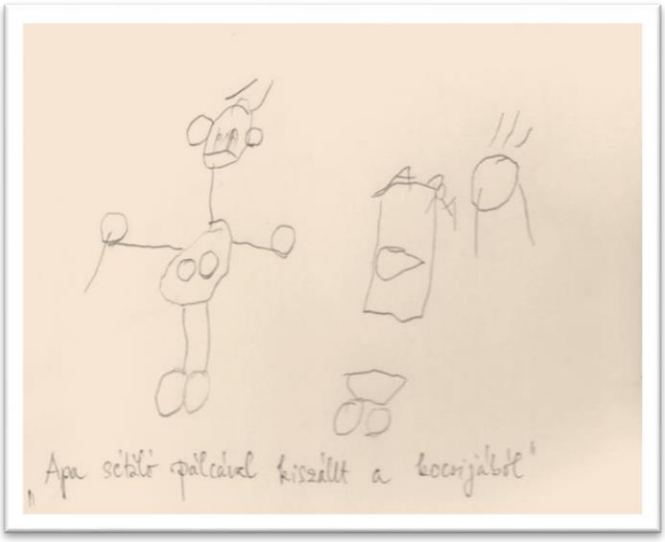
15. *Figure: Case 1. Spontaneous Human Figure Drawing. Title given by the child: „Reuven Professor and Me". December 2007. DQ: 71*

The adult figure is taller then him. This is the 6th month of the intervention.



16. Figure: Case 1. Spontaneous Human Figure Drawing. Title given by the child: „Myself". October 2008. DQ: 60

Spontaneous drawing of himself. The ears are located a bit higher. One of the feet is missing. The child has problems with body image and spatial orientation.



17. *Figure: Case 1. Spontaneous Human Figure Drawing. Title given by the child: „Dad has just got out of his car with his walking stick". January 2009. DQ: 79*

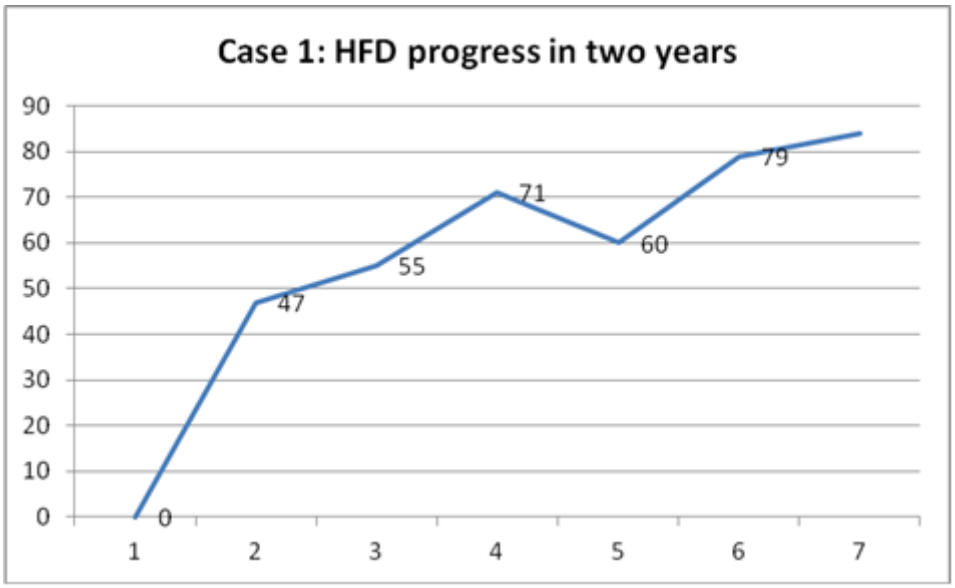
The first pieces of clothing appear. Buttons on the chest of the figure and a walking stick. The figure of the father is sublimated into a 'Lord'. The human figure is taller then his car. According to Lowenfeld it shows the subjective value and importance of the beloved person. The car has two parts, one with the window, and one with the two wheels, but they are not connected. The child still has problems with spatial orientation, especially in two dimensions. The sun is shining in the picture.

18. Figure: Case 1. Post-test Human Figure Drawing. Title given by the child: „My Father and his castle and his horse, just pulling a cart. My father is a king and I try to depict his robe on his arms". April 2009. DQ: 84

The father is an absolute 'King' by this time. He has a crown on his head and a robe on his arms. The figure is still larger then the castle or the horse which shows his importance. A very detailed picture. The naming (title) indicates a very rich conceptual development and vocabulary.

As these drawings reveal, the sun is often a thematised object in his drawings – even though motorically he is not up to the task yet, since our participant still has problems with motoric rotation. Feuer explains when the sun is often present in the child's drawings it means: „The

sun is the male principium, day and light. Yes, unique, active, opening up, consciousness, alertness, gold – some of the meanings which can be attached to the sun. Feuer, 2006. 37."
Our participant has developed from the pre-schematic stage to the schematic stage. *Figure 18* indicates the intensive development of human figure drawings of Case 1.



19. *Figure: Human Figure Drawing of Case Nr1 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)*

Summary of Post-Test Results Participant Nr 1
Case 1 has developed in language and communication, behaviours affecting learning and reasoning. An independent examination has also supported the general development of the child carried out by a local psycho-pedagogical committee in the last month of the intervention at the age of 10. Let us quote it: "The little boy shows a meaningful development in language, spatial orientation and human figure drawing. His present condition is closer to category mild than moderate retardation. At this point we cannot judge his IQ." Post-test: Goodenough IQ was found to be 61 at the Comittee.

2.2 Case Study: Participant Nr 2

Baseline Information and History of Standard Testing
Our participant's condition has been evaluated by one of the National Psychological Committees at the age of 5;3 with MAWGYI III. standardized test battery. The Committee indicated an IQ score of 53. Goodenough Scales: 4 points (age norm 11 points). His diagnosis was moderate mental retardation and comorbid autistic features, respectively obsessive attachment to mechanical items (lawn-movers or the gardening chain stores, Praktiker). Neurological medical reports has not indicated any deviation from general child development.
Dynamic Assessment (Pre-test)
Case 2 has been brought to us for dynamic assessment at the age of 5;5 by his parents. The main concern of the family was the little boy's emotional fluctuation – the change from heavy crying to strange laughter; in other occasions he would show very sudden physical agression especially against the mother. Dynamic Assessment procedures with LPAD Basic indicated extreme resistance to MLE, it was difficult to penetrate into the child's sensorial „aura". It was obvious, the boy had difficulties mainly in the input phase, namely very short attention

span; lack of labels but relevant modifiability in verbal-conceptual modality; very poor language both at receptive and expressive level. His deficient functions included sweeping perception; unsystematic search; egocentric communication; lack of labels – lack of superordinate concepts; lack of time and spatial orientation; no need for accurate data gathering. From elaboration phase: no definition of the problem; lack of planning behavior; episodic grasp of reality; no hypotethical thinking; problems with visual transport; no comparing behavior, spontaneous comparing.

He did not have a concept of number. Very strange intonation and echolalia characterised him, he would formulate his answers in questions.

Detailed Description of Intervention

Time of intervention was 25 months, between January 2007 - February 2009.

The intensity of intervention was 15 sessions/week in the first year, and 12 sessions from the second half of the intervention. The main tools for intervention were Organisation of Dots IE Basic with strong bridging to daily life; Compare and Find the Absurd tool; Emotions; and Cognitive games with mechanical objects (Sequencing; Spatial Orientation; Analogies).

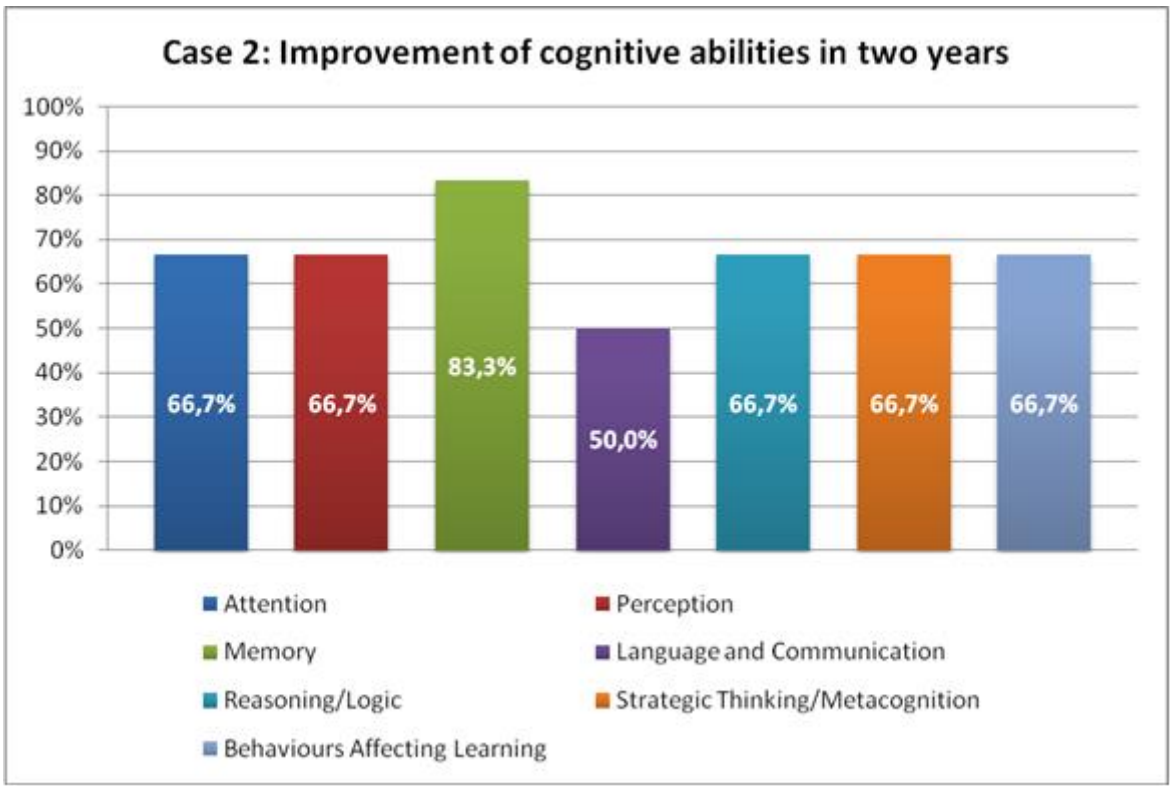
Case 2's development is just the opposite of Case 1 in terms of its dynamism. His therapists have nearly gave it up, since *in the first year he showed very little signs of modifiability*. The staff have emphasized Intentionality and Mediation of Meaning from the criteria of mediated learning experience when working with him. Lots of turn-taking situations have been created to differentiate between the concepts of 'me' and 'you', since we sensed the boy had problems attributing feelings and implicit intentions to others. We suspected of severe Asperger-syndrome, which has been proved later by an expert committee specialised in autistic children. Since his parents insisted we should continue working with the little boy after the first year, we introduced the tool 'From Empathy to Action'. We continued the transmittion of slightly abstract conceptual categories ('vehicles' or 'adults' or 'wild animals').

Very slowly he started to benefit more and more from human mediation (*Table 8*). His development became really spectacular for the second year.

8. Table: Case 2 LPAD-Basic Assessment Results

	Maximum scores possible	Pre-Test		Post-Test	
		Independently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/15	62/30	62/43	62/60
Mazes	16	16/4	16/5	16/9	16/16
Visual transport	16	16/7	16/16	16/12	16/16
Concept Formation with Inclusion	40	40/0	40/3	40/7	40/40
Concept Formation with Elimination	30	30/7	30/10	30/20	30/30
Test of Inferential Thinking	6 and 10	6/2 and 10/2	6/2 and 10/3	6/4 and 10/8	6/6 and 10/10
Part-Whole	22	22/7	22/14	22/18	22/21
Functional Part - Whole	16	16/5	16/7	16/12	16/16
Progressions	12	12/0	12/3	12/10	12/12
Picture Sequence	18	18/0	18/2	18/18	18/18
Absurdities	10	10/0	10/1	10/4	10/8

His improvement has been most dynamic in in memory (83,3% points). He has changed least in language and communication (50% points) according to Cognitive Abilities Profile (*Figure 20*).

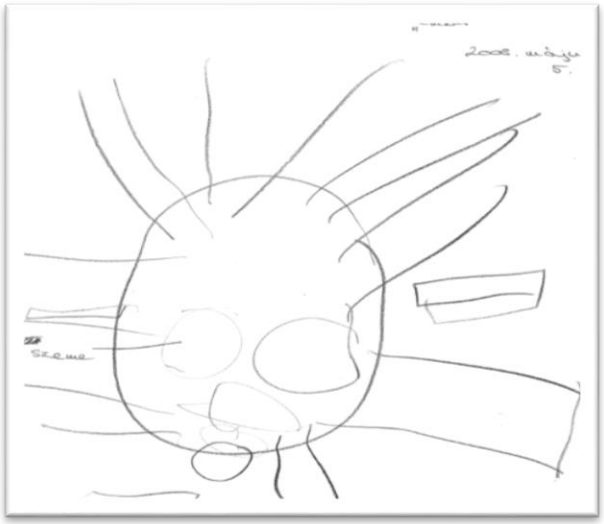


20. Figure: Improvement of cognitive abilities in two years in percentage points (Case 2)

Human Figure Drawing Development (Case 2)

21. Figure: Case 2. Pre-test Human Figure Drawing, January 2007. DQ: 68.

A real tedpole figure: head and legs. A scribble can be found on the left hand side and a horizontal line on the right.



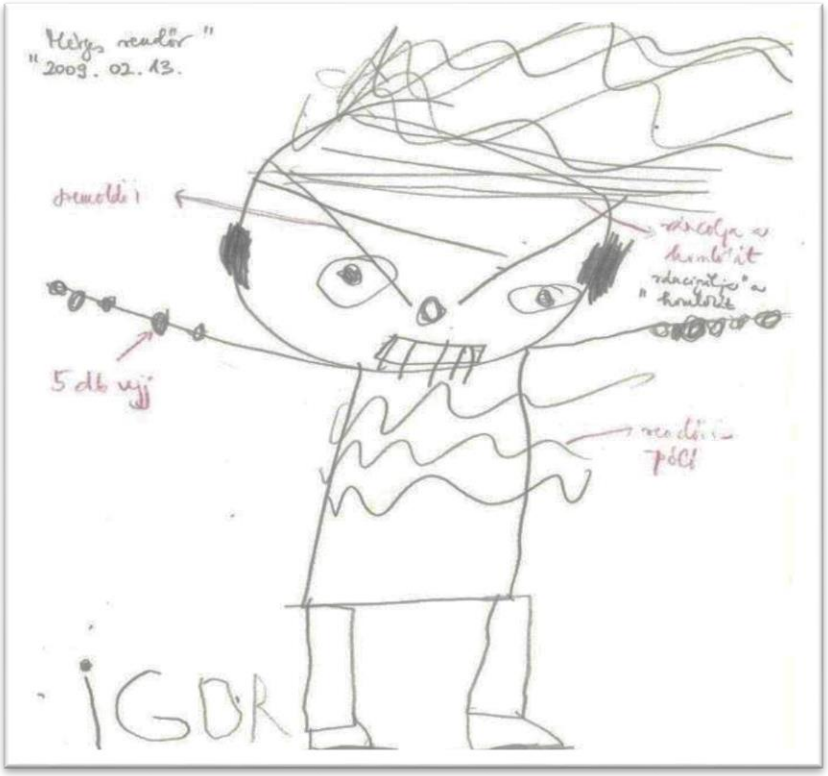
22. *Figure: Case 2. Spontaneous Human Figure Drawing, May 2008. DQ: 69*

This is the 16th month of the intervention. The little boy's drawling development is visible from his drawings as well. At this point he was still rather slow in his mental processing, and the therapist's general opinion was that it was very hard to approach him and penetrate into his cognitive processes.

The rectanges indicate that the boy has been exposed to the tool 'Organisation of Dots'. The ears are indicated by rectangles as well. There is hair all over the circular shape. A rather unbalanced human figure with huge eyes and nose. For 16 months he has not drawn at all in a spontaneious way. Our participant had a lot of echolalia – he had repeated the therapists's sentences two-three times till he grasped some meaning. He registered instructions very slowly. His general development had been very slow in the first one and a half years of the intervention.

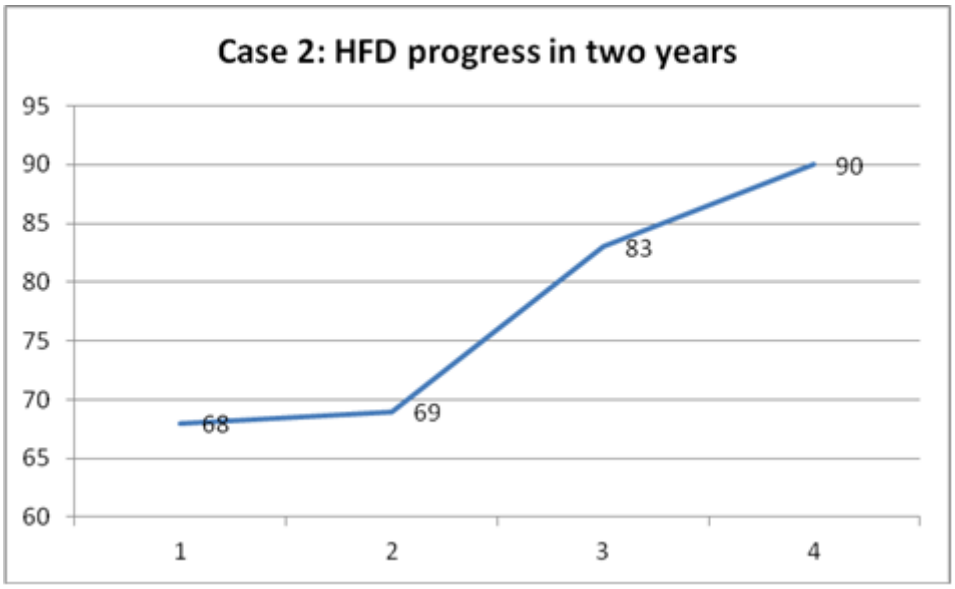
23. *Figure: Case 2. Spontaneous Human Figure Drawing, October 2008. DQ: 83.*

In the 20th month of the intervention an unexpected and sudden breakthough started. He presented less echolalia and his speech comprehension started to improve. The breakthrough has been reflected in his human figure development as well (*Figure 22*).
A real 'X-ray drawing', with the terms of Lowenfeld (Lowenfeld,1947) since the little boy shows the human figure from the inside as well. The nose and the hair are rather realistic – the drawing very much resembles to him.



24. Figure: Case 2. Post-test Human Figure Drawing. Title given by the child: „The Angry Policeman". February 2009. DQ: 90

Our participants development has become very dynamic by the 24th month. The detailed title given by the little boy indicates spectacular conceptual development. Though not a positive emotion is depicted yet, his words indicate a great deal of abstract thinking which he would not have before. We have noted his explanation: '*The policeman is wearing a policeman-T-shirt. He has wrinkles of anger on his forehead. The wind is blowing his hair.*' A motion has been put into two dimensions, he tries to depict the hair blown by the wind. The figure has clothes and very realistic shoes. This drawing is in the stage of realism.
The number of the fingers are precise, this shows a stronger body image and concept of number.
Our participant has developed from the pre-schematic stage to the end of the schematic and the beginning of the so called realistic stage in two years. Our explanation of the situation is best described by the words of Feuerstein (personal communication) that it took us 'two years to make cracks on the boys autistic aura'. *Figure 24* summarizes the development of his human figure drawings.



25. Figure: Human Figure Drawing of Case 2 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of Post-Test Results Participant Nr 2

As it is indicated by test results, our participant's development has been blocked a great deal till the age of 5;5. According to dynamic tests he could not benefit much from human mediation in the beginning (*Appendix 15*, CAP results). However, due to active intervention and systematic human mediation, his developmental curves has become steep and dynamic – his human figure drawing has normalised and both everyday experience and his test resuls indicated normalisation of most functions.

His Raven scores have changed from 9 to 27 raw scores within 25 months. His DIFER test results have changed from Preparatory stage to Optimal/Advanced/Final stage in all the domains in two years (*Appendix 15*).

His mental age according to PPVT has changed from 3;0 to 6;8 mental age (his cronological age was 7;6 years at the end of the intervention). His linguistic abilities stayed a bit modest compared to his cronological age, however he could fluently and adequately conduct conversations and socialize. Case 2 could continue his academic learning in a regular school and has learned how to read and write in the following school year after the end of our intervention.

2.3 Case Study: Participant Nr 3

Baseline Information and History of Standard Testing

'Participant 3' was a beautiful little girl with shiny blue eyes. She had visible gross motor problems and definite fine motor problems. The child has been evaluated by an Expert Committee in Baranya county at the age of 5;0. Delayed psychomotor development and a moderate level of intellectual disability was indicated: FQ=44. Her BNO codes were: F 80.1 (motoric aphasia) and F 71. She has been included into a regular kindergarden and her treatment included 7 Ayres sensomotor therapy weekly and 3 logopedia sessions in an early developmental center.

Our intervention lasted from November 2007 till November 2009, for 24 months altogether. The cronological age of the participant in the beginning of intervention was 5;7 years. She finished her acceleration procedure at the age of 7;7.

Detailed Description of Intervention

Participant number 3 had only 10-15 syllables upon arrival as expressive vocabulary. She pronounced first syllables only (eg. 'pa'=papa, „ké"=blue, „pi"=red and also for chicken). She didn't have syntax at expressive level at all. She would usually point to the objects she wanted or described very simple situations in a kinetic way with her two hands. Her first human figure drawing was a circle (*Figure 26*). Her attention span was not more than 2-3 minutes and one could easily lose her during assessment if the emotive aspects of the interaction were not presented carefully. She could be involved into interaction mainly with pictures of her favourite food, vanilla pudding. Otherwise she would resist any tasks demanding attention from her. She was higly motivated and patient only in the task chosen by her. She proved to be rather stubborn in the beginning.

Intensity of intervention was 12 session per week. 2 sessions were motoric and sensomotoric activities, and 10 sessions of MLE and MSL have been ensured.

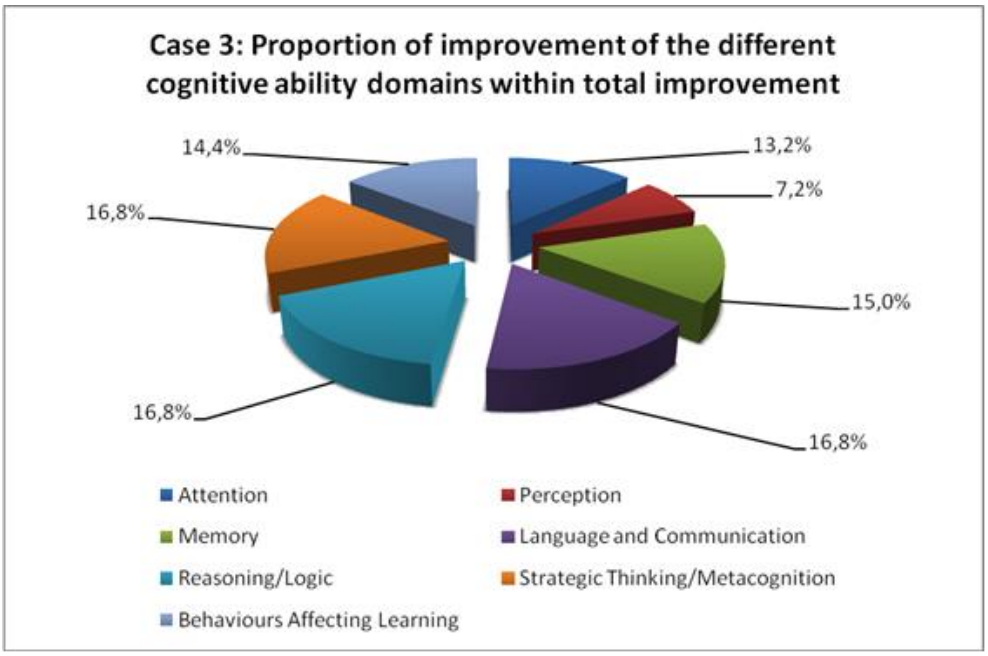
After 3 months of intervention, by January 2008 her attention span could be easily prolonged for 35 minutes. She also started to use holographic words to indicate a whole situation exactly at this point in time.

By the 7th month of the intervention (May 2008) we experienced a certain „language extacy" in her behaviour: she started to combine 3 word sentences and showed very strong joy when pointing to objects, analyzing their parts and naming every bit of small parts verbally. She was able to sequence 4 pictures telling a story in visual modality and made matrixes using two or three sources of information. Her concept of number started to consolidate (number one and two).

She actively used abstract words like „group" and „similarity". Her cognitive awareness and constant comparative behaviour seemed to be an interesting phenomena for strangers as the little girl still had strong dyslalia, yet she was highly active verbally and cognitively.

Her differential treatment included Mediated-Self-Talk to enhance linguistic abilities. The tools Organisation of Dots, Find and Compare the Absurd were used for a longer time to consolidate missing basic functions.

Her LPAD-Basic results indicated that our participant could benefit much more from human help by the end of the intervention then before (*Appendix 15*). According to Cognitive Abilities profile the proportion of the improvement of language/communication and reasoning/logic were highest within her total improvement (16,8 %) (*Figure 25*).



26. Figure: Case 3: Proportion of improvement of the different cognitive ability domains within total improvement

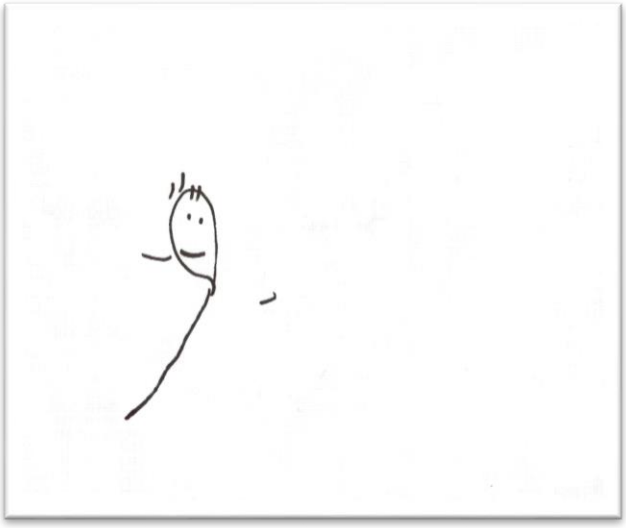
Her Raven Colored Matrices raw scores have changed from 7 raw scores to 15 (from percentile <5 to percentile 25). The results of the Gardner test indicated that our participant's active vocabulary had increased a great deal – she outperformed her peers having the same cronological age by the end of the second year. We note however, that she had serious dyspraxia and dyslalia. She had become a very fluent speaker, however more intervention in speech pathology will be needed in the future. Her mental age according to PPVT has changed from 2;6 to 8;0 years within the two year long intervention period.

It was not possible to administer the DIFER test for the 5;7 year old child due to impulsivity and resistance. Post-test results indicated that in the domain of 'Copying parts of letters' she remained in 'Preparatory phase'; in 'Phoneme awareness' she reached the optimal level by 95%; in the so called 'Vocabulary for relations' domain she reached the 'Final stage'; her 'Basic numeracy' results were in the 'Beginner phase'. According to *József Nagy* if the mathematical domain is still in the beginner or preparatory phase after intervention, it indicates intellectual disability (Nagy, 2000; 2003). The domains of 'Hypothetical thinking and 'Relationships based on experience' both reached the 'Final' stage.

Human Figure Drawing Development (Case 3)

27. *Figure: Case 3 Pre-test Human Figure Drawing, November 2007. Cronological age: 5;7 years. Raw Score: 1. DQ: Category A*

This is the beginning of the preschematic stage, the circle has already been closed.



28. *Figure: Spontaneous Human Figure Drawing, January 2008. Cronological age: 5;10 years. DQ: 78.*

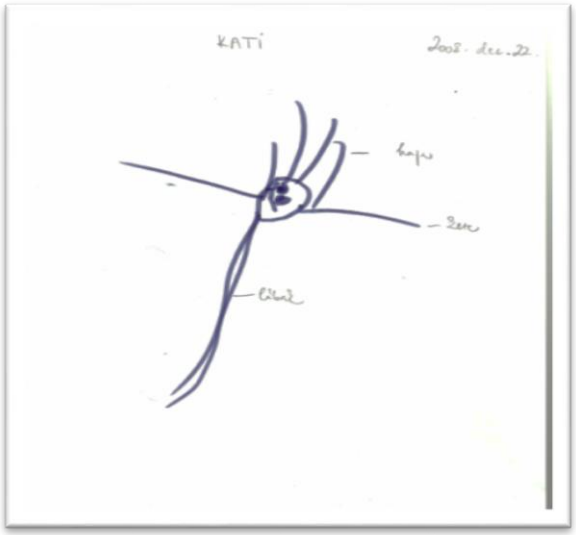
In the 3rd months of the intervention our participant draws a head-footer. She presents a quick and dynamic modifiability in all areas except mathematical operations. The tool 'From Unit to Group' proves to be rather hard for her.

29. *Figure: Case 3 Spontaneous Human Figure Drawing, February 2008. Cronological age: 5;11 years. DQ: 87*

Lowenfeld notes that 'tedpole figures' are developmental milestones, not necessarily present in every child's life (Lowenfeld, 1947).

30. *Figure: Case 3 Spontaneous Human Figure Drawing, October 2008. Cronological age: 6;7 years. DQ: 80*

Tedpole figure: just head and legs-and-arms. The trembling lines are due to severe dyspraxia.

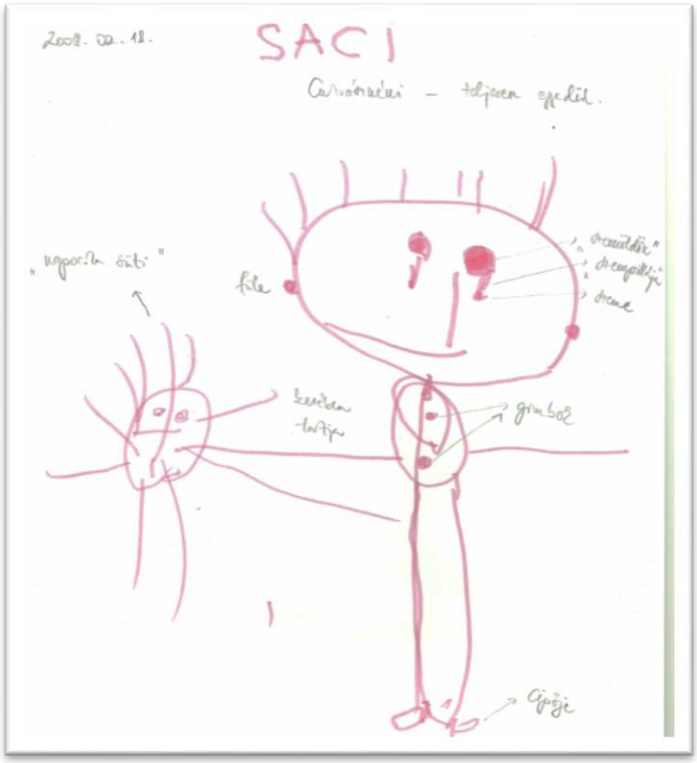


31. Figure: Case 3 Spontaneous Human Figure Drawing, December 2008. DQ: 75

Kárpáti notes that some of the figures are similar to spiders – a very common way of representing humans in the pre-schematic stage.

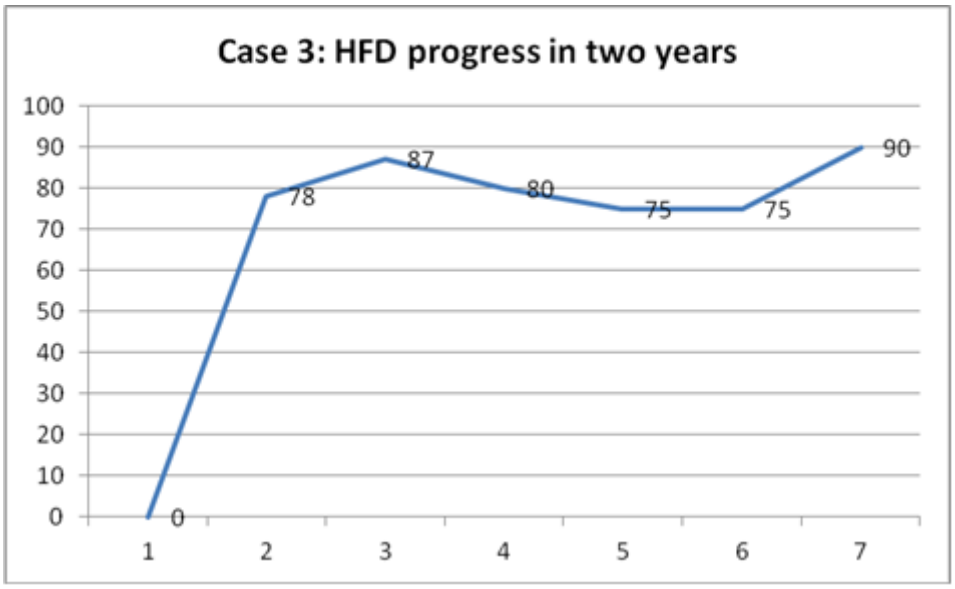
32. *Figure: Case 3 Spontaneous Human Figure Drawing, 2009 January. DQ: 75*

The most striking parts of the drawing are the two spirals and the feather-like ornament. The little girl started to draw the spiral from the inside. „In children's scribbles the outward spiral is considered to be the natural way of movement. The outward spiral is the sign of development, growth and opening up (Feuer, 2006. p. 38)".



33. Figure: Post-test. Spontaneous Human Figure Drawing. Title given by the child: „A pastry-cook holding a sunshine cookie". February 2009. DQ 90

Buttons and shoes are the first pieces of clothing depicted. The title of the drawing reveals creativity. By this time our participant learned to talk. Her conceptual development is remarkable. Her human figure drawing development is indicated by *Figure 32*.



34. Figure: Human Figure Drawing of Case Nr3 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of Post-Test Results Participant Nr 3

Two months after the end of the intervention, one of the National Expert and Rehabilitation Committees has carried out an examination with the standardised WISC-IV (2008 Hungarian standard). The child's actual age at this time was 7;10. Her results were the following:

Verbal Comprehension Index Similarities 9<7;0 Vocabulary 9< 7;0 Comprehension 3 < 6;6 General Knowledge 2 < 6;6 Word reasoning 12 < 8;6

Perceptual Reasoning Index Block design 4 <6;6 Picture Concepts 3 <6;6 Matrix reasoning 7 <6;6 Picture completion 7 <6;6

Working Memory Index Digit Span 2 <6;6 Letter-Number Sequencing 3 <6;6 Arithmetic 5 <6;6 Processing Speed Index Coding 6 <6;6 Symbol search 5 <6;6 Cancellation 7 <6;6

Summary: Verbal Comprehension Index (21): 83 Perceptual Reasoning Index (14): 68 Working Memory Index (5): 57 Speed (11) 74. Total IQ: 65.

The Examination Board emphasized the following: „our participant's mental processes have changed to the borderline of normalcy and mild mental retardation. Our participant's verbal intelligence is of high level, even though she has serious difficulties in speech production. The little girl's outbreaking results in Word Reasoning and Similarities in the Verbal Comprehension Index must be direct results of therapeutic intervention (Mediated Learning Experience). The girls's verbal comprehension is remarkable (on the level of average intelligence). Her results in the Perceptual Reasoning Index (which accounts for visuomotor coordination) are in the range of mild mental retardation, indicating that besides having a high level of verbality, her visual perception is weaker. Her fluid thinking is higher than mild retardation. The level of her Working Memory is the lowest, which indicates difficulties in mental manipulation, therefore she may have difficulties in performing tasks alone."

These results are remarkable, even if our findings indicated above (prepared by our external evaluator) represent higher results with Raven Coloured Matrices. The assessment board were unknown adults for our participant and the evaluation happened in a very different environment – these psychological factors have a limiting effect on the performance of children with intellectual disabilities.

Our participant continued her studies in a mainstream school with shadow teachers and has been suggested to continue an intensive speech therapy program.

2.4 Case Study: Participant Nr 4

Baseline Information and History of Standard Testing

Our participant (Case Nr 4) has been evaluated by Pécs University's Child Neurology Clinic, at the age of 5;0 where his delayed psychomotor development has been indicated (FQ=72). The etiology of the intellectual delay has soon been detected: a genetic examination has proved the mutation of the FMR1 gene, the existence of Fragile X-syndrome. At the age of 7, a Committee has examined the boy and reported moderate mental retardation and serious hyperactivity as comorbid fenomena. BNO codes listed: F71; F 80.8. The evaluation committee indicated serious behavioural deficits – such as motor and phonic ticks.

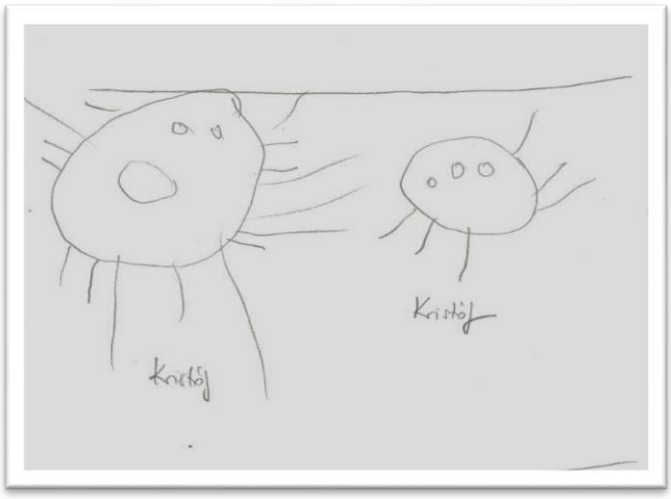
Dynamic Assessment (Pre-test)

Extreme level of impulsivity, blurred and sweeping perception and very short attention span has been experienced. However, significant modifiability has been seen in time orientation: after the teaching phase he could sequence 10 short stories alone. This is probably related to his interest in his daily programs – he would always ask family members to tell „what comes next", a detailed plan of his day.

Detailed Description of Intervention

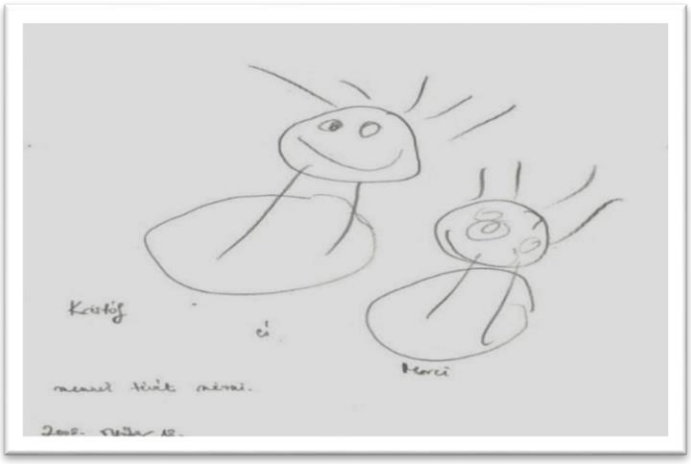
The time of intervention was from June 2008 till June 2010. Our participant's cronological age was 12;7 years at the start of intervention. Case 4's differential treatment included „Organisation of Dots" especially to control impulsivity and eliminate episodic grasp of reality and „From Empathy to Action" to raise awareness of other's feelings and needs (theory of mind-abilities) and 'Know and Identify' tool to ensure that his conceptual development would accelerate.

Human Figure Drawing Development (Case 4)



35. *Figure: Pre-test Human Figure Drawing, June 2008. Cronological age: 12;7 years DQ: 38*

According to our participant's chronological age (he is more than 12 years old) the self-portrait is rather delayed. Headfooters appear on the page.

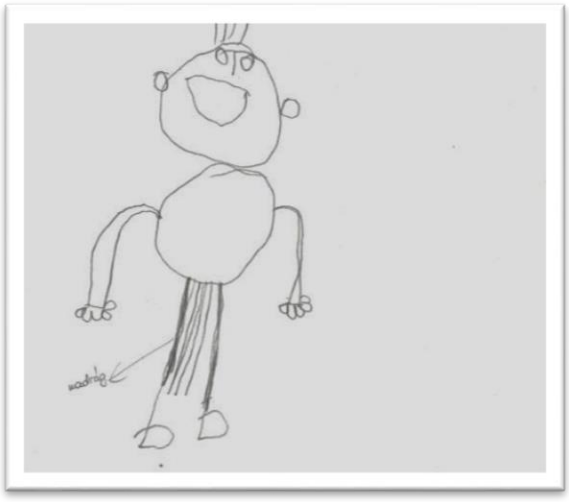


36. Figure: Spontaneous Human Figure Drawing. Title given by the child: „Kristóf and Marci are going to watch TV." October 2008. DQ: 43

The picture is showing friendship – the title of the drawing is longer and shows relation between our participant and another boy. These headfooters are slightly more detailed, the pupils have appeared.

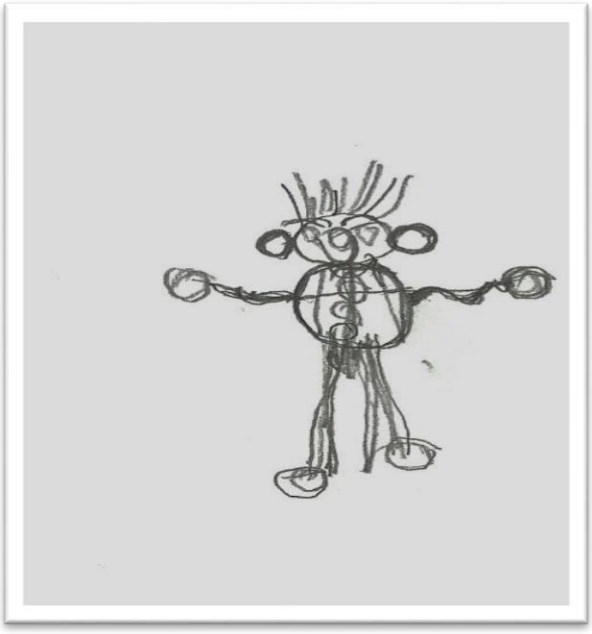
37. Figure: Spontaneous Human Figure Drawing, January 2009. DQ: 54

In the 7th month of the intervention he spontaneously presents the first proper human figure. The number of the arms indicate incertantities in number concepts.



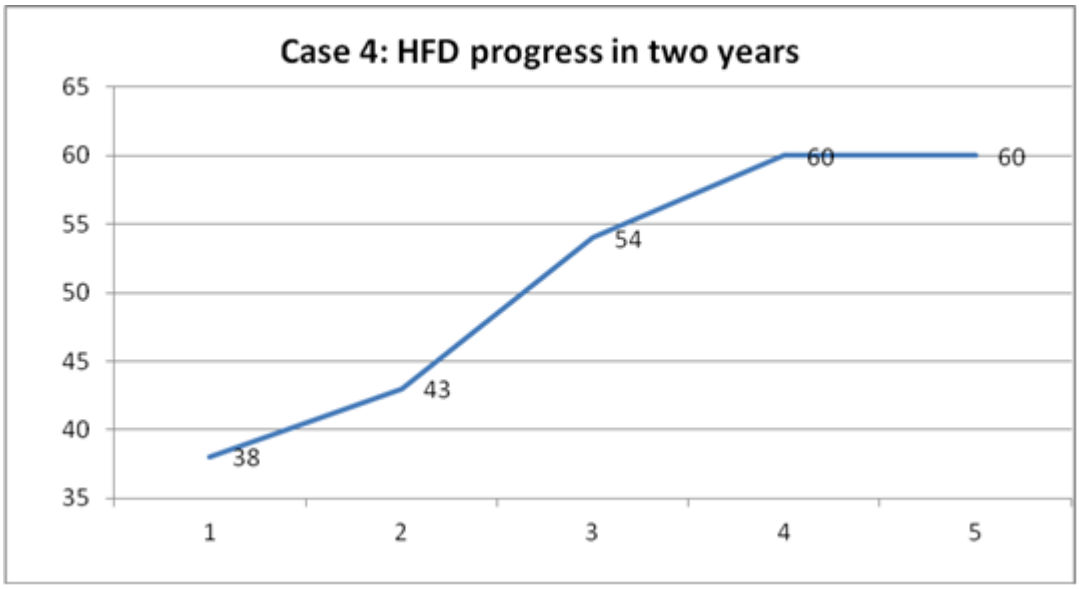
38. Figure: Spontaneous Human Figure Drawing, September 2009. DQ: 60

In the 15th month of the intervention the number of fingers became precise, and our participant started to make experiments with pieces of clothing: trousers and shoes. He depicted positive emotion, the character is laughing (*Figure 36*).



39. *Figure: Post-test Human Figure Drawing. The title given by the child: „Me in a squared shirt." June 2010. DQ: 60*

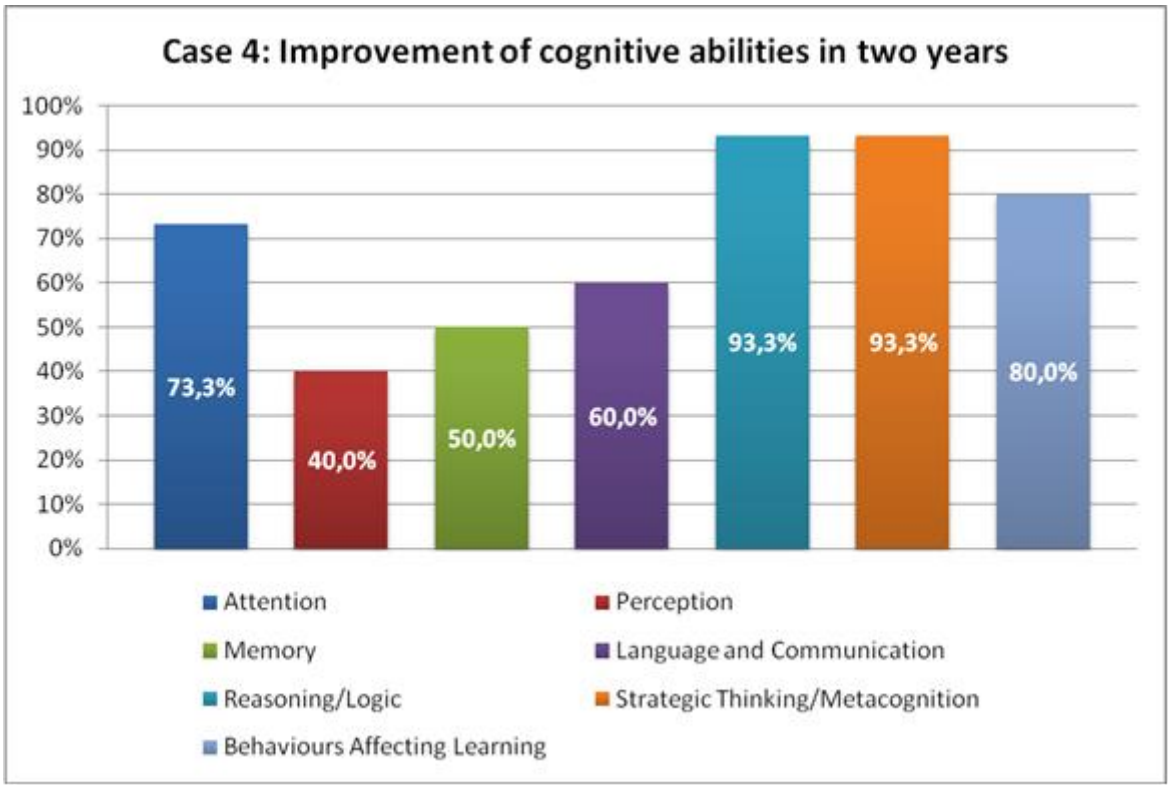
This drawing presents buttons, pieces of clothing and a pattern (squared shirt) and it is much more detailed than the one before (*Figure 37*). Though he re-writes nearly every body-parts two or three times, and the drawing seems a bit bizarre at first glimpse, it depicts a harmonious inner life of an adolescent. When the lines of a human figure are strengthened many times it may reveal „that the child is synthetizing knowledge and experience gained after active efforts in the outer world (Feuer, 2006. p. 32)." Case 4 has developed 22 points on the Goodenough-Harris Drawing Test within two years (*Figure 38*).



40. Figure: Human Figure Drawing of Case Nr2 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of Post-Test Results Participant Nr 4

Great improvement in direction of attention and control of impulsivity. Very high level of empathy. Very much self-aware, happy to carry out tasks alone for others. Significant development in language, human figure drawing, and planning. His receptive vocabulary has developed 5; 10 years according to PPVT. It was not possible to administer the DIFER test for the 12;4 year old child due to impulsivity and resistance as pre-test. Post-test results indicated that he has reached final and optimal levels in the domains of 'Copying parts of letters', 'Phoneme Awareness', 'Vocabulary for Relations' and 'Relations Based on Experience', however his 'Basic Numeracy' has stayed on beginner level (just like Cases 1 and 3) (*Appendix 15*). Case 4 has developed most dynamically in terms of fluid intelligence in the domains of 'Strategic thinking/Metacognition' and 'Reasoning/Logic' according to Cognitive Abilities Profile (*Figure 39*).



41. Figure: Improvement of cognitive abilities in two years in percentage points (Case 4)

2.5 Case Study: Participant Nr 5

Baseline Information and History of Standard Testing

Our participant (Case Nr 5) had very diverse standard test results upon arrival. One of the National Committees of Learning Potential and Rehabilitation indicated borderline intellectual disability between mild and moderate levels at the age of 5. Her BNO codes were F 70 and G 40. A Center of Neurology indicated moderate intellectual disability with considerable behaviour problems and stuttering at the age of 7;5, BNO codes were F71 and F80.80. An independent clinical psyhologist also indicated moderate intellectual disability, behaviour conduct problems and stubbornnes at the age of 7;6.

Our participant's cognitive condition seemed to decline – this suspicion has also been the main concern of the parents: they complained about deteriorating syntax and speech comprehension.

We underline from our participant's medical reports the presence of major and minor epileptic seizures since the age of 4 months. Later, MRI findings indicate left temporo-medialis dysgenesis. At the age of 8;6 (when our cognitive treatment has already been started) SCN1A mosaic mutation has been indicated by a molecular genetic center which confirmed the type of SMEI (Severe Myoclonic Epilepsy in Infancy or Dravet syndrome).

Literature confirmes mental retardation ranging from moderate to severe in this condition, with predominance of language impairment, and some patients having a major personality disorder, labeled autistic or psychotic **(**Genton, Velizarova & Dravet, 2011**)**. Fifty percent of the reported children have an IQ of less than 50 by school age. It is described as a progressive, debilitating type of epilepsy – mortality rates are high due to sudden unexpected death in epilepsy or accidents. In Dravet-syndrome cognitive and psysical deteriorisation has been experienced over time.

Dynamic Assessment (Pre-test)

DA procedures revealed extreme stubborness and problems with precise and accurate data gathering in the input phase. The little girl had problems with using more than one sources of information at the same time. Weak visuo-motor skills, ataxia and difficulties in word retrieval has been experienced.

Parents have been taught the main crieria of MLE and suggested to give possibilities to our participant to express her will in areas which may strengthen her feeling of autonomy and decrease defying and oppositional behaviour (ie. to choose from clothes and food; choose which places to visit in a turn-taking order with her sisters etc).

Detailed description of Intervention

Cognitive intervention lasted from February 2008 till February 2010. Our participant's cronological age was 7;5 at the start of intervention. She had 8 cognitive sessions per week. We had to be very careful with IE-basic Organisation of Dots tool, as according to clinical experience a considerable amout of exposure to the pages provokes epileptic seizures (pattern sensitivity). After a month of „Preparatory Phase" (when the little girl has learned the main abstract concepts) FIE-Basic instruments could be applied: „Organisation of Dots", „Emotions" and „From Empathy to Action". Since she had difficulties with percieving other's feeling and intentions and from time to time she presented verbal agression, we applied the tool titled „Learn to Prevent Violence' from the second year.

Human Figure Drawing Development (Case 5)

42. Figure: Pre-test Human Figure Drawing, February 2008. Cronological age: 7;5 years. DQ: 52

The head is improportially large compared to the body. Slightly bizarre figure at first glimpse – indicating that something is wrong. The child had severe epilepsy. The drawing also reveals poor motor coordination and visuo-motor skills.

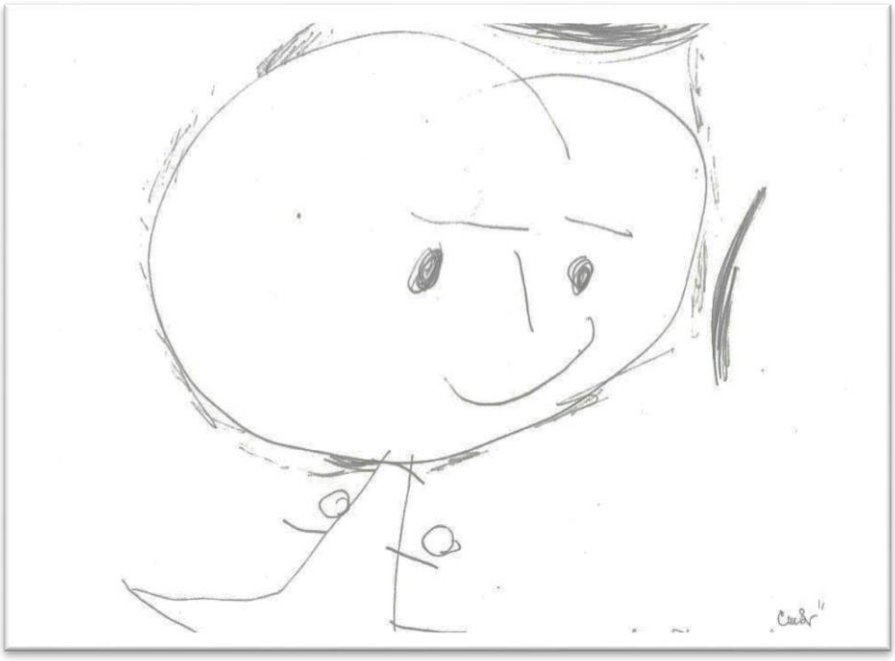
43. Figure: Spontaneous Human Figure Drawing, September 2008. Cronological age: 8;0. DQ: 75

Her next drawing depicts much more harmonious feelings in terms of mood, however still reveals poor visuo-motor skills. This is the 7th month of the intervention. Her emotive and cognitive regulation has improved a great deal.

44. *Figure: Spontaneous Human Figure Drawing, February 2009. Cronological age: 8;5 years. DQ: 78*

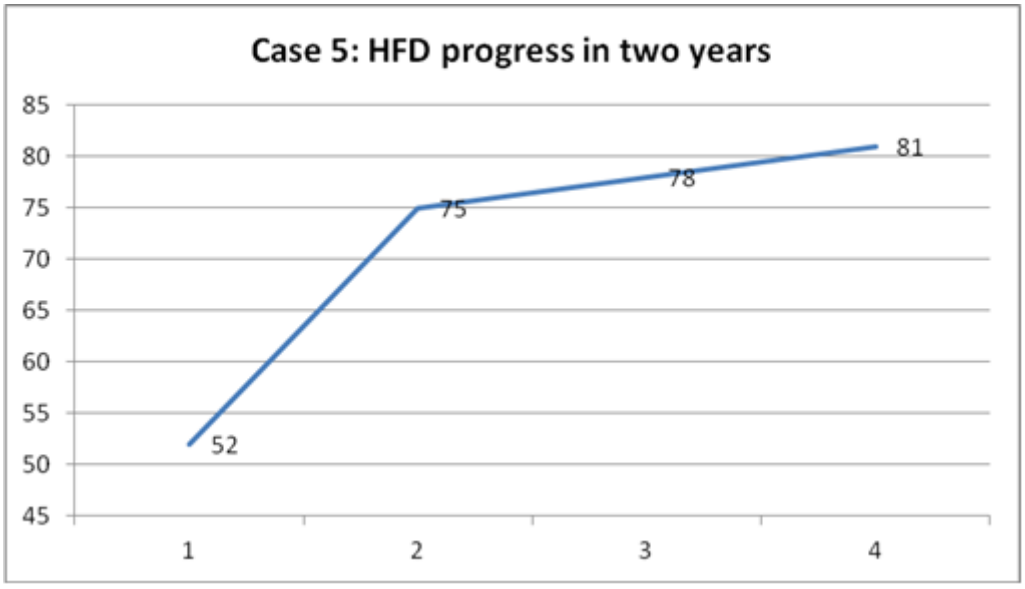
There is development in body proportion. Based on a few drawings we can observe that the structure of the human figures remains the same, revealing inflexibility in thinking (Nagy, 1905).

The black scribbles on the left and right hand side indicate something is wrong. At this time the little girl complained about a lot of headache.



45. *Figure: Post-test Human Figure Drawing, January 2010. Cronological age: 9;4 years. DQ: 81*

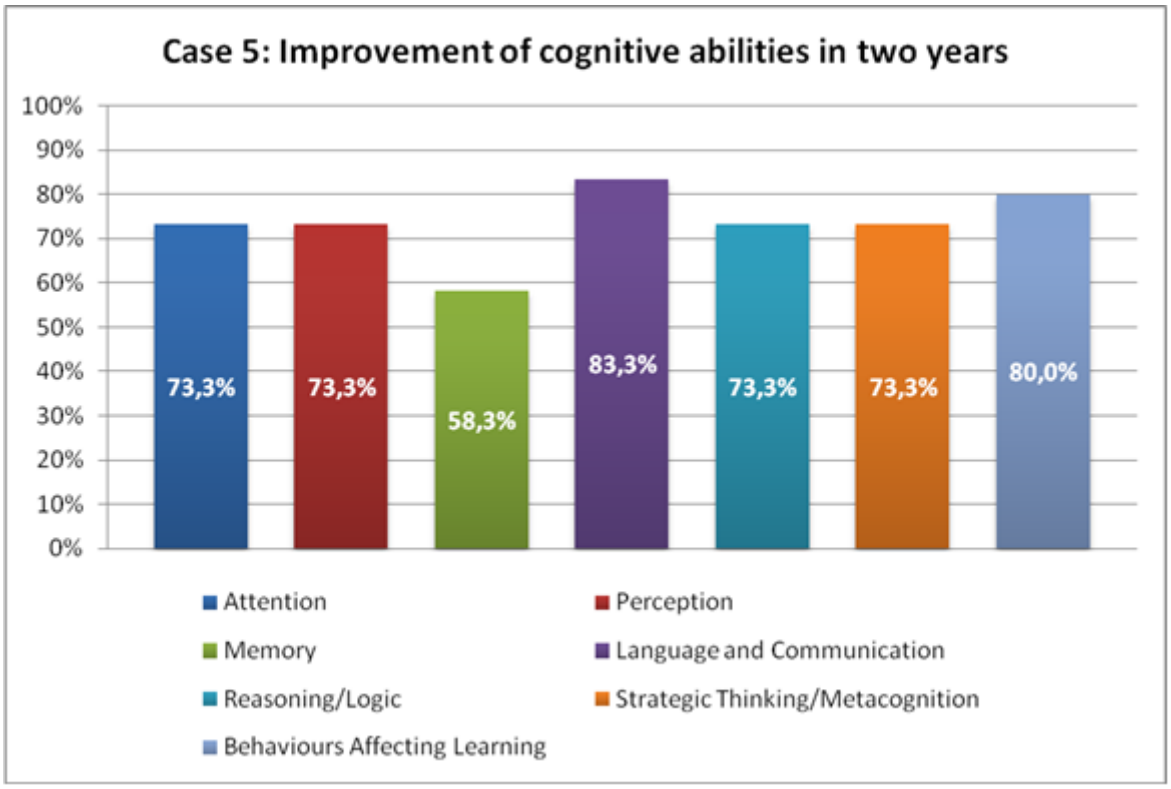
The head of the figure remains improportionally big compared to the body of the figure – indicating unconscious localisation of the problems of our participant (frequent headaches and severe epileptic seizures). However Harris-Goodenough scales indicate relevant cognitive development (*Figure 46*).



46. Figure: Human Figure Drawing of Case Nr 5 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of Post-Test Results Participant Nr 5

Remarkable development has been experienced in receptive and expressive language and behaviour control. MLE and FIE Basic tools significantly have contributed to the cognitive-behavioural development of the little girl (*Figure 46*).



47. Figure: Improvement of cognitive abilities in two years in percentage points (Case 5)

DIFER test results indicate that our participant has developed to final level in the domain of 'Copying Parts of Letters', to optimal level in 'Phoneme awareness', to advanced level in 'Vocabulary for Relations', to optimal level in 'Hypothetical Thinking' and to final level in 'Relationships based on experience'. However, her basic ability in 'Numeracy' changed from 'preparatory' level only to 'beginner' level (just like Case 1, 3 and 4) (*Appendix 15*).

2.6 Case Study: Participant Nr 6

Baseline Information and History of Standard Testing

Our participant (Case 6) has been evaluated in Semmelweis University Children's Clinic II. at the age of 6;4 where a psychologist and psychiater indicated cognitive impairment based on HAWIK test. Quote from the report: „The child is cooperative, however shows serious attention deficit problems. She is motivated to carry out a task, but her attention can easily be disturbed by external stimuli. Her social behaviour is more or less according to the age norm. Her intellectual development deviates from her age about a whole year, VQ=89, PQ=75, IQ=80. Her psychomotor processing speed is slow, and she is characterised by weak short term memory and even weaker abilities to synthetize. We hope her intellectual deficits can be corrected by systhematic cognitive therapy." An examination by the Committee of Speech Assessment and Rehabilitation has also strenghtened the borderline intellect of the child.

Dynamic Assessment (Pre-test)

DA procedures has revealed that our participant has very good sense of humor, curiosity and she is open to novelty -- affective elements are her strengths which can be utilized in the course of intervention. Dyspraxic movements and considerable level of visuo-motor problems set her back in proper collection of data in input level. She had difficulties in eye-

hand coordination as well. She not only impulsively treated information (it was very hard for her to wait to understand the task), but also presented blurred and sweeping perception. She had difficulties to generalise abstract concepts from concrete data (e.g. size, number, width or weight). In elaboration phase we found difficulties only in planning behaviour. In the output level she also had hardships: egocentric and impulsive communication were her characteristic deficient cognitive functions.

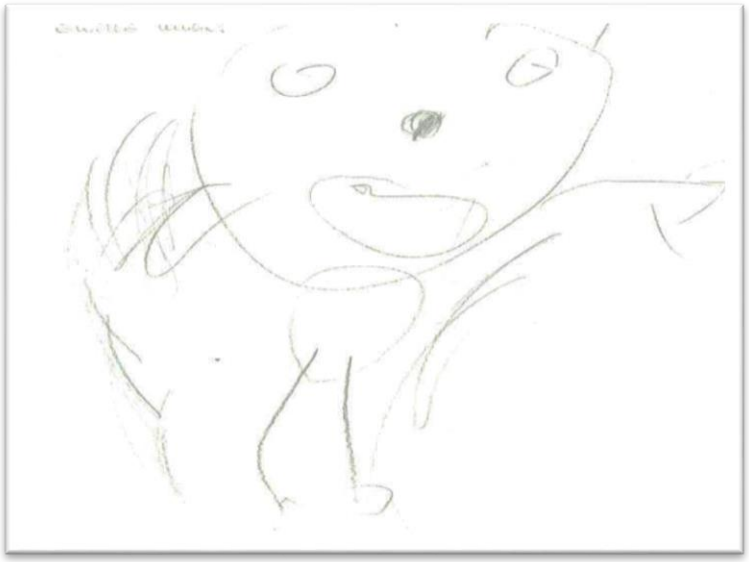
Detailed Description of Intervention

Time of intervention was 24 months, from 2010 March till March 2012.

The participant's age at the start of intervention was 6;6 years; her activation stopped at the age of 8;6. Intensity of intervention was 12 sessions per week.

The child has been exposed to daily mediated learning experience in the first 6 month of our intervention. After the first preparatory phase Instrumental Enrichment Basic – "Organisation of Dots" has been applied in 4 hours per week. Thorough mediation of shapes and size has been given in verbal modality in the therapy sessions – with a lot of transfer to daily life on shapes.

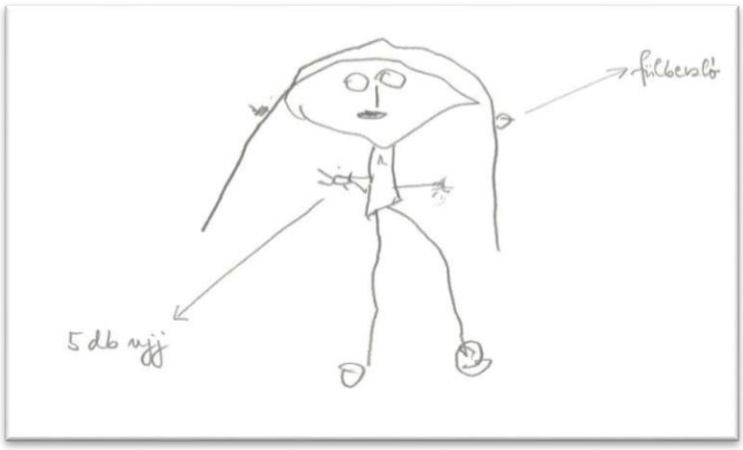
2.6 Human Figure Drawing Development (Case 6)



48. *Figure: Case 6 Pre-test Human Figure Drawing. The title of the drawing given by the child: „Clown". April 2010. Cronological age: 6;7 years. DQ: 76*

The drawing indicates low pressure of pencil and hypotonic muscle problems. Very loose connection between the parts – the child does not have a need for precision.

49. Figure: Spontaneous Human Figure Drawing, August 2010. Cronological age: 6;11 years. DQ: 76



50. Figure: Spontaneous Human Figure Drawing, February 2011. Cronological age: 7;5 years. DQ: 102

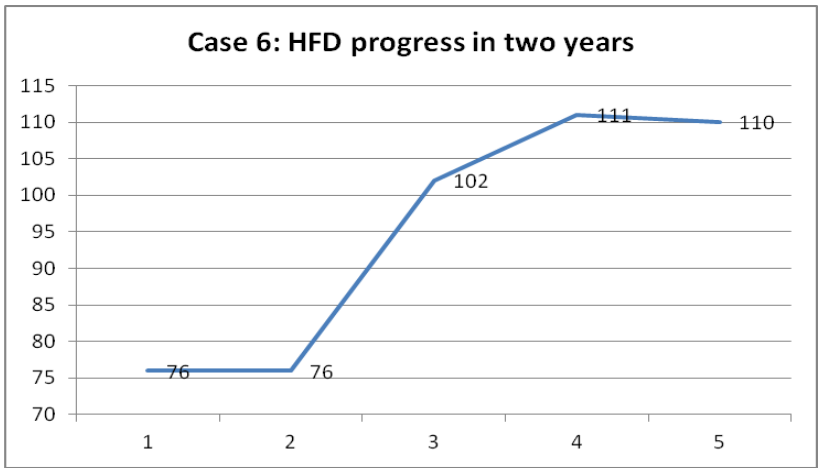
The picture became more detailed and shows already a need for precision. The number of fingers is fine. Stronger pressure of the pencil. The appearance of jewellery indicates cognitive development. This is the end of the first year of our intervention.

51. Figure: Spontaneous Human Figure Drawing. The title given by the child: „My father and my mother. My father is giving a nice flower to my Mum". May 2011. Cronological age: 7;5 years. DQ: 111

Emotional adjustment of the picture is warm – indicating harmony in family life. Perspective has appeared – this is the start of the stage of realism (Lowenfeld, 1947).

52. Figure: Spontaneous Human Figure Drawing. The title given by the child: „Michael". May 2012. Cronological age: 6;6 years. DQ: 110

This drawing is age-equvivalent, she draws lots of pieces of clothing (eye-glasses, bag, hat and patterns on the T-shirt). However, due to grapho-motoric problems the drawing is less harmonic.



53. Figure: Human Figure Drawing of Case Nr 6 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

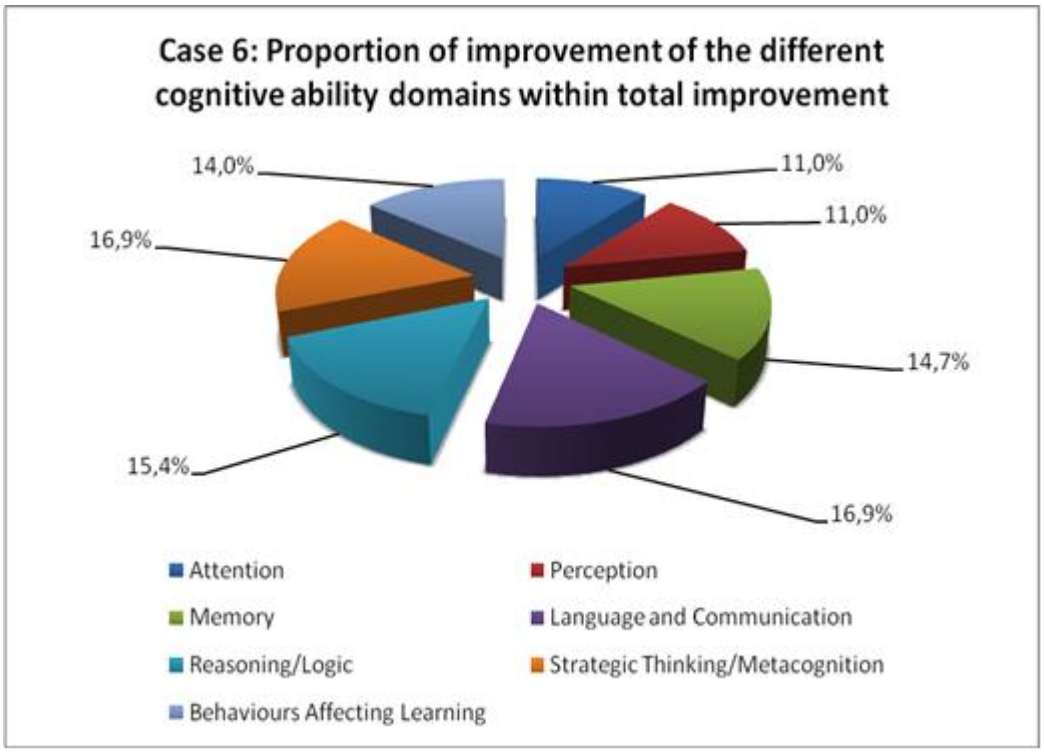
Summary of Post-Test Results Participant Nr 6

Our participant has improved her following cognitive functions: logical evidence; hypothetic thinking; became more self-autonomous; can look after her own things in school. More intervention is needed in gross motor and fine motor abilities.

Her Raven Colored Matrices results have changed from percentile <5 to 10-25 (in raw scores from 10 to 18). Her mental age according to PPVT has changed from 6;2 to 0. TROG test has been issued in Hungary by this time. Her TROG results indicate that her achievement has changed from 4;0 to 7;0 in years of normal development (she has grown 3 years in the 2 year-long intervention period) (*Appendix 15*).

According to Cognitive Abilities Profile her development has been largest in the domains of ’Strategic thinking/Metacognition’, in ’Language and Communication’ and ’Reasoning/Logic’ (*Figure 54*).

Results of DIFER test indicate that further intervention is needed in basic numeracy and mathematics (still in ’beginner’ level) (*Appendix 15*).



54. Figure: Case 6: Proportion of improvement of the different cognitive ability domains within total improvement

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2.7 Case Study: Participant Nr 7

Baseline Information and History of Standard Testing

Our participant (Case Nr 7) has been evaluated by one of the early developmental centers at the age of 4;0 where a psychologist indicated mild cognitive developmental disorder based on Bayley's Developmental Scales II. Quote from the report: „The young child shows serious attention deficit problems (ADHD), mild cognitive developmental disorder and mild degree of autism. Her social behaviour and spatial orientation needs urgent remediation.". BNO codes given: F 70.00 and F90.8.

Dynamic Assessment (Pre-test)

DA procedures has revealed that our participant has serious problems with attention – she had extreme blurred and sweeping perception and episodic grasp of reality. Her eye-hand coordination was very weak (Mazes instruments of LPAD-Basic indicated that she could not lead a straight line between two other straight lines). She had strange eye-movements and convergence insufficiency.

In terms of emotive behaviours she proved to be open to novelty, which could be utilized in the course of the intervention. Her language proved to be rather fragmented in terms of pragmatics: she would give adequate answers only about her beloved topics, fairies and cartoon heros. She seemed to live in an other world – in the world of fairy tales. When other daily-life topics had been initiated by the assessors, she would start a sentence but has never finished them. Dyspraxic movements and considerable level of visuo-motor problems set her back in the proper collection of data in input level.

Detailed Description of Intervention

Time of intervention was 24 months, from June 2011-June 2013.

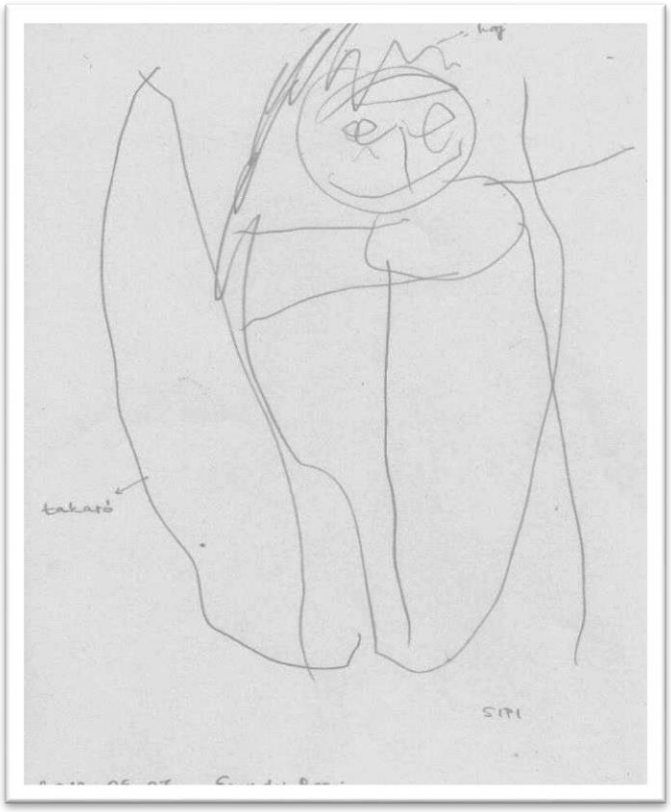
The participant's age at the start of intervention was 5;2 years; her activation finished at the age of 7;2. Intensity of intervention was 10 sessions per week.
The child has been exposed to daily mediated learning experience in the first 6 month of our intervention. After the first preparatory phase Instrumental Enrichment Basic – Organisation of Dots has been applied in 4 hours per week. Thorough mediation of shapes and size has been given in verbal modality in the therapy sessions – with a lot of transfer to daily life on shapes.

Human Figure Drawing Development

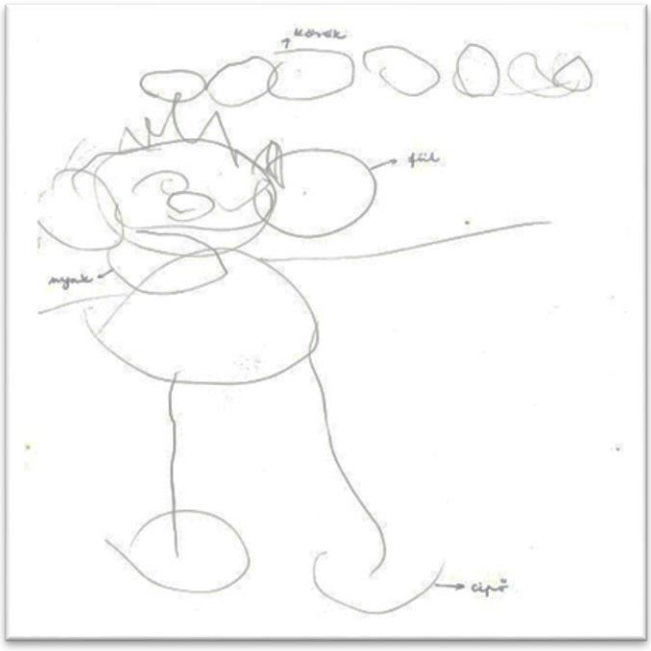
Pre-test Human Figure Drawing, June 2011. Missing data: she was not willing to draw.

55. Figure: Spontaneous Human Figure Drawing. Title given by the child: „Botond, my brother". March 2012 Cronological age:5;2. DQ: 88

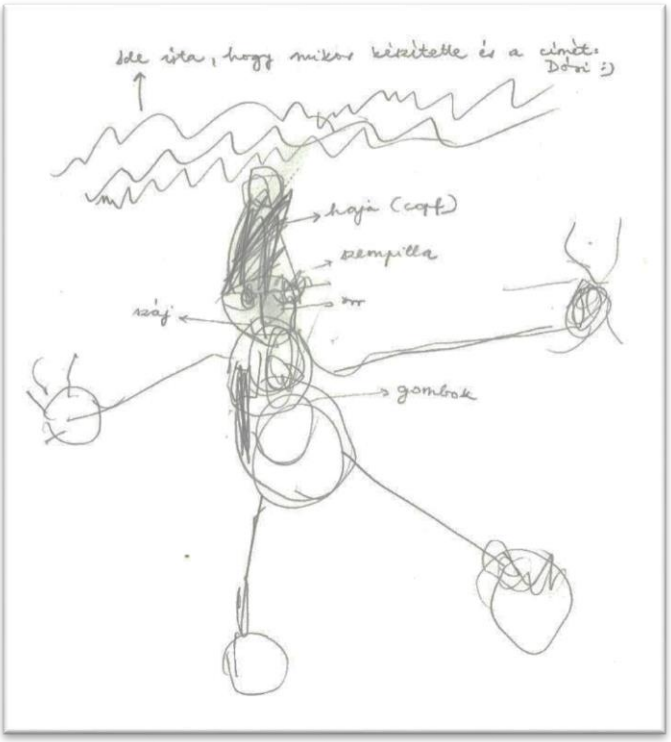
Her second drawing indicates loose pressure of the pencil on the page and hypotonic muscle problems.
She had severe difficulties in eye-hand coordination. She not only impulsively treated information but also presented blurred and sweeping perception in other cognitive tasks as well.
The drawing has been initiated by her and carried out in a spontaneous way. It took her less then 10 seconds to represent her young brother.



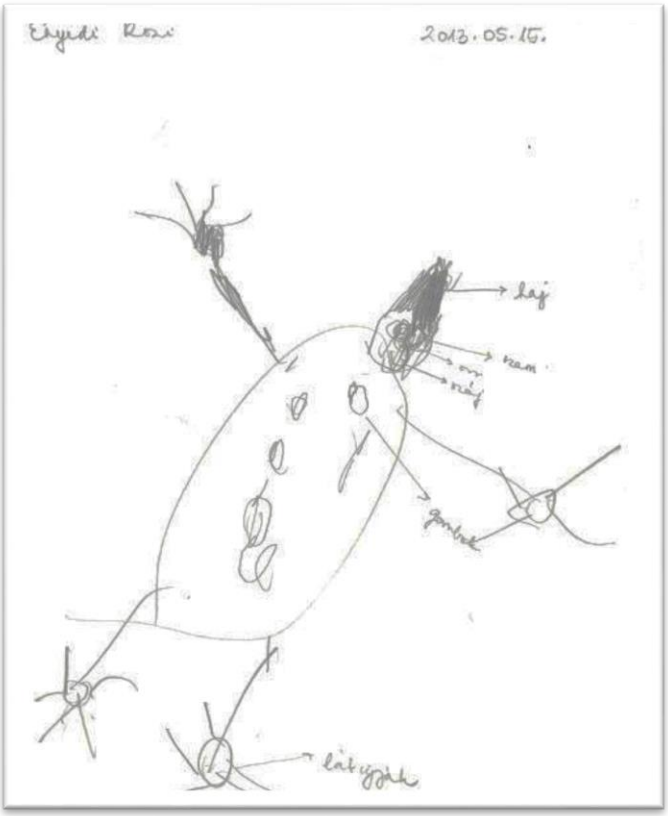
56. Figure: Spontaneous Human Figure Drawing, June 2012. Cronological age: 6;3 years. DQ: 88



57. Figure: Spontaneous Human Figure Drawing, October 2012. Cronological age:6;7 years. DQ:92



58. Figure: Post-Test Human Figure Drawing, May 2013. Cronological age: 6;2 years. DQ: 98.



59. Figure: Spontaneous Human Figure Drawing, February 2013. Cronological age: 6;11 years. DQ: 98

Summary of Post-Test Results Participant Nr 7

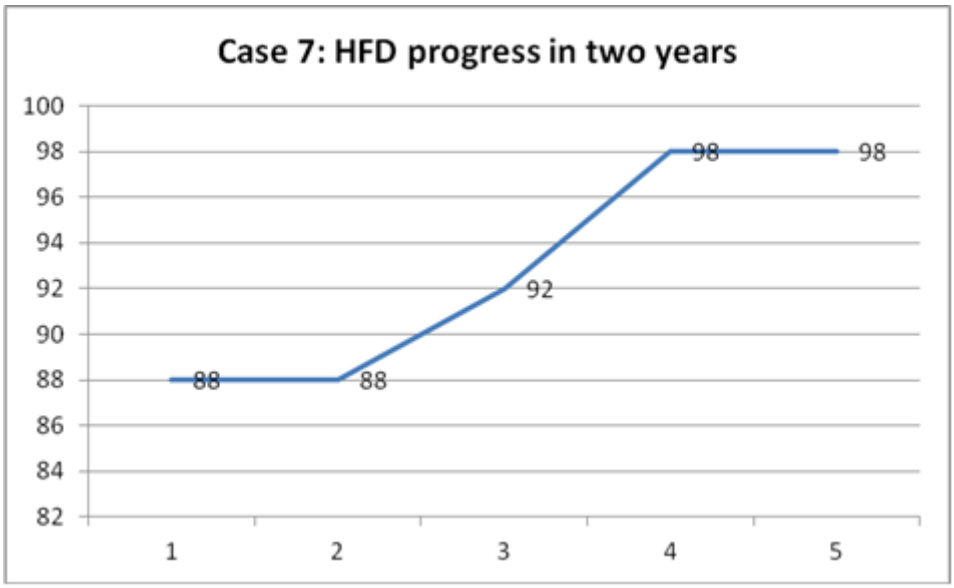
Case 7's modifiability was less spectacular than that of cases 1, 2, 3, 4, 5 and 6.

The little girl's cronological age was 5;3 years at the start of our intervention and 7;3 years at the end. Results of TROG test revealed the little girl was on the level of a 5;9 year-old child in understanding syntactic structures when we finished the intervention. Our program added 28 months to her reception of grammar within 24 months. Her difficulties were the following: spatial suffixes, longer sentences including logical formulas. It was still very hard for our participant to work in auditory modality. Results of TROG test and our observations have underlined the importance of future development of speech comprehension (*Table 9*).

9. Table: Case 7 Trog- test. Test for Reception of Grammar Pre- and Post-test Results

	Pre-test June 2011	**Post-test June 2013**
Number of blocks Completed	5	11
Age-equvivalence	3;5 years	5;9 years
Cronological Age	5;3 years	7;3 years

Her Human Figure Drawing results indicate serious visual problems. She has grown 10 points in her drawing quotient in two years on Harris-Goodenough test (the average improvement is usually 3 points in every 3 months in case of normal development). Excercises for eye-hand coordination and grafomotor development have been suggested. Positive results can be seen in her memory, strategic thinking/metacognition and according to Cognitive Abilities Profile (*Appendix 15*).



60. Figure: Human Figure Drawing of Case Nr 6 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

2.8 Case Study: Participant Nr 8

Baseline Information and History of Standard Testing

Our participant has been assessed by the National Committee of Movement Abilities and Rehabilitation in 2004. Experts indicated paraplegia (paralysis of the legs) and severe epileptic seizures, BNO codes G82 and G 40. One of the Hungarian National Committees of Learning Potential and Rehabilitation indicated moderate level of intellectual disability with cooperable behaviour, BNO code: F71. According to Budapest Binet test his IQ was 55.

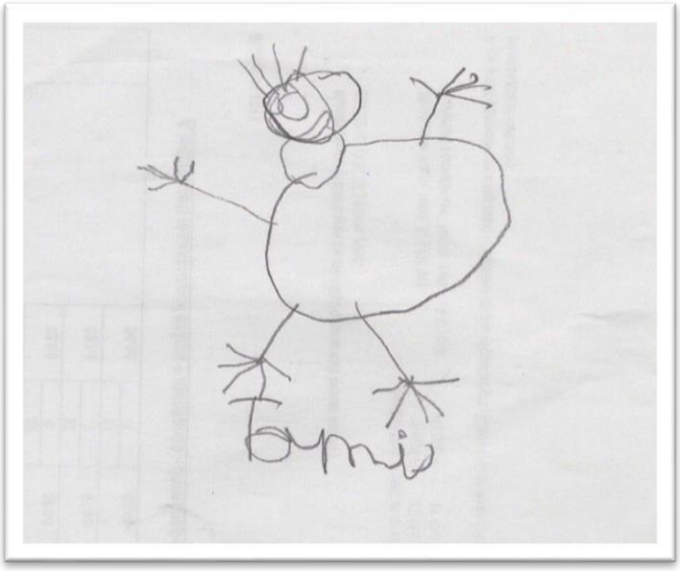
Dynamic Assessment

Dynamic Assessment procedures revealed serious blocking when difficulties arose in problem solving. Neither lots of mediation of meaning, nor mediation of feeling of competence could not move him out from his resistence to work when he started to experience failure. His strength were Part-Whole relations and Functional-Part-Whole relations indicating that he has started to establish relationships between different elements of the world (*Appendix 15*).

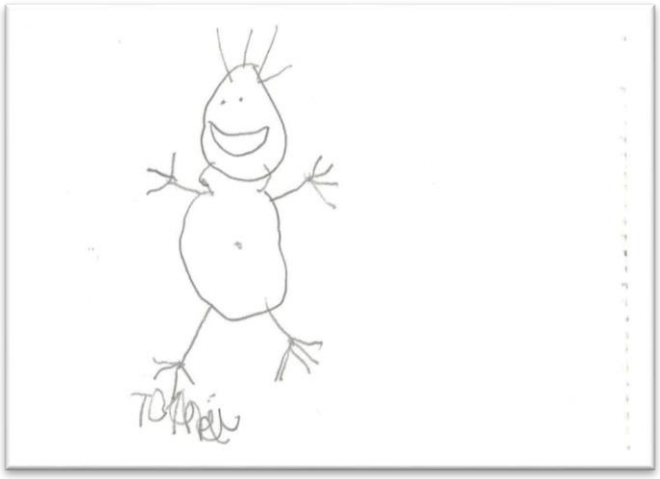
Detailed Description of Intervention

Our participant number 8 was the oldest among the 15 participants. His cronological age at the start of intervention was: 14;8 years and 16;8 at the end of the intervention. Time of intervention was from April 2010 to April 2012. Intensity of sessions was 7 sessions per week. The following FIE-Basic Instruments used in the first year: 'Organization of Dots Basic', 'Tri-channel Analogies' and 'Compare and Find the Absurd'. His differential treatment included reading as well, since he was able to read short sentences upon arrival. After 6th months of preparatory general MLE activities (primary cognitive behaviours) we introduced the tool 'Learning to Ask Questions for Reading Comprehension'.

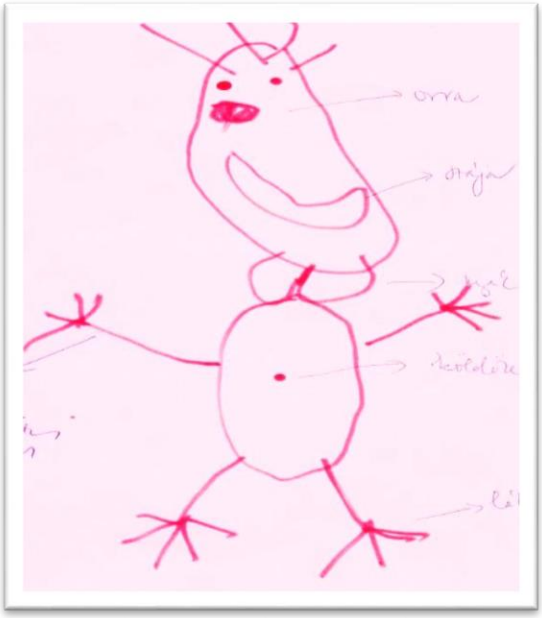
Development of Human Figure Drawing



61. Figure: Pre-test Case 8 April 2010 Cronological age 14;8 DQ:41

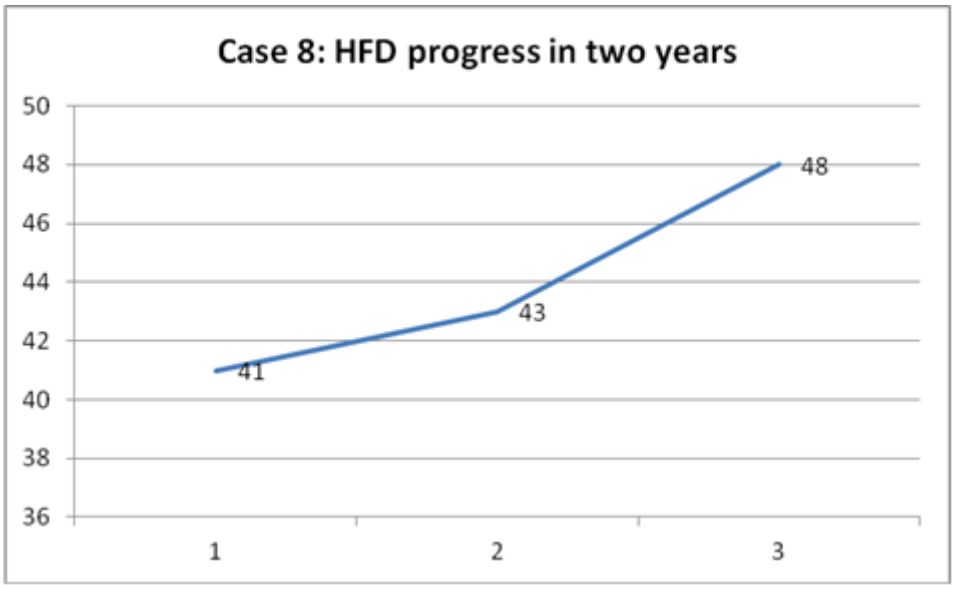


62. Figure: April 2011 Cronological age 15;8 DQ:43



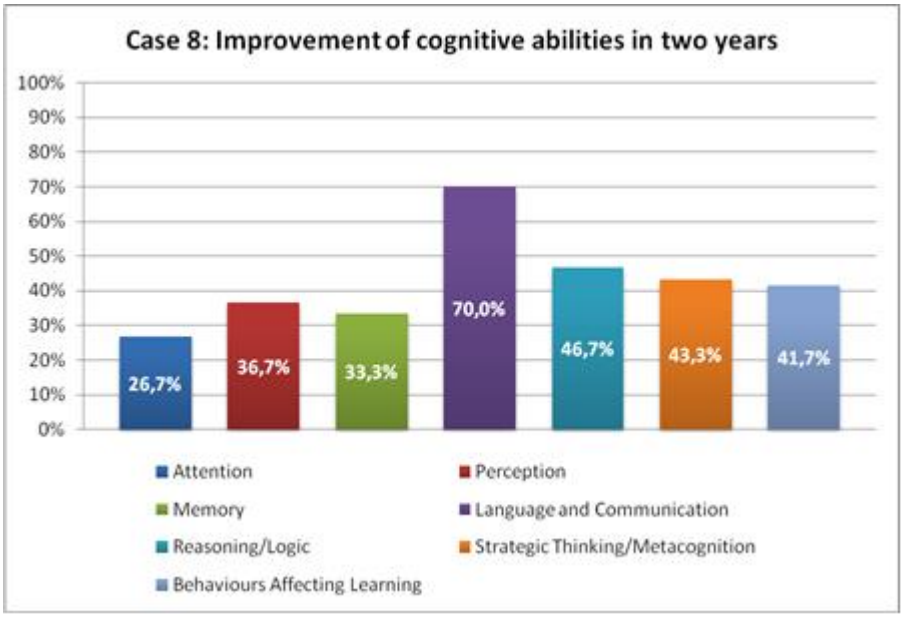
63. Figure: Post-test Human Figure Drawing April 2012 Cronological age 16;8 DQ:48

Our participant's HFD is a bit modest compared to the former participans' development. We should not forget that Case 8 had severe motor problems (*Figure 63*).



64. Figure: Human Figure Drawing of Case Nr 8 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of Post-Test Results Participant Nr 8



65. Figure: Improvement of cognitive abilities in two years in percentage points (Case 5)

Our participant has developed by 70%p in the domain of Language and Communication in 24 months. The same is strengthened by static test results. According to PPVT our participant's receptive vocabulary has developed meaningfully: the gain is minimum 3 years. Our participant's expressive vocabulary has developed meaningfully: the gain is minimum 4;10 years.

The older boy's abilities for school learning has developed a great deal, even though he has serious motor problems. 'Basic numeracy' and 'Copying parts of letters' has developed from preparatory/beginner phase to final/advanced phase – even though these areas has not been targetted by the intervention program in a direct way. Relationships based on experience and hypothetical thinking are in the advanced/final phase.

10. Table: Trog: Trog- Test for Reception of Grammar Pre- and Post-test Results

	Pre-test April 2010	Post-test April 2012
Number of blocks Completed	5	13
Age-equvivalence	3;5 years	7;6 years
Cronological Age	14;8 years	16;8 years

Our participant has gained 4;1 years in understanding syntactic structures. This is a huge development in speech comprehension. Our participant Nr 8 hopefully will benefit much more from a mainstream inclusive school setting: his speech comprehension and active vocabulary has developed 3-5 years within the two-year intervention period. According to dynamic assessment results (LPAD-basic), he can certainly benefit twice as much from human mediation than before, and has gained a great deal of independence in problem solving.

2.9 Case Study: Participant Nr 9

Baseline Information and History of Standard Testing

Our participant has been assessed by the National Committee of Movement Abilities and Rehabilitation in 2005. Expersts indicated severe hypotonia due to prae and perinatal injury, BNO code G80. One of the Hungarian National Committees of Learning Potential and Rehabilitation indicated moderate level of intellectual disability with cooperable behaviour, but very slow reaction time; incoordinated movements and severe speech deficiency 2009. BNO codes: F71 R 69, Q 89.7, G93,9 , H50.1, H52.1. According to Brunet-Lezine psychomotor developmental scales his developmental quotient was FQ:43.

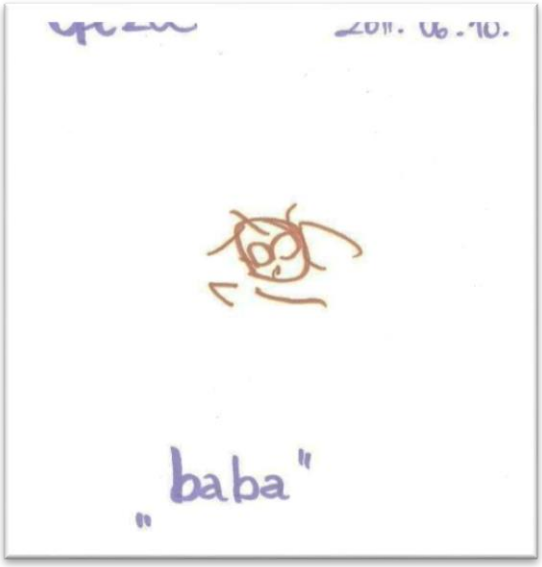
Dynamic Assessment (Pre-test)

Dynamic Assessment procedures revealed that in visual modality he could compare, and use analogies. His learning potential in this modality seemed very high. We also noticed that he developed his own sign language with the mother. After careful observations we counted about 120 different signs that he would combine. As for complexity, he combined signs up till 5 items. Since our participant could not talk and showed a strong preference to visual modality, this was the main channel of the intervention besides verbal MLE from the staff.

Detailed description of Intervention

The time of intervention was from June 2011 till June 2013. Cronological age at the start of intervention was 6;8 years and 8;8 at the end of the intervention.
Intensity of sessions: 10 sessions per week in the first two year. In the last year 7 hours/week.
FIE Basic Instruments: „Organization of Dots Basic".
Our participant's development was very spectacular from the 4th week. He enjoyed categorisation tasks very much. Creation of 'Primary cognitive behaviours' lasted for about 6 months. We used his laptop as an augmentative communicational device with a talk-pad. We taught him how to type and read in his computer in 1,5 years.
Even though it is not possible to administer every items of this test to the our participant, his development in numerical-mathematical and graphomotoric areas are significant (he is in Advanced phase in both domains). Compared to previous results, his phoneme awareness is 10 percent higher.

Human Figure Drawing Development (Case 9)

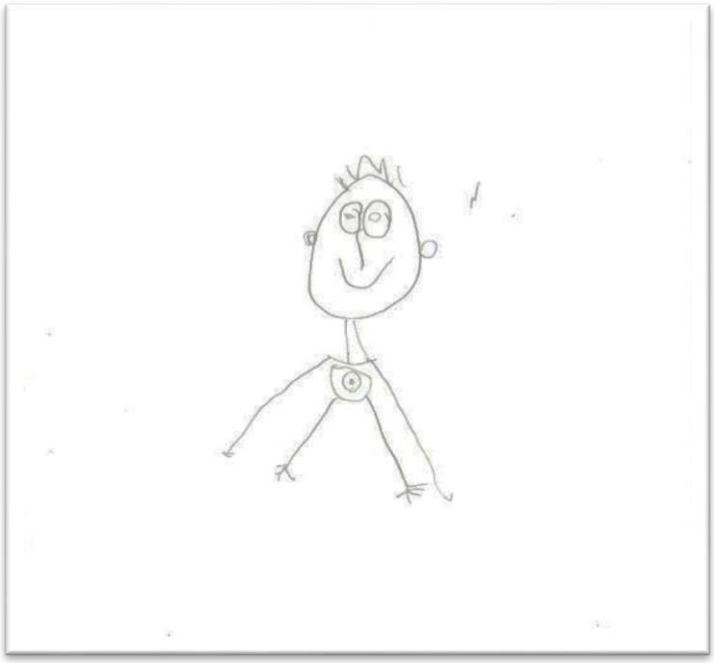


66. Figure: Pre-test Human Figure Drawing, June 2011. Cronological age 6;8 DQ:60

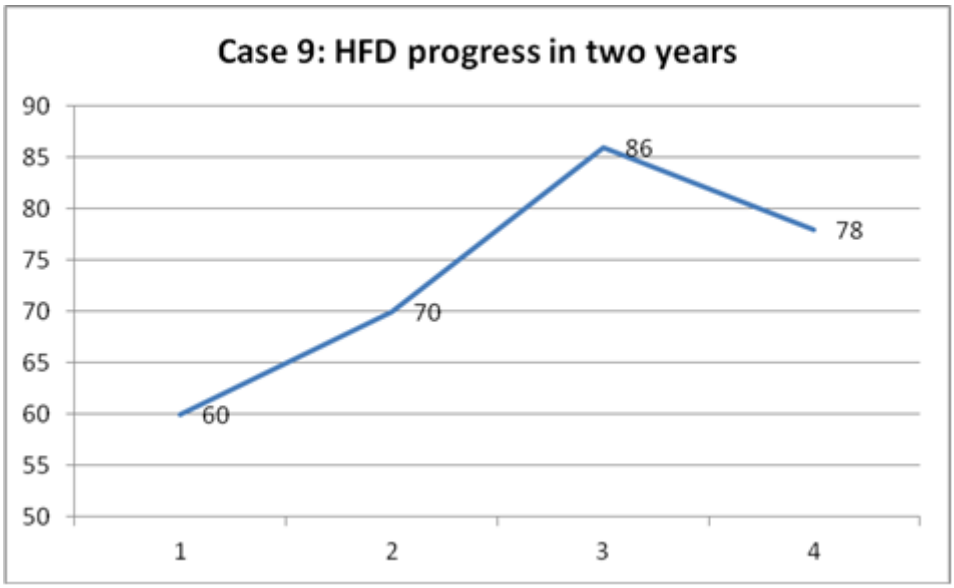
The drawing is at the pre-schematic stage. Less then a head-footer, a circle with two eyes.

67. Figure: Spontaneous Human Figure Drawing, September 2011. Cronological age: 6;11 DQ: 70.

68. Figure: Spontaneous Human Drawing Figure, May 2012. Cronological age: 7;6 years. DQ:86.



69. Figure: Case 9 Spontaneous Human Figure Drawing, June 2013. Cronological age: 8;8. DQ: 78



70. *Figure: Human Figure Drawing of Case Nr 9 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)*

Summary of Post-Test Results Participant Nr 9

One of the most striking results in our participants development that verbal static tests can be administered to him – though he had not been „measurable" at the start of intervention.

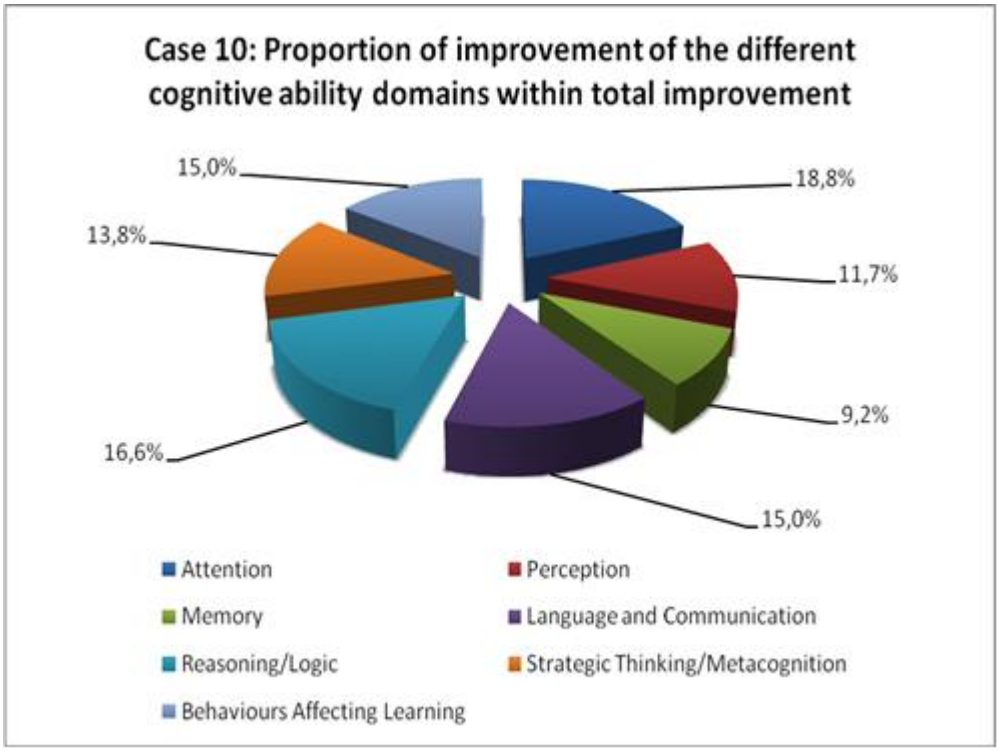
In the last six months, towards the end of the intervention a very careful planning behaviour could be experienced in the case of our participant 9. He would plan how to go home, he would plan how to organize the dots on his page, and he would write down the steps on a sheet of paper. But when he was supposed to carry out the tasks, he presented some impulsive behaviour. So seemingly he has improved in input and elaboration phase, but would make mistakes in the output level. By the end of our intervention he could articulate and used about 300 words in a holographic way.

According to Raven Colored Matrices Case 9 has developed to normalcy in terms of his cognitive abilities (It was not possible to administer the test as pre-test, and after 24 month it showed 24 raw scores which is in the normal range). We have to further develop his visuo-motor coordination and ability to analyze part and whole. Therefore our plans are to continue the systematic work with our participant with IE Standard Instruments of Analytic Perception and Organisation of Dots which require greater mental work than FIE Basic tools.
Considerable investments are needed to develop his speech because of his central speech disorder. We need to do that to such a level that it will lead to social inclusion and later complete socialisation. Therefore we will continue to teach our participant read and type on his laptop longer texts.
On the 21st of February 2012, the National Committee of Learning Potential and Rehabilitation has examined the little boy again. Quotes from the report: „His attention is very long, he is persistant in doing several tasks. Based on Snijders-Omen Nonverbal Intelligence Test we see great development: he can sort by size, shape, colour, he is able to categorize pictures. His long and short term memory is very good. We cannot judge his intelligence."

2.10 Case Study: Participant Nr 10

Baseline Information and History of Standard Testing
Case 10 is a child with Autism Spectrum Disorder. His first assessment happened at the age of 4;0 by a Committee and his BNO code was 84.0. Assessors indicated obsessive-compulsive behaviour and a total lack of understanding human speech. Participant Nr 10 has started GFCF diet right after his examination and became more tranquil in terms of emotional adjustment then before: he started to talk in short sentences and carry out simple tasks if he was asked by his parents. However, at the age of 8;0 he started to deteriorate from a social point of view: he became violent and attacked another boy in his special school. His parents has been asked to find a more segregative school for him, specialised in ASD, since he became dangerous for his peers.
Finally, he could stay in his original school – but became very closed and hardly communicated with anyone. His agressive behaviour and closed personality have been the main concern when he has been referred to our staff.
Dynamic Assessment (Pre-test)
In the first 5-6 sessions he attacked some of us – he would hit anyone who wanted to approach him. Later our impression was that if we carefully pre-mediated what we wanted, and repeated two-three times our intention slowly and carefully, and how and why we wanted it to be done, he would carry out basically any tasks (mediation of meaning). He lost his intrinsic motivation very easily, so we had to find topics that he liked. Since he has been constantly quoting from his favourite cartoons citing very long texts – as if a cartoon was „on" in his mind and inner speech, which which he was murmuring aloud – assessment happened within the context of his films. We sketched the „program" for the days of assessment on a sheet of paper (actually it was a visual timetable) and it made him much calmer.
Raven Coloured Matrixes could be administered. His intellectual screening showed a level of a 6 year-old child's functioning. His ATEC scales gave a total score of 134, which indicate serious level of autism (*Appendix 4*).
Detailed Description of Intervention

Time of intervention was 24 months, from March 2011 till March 2013.The participant's age at the start of intervention was 10;11 years. Cronological age at the end of the intervention was 12;11 years. Intensity of intervention was 9 sessions per week.
The child has been exposed to daily mediated learning experience in the first 6 months of our intervention. After the first preparatory phase Instrumental Enrichment Basic – Organisation of Dots has been applied in 5 hours per week. Thorough mediation of shapes and size has been given in verbal modality in the therapy sessions – with a lot of transfer to daily life on shapes. The tool titled "Emotions" has been applied to teach the recognition, verbalisation and transfer of emotions (metacognition). Strategies and language has been given for better control of negative emotions. Besides this, we have been working on primary cognitive behaviour for 2 years in his case.
Summary of Post-Test Results Participant Nr 10



71. Figure: Case 10 Proportion of improvement of the different cognitive ability domains within total improvement

According to Cognitive Abilities profile he improved most in language in proportion to other cognitive ability domains within his total improvement. However, when compared to the norm, he still showed serious language deficits. For example TROG test (which had been impossible to administer as pre-test) as post-test indicated that his reception of syntactic structures was that of a 3 year-old child.
The fact that DIFER-test -- reflecting on more crystallized intelligence -- could be administered in post-test phase indicates growth in cooperation of our participant. However, test results cannot be interpreted as objective data – he knew much more, but showed reluctance in copying parts of letters, for instance. (Dynamic assessment data are much higher when repeated observations in session have been ensured, or more animated ways of communication were offered.) This phenomena indicates the importance of dynamic assessment procedures as complementary ways of assessment.

Human Figure Drawing Development (Case 10)

72. Figure: Pre-test Human Figure Drawing, March 2011. Cronological age: 10;11 years. DQ: 69.

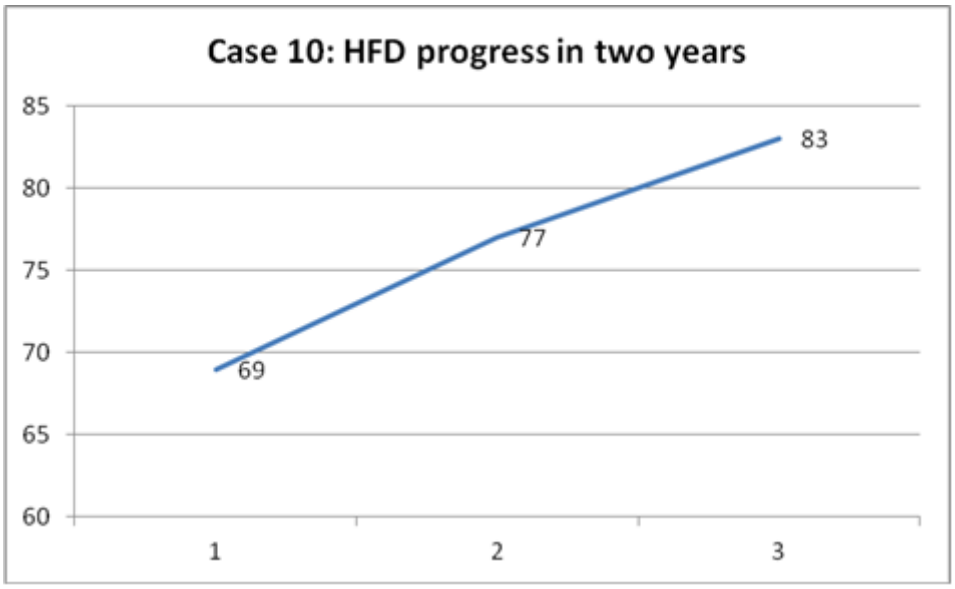
Interestingly, he has drawn a circle around the body which may indicate that he is in a closed system -- or there are barriers between him and the outer world. The number of fingers is not right, showing he is insecure in numbers.

73. Figure: Spontaneous Human Figure Drawing. The title given by the child: „My father". March 2012. Cronological age:11;11 years. DQ: 77.

He did not depict himself, but another party. By this time the number of fingers is proper.

74. Figure: Post-test Human Figure Drawing, March 2013. Cronological age:12;4 years. DQ: 83.

He has started to draw a two-dimension figure. The costume and proper shoes of the person reflect serious cognitive development.



75. Figure: Human Figure Drawing of Case Nr 10 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of Post-Test Results Participant Nr 10

Our participant has developed a great deal in self-regulation, planning and communication. By the end of the intervention he started to greet other children on arrival, monotonely though, but this has not been in his behavioural repertoire before. The fact that even tests with static interactions could be administered indicate that the child has developed meaningfully in cooperation and language. We consider it a very remarkable phenomenon that his communication has changed in a way that he is able to solve linguistic abilities tests in static circumstances as well. He carries out basically any motoric, cognitive or social tasks if our wish is presented to him in written-verbal modality. He needs less mediation in defining problems, finding out what he has to do with certain problems. When he understands a challenge, he immediately starts planning the solution. His ATEC scale scores has decreased from 134 to 63 which is a remarkable change (*Appendix 4*). One of the most important results

of our intervention is that he stopped his agressive behaviour and had not hit anyone in the last 18 month of the intervention. The main focus of our intervention was to teach him the precise recognition of human emotions based on objective signs; to recognise these emotions whenever they come; to verbalise them and use self-regulatory strategies and optimistic alternatives for problem solution, which may have triggered negative emotions.

2.11 Case Study: Participant Nr 11

Baseline Information and History of Standard Testing

Our participant has shown the signs of severe autism since the age of 2;0. He has been evaluated by one of the National Committees of Learning Potential and Rehabilitation at the age of 4;2. His intellectual abilities has been explored by Brunet-Lezine Developmental Scales and he was evaluated as having borderline moderate/severe intellectual disability. His BNO codes are F 71 and F72. A child neurologist and psychiater has evaluated him at the age of 5;2 in a hospital in Szolnok. She confirmed the borderline intellectual disability and infantile autism, BNO code F 84.

From his anamnesis we indicate that the little boy was born with caesarian section on the 40th gestational week of pregnancy. He was resuscitated after birth and respirated for a few days to keep him alive. He started to walk at the age of 2;0.

As for family history, unfortunately, he has lost his mother at the age of 4;0 in a tragic illness. His grandparents and aunt has taken over his custody – they do it with utmost care since the tragedy.

The little boy attended a special kindergarten in his home-town. Not toilet trained at the time of referral, does not take notice of his peers. Has poor eye contact but does not resists cuddling and holding. He would simply twist objects and perform repetitive movements, such as rocking, spinning or hand-flapping.

Dynamic Assessment

LPAD-Basic Assessment could not have been carried out due to lack of cooperation and general cognitive ability.

Sensory screening procedures has revealed that he liked tactile stimulation: being touched and cuddled -- especially deep pressure made him calm. Therefore, in the intervention phase we have planned a sensory stimulation program based on the suggestions of Carol Kranowitz and infused cognitive activation into occupational therapy (Cranowitz, 2005; 2006).

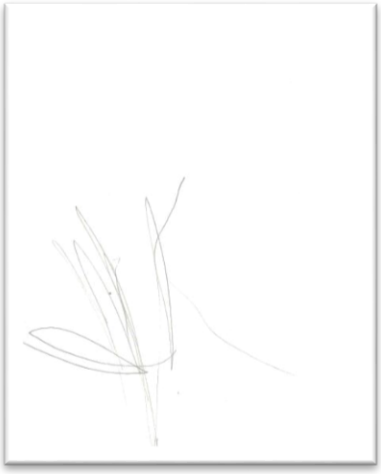
Detailed Description of Intervention

Time of intervention was from May 2011 till May 2013. Cronological age at the start of intervention was 6;3. Cronological age at the end of the intervention was 8;3. Intensity of the intervention was 7 sessions per week. Obviously, FIE-Basic Instruments have not been within the little boy's zone of proximal development.

Very basic cognitive operations has been in focus – choosing, comparing, identification, differentiation, categorisation, seriation etc. The ways of interaction has always been according to the criteria of MLE. Also, we used a special type of MLE interaction, defined by Feuerstein et al. as Mediated Self-Talk, a think-aloud, talk-aloud approach to building language and communication (or MST) (Feuerstein et al, 2013).

Very basic Picture Exchange System has also been used and mediated as an augmentative communicational tool.

Human Figure Drawing Development (Case 11)



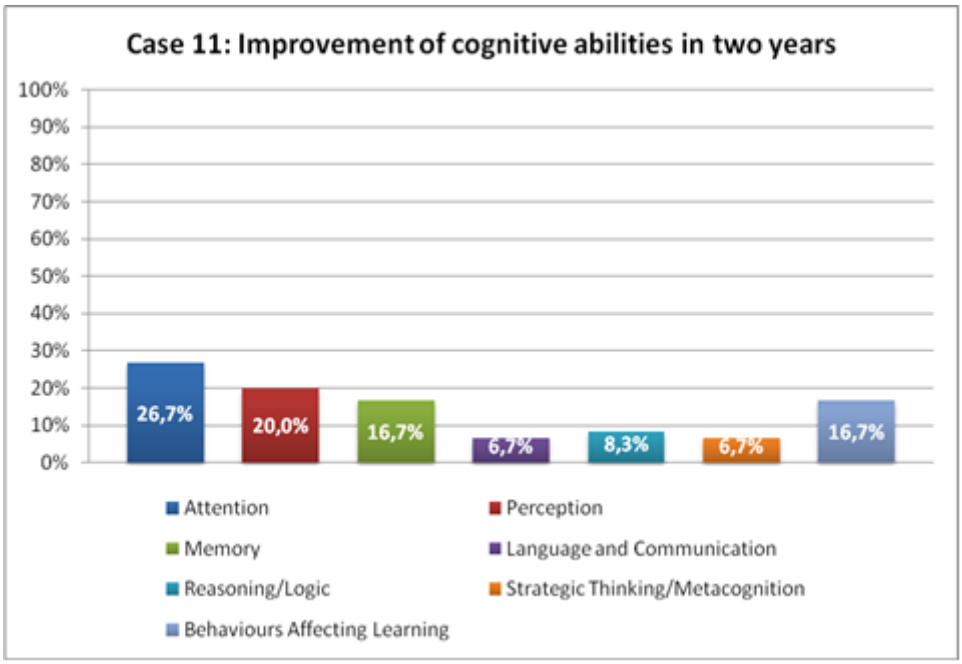
76. Figure: Pre-test: Human Figure Drawing. May 2011. Cronological age: 6;3 years. Category „A". Scribbling stage

77. Figure*: Human Figure Drawing. May 2012. Cronological age: 7;3 years. Category „A"*

78. Figure: Post-test. Human Figure Drawing. May 2013. Cronological age: 8;3 years. Category „A"

Summary of results of Case 11

We could not modify our participant's cognition meaningfully. We could teach him how to choose from two items -- basic pictures of food; animals; and family members. According to dynamic assessment profiles his attention span became longer and his perception slightly improved (*Figure 79*). One remarkable development in linguistic abilities is that his speech comprehension has improved, according to triangulation of CAP: caretakers indicated positive signs of better receptive language in home settings. This change is also indicated by expressive language: he has acquired 3-5 words ('horse'; 'no'; 'snow' etc.) which he would pronounce in therapy sessions from time to time in adequate situations. The originally non-verbal child has started to pronounce a few basic words – usually without eye-contact and joint gaze. This is a breakthrough – however considering the 24 months long investment, this change is considered minor in terms of time-span and efforts.



79. Figure: Improvement of cognitive abilities in two years in percentage points (Case 11)

2.12 Case Study: Participant Nr 12

Baseline Information and History of Standard Testing

Case 12 is a female child from twin graviditi. She was born as second „B" child. Because of postinfectious hydrocephalus internus, the little girl had a shunt operation in the National Institute of Neurosciences at three months. She presented severe epilepsy. Her BNO codes are G9110. and BNO G4010. At the age of 6, lumbal stem cells transplantation happened in China. Due to this intervention shunt malfunctions occured already on the airplane back to home. The occlusion (blockage) of the proximal ventricular catheter made another operation necessary at National Institute of Neurosciences. This event has further deteriorated her intellectual condition.

Our participant's psycho-pedagogical reports indicate severe symptoms of ADHD, hemiphlegia, moderate intellectual disability, BNO F71.

Dynamic Assessment (Pre-test)

All emerging cognitive functions were delayed, she especially had problems with input phase. She would give trial and error responses and did not have any basic concepts (colour, size, number and position). Her attention span was not more than 5-10 seconds.

Detailed Description of Intervention

The intervention happened from September 2010 till September 2012, altogether 24 months. Cronological age at the start of intervention was 7;8 years. Cronological age at the end of intervention was 9;8 months.

She had to be targeted with our general preparatory program. Basic Concepts: color, shape, size, orientation in space and related concepts, number and quantity, time, cause and effect relationships, feelings and moods, the human body (body parts and their functions) have been taught to her. Also we have been mediating general knowledge about the immediately experienced world. Our main concern was also to teach her primary Cognitive behaviours: attending to stimuli, focusing, imitative behaviours, symbolic play, question and answer responses, initiatory/adaptive play (Feuerstein, Mintzker&Feuerstein, 2006).
The main mental operations we have been working on in the first year were comparison, classification, analysis and synthesis in verbal, visual and auditory modalities.

After the first year of intervention, her cognitive acceleration happened with Feuerstein's Instrumental Enrichment Basic Programme, which included the use of 'Organization of Dots' tool. We have prepared her for the tool by making her draw horizontal and vertical lines and connecting bigger sized dots on a separate sheet of paper. It took us for about 2 months to teach her concepts of 'triangle', 'square', 'rectangle', 'horizontal', 'vertical', 'rotated' and 'overlapping'. We have also introduced the tool 'Identifying emotions' from the second year.

She needed a serious investment in the first year and her modifiability seemed a bit modest. Micro-changes have been experienced in the first year: increased interest in objects and puzzles, increased ability to use more than otwo sources of informantion at the same time. Her cognition and speech comprehension started to grow from the second year in a way that she would be assessed by static measures. On PPVT she would perform 13 raw-scores (3 years in mental age) as pre-test. As post-test she performed 48 raw-scores (5 years in mental age) after two years. As pre-test it was not possible to administer the Raven test. (*Appendix 15*).

Her speech comprehension has increased a great deal in two years: TROG test could not be administered as pre-test (she did not understand the simple task that she is supposed to point at the picture that has been named by the assessor), as post-test showed that she could perform on the level of a 3;5 year old child.

11. Table: Trog-test. Test for Reception of Grammar

	Pre-test	**Post-test May 2013**
Number of blocks Completed	Impossible to administer	5
Age-equvivalence	-	3;5 years

Human Figure Drawing Development (Case 12)

80. *Figure: Pre-test Human Figure Drawing, September 2010. Cronological age: 7;8 years. DQ: Category „A"*

The first human figure is a circle-shaped scribble. Strong pressure of the pencil.

81. Figure: Spontaneous Human Figure Drawing, May 2011. Cronological age: 8;4 years. DQ:Category „A"

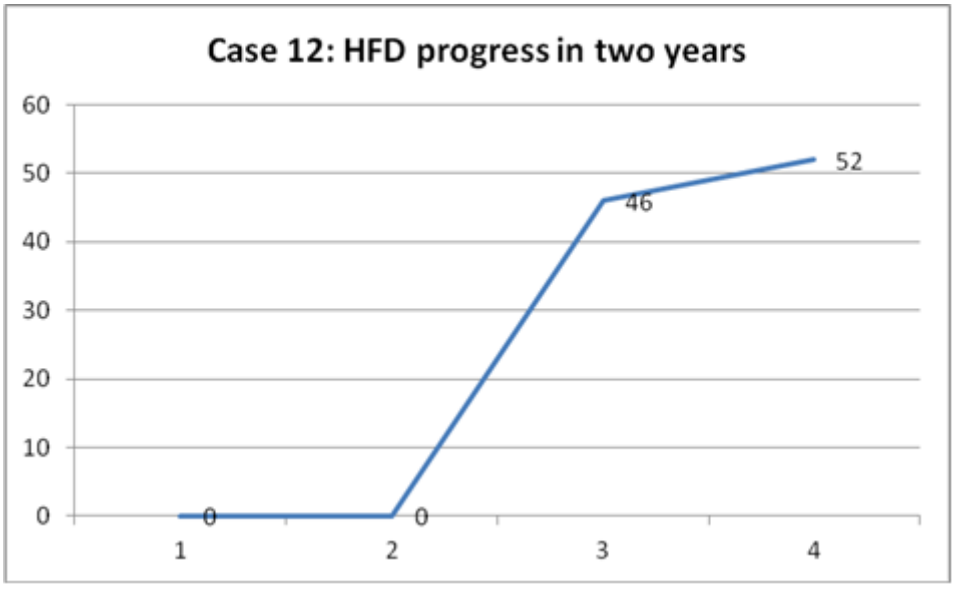
A more advanced scribble: some of the lines are aggregated in spots.

82. Figure: Spontaneous Human Figure Drawing, June 2012. Cronological age: 9;5 years. DQ 46

A real breaktrough happened in the 20th month of the intervention. She explained all the bodyparts. The drawing indicates she started to integrate knowledge, a more coherent figure is presented.

83. *Figure: Post-test Human Figure Drawing. September 2012. Cronological age: 9;5 years. DQ 52*

This is a spontaneous drawing in the 24th month. Head, trunk, hair and ears are clearly visible.

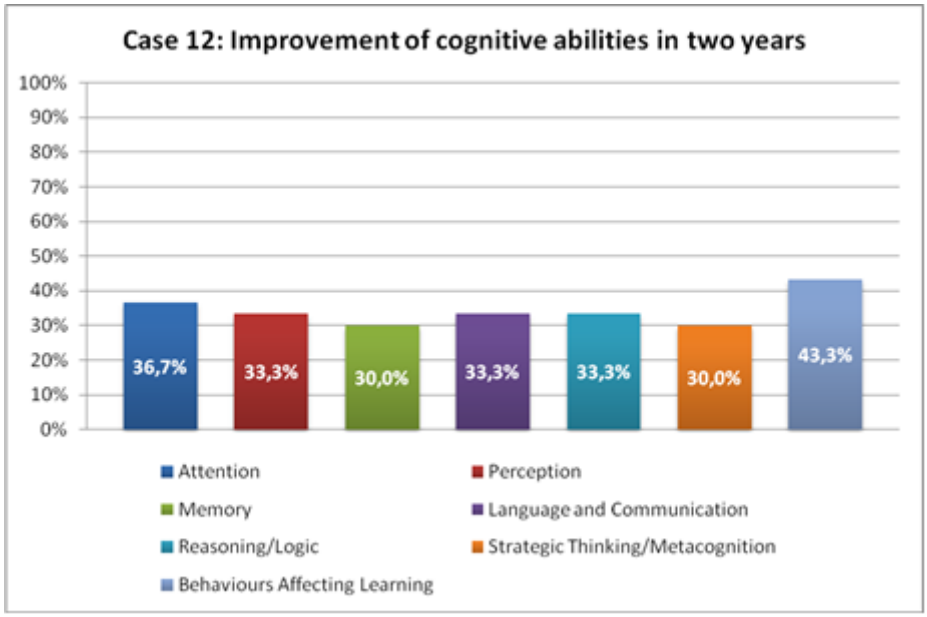


84. *Figure: Human Figure Drawing of Case Nr 12 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)*

Summary of Post-Test Results Participant Nr 12

Our participant did not show relevant modifiability in the first year. Her attention span was extremely short. Word-retrieval problems and difficult working memory problems were experienced. From the beginning of the second year we sensed a breakthrough in her input cognitive functions: she started to label objects precisely and she became really persistent in simple problem-solving. This latter one indicates increased self-regulation while learning.

Our participant's development in human figure drawing indicates she has started to become more integrated after two years of intensive acceleration. Cognitive Abilities Profile indicated 43,3%p growth in behaviours affecting learning (*Figure 85*).



85. Figure: Improvement of cognitive abilities in two years in percentage points (Case 12)

2.13 Case Study: Participant Nr 13

Baseline Information and History of Standard Testing

Our young participant (Nr 13) has been born with Down-syndrome (Trisomy 21). The physical characteristics of the syndrome were quite pervasive in his case: our young participant had small head compared to the body, short and thick neck, an excessively protruding tongue and upward slanting eyes. He had hypoton, low muscle tone. One of the pedagogical services in Csongrád county have examined the little boy and based on Bayley's scales has indicated an FQ of 39.

Dynamic Assessment

Dynamic assessment happened on the basis of observations based on MLE criteria. The very positive eyles of normalcy in the young child's cognitive-behavioural repertoire was that he loved to communicate in non-verbal modality. Therefore we have created specific metacommunicative signs accompanied with verbalisation already at the phase of assessment. Another strength was that he loved to learn in visual modality. He loved to imitate: delayed but very precise imitation has characterised his behaviour. He presented unclear and sweeping perception – he was extremely impulsive; he had episodic grasp of reality and lack of planning behaviour.

Detailed Description of Intervention

Intervention lasted from May 2011 till May 2013, altogether 24 months.

Cronological age at the start of intervention was 2;8 years. Cronological age at the end of intervention was 4;8 years. Intensity of the cognitive intervention has been 8 sessions per week. Our participant has been given general enrichment with MLE and MST (mediated self-talk). Basic concepts of colour, number, direction, quantities have been emphasized in his program.

The only FIE tools used were „Emotions" and the first pages of „Organisation of Dots" (this latter one has been enlarged significantly). We insisted that he would start connecting dots on a separate page, learn to connect them in a precise manner, learn the different shapes and practice mental rotations and gestalt tasks at his developmental level. Based on our former experience we hypothised it may help to integrate most of his input functions. Oral-motor therapy has also been infused into the cognitive program to develop seriously delayed oral-motor abilities.

12. Table: Kiphard Sensorimotor and Psychosocial Scales

	September 2011	**May 2012**	**September 2013**
Cronological age	36 months	44 months	48 month
Optic Perception	31 month	39 month	40 month
Hand movement (Fine Motor)	25 month	44 month	44 month
Gross Motor	30 month	36 month	38 month
Acoustic Perception	34 month	43 month	45 month
Speech (production)	23 month	29 month	31 month
Social Relationships	32 month	44 month	47 month

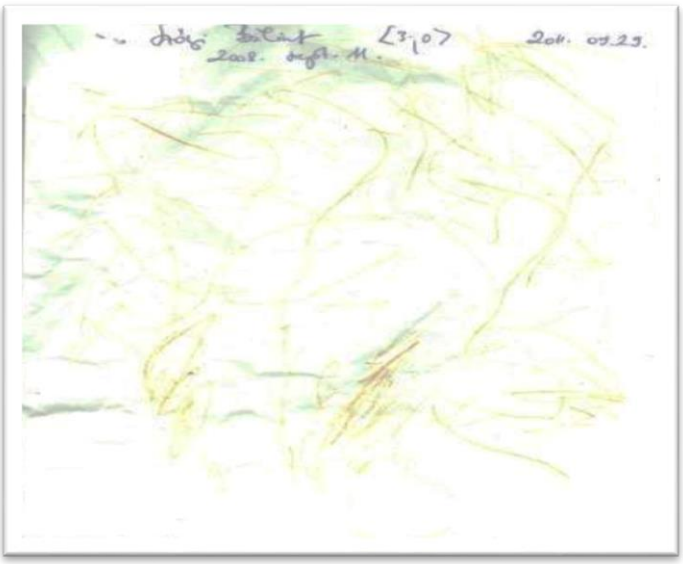
According to Kiphard Speech production, gross and fine motor development seemed to be most delayed – this is very characteristic of the given syndrome.

13. Table: Peabody Passive Vocabulary Test Results

Date	**Pre-test May 2011**	**After 12 months of intervention, May 2012**	**Post-test, after 24 months after intervention, May 2013**
Raw Score	8	39	56
Mental age	<2	3;5	6;0
Cronological Age	2;8	3;8	4;8

Our participants *receptive language* has developed to an unexpected level – the gain is 4 years within the 24 month intervention period. This is a remarkable, unusual change.

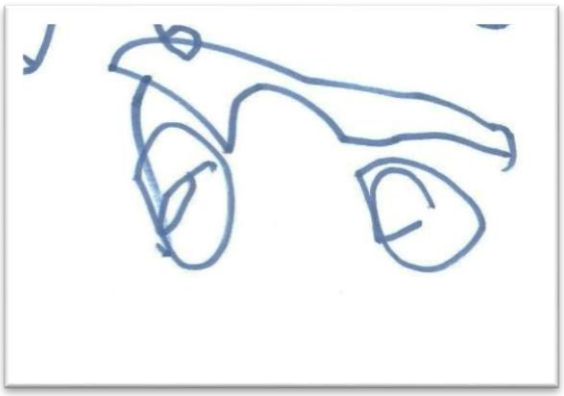
Human Figure Drawing Development (Case 13)



86. *Figure: Pre-test Human Figure Drawing, September 2011. Cronological age: 3;0 years. DQ: Category „A"*

Marks on the paper with low pressure of the pencil.

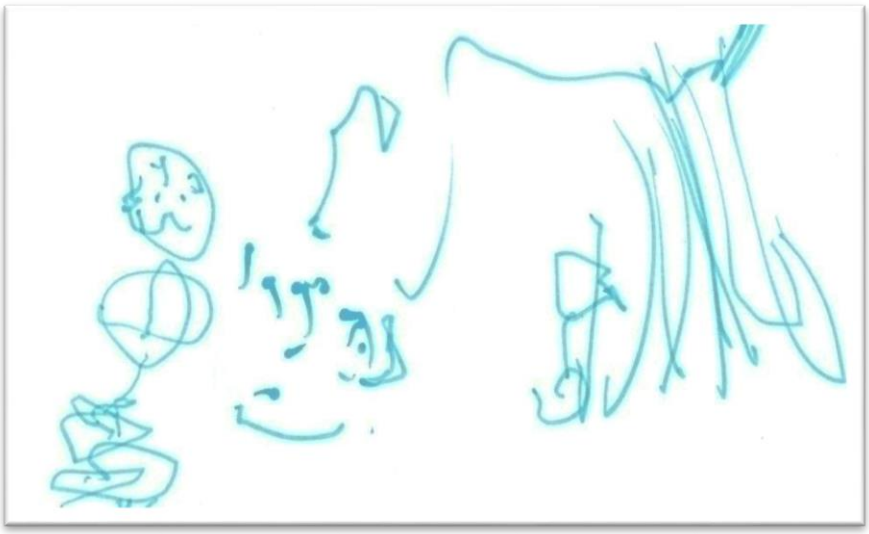
87. Figure: Spontaneous Human Figure Drawing. The title given by the child:„ A man". March 2012. Cronological age: 3;6 DQ 115.



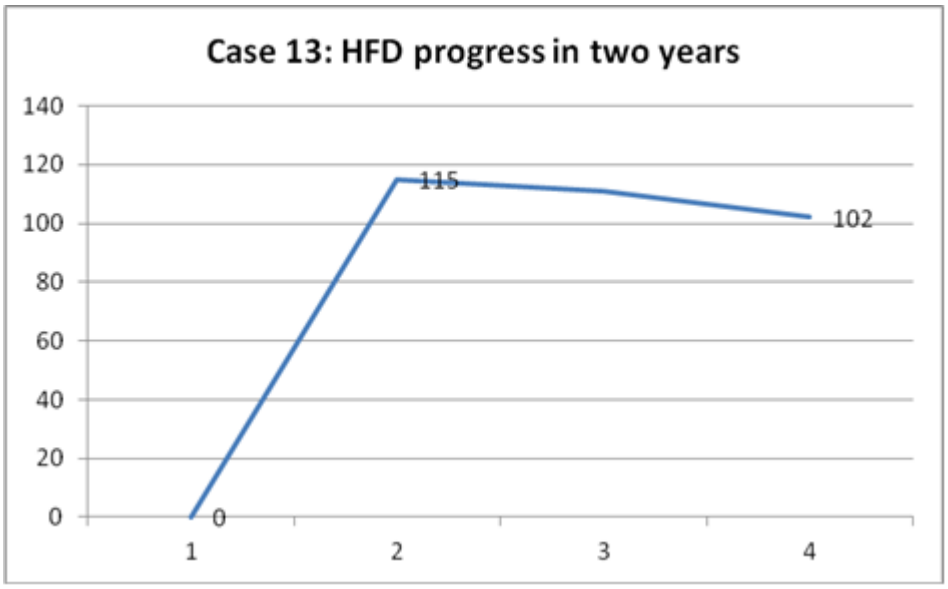
88. Figure: Spontaneous Human Figure Drawing. The title given by the child:„ A man". March 2012. Cronological age: 3;6 DQ 115.

A few days later he has drawn a car. The title given by the child:„ A tactor".

89. Figure: Spontaneous Human Figure Drawing. The title given by the child:„Mum". October 2012. Cronological age: 4;1 years. DQ 111



90. Figure: Post-test Human Figure Drawing. The title given by the child: „Daddy". May 2013. Cronological age: 4;8 years. DQ 10



91. *Figure: Human Figure Drawing of Case Nr 13 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)*

Summary of results of Case 13

Our participant's *receptive language* has developed to an unexpected level – the gain is 4 years within the 24 month intervention period. This is a remarkable, unusual change. Literature is replete with evidence that children with Down-syndrome have markedly lower receptive and expressive language abilities than other children in the population of children with moderate intellectual disability (Radványi & Pléh, 2002; Radványi, 2005)

Our participant has developed a great deal in self-regulation, planning and communication. His conceptual development is remarkable. In the post-test phase of the intervention the child is still in the holographic phase of language development: one or two words mean and describe a whole situation. His expressive vocabulary is rich and combined with gestures he is able to maintain even longer conversations. He is extremely social and brave: he is very happy to make services to adults and get to know them, not only his peers.

2.14 Case Study: Participant Nr 14

Baseline Information and History of Standard Testing

Our participant has been examined by SOTE Child Neurology Clinic at the age of 4;8 where psychiatrists indicated Pervasive Developmental Disorder (PDD), and borderline cognitive abilities between normalcy and mild intellectual disability. BNO F84.90 and F 70. „Slow and delayed speech development, she lives in her own world. Bonding to parents has developed, but has her own inner space: likes being alone, ignores peers. Bizarre affective reactions – when happy starts to scream or gets very angry if praised.

Pécs University Institute of Human Genetics in 2011 notes: „Genetic anomalies behind the clinical symptoms could not be identified, no definitive genetic syndrome can be suspected." Later, food intolerance tests indicated serious gluten, casein and egg intolerance. A child neurology center states the following in 2011: „Clinical symptoms indicate Pervasive Developmental Disorder, MRI findings indicate perinatal hypoxia-hypovolemia".

Dynamic Assessment

The most striking experience of the asessors was the little girl's inadequate reciprocity. When a question has been asked, she would always answer, but her sentences were unrelated to the question. Strange vocal tone and intonation characterised her speech. Her curiosity could be

raised, but her attention shifted away very easily. It was very hard for her to sit at the table for more than 10 minutes, she would stand up many times during assessment.

Detailed Description of Intervention

Time of intervention was from December 2010 till December 2012. Cronological age at the start of intervention was 4;8 years. Cronological age at the end of intervention was 6;8. Intensity of the cognitive intervention was 8 sessions per week.

We used cognitive toys (like puzzles and toys with forms or toys which required complex use of stimuli) in the introductory phase. Our mediators have been very determined to ensure that the so called „mediational loop" will be closed when we instructed her (*see Chapter 1.3.1*). Otherwise the stimuli would not reach her elaboration. Effects of our intervention has been experienced basically from the first sessions: the little girl proved to be very amenable for change. After the first week her attention span started to grow and her self-regulation also started to change into positive direction.

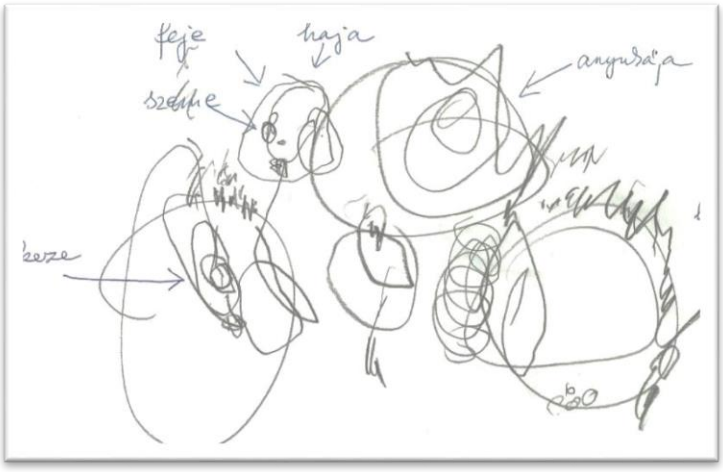
Used FIE tools from the 6th month of the intervention were „Organization of Dots", „Compare and Discover the Absurd" and „Know and Identify". From the second year we applied the tool „Learn to Ask Questions for Reading Comprehension','Tri-channel Attentional Learning' and 'From Unit to Group'.

Human Figure Drawing Development (Case 14)

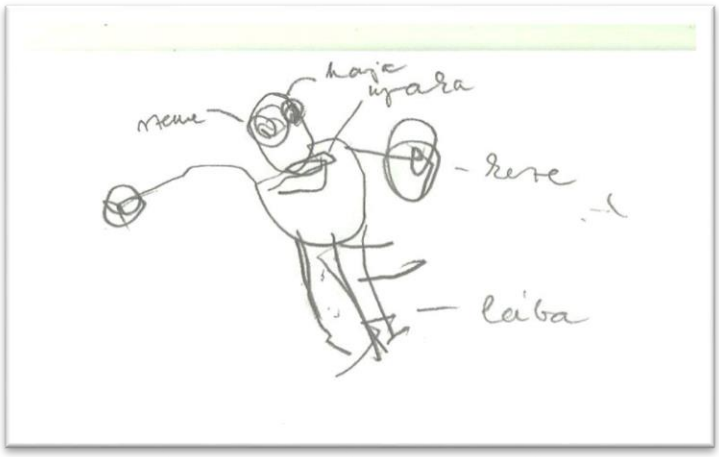
92. Figure: Pre-test Human Figure Drawing, December 2010. Cronological age: 4;8 years. DQ: Category „A"

93. Figure: Spontaneous Human Figure Drawing. The title given by the child:„Mum". April 2011. Cronological age: 5;0 years. DQ 80

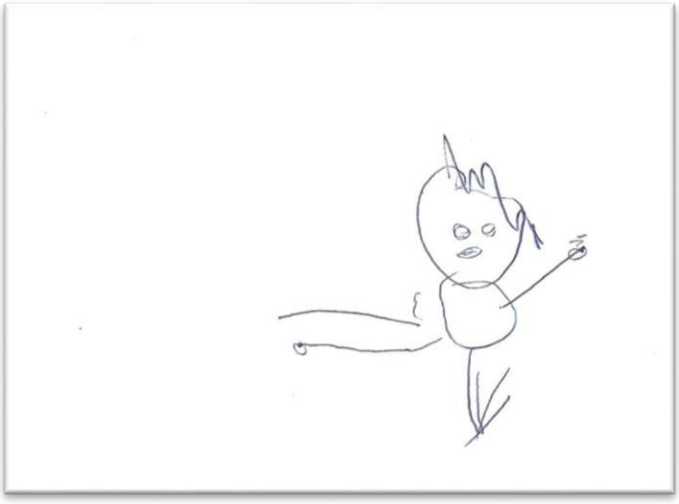
Though bodyparts are scattered in this picture -- indicating serious episodic thinking and lack of establishing relationships -- the development is visible: she has started to observe small details.



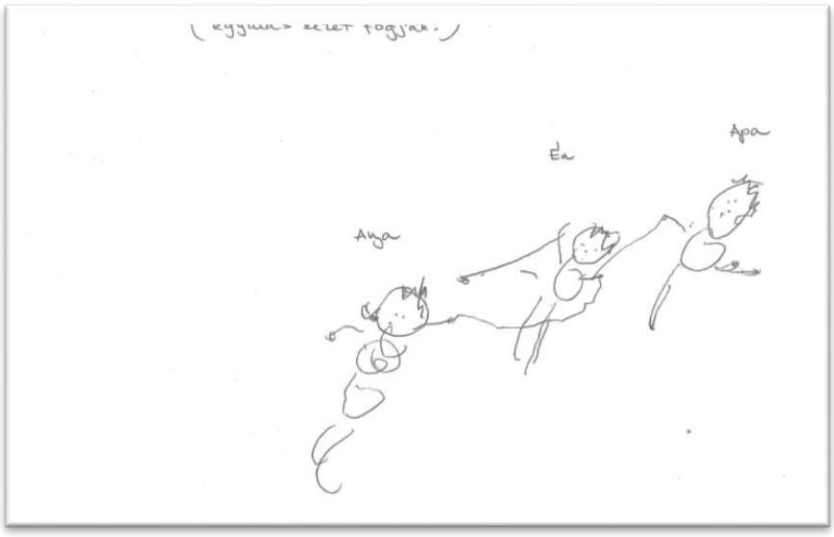
94. Figure: Spontaneous Human Figure Drawing, November 2011. Cronological age:5;7 years. DQ 95



95. Figure: Spontaneous Human Figure Drawing, February 2012. Cronological age:5;10 years. DQ 112

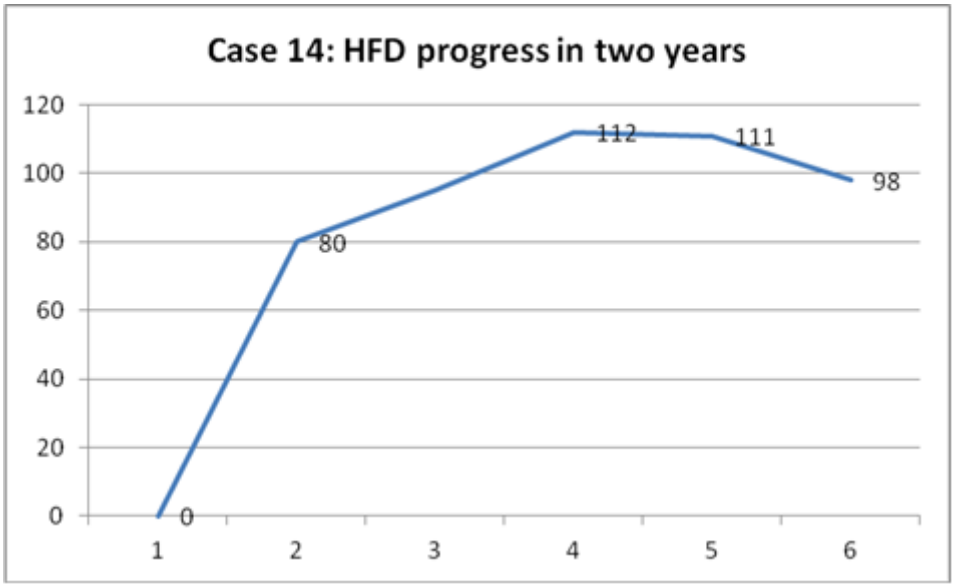


96. Figure: Spontaneous Human Figure Drawing, May 2012 Cronological age:6;1 years. DQ 111



97. Figure: Spontaneous Human Figure Drawing. The title given by the child: „My Family Holding Each Other's Hand". December 2012. Cronological age: 6;1 years. DQ 98

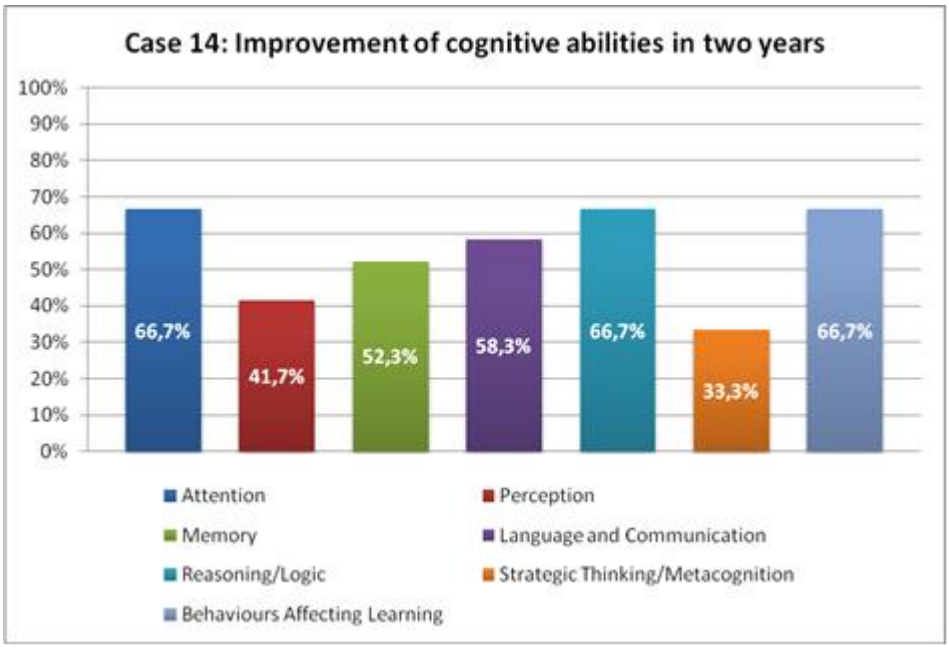
The child has started to depict human relations – which is a virtual, abstract concept. This indicates serious cognitive-emotive development in Pervasive Developmental Disorder (*Figure 98*).



98. Figure: Human Figure Drawing of Case Nr 14 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)

Summary of results of Case 14

Our participant has developed a great deal in self-regulation, planning and communication. According to Cognitive Abilities Profile her attention, reasoning/logic and behaviours affecting learning have developed by 66,7 %p each (*Figure 99*).



99. Figure: Improvement of cognitive abilities in two years in percentage points (Case 12)

Her linguistic and conceptual development is remarkable. TROG-test also indicated serious development from an age-equvivalence of 2;0 to 5;0.

Her human figure drawing evolves by a stunning rate – from scribbled lines we arrive to a picture where family members are holding each other's hand (virtual relationship is projected on the paper). The little girl showed a remarkable level of modifiability from the first sessions.

2.15 Case Study: Participant Nr 15

Baseline Information and History of Standard Testing

Our participant has been suspected to have Down-synrome, mosaic type, at the age of 1;0. By the age of 18 months the syndrome has been detected and proved. Since our participant's general mental and physical condition has been satisfactory, no special physical or cognitive intervention has been initiated by early developmental centers. However, when examined by one of the pedagogical services at the age of 5;8, borderline intellectual abilities have been indicated between normalcy and mild intellectual disability.

Dynamic Assessment

The first impressions were that our young participant has serious visuo-motor delay. This has been suggested by his very low level of human figure drawing as well (*Figure 100*). He presented blurred and sweeping perception – he was very impulsive and presented episodic grasp of reality. It was very hard for him to obtain logical evidence from concrete facts and had very weak temporal and spatial orientation. He could not define the exact date, season and name of the day. Despite his very rich expressive vocabulary, he had hardships defining a problem. He presented lack of planning. He had a lot of trial and error responses – he tried to „read" the exact answers from the face of the assessor. He lacked abstract concepts – names of shapes and time postpositions.

The main concern of parents was that he had been „easily influenced by his peers, and had a much more regressive character compared to his cronological age".

Detailed Description of Intervention

Time of intervention was from August 2011 till August 2013.

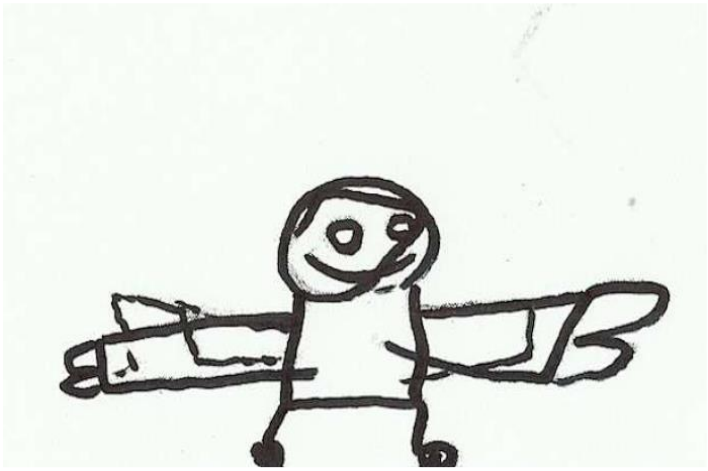
The boy's cronological age at the start of intervention was 7;0 years. Cronological age at the end of intervention was 9;0. Intensity of the cognitive intervention was 7 sessions per week. The following FIE-Basic tools could be applied from the beginning of our intervention: „Organisation of Dots", „Emotions" and „Spatial Orientation". General MLE with lots of transfer in defining problems, planning and orientation in time and space were part of his treatment with a strong transfer to his school subjects (reading, writing and mathematics). We asked parents to buy a wrist-watch to their son to help him orient in time.

Our participant had a very highly developed receptive language. Finally, at the age of 9 he still forwarded his cronological age by 3 years according to PPTV measures (*Appendix 15*). Striking results of TROG-Test also indicated that he has grown from 7;0 years to 10;0 years (age-equvivalence) in understanding syntactic structures within two years (*Table 14*).

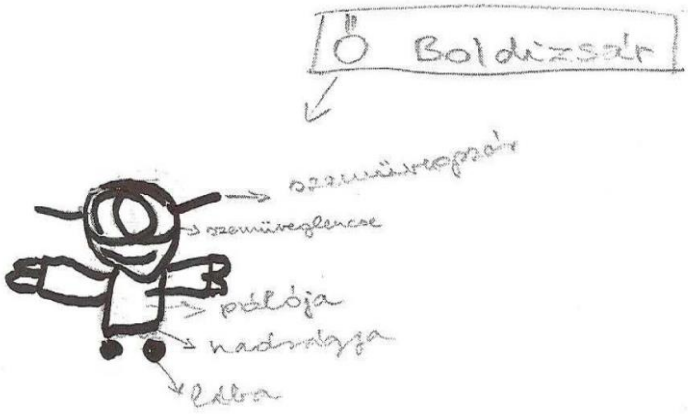
14. Table: Trog- test. Test for Reception of Grammar Pre- and Post-Test Results

Case 15	Pre-test December 2010	Mid-Term Test April 2012	Post-test December 2012
Number of blocks Completed	13	14	16
Age-equvivalence	7;0	7;6	10;0
Cronological Age	7;0	8;0	9;0

Human Figure Drawing Development



100. Figure: Pre-test Human Figure Drawing, August 2011. Cronological age:7;0 DQ 90



101. *Figure: Human Figure Drawing, August 2012 Title of the Drawing: „Myself".Cronological age:8;0 DQ 82*

The second drawing is much more detailed than the first one – our participant is realistic in the sense that he depicts himself precisely (T-shirt, trousers, glass lenses and the rim of the glasses etc). But he also grew older and he achieves less scores on the Goodenough-Harris test. This is an example that even zero score gain may cover development in case of children with intellectual disabilities.

102. Figure: Human Figure Drawing, August 2013 Cronological age:9;0 DQ 120

Summary of results of Case 15

Based on dynamic assessment result and the therapists'observations his perception has developed a great deal – his scores doubled in LPAD-Basic. He treated stimuli in a much

more precise and systematic manner at the end of the intervention. Cognitive Abilities Profile indicates that his perception has grown by 76,7%p within two years. He has developed in planning and strategic thinking in order to successfully solve tasks. He was able to realize and apply logical evidences and apply abstract concepts in practical problem solving by the end of the intervention. His active vocabulary scores have tripled (*Appendix 15*) and he could easily solve abstract problems in the end. He formulated less trial and error responses.
His parental interviews also strengthened that our participant started 'to see' much better – and parents sensed that the boy is using cognitive strategies to develop his vision ('*The other day he said that the rule he was taught, for example that objects which are further seem smaller, help him to orient in space much more.'*) Parents also reported about .. (*'His social abilities improved, seldom it happens that he ignores his peers and plays alone. He cites the actual date by heart and is very safely oriented in time and space.*')
To sum up our participants development, he has shown a remarkable development after the two year intervention period – he has developed a passive vocabulary three years higher than his cronological age, his human figure drawing has developed 1,5 years above his cronological age and his general intelligence is much above his peer group (according to Raven test he has grown into the 50-75 percentile).

3. Analysis by Descriptive Statistics and Test Statistics

General Cognitive Development of Participants

Though our population in the study consisted of rather heterogenous children both in age and original levels of functioning, also in the severity of comorbid phenomena, we tried to treat them as a group for further analysis. Average improvement of our participants on normative tests is summarized in *Table 15*.

15. Table: Average improvement in Raven's Colored Matrices, Peabody's Passive Vocabulary Test, Gardner's Expressive Language Test in two years

	Mean of improvement	**Standard deviation**	**Min.**	**Max.**	**Theoretical maximum**	**Average percentage points of improvement**
Raven	10,57	5,90	0	24	36	29,37%
PPVT	43,71	23,76	11	101	150	29,14%
PPVT (mental age in months)	46,43 = 3 years, 10 months	20,06	12	90	-	-
Gardner T	32,29	15,55	5	69	79	40,87%

Aggregated data show that Raven Colored Matrices results have improved by 29,37 percentage points from pre- to post-intervention measures. (We have excluded one case, Case 11, due to his status of severe intellectual disability.) Peabody Passive Vocabulary Test results have improved by 29,14 percentage points, which means 46,43 months (3 years, 10 months) development in mental age over the two years.

The most salient changes according to test results are the *development of linguistic/conceptual domains* – just in line with the results of the study which has applied FIE-Basic with preschool children with regular intelligence (Ben-Hur & Feuerstein, 2011)**.**

The most striking gains are in the field of *receptive vocabulary* (assessed by PPVT): 73,3% of children has gained 3;0 – 5;6 mental years during the 24 months intervention period. (Case 1 has gained 8;6 mental years during the 24 months.) 20 % of students has gained 2;0 mental years during the 24 month intervention time. Understanding syntactic structures (assessed by TROG test) has also developed, generally between 2;4 -- 5;2 years during the 24 months long intervention phase.

This fact means that language/conceptual development can be effectively modified by social constructivist approaches – and seems to support the ideas of Vygotsky who thought language is made meaningful by interactions with adults who could assist children to reach a higher level of development (Vygotsky, 1968).

As for *expressive language development*, Gardner test has indicated 3;0 – 6;0 years of development in expressive vocabulary in two years. A general, common experience of therapists, the external evaluator, caretakers and school staff was that children became intensly active verbally – they rapturously labelled objects and phenomena in their environment and presented constant comparative behaviour.

Test Statistics

Analysis by test-statistics has indicated that there were *significant changes* in the cognitive development of the participants between pre-test and post-test measures. The differences concerning cases with moderate and mild intellectual disability are also differentiated (*Table 16*.).

16. Table: Results of Paired-samples T-test and Wilcoxon signed-rank test (n=14)

				95% confidence interval of the difference				**Nonparametric test for two related sample**
	Mean	**Standard deviation**	**Standard error of mean**	**Lower**	**Upper**	**t**	**df**	**Wilcoxon's Z**
Raven	10,57	6,12	1,64	7,04	14,18	**6,460*** **	13	**-3,185****
Peabody	43,71	24,66	6,59	29,48	57,95	**6,634*** **	13	**-3,296*** **
Gardner	32,29	16,14	4,31	22,97	41,61	**7,484*** **	13	**-3,297*** **
Differences in cases with moderate ID								
Raven	9,22	7,31	2,44	3,60	14,84	**3,784****	8	**-2,533***
Peabody	49,22	27,72	9,24	27,91	70,53	**5,327*** **	8	**-2,666****
Gardner	35,11	19,40	6,47	20,20	50,02	**5,430*** **	8	**-2,666****
Differences in cases with mild ID								
Raven	13,00	1,87	0,84	10,68	15,32	**15,538*** **	4	**-2,032***
Peabody	33,80	15,74	7,04	14,26	53,34	**4,802****	4	**-2,023***
Gardner	27,20	6,61	2,96	18,99	35,41	**9,201*** **	4	**-2,032***

***** - p<0,001; ** - p<0,01; * - p<0,05**

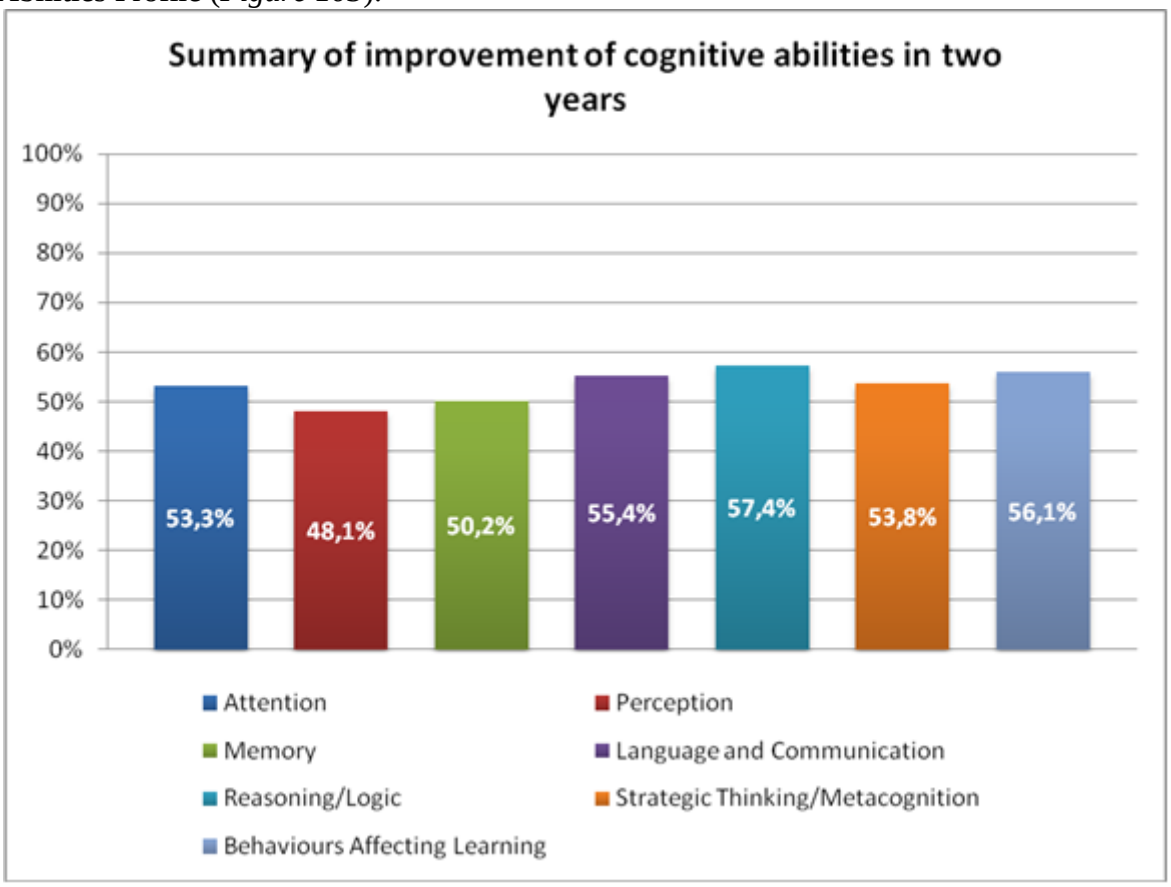
Notes: SD: This is the corrected standard deviation (the sum of squares divided by *n-1* instead of *n*).

Paired samples T-test showed significant differences between pre-test and post-test measures in general intelligence (Raven Coloured Matrices) and in receptive/expressive language even though our sample was rather small (n=14). The same was experienced when we analysed the results of the few cases having only mild intellectual disability (n=5): the significant differences indicate that the participants' development was large.

Summary of Results Gained by Dynamic Assessment Procedures: Cognitive Abilities Profile and LPAD-Basic

Results gained by dynamic assessment procedures show that our study is in line with the Alaskan study involving preschool children with regular intelligence (Ben-Hur & Feuerstein, 2011): the *conceptual/linguistic*, *reasoning/logic domains* and *behaviours*

affecting learning have been the areas where the most salient changes happened in case of children with intellectual disability after the two years intervention period (in conceptual/linguistic areas 55,4 percentage points, in reasoning/logic 57,4 and in behaviours while learning 56,1 percentage points growth have been experienced) according to Cognitive Abilities Profile (*Figure 103*).



103. Figure: Summary of improvement of cognitive abilities in two years

The elicited changes are meaningful in all the following areas: attention, perception, memory, receptive/expressive language and communication, reasoning/logic, strategic thinking/metacognition and behaviours while learning. Total growth was 53,46 percentage points after the intervention (*Table 17*)

17. Table: Average improvement of cognitive abilities in two years

	Average percentage points of improvement	Standard deviation of percentage points	Min	Max
Attention	53,27%	18,44%	23,33%	73,33%
Perception	48,14%	16,83%	20,00%	76,67%
Memory	50,21%	19,47%	16,67%	83,33%
Language and Communication	55,36%	23,81%	6,67%	93,33%
Reasoning/Logic	57,40%	23,70%	8,33%	93,33%
Strategic Thinking/Metacognition	53,75%	26,14%	6,67%	93,33%
Summary	53,46%	21,73%	6,67%	93,33%

Notes: Case 13 was excluded due to his young age. SD: Uncorrected, because there wasn't sampling.

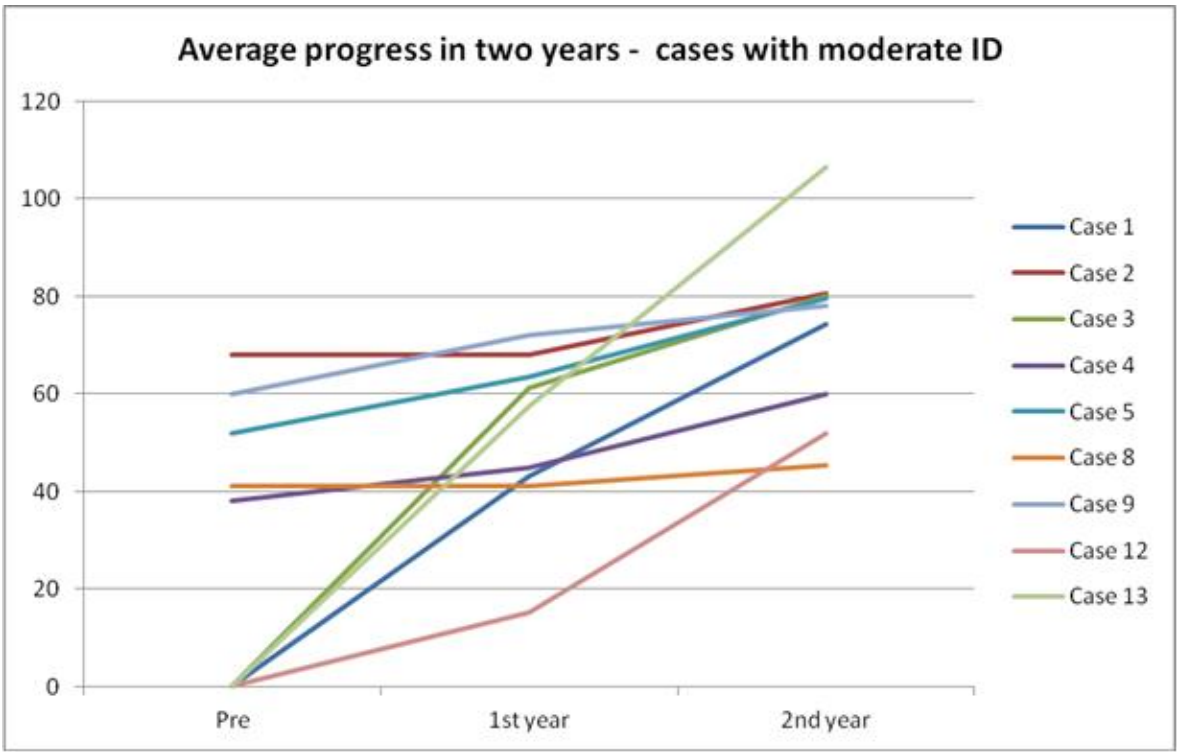
According to CAP results 80% of our population has reached inconsistent independent problem solving in the above mentioned areas from total dependency from an adult in problem-solving tasks (from baseline profile to post-intervention profile). The very same has been shown by LPAD-Basic: while participants arrived for intervention without the ability to learn in a direct way from the sorrounding stimuli, and without benefiting from other human's help, they left with the ability of direct learning from their environment or at least with an increased ability to gain from other human's help (*Appendix 15*).

We could lead 74% of children with intellectual disability to metacognitive awareness – they could clearly recognise and name the operations they have been doing with concrete or abstract data ('*I am comparing these three objects according to height*'; '*I am creating a sequence where the number of the objects are growing by two*') and they could recognise the operations in other context. 70% of them has presented a constant comparative behaviour, especially in the beginning of the intervention period – they have developed a need to compare everything they experienced and figure out a criteria for commonalities. Their episodic world-view has started to turn into a self-generating cognitive behaviour in finding relationships between data.

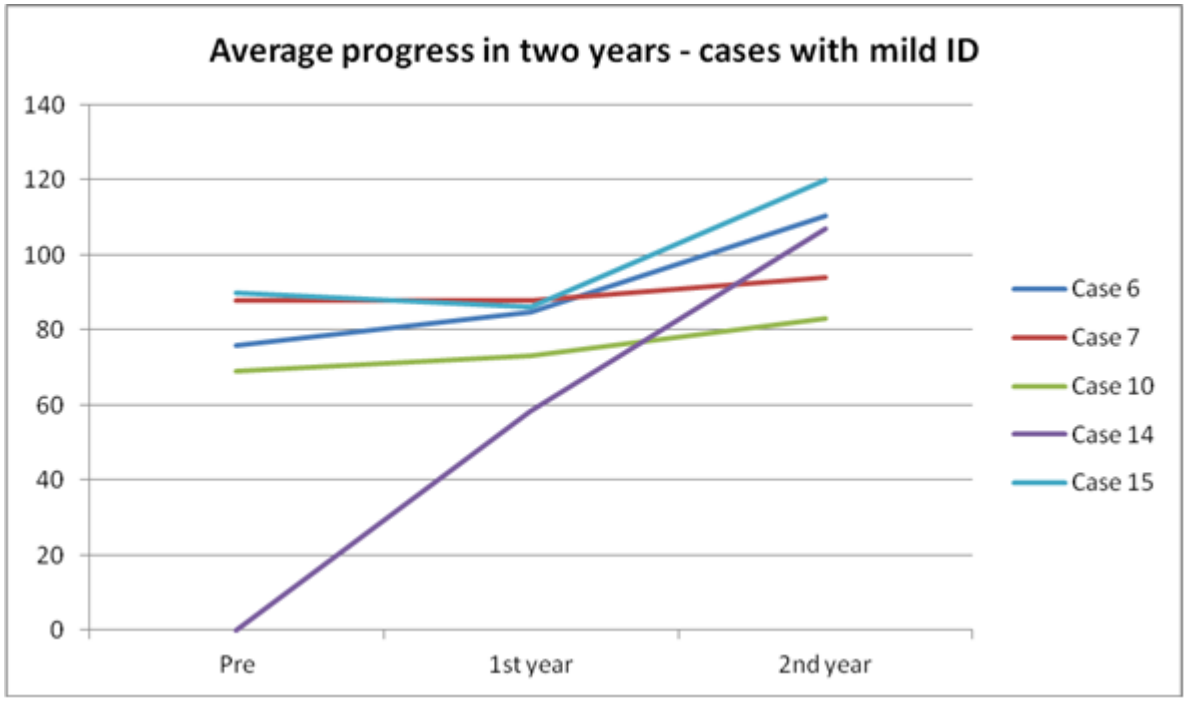
Sub-tests of CAP indicated two cognitive areas where development of children have *not been satisfactory*, even though test results do not necessarily show negative tendency in these areas: spatial and time orientation. Children acquired spatial and time concepts relatively easily (eg. in between, below, right and left; one hour later, after lunch or before going to bed). However, they presented too much trial and error answers when oriented in real space and time. The FIE-Basic tool titled „Orientation in Space" has helped to clarify spatial concepts, but as the intervention has changed to other cognitive domains, 60% of our students forgot the adequate use of spatial concepts, even though further activation contained spatial-time orientation tasks and mediation in a general level. (CAP results have also shown this fact: children gained lower points on the item 'Perceiving spatial relationships' under the section of Perception' (mean 2,5). 'Orientation in Space' tool should be extended with further sensorial modalities in order to effectively deal with the area. FIE-Basic program does not have a tool for orientation in time. We suggest further development of FIE-Basic tools possibly in these two cognitive domains of space and time.

Human Figure Drawing Development of Participants

The very intensive human figure drawing development of the participants – as a „byproduct" of our intervention – prove to be surprising. We neither 'taught' our participants to draw a man, nor ever modelled how to draw a human figure. We did not accept any spontaneous human figure drawings from the participants's home to keep our examinations under control, and to make sure no help has been given while drawing. Also, many of the drawings presented in our research have been *spontaneous* human figure drawings made in our clinical laboratory. This shows that the ability to depict a human body has become a *constant, permeable, structural change (Figure 104 and Figure 105).*



104. Figure: Diagrams of Human Figure Drawing Development -- Average progress of children with moderate ID in two years (sum)



105. Figure: Diagrams of Human Figure Drawing Development -- Average progress of children with moderate ID in two years (sum)

Most DA procedures use human figure drawing on part of the assessor as a model: a perfect figure drawn by the assessor in the teaching phase will elicit a better human figure drawing in the post-test phase on part of the child. Ágnes Lányiné Engelmayer also mentions that by help (by modelling a proper human figure) retarded performers may improve their drawings (Lányiné, 2012). However, this change proves to be temporal according to our

clinical experience: the improved human figure disappeares after a few days or weeks from the cognitive repertoire of the child.

In our experiment human figure drawing development must be a direct effect of the tool „Organisation of Dots" (which has effects on motoric rotation on a representational level) and strong daily transfer on shapes and parts of the human body. Usually we started our intervention with Organisation of Dots – and completed the instrument after 6-10 months, yet in the last phase of our intervention the advanced human figure stayed with our participants (post-test) -- as can be seen in the individual case descriptions.

In many of the cases we can be witnesses of how the child develops from a scribbling stage to the pre-scematic or even the schematic stage withing 6 months (for example Case 1, 2, 3, 14). From scribbled lines a human figure evolves and stands on its feet.

In most cases the motoric development does not follow the more dynamic conceptual-linguistic development of the child – in these cases the title of the drawing, the description of the beloved parent, caretaker or friend is really reach verbally (e.g. *„Dad has just got out of his car with his walking stick"; „A pastry-cook holding a sunshine cookie"; „My father and his castle and his horse, just pulling a cart. My father is a king and I try to depict his robe on his arms" or „My family holding each others hand" etc)*. The idealised and imagined pieces of clothing or situation are verbally precise and flourish, but due to lack of motoric abilities (e.g. lack of ability to rotate) are just poorly indicated in the picture (Case 1; Case 2; Case 14).

General changes indicated by parental surveys

The Cognitive Abilities Profile (CAP) used as a survey and consultational tool with parents concerning cognitive, emotive and behaviour changes of the clients showed meaningful signs of modifiability. Structural minor and major changes indicated by parental surveys were the following:

*Rapid growth in receptive language, later expressive language, usually starting from the 3-4th week of intervention; parental interviews indicate that after the 3rd month of intervention (with the exception of the two participants with severe autism) children became real „chatter-boxes". Four non-verbal children become verbal – and felt a strong drive to point at pictures and objects and make their parents verbalize the objects in the axis of their joint gaze. Usually after 4 months of intervention non-speaking children started to formulate 2 word sentences and after 6 months they had 4-word-syntactic-structures.

*****Increased, nearly constant comparative behaviour and a need to find relationships between data (One parent reported that his child has been standing with a bottle of drink in his hand in the street and ran to the street poster nearby to compare his drink to the great-sized representation of the same drink on the wall shouting „*My Fanta is small, and this is big. They are not the same size*!"); Parents also notice that their children became very demanding with their constant „why" questions concerning cause and effect relationships (Case 1 has asked his parents after 15 months of intervention: *„I wish I knew where the fire disappeares after it has burned. What will become of fire after it has burned? Do you know, mother?"*)

*Parents reported about considerable change in structured play and inner speech (both in quality and quantity).

*In 3 cases normalisation of hypotonic muscle tone for a few hours after the intervention sessions has been reported. This did not prove to be long-term effect – but has been mentioned in all the 4 interviews during the two-year-long intervention period.

*Parental surveys report better visual perception: young clients perceive surprisingly small details of their environment (like a tiny cut on the surface of a table; or an extra, small piece of thread on the shirt of the caretaker).

*Unexpected development of human figure drawings without pre-mediation.

*Behavioural changes are indicated in most cases: decreased impulsivity; less temper-tantrums. Usually in the 6th month of the intervention cognitive structures started to consolidate and meaningful behavioural changes has been experienced in all cases. As children has started to learn how to handle stimuli, they presented less temper tantrums, less impulsivity and mood swings and showed a better self-regulation in all areas in life. This fact shows that cognitive rehabilitation with MLE has positive effects on behaviour of the participants.

Sum of School Readiness Screening

The sum of Difer-test results showed children gain 39,46 percent points as a mean improvement in Difer-test. Results show that – with the exception of three cases -- most children have become ready for academic school subjects (reading and writing and basic mathematics) and have reached a considerable level of independence in their learning. In these cases inclusion into mainstream schools will definitely be more than „mere" social inclusion. Their development in the so called 'basic skills' may be a strong basis for academic involvement into academic subjects with shadow-teachers. (We had to exclude 3 cases from our analysis since DIFER could not have been administered even after the treatment period: one child with severe autism and profound intellectual disability /Case 11/; a girl with severe working memory problems /Case 12/; and young child with Down-syndrome /Case 13/ who was 2;8 in the beginning of the intervention.)

18. Table: : Average improvement in DIFER test in two years

	Average percentage points of improvement	**Standard deviation of percentage points**	**Min**	**Max**
Copying Parts of Letters	39,50%	24,55%	0,00%	87,00%
Phoneme Awareness	39,25%	33,23%	0,00%	97,00%
Vocabulary for Relations	41,92%	26,82%	0,00%	83,00%
Basic Numeracy	42,00%	28,80%	3,00%	84,00%
Hypothetical thinking	31,58%	27,12%	0,00%	75,00%
Relationships based on experience	42,50%	28,53%	0,00%	81,00%
Summary	39,46%	28,54%	0,00%	97,00%

Notes: Case 11, 12, 13 are excluded due to missing data. SD: Uncorrected, because there wasn't sampling.

Both the remediation of prerequisites of learning and behavioural changes made it possible that 80% of our participants (12 cases out of the 15) could be safely placed into inclusive school settings. This is in line with the findings of Samuels, Killip, MacKenzie & Fagan (1992) who showed that a 1 year application of Bright Start Program with children with severe learning disabilities allowed 75% of the intervention group to be recommended for regular classes versus only 25% of the non-cognitive control group (cited by Kozulin et al, 2010). (Bright Start Program is based on Feuerstein's Mediated Learning Experience and other didactic elements of FIE Standard, Level 1, like the tools titled Comparision or Categorisation.) (See *Section 4.4.2*)

Since no other intervention programs have been applied, MLE and FIE-Basic are the only responsible variables for the change.

III. SUMMARY AND CONCLUSIONS

We summarize our results in light of the hypothetical questions. We have evidence from international research studies that MLE and FIE-Basic have a positive effect on children with *regular intelligence* or children in the *socially disadvantaged population* (Ben-Hur & Feuerstein, 2011; Salas et al., 2010, see *Chapter 3.6*). Our aim was to apply MLE and FIE-Basic in Hungary with *children of atypical development.* We wanted to see what changes will the program elicite in the cognitive-emotive condition of *children having moderate and mild intellectual disability*.

Hypothetical Question 1

Is this possible to elicit changes in the development of fluid intelligence of children with moderate and mild intellectual disability as well?

Raven Colored Matrices showed an increase in general intelligence by 29,37%p within the two year long intervention period. PPVT has indicated a 3 year 10 month growth in mental years within the two year long intervention time. (PPVT shows high correlation with other intelligence tests, see *Chapter 1.4.2.*) Analysis by test-statistics has indicated that there were *significant changes* in the cognitive development of the participants between pre-test and post-test measures on Raven's Colored Matrices (mean 10,57, SD=6,12, t=6,460, p<0,001;). If we differentiate children's results who have mild intellectual disability from those who have moderate intellectual developmental disorder, the pre- and post-test results are also significant (results of children having mild intellectual disability: mean 13,00, SD=1,87, t=15,538, p<0,001); results of children having moderate intellectual disability: mean 9,22, SD=7,31, t= 3,784 , p<0,01).

We conclude that FIE-Basic is an effective program under clinical applications for the enhancement of fluid intelligence of children who have mild-to-moderate intellectual disability. Our results are in line with the results of the only study which examined the effects of the program in case of children having atypical development (Kozulin et al., 2010).

Hypothetical Question 2

Is it possible to elicite changes in the participants' *concept development*, *receptive/expressive language* and *communication*? Based on Ben-Hur's and Feuerstein's study (Ben-Hur & Feuerstein, 2011, see *Chapter 3.6*) we expect that the program will positively influence not only regular children's conceptual development but also those who have intellectual disability.

Analysis by test-statistics has indicated that there were *significant changes* in receptive language of the participants between pre-test and post-test measures on Peabody Passive Vocabulary Test (mean 43,71, SD=24,66, t=6,634, p<0,001) and Gardner's Expressive Vocabulary Test (t=7,484, p<0,001; mean 32,29, SD=16,14).

Results of Cognitive Abilities Profile also indicated that the participants development had been striking in the domain of *language and communication* (improved by a mean of 55,36%p within the two years long intervention). The titles of the individual human figure drawings of the participants also indicate that their conceptual development (presented in the titles of the drawings) have become very rich verbally.

Individual TROG test results have strengthened that understanding syntactic structures has also developed, generally between 2;4 -- 5;2 years during the 24 months long intervention phase. Out of the 4 non-verbal children 3 became verbal (Case 3, Case 13; Case 9 has learned to read and type on his assisted communication device, and the 4th child with severe intellectual disability started to have holographic 1 word sentences). We also mention that Case 1 has developed 7;4 years (in mental ages) in the two year long intervention period.

We need to mention the results gained by LPAD-Basic as well. We administered the test in a way that we could see both in pre- and post-test phases how many items the individual could solve without mediation and later with the help of mediated interactions. It is visible

from pre- and post test results that children with mild to moderate intellectual disability have gained much more from verbal help in post-test phase. Children were able to *benefit much more from human mediation* after the intervention. This point is very important for instance in terms of copying strategies of individuals with ID in everyday social interactions. Research says that adults with mild ID experience more frequent and severe stress from negative social interactions than from other categories of stressful events, making this category of stressors particularly detrimental for their psychological wellbeing (Bramston, Fogarty, & Cummins, 1999).

We conclude that MLE and FIE Basic has significant effects on concept development and language abilities of children having atypical development. One explanation may be that systematic and intensive human mediation is responsible for the conceptual change (Vygotsky, 1986). Human mediation is an approach where cognitive activation is *highly verbal* and *abstract*, consequently it will positively effect verbal areas in the brain (see *Chapter 1* on Mirror neurons).

Hypothetical Question 3

Is this possible to enhance *reasoning abilities* of children having moderate and mild intellectual disability? Based on Beasley (1984) we hypothized that our intervention will bring about changes in reasoning abilities of children in the atypical group as well (see *Chapter 3.6*).

According to Cognitive Abilies Profile results the domain of *reasoning* improved by 57,40%p within the 2 years. This proved to be the highest difference between pre- and post test measures by CAP. We note that CAP in this domain evaluate how well the learner can consciously compare two or more items; how well the learner can consciously put items or concepts into classes; how well the learner can use logical reasoning to establish cause and effect relationships and how well he/she can make predictions when the information is not explicit.

We note from individual case studies that children have developed their acknowledgement of the existence of a problem or a discrepancy (see the tool 'Compare and Find the Absurd, *Chapter 1.3*). Case 1, Case 2, Case 3, Case 4, Case 5, Case 6, Case 7, Case 14 and Case 15 have developed a strong need to find logical evidence: to support or justify their conclusions or problem solving efforts. 70% of them has presented a constant comparative behaviour, especially in the beginning of the intervention period – they have developed a need to compare everything they experienced and figure out a criteria for commonalities. The appearance of 'Why' and 'What for' questions also suggest that their episodic world-view has started to decrease and they started to find relationship between objects, events or situations. All the individual drawings show as well that children started to sythetize their experience.

We conclude that the program has meaningful effects on reasoning abilities of children who have intellectual disability.

Hypothetical Question 4

The study of *Alas* et al. note that one of the effects of FIE-Basic on socially disadvantaged children was that their attention skills, self-regulation have improved and the experimental group became less distracted (Alas et al, 2010). Is this possible to develop these children to metacognitive awareness, self-regulation and internalized psychological control while learning? Based on criteria of MLE (see *Chapter 5.3*) we expect that there will be growth in children's self-regulation while treating stimuli.

According to Cognitive Abilities Profile strategic thinking and metacognition have grown by 53,75%p in two years. We may interpret children's advancement on Raven test also that they have a better regulation of their learning processes. The domain of Cognitive Abilities Profile also indicated a 56,1%p growth in the domain of 'Behaviours while learning'.

We mention from individual cases we could lead 74% of children with intellectual disability to cognitive and metacognitive awareness – they could clearly recognise and name the operations they have been doing with concrete or abstract data ('*I am comparing these three*

objects according to height'; '*I am creating a sequence where the number of the objects are growing by two*') and they could recognise simple operations in other context.
We conclude that FIE-Basic accompanied by the criteria of MLE as a way of interaction has positive effects on children's strategic thinking, metacognition and self-regulation.
We add that children's perception has also showed remarkable growth according to CAP by 48,1 %p. One explanation can be that it is a direct effect of improved cognitive and metacognitive strategies. Feuerstein formulated this in the following way: „we give cognitive and metacognitive crutches to the learner to help the limping perception (Feuerstein, personal communication)". We note however, that sub-tests of CAP indicated two cognitive areas where development of children have *not been satisfactory*, even though test results do not necessarily show negative tendency in these areas: spatial and time orientation. Children acquired spatial and time concepts (eg. in between, below, right and left; one hour later, after lunch or before going to bed). However, they presented too much trial and error answers when oriented in real space and time. The FIE-Basic tool titled „Orientation in Space" has helped to clarify spatial concepts, but as the intervention has changed to other cognitive domains, 60% of our students forgot the adequate use of spatial concepts, even though further activation contained spatial-time orientation tasks and mediation in a general level. (CAP results have also shown this fact: children gained lower points on the item 'Perceiving spatial relationships' under the section of Perception' (mean 2,5). We suggest that 'Orientation in Space' tool should be extended with further sensorial modalities in order to effectively deal with the area. FIE-Basic program does not have a tool for orientation in time. We suggest further development of FIE-Basic tools possibly in these two cognitive domains.

Hypothetical Question 5

Will the elicited changes generalize to other areas that we cannot prognose? Based on one of Feuerstein's criterion about SCM (the generalizability of a change) we prognose that the induced changes will affect other areas of the individual's functioning (Feuerstein, Rand & Feuerstein, 2006. p 47) (see *Chapter 5.2*).

Our participants have started to draw human figures, family members or objects in a spontaneous way parallel the cognitive intervention. The rhythm, the growing quality and ease with which these drawings have been created imply that this process can be interpreted as a sign of modifiability. No other studies have noted this generalized change. Development of human figure drawings means a sythetised cognitive, motor and verbal development. We explain the growing human figure drawings have been elicited by the tool 'Organisation of Dots' and exaggerated learning of shapes. However László Nagy and Andrea Kárpáti emphasize the role of speech development in children's graphic development. „Researchers have not answered the question how verbal development and children's graphic development relate to each other. We just know, there is a strong and mutual relationship between the two (Kárpáti, 2001, p. 63)". The program has targetted cognitive-emotive aspects of the participants, graphic education has not happened during the intervention. Our conclusion is that the program's effects have generalized into increased levels of human figure drawings of the participants.

Finally, we need to highlight one more important aspect of our intervention. Results gained by a school screening criterion-oriented test system, the DIFER-test, have shown a mean growth of improvement by 39,46%p in domains necessary for school readiness following the intervention. Our research has supported that the traditional classification system that is built around IQ scores (intellectual categories) may not to be valid in the long run in terms of functioning and levels of independence if acceleration programs are applied. Along with Haywood and his associates we conclude that thinking-skills programs like FIE-Basic or Bright Start may contribute to successive inclusive processes of children with moderate and mild intellectual disability in mainstreams schools (Haywood et al., 1992).

Our research has strengthened that the „boundaries of human intellect can be enlarged" (Csapó, 2013), even in case of the clinical population where traditional approach views abilities as constant and immutable or minimally plastic. We do not view intellectual disability totally „curable" as Goddard started to believe at the end of his carrier (see *Introduction*). Yet, our experiment revealed that there is a much wider „hidden" or „latent" learning potential in most children belonging to the clinical population than we have had earlier hypothesized -- given a thorough, molar, individually tailored and intensive program focusing on precognitive, cognitive, and metacognitive elements of learning. Our research has also proved it is possible to co-construct not yet existing cognitive structures with a human mediator, as implied by Vygotsky (1968).

IV. FURTHER RESEARCH AND PEDAGOGICAL IMPLICATIONS OF THE FINDINGS

Development of cognitive skills takes many years (Csapó, 2003; Kalmár, 2007). Most basic cognitive skills need 5-10 years to develop to an optimal level even in case of regular children which would grant their successful school advancement. These basic skills serve as a basis for the whole personality (Nagy, 2003).

We may examine cognitive skills devoid of content and the modality they are activated in, and create a system of emerging cognitive functions which serve as basis for more complex mental operations and which can be considered as prerequisites of learning in the younger child (Feuerstein, Feuerstein & Falik, 2010). The FIE-Basic program aims at developing these molar functions and has been designed for a 3 year-application. It claims to accelerate the development of emerging cognitive functions, enhance self-regulation and intrinsic motivation of young learners from 4 to 9 mental years. We have very few research examining the effects of the program with a limited intervention time (7-10 months) and intensity (altogether 40-60 hours).

The novelty of our research that it examined the impacts of the program for two years on children with intellectual disability with a very strong intensity (7-15 hour a week, 700-1400 hours within two years). Since we had a rather heterogenious group of children with intellectual disability (from severe to mild intellectual developmental disorder) our research has explored the effects of a more complex program (MLE, MST to create primary cognitive behaviours and then applied FIE-Basic) on children with atypical development mainly in a qualitative way but with quantifying endeavours. We have proved the usability of FIE-Basic, MLE and MST in case of this special population. However, further research is needed to clarify the long-term effects of the program (for four or even more years) and a large scale study with more participants may show whether the program has differential effects on the clinical population of different etiology. These directions, however require considerable amount of financial investments and time.

The changes we have brought about can definitely be considered as structural changes. „The change in the rapidity and skill with which the child learns, and the quality of his learning, demonstrate that the individual has changed in a structural way. The type of structural cognitive change we are seeking to produce is one that *cannot be explained in terms of small increments in rate or precision*, but by *change that appears to have „jumped the tracks", one that represents a radical transformation or a creative and productive synergism of thought* (Feuerstein, Rand & Feuerstein, 2006. p. 47.)".

Our experiment brought about intensive changes in human figure drawing development of the participants. Former analyses of the effects of the program have not examined this aspects of the development.

Our experiment has highlighted the huge challenges of assessment of children with intellectual disability within static circumstances and with normative tests: when static tests show no gain (e.g Raven test), yet human figure development and dynamic, interactive assessment plus parental interviews show marked growth in all the examined cognitive-behavioural areas (26,6 % of the participants had lower gains in Raven test, however their gain according to DA, HFD, language tests and everyday functioning are much higher). We want to emphasize the *need for dynamic assessment of children with retarded performance*. The same conclusion is outlined by Kozulin and his associates: „It can be questioned whether the chosen test procedures to evaluate progress are the most suitable for this (i.e. clinical) population. Although there may be better ways to study fluid intelligence, we ... [use] the WISC and Raven, because they are widely used, standardized and recognized. While their usefulness to compare intellectual performance within the general population is well

established, it is much less evident that they give a fair picture of intelligence in children performing in the lower area (Kozulin at al, 2010. pp. 7-8).” Today DA means very heterogenous assessment systems – it is not just one or two test batteries but a whole differential paradigm. Our thesis has introduced this paradigm and classified the most important dynamic assessment systems in the complex palette of DA. Our classification may serve as a basis for researchers or pedagogues who would like to study the field further (*Chapter 4.1*).

As far as we know, in Hungary a thinking-skills program has never been applied with learners with intellectual disability. It would be very important to introduce such acceleration programs into the rehabilitation of children with intellectual disability in Hungary. Also, we suggest that the education and rehabilitation of learners with intellectual disability should be enriched with *explicite* cognitive and metacognitive strategy teaching.

The program is rather demanding in terms of human and financial resources. The systems we have applied require lots of investment in terms of high-quality teacher training and the individual treatment of children with intellectual disabilities for a longer period of time.

Our research suggests that it is possible to improve fluid intelligence of children with cognitive impairments, using a comprehensive program such as MLE, FIE-Basic and MST. If applied systematically with young children with intellectual disabilities for a longer period of time (maybe even for 3-4 years) the applied systems are expected to lead to increased learning effectiveness, more effective basic cognitive processes and thinking skills, and to prepare children for school learning and a better adaptation to challenges of everyday life.

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APPENDICES

Appendix 1

According to a first comprehensive report in 2013 in the United States on children's mental health, almost twenty per cent of American children suffer from some kind of mental problems, like ADHD, learning disorders, mental retardation and autism. This surveillance also emphasizes the growing comorbidity of autism with mental retardation between 2005 and 2011. (Centers for Disease Control and Prevention. Mental health surveillance among children — United States 2005–2011. MMWR 2013;62(Suppl; May 16, 2013):1-35.) According to the survey by the Health Resources and Services Administration (part of the U.S. Department of Health and Human Services), more than one-fifth of U.S. households with children have at least one child with special needs. We do not have unequivocal data on the number of children and adults suffering from intellectual disabilities in many European countries, but most resources agree in the fact that about 60 per cent of people with intellectual disabilities do not have even primary school level qualifications, and people with multiple disabilities are totally outlined from the labor market.
Estimated prevalence figures for Intellectual Disability in European Union Member States
Resource: www.easpd.org

Estimated Prevalence Figures for Intellectual Disability in European Union Member States				
Country	Population (millions)	Moderate, Severe & Profound Intellectual Disability 0.3%	All Intellectual Disability at 1%	All Intellectual Disability at 2.5%
1. Austria	8.1	24,300	81,000	202,500
2. Belgium	10.2	30,600	102,000	255,000
3. Cyprus	0.2	600	2,000	5,000
4. Czech Republic	10.3	30,900	103,000	257,500
5. Denmark	5.3	15,900	53,000	132,500
6. Estonia	1.4	4,200	14,000	35,000
7. Finland	5.1	15,300	51,000	127,500
8. France	60.4	181,200	604,000	1,510,000
9. Germany	82.0	246,000	820,000	2,050,000
10. Greece	10.5	31,500	105,000	262,500
11. Hungary	10.2	30,600	102,000	255,000
12. Ireland	3.7	11,100	37,000	92,500
13. Italy	57.6	172,800	576,000	1,440,000
14. Latvia	2.4	7,200	24,000	60,000
15. Lithuania	3.5	10,500	35,000	87,500
16. Luxembourg	0.43	1,290	4,300	10,750
17. Malta	0.44	1,320	4,400	11,000
18. Netherlands	15.8	47,400	158,000	395,000

Number of people with intellectual disabilities in Europe totals up to minimum 4,5 million and maximum 11,3 million.

Appendix 2

The Estimated Number of People with Mental Retardation, Autism and Multiple Severe Disabilities in Hungary

Statistical data about the number, education and conditions of people with intellectual disabilities are rather haphazard in Hungary, there has never been a comprehensive, nationwide research carried out about this population. However, the estimated number of people with intellectual developmental disorders, autism and multiple severe disabilities totals up to about 140 000 people, and some experts speak even about a few hundred thousand people.

Number of the Population	**Resource**
People with Mental Retardation 56 963 people – Census 40–52 000 people – Estimation	 Census (2001) Bass (2008)
People with Severe and Multiple Disabilities 10–12 000 people – Estimation 10 000 people – Estimation	 Bass (2008) Marketing Centrum (2009)
People with Autism 60 000 people – Estimation	 Petri and Vályi (2009)

Resource:

Bass, L. (Ed.) (2004). Jelentés a súlyosan-halmozott an fogyatékos embereket nevelő családok életkörülményeiről. Budapest: Kézenfogva Alapítvány.

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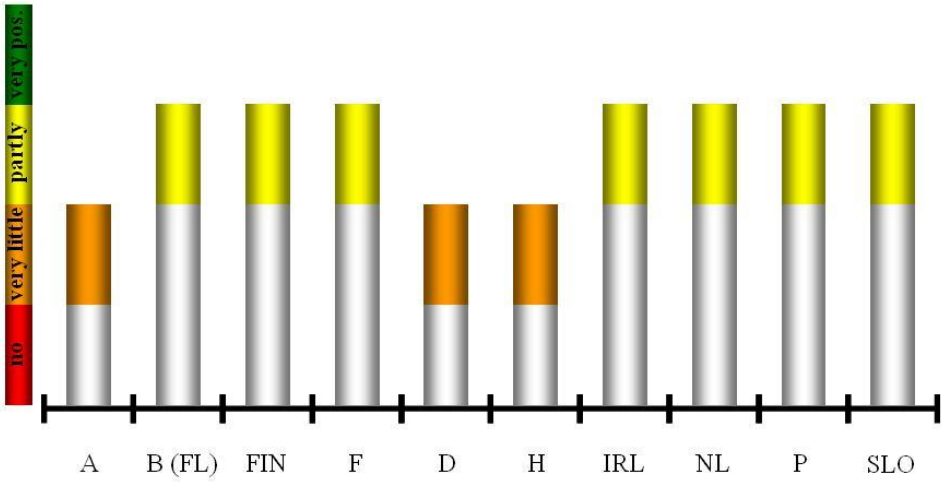
Appendix 3

'P2i Barometer Assessment' is the result of a comprehensive research into the situation of present inclusive education at a national level in the 10 partner EU-countries, participating in the project, namely Austria, Belgium/Flanders, Finland, France, Germany, Hungary, The Netherlands, Portugal and Slovenia. All p2i-project documents are available: www.pathwaystoinclusion.eu

Development of accommodation of educational measures (i.e. individual curricula, didactical adaption, teaching methods, alternative ways of testing) (EASPD Barometer Research 2012, p. 36.)



This table indicates that progress in realizing inclusive teaching methods in educational processes is rated very differently in European countries. However, the education of teachers for learners with special educational needs is still dominated by the special school's perspective, especially in countries with a strong tradition of special education -- and teachers usually refer to their lack of expertise when it comes to allowing access to mainstream educational settings.

Appendix 4

Case 10, ATEC March 2013, Post-test

Date: 3/25/2013 7:22:15 AM
Child's Name: **xx**

TOTAL AND SUBSCALE SCORES
Total Score: **63**
I. Speech/Language/Communication: **17**
II. Sociability: **12**
III. Sensory/Cognitive Awareness: **14**
IV. Health/Physical/Behavior: **20**

I. Speech/Language/Communication
1. Knows own name: **Very true**
2. Responds to `No' or `Stop': **Very true**
3. Can follow some commands: **Somewhat true**
4. Can use one word at a time: **Somewhat true**
5. Can use 2 words at a time: **Somewhat true**
6. Can use 3 words at a time: **Somewhat true**
7. Knows 10 or more words: **Very true**
8. Can use sentences with 4 or more words: **Not true**
9. Explains what he/she wants: **Not true**
10. Asks meaningful questions: **Not true**
11. Speech tends to be meaningful/relevant: **Somewhat true**
12. Often uses several successive sentences: **Not true**
13. Carries on fairly good conversation: **Not true**
14. Has normal ability to com municate for his/her age: **Not true**

Total for Section I: **17**

**II. Sociability
1. Seems to be in a shell - you cannot reach him/her: **Somewhat descriptive**
2. Ignores other people: **Somewhat descriptive**
3. Pays little or no attention when addressed: **Somewhat descriptive**
4. Uncooperative and resistant: **Not descriptive**
5. No eye contact: **Somewhat descriptive**
6. Prefers to be left alone: **Not descriptive**
7. Shows no affection: **Not descriptive**
8. Fails to greet parents: **Not descriptive**
9. Avoids contact with others: **Somewhat descriptive**
10. Does not imitate: **Not descriptive**
11. Dislikes being held/cuddled: **Not descriptive**
12. Does not share or show: **Somewhat descriptive**
13. Does not wave `bye bye': **Not descriptive**
14. Disagreeable/not compliant: **Not descriptive**
15. Temper tantrums: **Somewhat descriptive**
16. Lacks friends/companions: **Somewhat descriptive**
17. Rarely smiles: **Somewhat descriptive**
18. Insensitive to other's feelings: **Somewhat descriptive**
19. Indifferent to being liked: **Somewhat descriptive**
20. Indifferent if parent(s) leave: **Somewhat descriptive**

Total for Section II: **12**

III. Sensory/Cognitive Awareness
1. Responds to own name: **Somewhat descriptive**
2. Responds to praise: **Somewhat descriptive**
3. Looks at people and animals: **Somewhat descriptive**
4. Looks at pictures (and T.V.): **Very descriptive**
5. Does drawing, coloring, art: **Somewhat descriptive**
6. Plays with toys appropriately: **Very descriptive**
7. Appropriate facial expression: **Somewhat descriptive**

8. Understands stories on T.V.: **Very descriptive**
9. Understands explanations: **Somewhat descriptive**
10. Aware of environment: **Somewhat descriptive**
11. Aware of danger: **Somewhat descriptive**
12. Shows imagination: **Somewhat descriptive**
13. Initiates activities: **Somewhat descriptive**
14. Dresses self: **Very descriptive**
15. Curious, interested: **Somewhat descriptive**
16. Venturesome - explores: **Somewhat descriptive**
17. Tuned in - Not spacey: **Somewhat descriptive**
18. Looks where others are looking: **Somewhat descriptive**

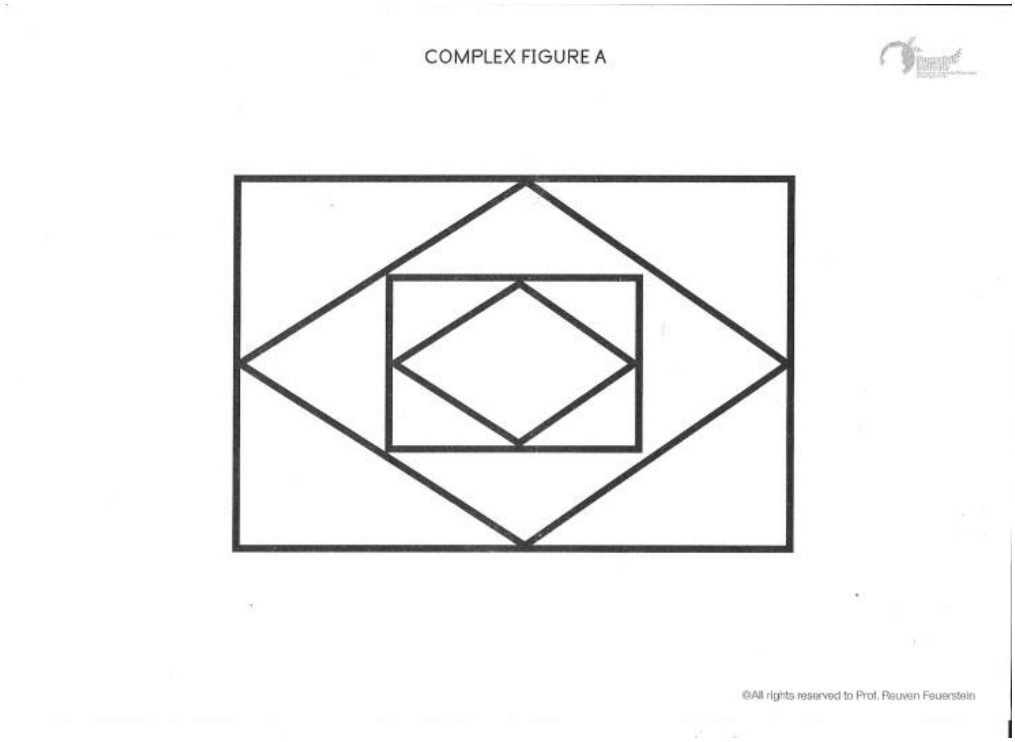
Total for Section III: **14**

IV. Health/Physical/Behavior
1. Bed-wetting: **Not a Problem**
2. Wets pants/diapers: **Not a Problem**
3. Soils pants/diapers: **Not a Problem**
4. Diarrhea: **Not a Problem**
5. Constipation: **Not a Problem**
6. Sleep problems: **Not a Problem**
7. Eats too much/too little: **Not a Problem**
8. Extremely limited diet: **Serious Problem**
9. Hyperactive: **Not a Problem**
10. Lethargic: **Not a Problem**
11. Hits or injures self: **Not a Problem**
12. Hits or injures others: **Minor Problem**
13. Destructive: **Not a Problem**
14. Sound-sensitive: **Moderate Problem**
15. Anxious/fearful: **Minor Problem**
16. Unhappy/crying: **Minor Problem**
17. Seizures: **Not a Problem**
18. Obsessive speech: **Moderate Problem**
19. Rigid routines: **Moderate Problem**
20. Shouts or screams: **Minor Problem**
21. Demands sameness: **Moderate Problem**
22. Often agitated: **Minor Problem**
23. Not sensitive to pain: **Not a Problem**
24. Hooked or fixated on certain objects/topics: **Moderate Problem**
25. Repetitive movements: **Moderate Problem**

Total for Section IV: **20**

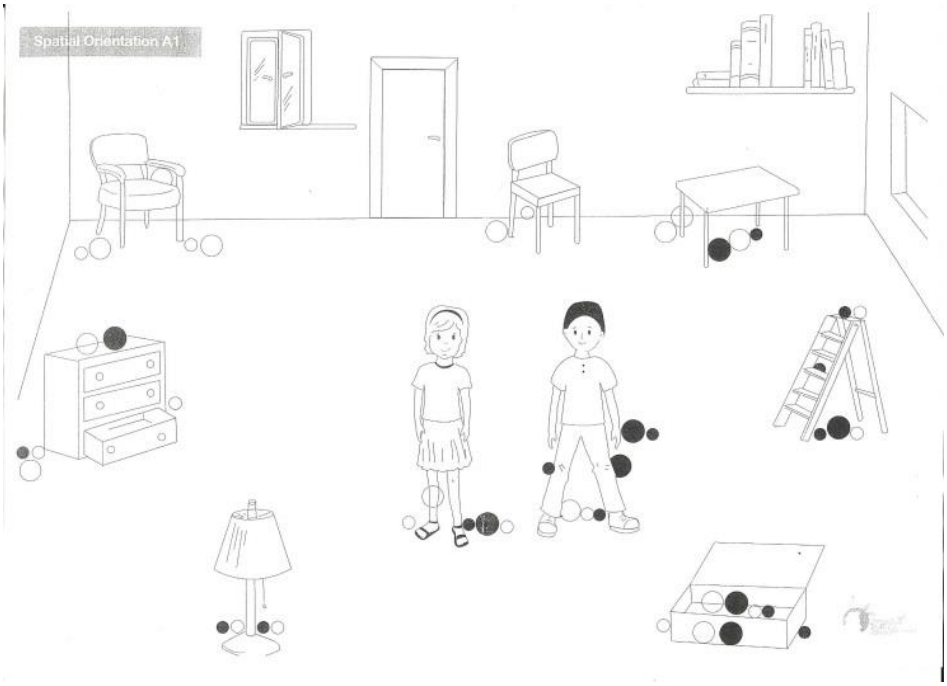
Appendix 5

The Complex Figure Drawing Test ’A’ from LPAD-Basic



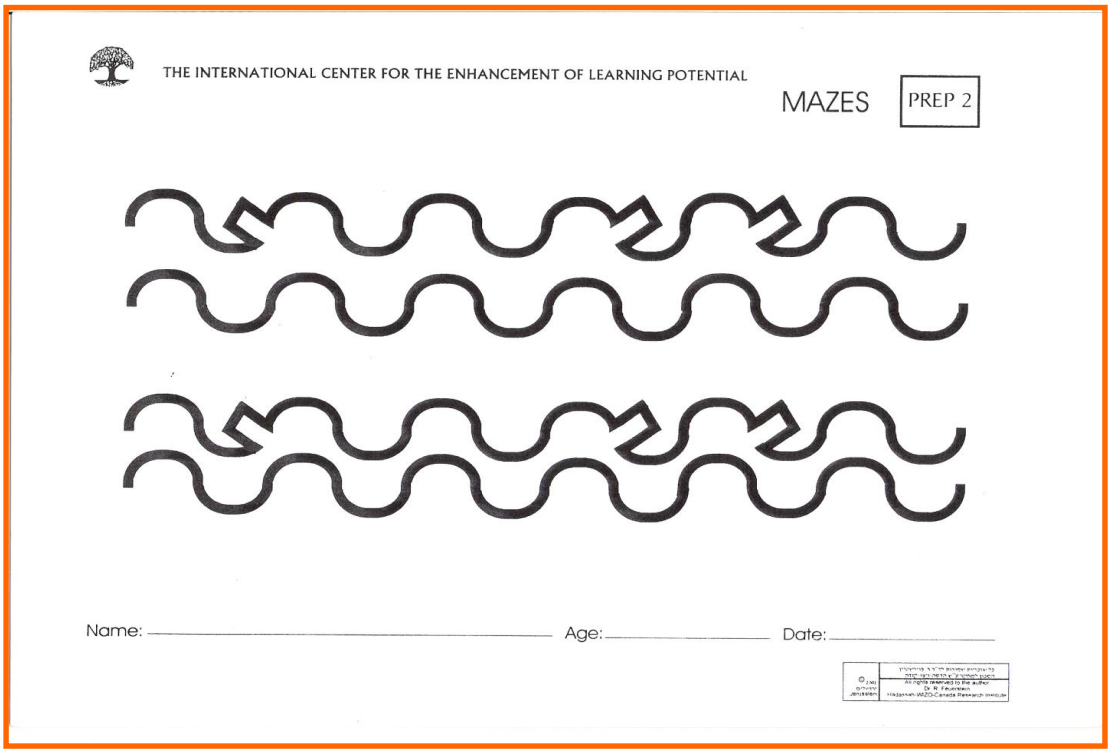
Appendix 6

Sample of Spatial Orientation Test from LPAD-Basic



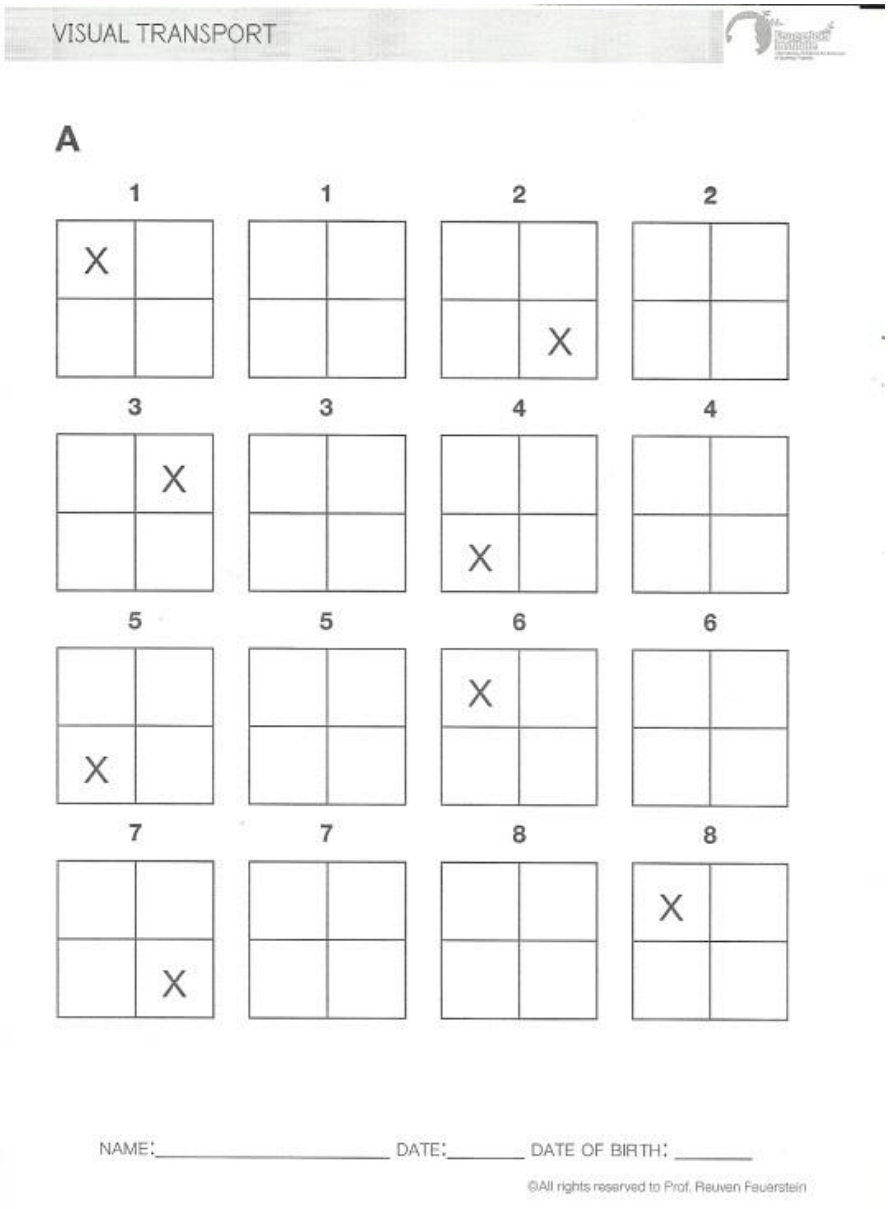
Appendix 7

Sample of Mazes Test from LPAD-Basic



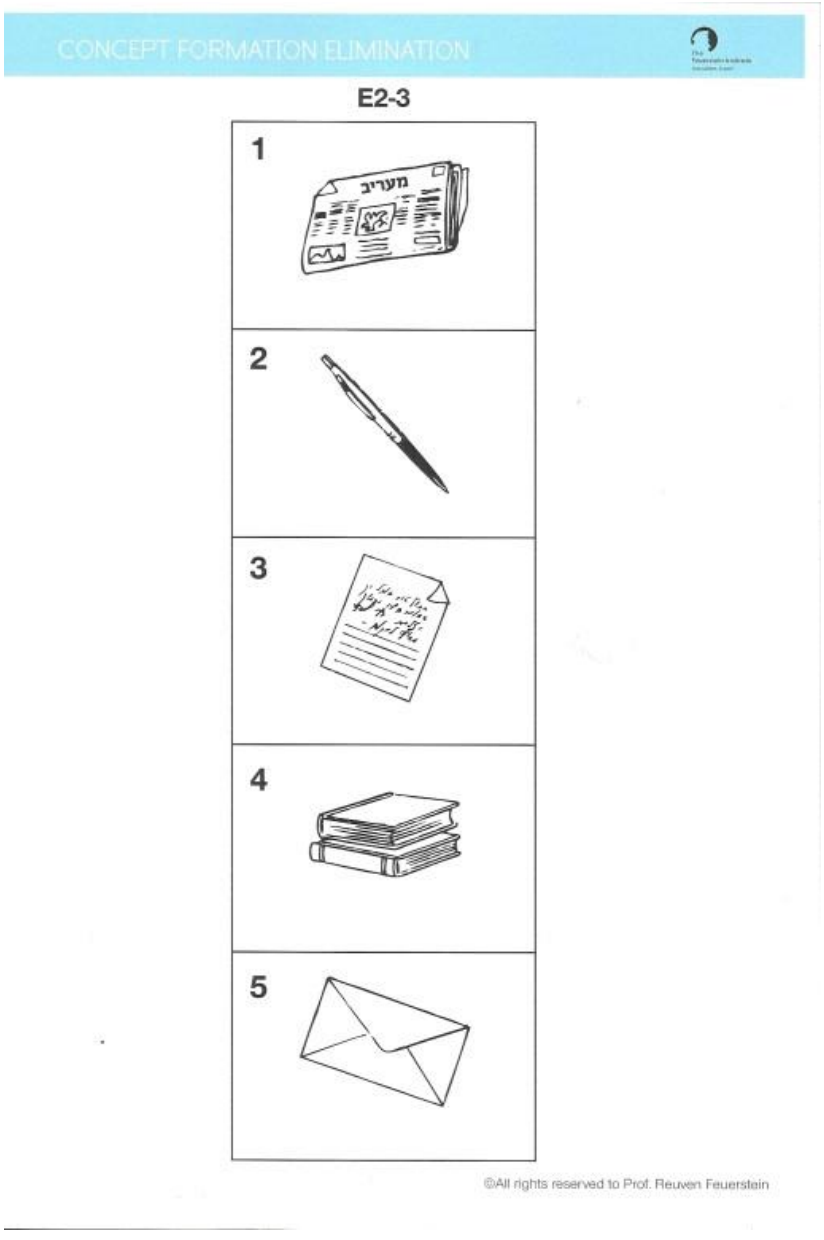
Appendix 8

Sample of the Visual Transport Test from LPAD-Basic



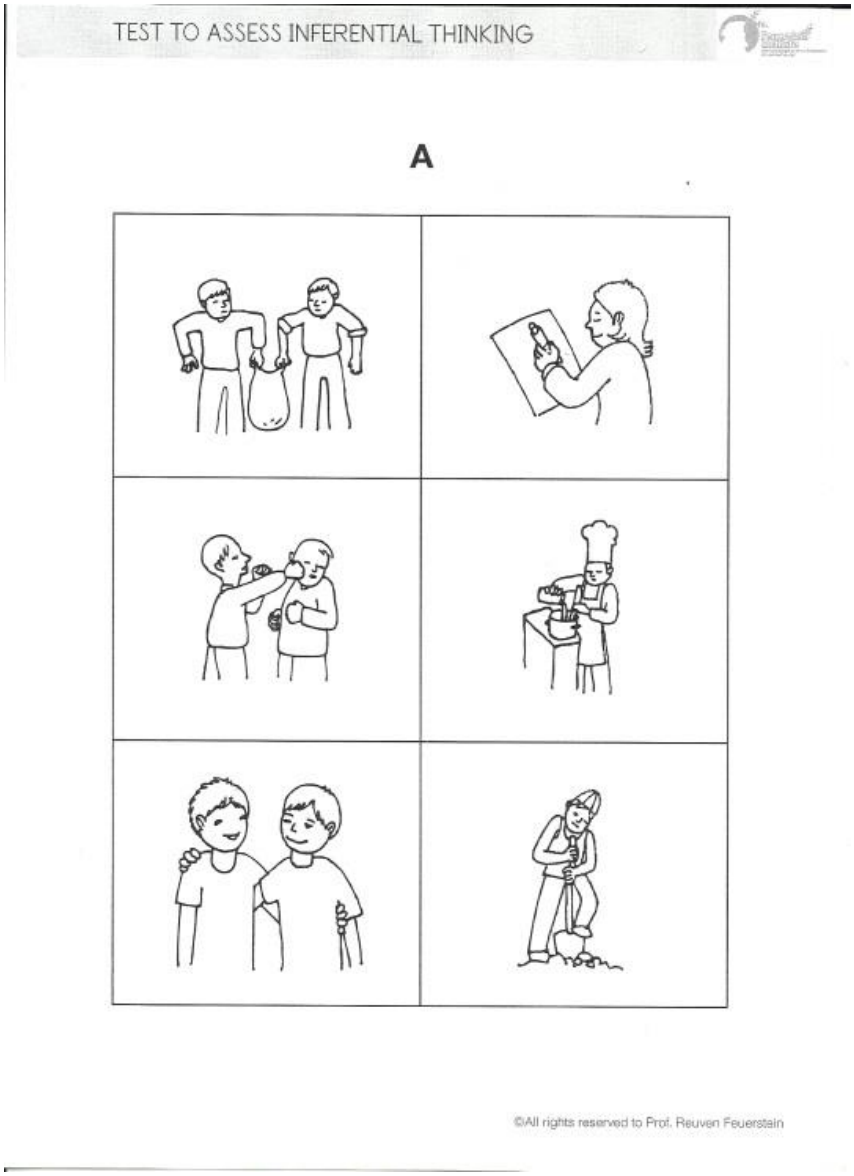
Appendix 9

Sample of the Concept Formation with EliminationTest from LPAD-Basic



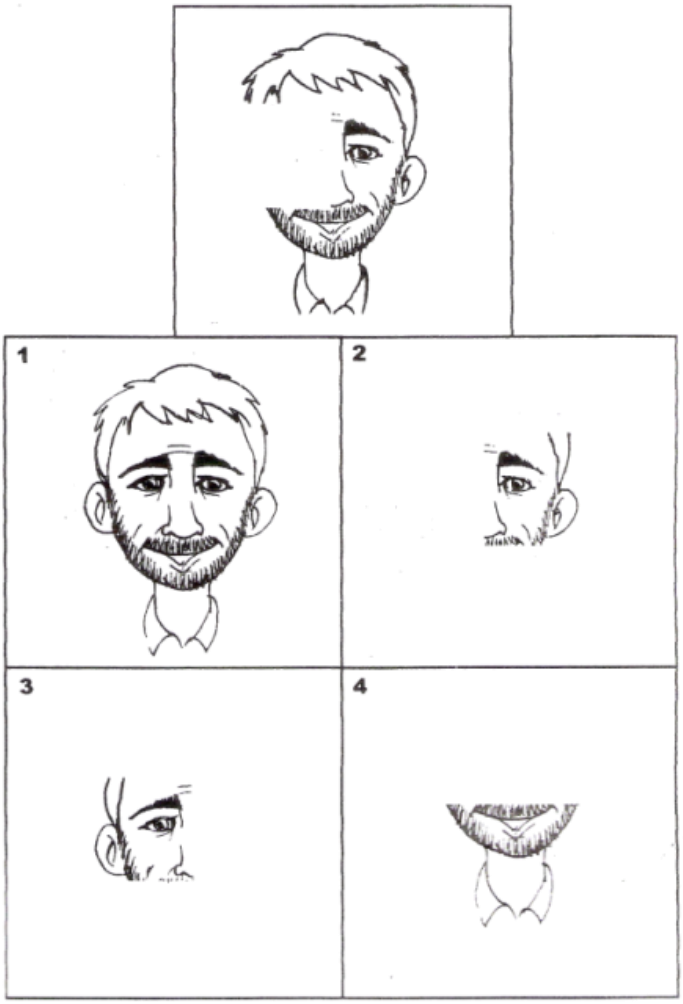
Appendix 10

Sample of Inferential Thinking Test from LPAD-Basic



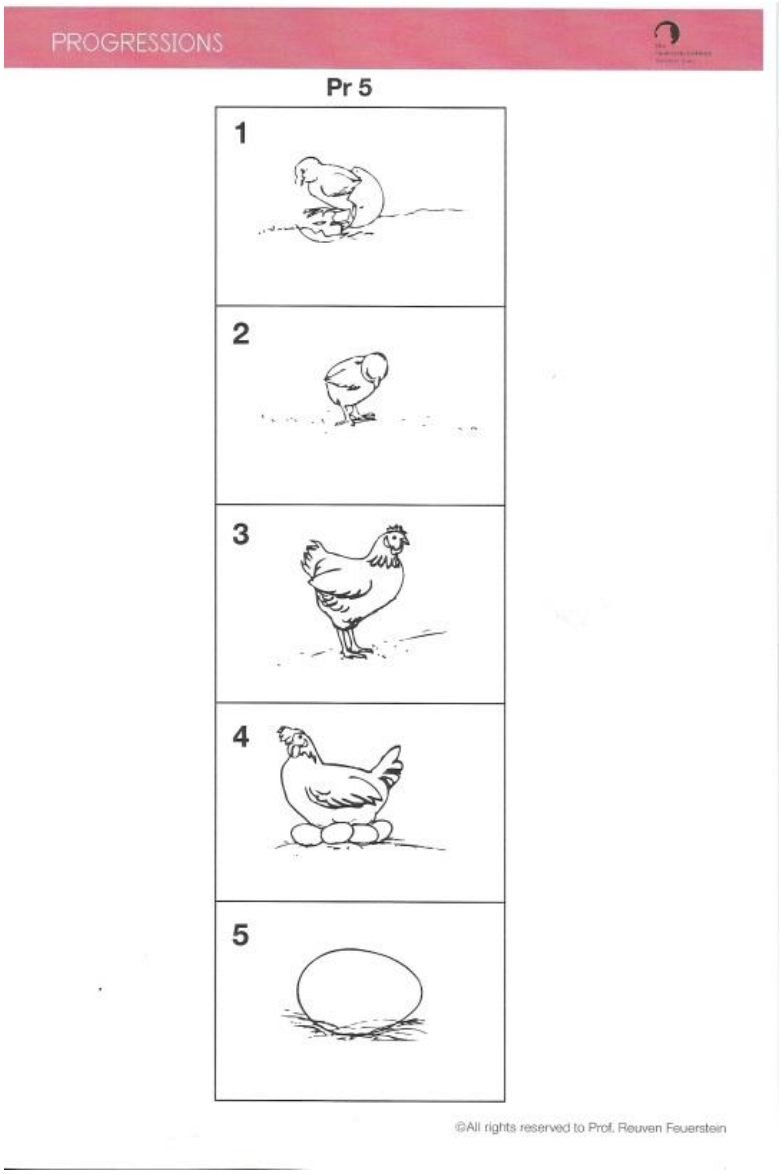
Appendix 11

Sample of the Part-Whole Test from LPAD-Basic



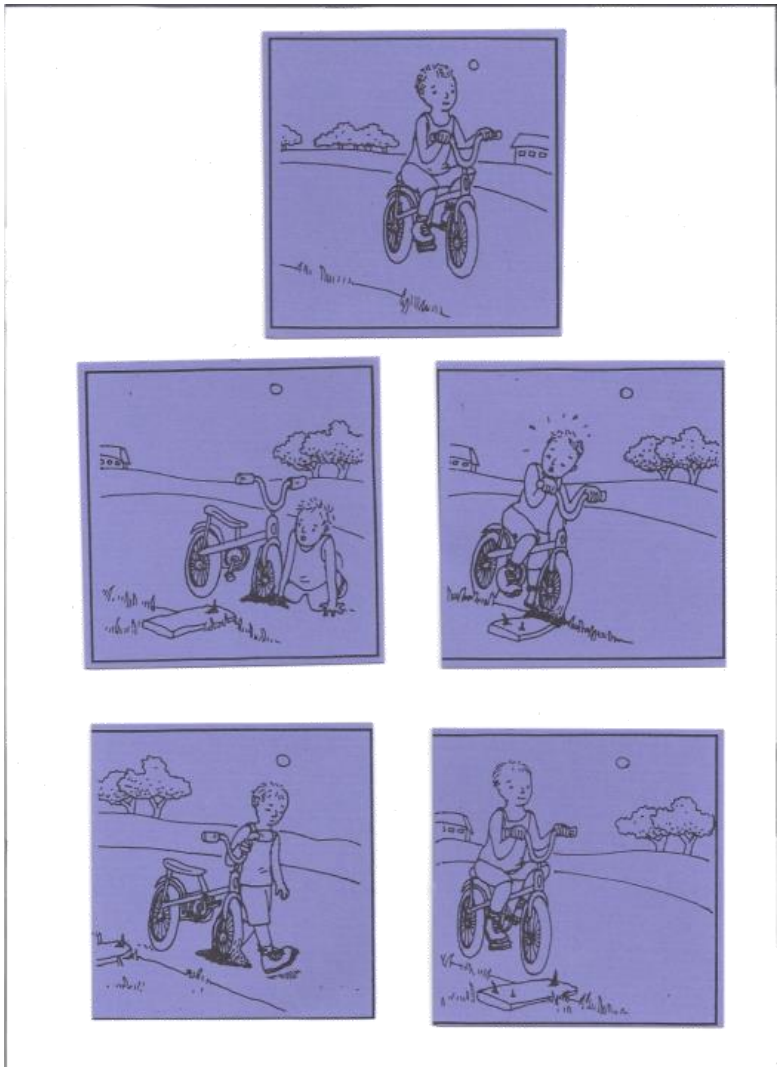
Appendix 12

Sample of the Progressions Test from LPAD-Basic



Appendix 13

Sample of the Picture Sequencing Test from LPAD-Basic



Appendix 14

Sample page of the Absurdities Test from LPAD-Basic

Appendix 15

Case 1
Case 1 Dynamic Assessment Results -- Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	2	2,75	3	3,2
Perception	1	2	2,75	3	3,2
Memory	1	2	2,5	2,75	2,75
Language and Communication	1	2	3	3	3,5
Reasoning/Logic	1	2	2,75	3	3,2
Strategic Thinking/Metacognition	1	2	2,73	3	3,2
Behaviours Affecting Learning	1	2	2,87	3	3,4

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Case 1 Raven Coloured Matrices Results

	Pre-test April 2007	After 12 months of intervention, April 2008	Post-test April 2009
Raw Score	10	13	18
Cronological age	8;6	9;6	10;6
Percentile	<5	<5	5

Case 1 Peabody Passive Vocabulary Test Results

	Pre-test April 2007	After 12 months of intervention, January 2008	Post-test, after 24 months after intervention, February 2009
Raw Score	12	79	113
Mental age	2;6	8;0	10;0
Cronological Age	8;6	9;6	10;6

Case 1 Gardner's Active Vocabulary Test

Date	Pre-test April 2007	After 12 months of intervention, January 2008	Post-test, after 24 months after intervention, February 2009
Raw Score	19	58	72
Cronological Age	8;6	9;6	10;6

Case 1 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children
Pre-test: Not possible to administer.

	Raw Score		Level		Percentage %	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Copying Parts of Letters	**0**	3	Preparatory	Preparatory	0	13
Phoneme Awareness (Difference between 2 sounds, 2 words)	**0**	58	Preparatory	Optimal	0	97
Vocabulary for Relations	0	13	Preparatory	Beginner	0	54
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	0	40	Preparatory	Beginner	0	69
Hypothetical thinking (if..then, therefore…)	0	--	Preparatory		--	--
Relationships based on experience (It is sure that…?)	0	26	Preparatory	Final	0	81

Case 2

Case 2 Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	2	2,7	3	3
Perception	1	2	2,75	3	3
Memory	1	3	3	3,5	3,5
Language and Communication	1	1,3	2	2,3	2,5
Reasoning/Logic	1	2,5	2,6	2,6	3
Strategic Thinking/Metacognition	1	2	2,75	2,8	3
Behaviours Affecting Learning	1	1,5	2	2,5	3

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Static Test Results

Case 2 Raven Coloured Matrices Results

Date	**Pre-test January 2007**	**After 12 months of intervention, January 2008**	**Post-test, after 25 months of intervention, February 2009**
Raw Score	9	18	27
Cronological age	5;5	6;5	7;6
Percentile	5	55	85

Case 2 Peabody Passive Vocabulary Test Results

Date	Pre-test January 2007	After 12 months of intervention, January 2008	Post-test, after 25 months of intervention, February 2009
Raw Score	18	40	63
Mental age	3;0	4;5	6;8
Cronological Age	5;5	6;5	7;6

Case 2 Gardner's Active Vocabulary Test

Date	Pre-test January 2007	After 12 months of intervention, January 2008	Post-test, after 24 months of intervention, February 2009
Raw Score	17	29	50
Cronological Age	5;5	6;4	7;6

Case 2 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		Level		Percentage %	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Copying Parts of Letters	3	24	Preparatory	Optimal	13	100
Phoneme Awareness (Difference between 2 sounds, 2 words)	32	47	Preparatory	Advanced	53	78
Vocabulary for Relations	9	18	Preparatory	Advanced	38	75
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	4	53	Preparatory	Optimal	7	91
Hypothetical thinking (if..then, therefore…)	2	20	Preparatory	Advanced	6	63
Relationships based on experience (It is sure that…?)	8	26	Preparatory	Final	25	81

Case 3

Case 3 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Independently	With mediation	Independently	With mediation
Spatial Orientation	62	62/7	62/10	62/21	62/36
Mazes	16	16/0	16/0	16/3	16/7
Visual transport	16	16/2	16/4	16/8	16/12
Concept Formation with Inclusion	40	40/0	40/0	40/33	40/40

Concept Formation with Elimination	30	30/7	30/10	30/20	30/30
Test of Inferential Thinking	6 and 10	6/2 and 10/2	6/2 and 10/3	6/6 and 10/10	6/6 and 10/10
Part-Whole	22	22/8	22/13	22/19	22/22
Functional Part -Whole	16	16/5	16/7	16/10	16/16
Progressions	12	12/0	12/1	12/7	12/12
Picture Sequence	18	18/0	18/1	18/15	18/18
Absurdities	10	10/0	10/1	10/9	10/10

Case 3 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / **Profile**	**BP**	**R1**	**R2**	**R3**	**PT**
Attention	1	2,8	2,9	3	3,2
Perception	2	2,6	2,8	3	3,2
Memory	1	2,8	2,5	2,7	3,5
Language and Communication	1	2,5	3,1	3	3,8
Reasoning/Logic	1	2,7	2,7	3	3,8
Strategic Thinking/Metacognition	1	2,7	2,7	3	3,8
Behaviours Affecting Learning	1	2,8	2,8	3	3,4

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Static Test Results

Case 3 Raven Coloured Matrices Results

Date	**Pre-test November 2007**	**After 12 months of intervention, November 2008**	**Post-test, after 24 months of intervention, November 2009**
Raw Score	7	12	15
Cronological age	5;7	6;7	7;7
Percentile	< 5	10	25

Case 3 Peabody Passive Vocabulary Test Results

Date	**Pre-test November 2007**	**After 12 months of intervention, November 2008**	**Post-test, after 24 months of intervention, November 2009**
Raw Score	12	64	83
Mental age	2;6	6;1	8;0
Cronological Age	5;7	6;7	7;7

Case 3 Gardner Expressive Vocabulary Test

Date	Pre-test November 2007	After 12 months of intervention, November 2008	Post-test, after 24 months of intervention, November 2009
Raw Score	0	20	69
Cronological Age	5;7	6;7	7;7

Case 3 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children
Pre-test: not possible to administer due to impulsivity and resistance.

	Raw Score		Level		Percentage %	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Copying Parts of Letters	--	5	--	Preparatory	--	21
Phoneme Awareness (Difference between 2 sounds, 2 words)	--	57	--	Optimal	--	95
Vocabulary for Relations	--	20	--	Final	--	83
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	--	40	--	Beginner	--	69
Hypothetical thinking (if..then, therefore…)	--	24	--	Final	--	75
Relationships based on experience (It is sure that…?)	--	26	--	Final	--	81

Case 4

Case 4 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Independently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/7	62/12	62/7	62/29
Mazes	16	16/3	16/7	16/9	16/15
Visual transport	16	16/7	16/9	16/12	16/16
Concept Formation with Inclusion	40	40/0	40/4	40/13	40/40
Concept Formation with Elimination	30	30/0	30/1	30/18	30/28
Test of Inferential Thinking	6 and 10	6/2 and 10/2	6/2 and 10/3	6/4 and 10/8	6/6 and 10/10
Part-Whole	22	22/8	22/10	22/17	22/20
Functional Part -Whole	16	16/5	16/6	16/12	16/16
Progressions	12	12/2	12/3	12/7	12/11
Picture Sequence	18	18/0	18/10	18/10	18/18
Absurdities	10	10/0	10/3	10/6	10/10

Case 4 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	2,5	2,9	3	3,2
Perception	2	2,4	2,9	3	3,2
Memory	2	2,8	2,8	2,9	3,5
Language and Communication	2	2,5	3,5	3,2	3,8
Reasoning/Logic	1	2,9	2,7	3	3,8
Strategic Thinking/Metacognition	1	2,6	2,7	3	3,8
Behaviours Affecting Learning	1	2,8	2,8	3	3,4

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Case 4 Raven Coloured Matrices Results

Date	**Pre-test June 2008**	**After 12 months of intervention, June 2009**	**Post-test after 24 months of intervention, June 2010**
Raw Score	14	18	20
Cronological age	12;7	13;7	14;7
Percentile	<5	<5	<5

Case 4 Peabody Passive Vocabulary Test Results

Date	**Pre-test June 2008**	**After 12 months of intervention, November 2008**	**Post-test, after 24 months of intervention, June 2010**
Raw Score	101	119	131
Mental age	5	10;11	10;11
Cronological Age	12;7	13;1	14;7

Though the test can be administered till the age of 11, we used it since there is no receptive language test in Hungarian that would give an overview of children's vocabulary development in the clinical population.

Case 4 Gardner' s Active Vocabulary Test Results

Date	**Pre-test June 2008**	**After 12 months of intervention, June 2009**	**Post-test, after 24 months of intervention, June 2010**
Raw Score	30	69	77
Cronological Age	12;7	13;1	14;7

Though the test can be administered till the age of 11, we used it since there is no expressive language test in Hungarian that would give an overview of children's vocabulary development in the clinical population.

DIFER TEST

Pre-test: Not possible to administer for the 12;4 year old child due to impulsivity and resistance. Post-test results are indicated in Table 6.25.

Case 4 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		Level		Percentage %	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Copying Parts of Letters	--	20	--	Final	--	83
Phoneme Awareness (Difference between 2 sounds, 2 words)	--	56	--	Optimal	--	93
Vocabulary for Relations	--	20	--	Final	--	83
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	--	40	--	Beginner	--	69
Hypothetical thinking (if..then, therefore…)	--	21	--	Advanced	--	66
Relationships based on experience (It is sure that…?)	--	22	--	Final	--	69

Case 5

Case 5 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Independently	**With mediation**	**Independently**	**With mediation**
Spatial Orientation	62	62/10	62/40	62/49	62/59
Mazes	16	16/0	16/3	16/5	16/10
Visual transport	16	16/8	16/14	16/14	16/16
Concept Formation with Inclusion	40	40/0	40/1	40/7	40/22
Concept Formation with Elimination	30	30/0	30/8	30/17	30/30
Test of Inferential Thinking	6 and 10	6/2 and 10/4	6/2 and 10/6	6/4 and 10/9	6/6 and 10/10
Part-Whole	22	22/7	22/14	22/18	22/21
Functional Part - Whole	16	16/	16/7	16/12	16/16
Progressions	12	12/0	12/6	12/10	12/12
Picture Sequence	18	18/0	18/2	18/11	18/18
Absurdities	10	10/0	10/4	10/7	10/10

Case 5 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	2	2,75	3	3,2
Perception	1	2	2,75	3	3,2
Memory	1	2	2,5	2,75	2,75
Language and Communication	1	2	3	3	3,5
Reasoning/Logic	1	2	2,75	3	3,2
Strategic Thinking/Metacognition	1	2	2,73	3	3,2
Behaviours Affecting Learning	1	2	2,87	3	3,4

N. Not applicable/Not observed

1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Case 5 Raven Coloured Matrices Results

Date	Pre-test February 2008	After 12 months of intervention February 2009	Post-test after 24 months of intervention February 2010
Raw Score	10	16	18
Cronological age	7;5	8;9	8;5
Percentile	<5	5-10	10-25

Case 5 Peabody Passive Vocabulary Test Results

Date	Pre-test February 2008	After 12 months of intervention, February 2009	Post-test, after 24 months after intervention, February 2010
Raw Score	64	75	92
Mental age	6;2	7;2	10;0
Cronological Age	7;5	8;5	9;5

Case 5 Gardner's Active Vocabulary Test Results

Date	Pre-test February 2008	After 12 months of intervention, February 2009	Post-test, after 24 months after intervention, February 2010
Raw Score	36	40	72
Cronological Age	7;5	8;5	9;5

Case 5 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		Level		Percentage %	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Copying Parts of Letters	5	17	Preparatory	Final	21	71
Phoneme Awareness (Difference between 2 sounds, 2 words)	42	57	Advanced	Optimal	70	95
Vocabulary for Relations	10	19	Preparatory	Advanced	42	79
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	4	40	Preparatory	Beginner	7	69
Hypothetical thinking (if..then, therefore…)	6	28	Preparatory	Optimal	19	88
Relationships based on experience (It is sure that…?)	10	27	Beginner	Final	31	84

Case 6

Dynamic Assessment Results

Case 6 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Indepen dently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/12	62/20	62/27	62/40
Mazes	16	16/0	16/5	16/8	16/16
Visual transport	16	16/4	16/12	16/15	16/16

Concept Formation with Inclusion	40	40/4	40/7	40/19	40/24
Concept Formation with Elimination	30	30/6	30/11	30/22	30/28
Test of Inferential Thinking	6 and 10	6/6 and 10/7	6/6 and 10/8	6/5 and 10/10	6/6and 10/10
Part-Whole	22	22/7	22/12	22/18	22/22
Functional Part - Whole	16	16/8	16/14	16/14	16/16
Progressions	12	12/4	12/10	12/12	12/12
Picture Sequence	18	18/0	18/4	18/12	18/17
Absurdities	10	10/4	10/6	10/7	10/10

Case 6 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / **Profile**	**BP**	**R1**	**R2**	**R3**	**PT**
Attention	2	2,5	2,8	3	3,5
Perception	2	2	2,8	3	3,5
Memory	1,9	2	2,7	2,75	3,9
Language and Communication	1,6	2	3	3	3,9
Reasoning/Logic	1,7	2	2,75	3,2	3,8
Strategic Thinking/Metacognition	1,5	2	2,73	3,4	3,8
Behaviours Affecting Learning	1,9	2	2,87	3,4	3,8

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Static Test Results

Case 6 Raven Coloured Matrices Results

Date	**Pre-test March 2010**	**After 12 months of intervention March 2011**	**Post-test after 24 months of intervention March 2012**
Raw Score	15	22	28
Cronological age	6,6	7;5	8;6
Percentile	25-50	50-75	75-90

Case 6 Peabody Passive Vocabulary Test Results

Date	**Pre-test March 2010**	**After 12 months of intervention, February 2011**	**Post-test, after 24 months after intervention, March 2012**
Raw Score	54	84	101
Mental age	5,4	8;0	10;6
Cronological Age	6,6	7;5	8;6

Case 6 Gardner's Active Vocabulary Test Results

Date	**Pre-test March 2010**	**After 12 months of intervention, February 2011**	**Post-test, after 24 months after intervention, March 2012**
Raw Score	35	50	68
Cronological Age	6,6	7;5	8;6

Case 6 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		**Level**		**Percentage %**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Copying Parts of Letters	3	14	Preparatory	Advanced	13	58
Phoneme Awareness **(Difference between 2 sounds, 2 words)**	37	46	Preparatory	Advanced	62	77
Vocabulary for Relations	9	14	Preparatory	Beginner	38	58
Basic Numeracy **(Counting, mathematical operations with sticks, recognising numbers)**	34	36	Beginner	Beginner	59	62
Hypothetical thinking **(if..then, therefore…)**	13	22	Beginner	Advanced	41	69
Relationships based on experience **(It is sure that…?)**	9	22	Preparatory	Advanced	28	69

Case 6 Trog- test. Test for Reception of Grammar

	Pre-test March 2010	**Post-test, after 24 months after intervention, March 2012**
Number of blocks Completed	6	13
Age-equvivalence	4;0	7;0
Cronological Age	6;6	8;6

Case 6 Screening Test of Language Development (Pléh-Palotás-Lőrik 2002)

	March 2010	**March 2012**
Nouns -- Formation of Plurals	5/2 Mistakes: „vízilók", „majomok"	5/5
Nouns	no mistakes	5/5
Spatial Suffixes **-ba, -ban** **-on** **-ról** **-ra** **-ból**	6/4 Mistakes „pohár tetejére"	5/5
Spatial Postpositions **elé, alá, közé, mögé mellé** **alatt, között, mögött, mellett, előtt** **mellől, mögül, elől, alól, közül**	15/9	15/12 Mistakes: középre, közé, mellé

Case 7

Dynamic Assessment Results

Case 7 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Indepen-dently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/11	62/18	62/28	62/44
Mazes	16	16/4	16/6	16/7	16/12
Visual transport	16	16/3	16/11	16/16	16/16
Concept Formation with Inclusion	40	40/4	40/7	40/19	40/24
Concept Formation with Elimination	30	30/6	30/11	30/22	30/28
Test of Inferential Thinking	6 and 10	6/6 and 10/7	6/6 and 10/8	6/5 and 10/10	6/6and 10/10
Part-Whole	22	22/7	22/12	22/18	22/22
Functional Part -Whole	16	16/8	16/14	16/14	16/16
Progressions	12	12/4	12/10	12/12	12/12
Picture Sequence	18	18/0	18/4	18/12	18/17
Absurdities	10	10/4	10/6	10/7	10/10

Case 7 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities Profile	BP	R1	R2	R3	PT
Attention	1	1,9	1,9	2	2,5
Perception	2	2,5	2,8	3	3,1
Memory	2	2,9	2,7	2,75	3,9
Language and Communication	1,6	2	2	3	3,1
Reasoning/Logic	2	2,8	2,9	3,2	3,8
Strategic Thinking/Metacognition	2	2,9	2,9	3,4	3,8
Behaviours Affecting Learning	1,9	2,9	2,9	3,0	3,0

Case 7 Raven Coloured Matrices Results

Date	Pre-test June 2011	After 12 months of intervention, June 2012	Post-test after 24 months of inter-vention, June 2013
Raw Score	10	11	20
Cronological age	5;2	6;2	7;2
Percentile	10	10	50 -- 75

Case 7 Peabody Passive Vocabulary Test Results

Date	Pre-test June 2011	After 12 months of intervention, June 2012	Post-test, after 24 months of intervention, May 2013
Raw Score	42	58	83
Mental age	4;11	6;0	8;6
Cronological Age	5;2	6;2	7;2

Case 7 Gardner's Active Vocabulary Test Results

Date	**Pre-test June 2011**	**After 12 months of intervention, June 2012**	**Post-test after 24 months of intervention, June 2013**
Raw Score	27	36	57
Cronological Age	5;2	6;2	7;2

Case 7 *Difer Test for Diagnostic Assessment of 4-9 Year-Old Children*

	Raw Score		**Level**		**Percentage %**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Copying Parts of Letters	1	7	Preparatory	Beginner	4	29
Phoneme Awareness (Difference between 2 sounds, 2 words)	60	60	Optimal	Optimal	100	100
Vocabulary for Relations	14	16	Beginner	Beginner	58	67
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	16	30	Preparatory	Beginner	28	52
Hypothetical thinking (if..then, therefore…)	22	26	Final	Final	69	81
Relationships based on experience (It is sure that…?)	24	24	Final	Final	75	81

Case 7 Trog- test. Test for Reception of Grammar Pre- and Post-test Results

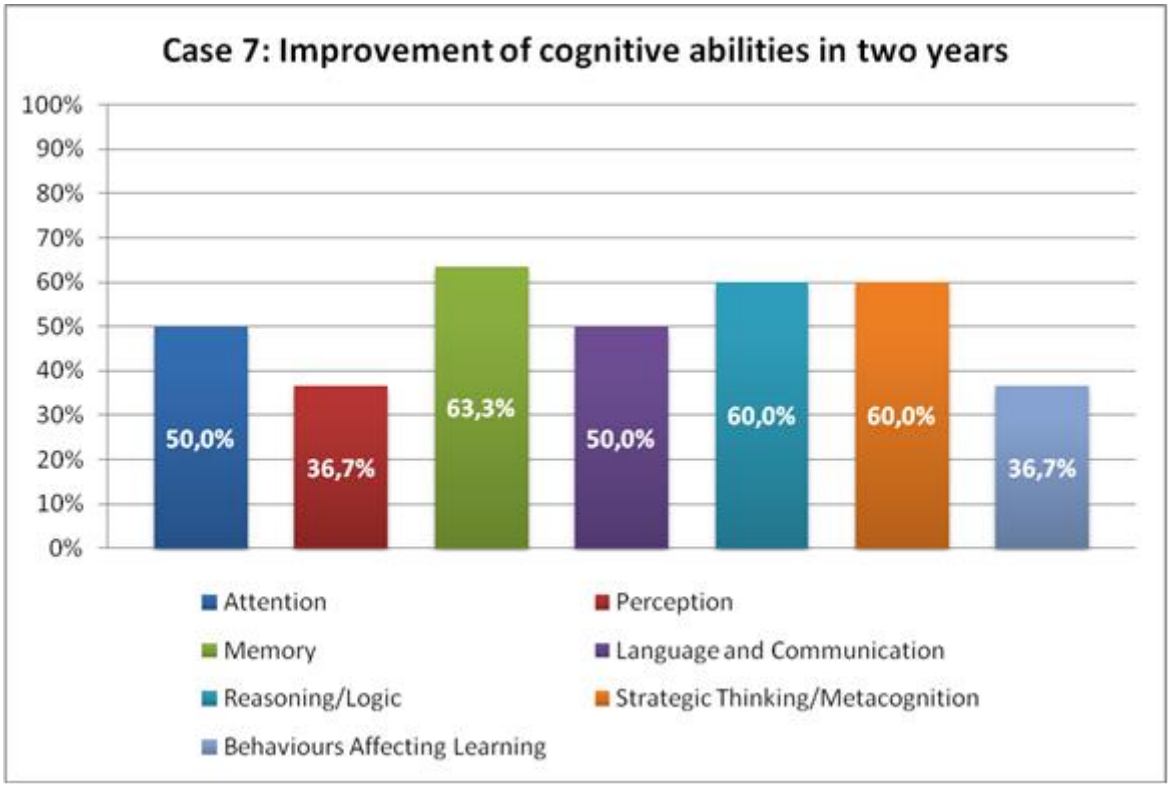
	Pre-test June 2011	**Post-test June 2013**
Number of blocks Completed	5	11
Age-equvivalence	3;5 years	5;9 years
Cronological Age	5;3 years	7;3 years

TROG test reveals the little girl is on the level of a 6 year-old in understanding syntactic structures. Her difficulties were the following: spatial suffixes, longer sentences including logical formulas. It is still very hard for our participant to work in auditory modality.

Case 7 Screening Test of Language Development (PPL) Pre and Post-test.

	Pre-test June 2011	**Post-test May 2013**
Nouns – Formation of Plurals	5/ 4 Mistake: vizilók	5/ 5
Nouns	5/ 4 Mistake: kőt	5/4 Mistake: 'kőt'
Spatial Suffixes	5/ 3 Mistake: sok halacskát, vödröket	5/4 Mistake: 'vödöröket'
-ba, -ban	6/1	6/4
-on	2/1	1/1
-ra	1/0	2/1
-ról	1/0	1/1
-ból	1/0	1/1
Spatial Postpositions **elé, alá, közé, mögé mellé** **alatt, között, mögött, mellett, előtt** **mellől, mögül, elől, alól, közül**	1/0 15/2 Correct: alá, alatt	15/12 Mistakes: mögött, előtt, mögül

According to PPL test we can state that the little girl's morphological language has improved a great deal. We clearly see the effects of Mediated Learning in her spatial orientation, represented in her linguistic representations (spatial postpositions) as well.



Case 8

Dynamic Assessment Results

Case 8 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Indepen-dently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/5	62/16	62/55	62/61
Mazes	16	16/2	16/7	16/7	16/10
Visual transport	16	16/7	16/8	16/13	16/15
Concept Formation with Inclusion	40	40/6	40/6	40/27	40/30
Concept Formation with Elimination	30	30/6	30/16	30/21	30/28
Test of Inferential Thinking	6 and 10	6/4 and 10/5	6/6 and 10/9	6/6 and 10/10	6/6 and 10/10
Part-Whole	22	22/9	22/11	22/19	22/22
Functional Part - Whole	16	16/8	16/15	16/13	16/16
Progressions	12	12/6	12/12	12/12	12/12
Picture Sequence	18	18/4	18/6	18/14	18/18
Absurdities	10	10/5	10/6	10/9	10/10

Case 8 Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1,7	1,9	1,9	2	2,5
Perception	1,8	1,9	2,3	2,6	2,9
Memory	1,7	1,8	2,3	2,5	2,7
Language and Communication	1,7	2	2,5	3	3,8
Reasoning/Logic	1,4	1,6	2,1	2,3	2,8
Strategic Thinking/Metacognition	1,5	1,7	2,3	2,5	2,8
Behaviours Affecting Learning	1,75	2	2,5	2,8	3

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Case 8 Raven Coloured Matrices Results – due to age range the test is not applicable, yet we administered it for research purposes

Date	**Pre-test June 2011**	**After 12 months of intervention, June 2012**	**Post-test after 24 months of intervention, June 2013**
Raw Score	- (14)	- (18)	- (21)
Cronological age	14;8	15;8	16;8
Percentile	- (<5)	- (<5)	- (<5)

Case 8 Peabody Passive Vocabulary Test Results – due to age range the test is not applicable, yet we administered it for research purposes

Date	**Pre-test April 2010**	**After 12 months of intervention, April 2011**	**Post-test, after 24 months of intervention, April 2013**
Raw Score	68	90	141
Mental age	7;0	9;6	11;0
Cronological Age	14;8	15;8	16;8

Case 8 Gardner Expressive Language Test – due to age range the test is not applicable, yet we administered it for research purposes

Date	**Pre-test April 2010**	**After 12 months of intervention, April 2011**	**Post-test, after 24 months of intervention, April 2012**
Raw Score	42	70	76
Mental age	6;0	10;0	10;10
Cronological Age	14;8	15;8	16;8

Case 8 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		Level		Percentage %	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Copying Parts of Letters	6	15	Preparatory	Advanced	25	63
Phoneme Awareness (Difference between 2 sounds, 2 words)	45	60	Advanced	Optimal	75	100
Vocabulary for Relations	10	21	Preparatory	Final	42	86
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	40	48	Beginner	Final	69	81
Hypothetical thinking (if..then, therefore…)	18	24	Advanced	Final	56	75
Relationships based on experience (It is sure that…?)	15	22	Beginner	Advanced	47	69

Case 8 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		Level		Percentage %	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Copying Parts of Letters	6	15	Preparatory	Advanced	25	63
Phoneme Awareness (Difference between 2 sounds, 2 words)	45	60	Advanced	Optimal	75	100
Vocabulary for Relations	10	21	Preparatory	Final	42	86
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	40	48	Beginner	Final	69	81
Hypothetical thinking (if..then, therefore…)	18	24	Advanced	Final	56	75
Relationships based on experience (It is sure that…?)	15	22	Beginner	Advanced	47	69

Case 9

Case 9 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Indepen-dently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/0	62/0	62/5	62/9
Mazes	16	16/3	16/5	16/8	16/12
Visual transport	16	16/5	16/11	16/9	16/16
Concept Formation with Inclusion	40	40/0	40/0	40/0	40/0
Concept Formation with Elimination	30	30/0	30/0	30/0	30/1
Test of Inferential Thinking	6 and 10	6/0 and 10/0	6/0 and 10/0	6/0 and 10/0	6/0 and 10/0
Part-Whole	22	22/9	22/12	22/14	22/21

Functional Part - Whole	16	16/11	16/16	16/14	16/16
Progressions	12	12/5	12/8	12/9	12/12
Picture Sequence	18	18/9	18/15	18/17	18/18
Absurdities	10	10/0	10/2	10/3	10/5

Case 9 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / Profile	**BP**	**R1**	**R2**	**R3**	**R4**	**PT**
Attention	2	2,1	2,3	2,6	3,1	3,3
Perception	1,3	1,4	1,7	2	2,2	2,7
Memory	1,8	1,9	2,2	2,4	2,8	3,1
Language and Communication	1,1	1,1	1,2	1,5	1,6	2
Reasoning/Logic	2,0	2,0	2,4	2,5	2,9	3
Strategic Thinking/Metacognition	1,5	1,6	1,8	2,1	2,5	2,7
Behaviours Affecting Learning	1,8	2,1	2,5	2,8	3,1	3,5

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Case 9 Raven Coloured Matrices Results

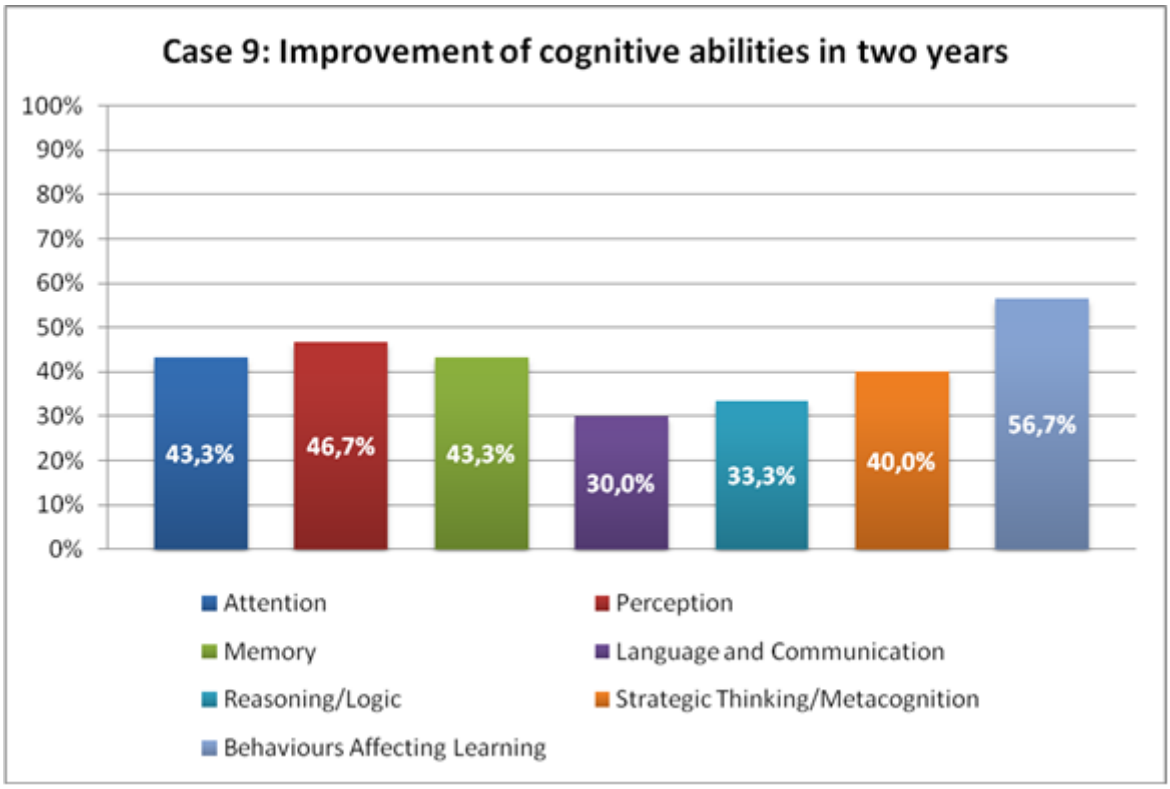
Date	**Pre-test June 2011**	**After 12 months of intervention, June 2012**	**Post-test after 24 months of intervention, June 2013**
Raw Score	Not possible to measure	20 p average intelligence	24 p average intelligence
Cronological age	6;8	7;8	8;8
Percentile	0	50	50

Case 9 Peabody Passive Vocabulary Test Results

Date	**Pre-test June 2011**	**After 12 months of intervention, June 2012**	**Post-test, after 24 months of intervention, May 2013**
Raw Score	1	6	13
Mental age	--	--	2;6
Cronological Age	6;8	7;8	8;8

Case 9 Gardner's Active Vocabulary Test

Date	**Pre-test June 2011**	**After 12 months of intervention, June 2012**	**Post-test after 24 months of intervention, June 2013**
Raw Score	**0**	**2**	**5**
Cron. Age	**6;8**	**7;8**	**8;8**



Case 9 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

	Raw Score		Level		Percentage %	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**	**Pre-test**	**Post-test**
Copying Parts of Letters	5	13	Preparatory	Advanced	21	54
Phoneme Awareness **(Difference between 2 sounds, 2 words)**	33	40	Preparatory	Preparatory	55	67
Vocabulary for Relations	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate
Basic Numeracy **(Counting, mathematical operations with sticks, recognising numbers)**	45	50	Beginner	Final	77	86
Hypothetical thinking **(if..then, therefore…)**	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate
Relationships based on experience **(It is sure that…?)**	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate	Due to lack of speech production it is not possible to evaluate

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Case 10

Case 10 LPAD-Basic Assessment Results

	Maximum scores possible	Pre-Test		Post-Test	
		Indepen-dently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/0	62/5	62/60	62/60
Mazes	16	16/16	16/16	16/16	16/16
Visual transport	16	16/16	16/16	16/16	16/16
Concept Formation with Inclusion	40	40/0	40/3	40/12	40/28
Concept Formation with Elimination	30	30/0	30/0	30/21	30/28
Test of Inferential Thinking	6 and 10	6/0 and 10/0	6/0 and 10/3	6/6 and 10/5	6/6 and 10/10
Part-Whole	22	22/19	22/19	22/19	22/22
Functional Part -Whole	16	16/12	16/15	16/15	16/16
Progressions	12	12/5	12/5	12/8	12/11
Picture Sequence	18	18/12	18/12	18/15	18/18
Absurdities	10	10/0	10/0	10/2	10/4

Case 10 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	1,5	2	2	2,875
Perception	1,25	1,25	1,66	1,83	2,42
Memory	1,33	1,58	1,83	1,91	2,25
Language and Communication	1	1,5	1,875	2,125	2,5
Reasoning/Logic	1	1,58	2,08	2,25	2,66
Strategic Thinking/Metacognition	1	1,125	1,375	1,81	2,375
Behaviours Affecting Learning	1	1,125	1,56	1,81	2,5

N. Not applicable/Not observed

1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response

Consistently and independently able/responsive

Case 10 Raven Coloured Matrices Results

Date	Pre-test March 2011	After 12 months of intervention, March 2012	Post-test after 24 months of intervention, March 2013
Raw Score	23	36 Extremely high intelligence	36 Extremely high intelligence
Cronological age	10;11	11;11	12;11
Percentile	10	> 95	95

Case 10 Peabody Passive Vocabulary Test Results

Date	Pre-test March 2011	After 12 months of intervention, March 2012	Post-test, after 24 months after intervention, March 2013
Raw Score	21	45	32
Mental age	3	5	5
Cronological Age	10;11	11;11	12;11

Case 10 Gardner's Active Vocabulary Test

Date	Pre-test March 2011	After 12 months of intervention, March 2012	Post-test after 24 months of intervention, March 2013
Raw Score	9	13	36
Cronological Age	10;11	11;11	12;11

Case 10 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children
Pre-test: Not possible to administer for the 10;11 year old child due to severe resistance.

	Raw Score		Level		Percentage %	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Copying Parts of Letters	Not possible to administer	8	Advanced phase	Beginner phase	Not possible to administer	33
Phoneme Awareness (Difference between 2 sounds, 2 words)	Not possible to administer	19	Not possible to administer	Preparatory phase	Not possible to administer	32
Vocabulary for Relations	Not possible to administer	19	Beginner phase	Advanced phase	Not possible to administer	79
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	Not possible to administer	38	Not possible to administer	Beginner phase	Not possible to administer	66
Hypothetical thinking (if..then, therefore…)	Not possible to administer	Not possible to administer	Not possible to administer	Not possible to administer	Not possible to administer	Not possible to administer
Relationships based on experience (It is sure that…?)	Not possible to administer	Not possible to administer	Not possible to administer	Not possible to administer	Not possible to administer	Not possible to administer

Case 10 Trog- test. Test for Reception of Grammar

	Pre-test March 2011	Post-test after 24 months of intervention, March 2013
Number of blocks Completed	Impossible to administer	4
Age-equvivalence	0	3;0

Case 11

LPAD-Basic Assessment could not have been carried out due to lack of cooperation and general cognitive ability.

Table Case 11 Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	1,125	1,25	1,75	1,80
Perception	1	1,16	1,16	1,5	1,60
Memory	1	1	1	1,42	1,50
Language and Communication	1	1	1,125	1,125	1,20
Reasoning/Logic	1	1	1,08	1,25	1,25
Strategic Thinking/Metacognition	1	1	1,06	1,125	1,20
Behaviours Affecting Learning	1	1	1,25	1,44	1,50

N. Not applicable/Not observed

1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Static Test Results

Case 11 Peabody Passive Vocabulary Test Results

Date	Pre-test May 2011	After 12 months of intervention, May 2012	Post-test, after 24 months after intervention, May 2013
Raw Score	0	0	3
Mental age	-	-	1;0
Cronological Age	6;3	7;3	8;3

It was not possible to administer any other tests in static circumstances to our participant.

Case 12

Dynamic Assessment Results

Case 12 LPAD-Basic Assessment Results

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Indepen-dently	With mediation	Indepen-dently	With mediation
Spatial Orientation	62	62/0	62/2	62/7	62/22
Mazes	16	16/4	16/9	16/16	16/
Visual transport	16	16/0	16/2	16/2	16/5
Concept Formation with Inclusion	40	40/0	40/0	40/2	40/16
Concept Formation with Elimination	30	30/0	30/0	30/0	30/3
Test of Inferential Thinking	6 and 10	6/0 and 10/1	6/3 and 10/2	6/0 and 10/0	6/4 and 10/6
Part-Whole	22	22/1	22/3	22/5	22/10
Functional Part -Whole	16	16/1	16/4	16/1	16/6
Progressions	12	12/0	12/1	12/2	12/4
Picture Sequence	18	18/0	18/2	18/0	18/4
Absurdities	10	10/0	10/1	10/0	10/5

Case 12 Dynamic Assessment Results -- Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	1,1	1,7	2	2,1
Perception	1	1,2	1,4	1,9	2
Memory	1	1	1	1,4	1,9
Language and Communication	1	1	1,5	1,8	2
Reasoning/Logic	1	1	1,3	1,5	2
Strategic Thinking/Metacognition	1	1	1	1,3	1,9
Behaviours Affecting Learning	1	1	1,4	1,3	2,3

N. Not applicable/Not observed

1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Static Test Results

Case 12 Raven Coloured Matrices Results

Date	Pre-test September 2010	After 12 months of intervention, September 2011	Post-test after 24 months of intervention, September 2013
Raw Score	Not possible to administer	Not possible to administer	4 p
Cronological age	7;8	8;8	9;8
Percentile	-	-	<5

Case 12 Peabody Passive Vocabulary Test Results

Date	Pre-test September 2010	After 12 months of intervention, September 2011	Post-test, after 24 months of intervention, September 2012
Raw Score	13	31	48
Mental age	3	4;3	5
Cronological Age	7;8	8;8	9;8

Case 12 Gardner's Active Vocabulary Test

Date	Pre-test March 2011	After 12 months of intervention, March 2012	Post-test after 24 months of intervention, March 2013
Raw Score	8	19	28
Cronological Age	7;8	8;8	9;8

Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

Pre- and Post-test: Not possible to administer due to impulsivity and resistance.

Case 13

Case 13 Gardner's Active Vocabulary Test

Date	Pre-test May 2011	After 12 months of intervention, May 2012	Post-test, after 24 months after intervention, May 2013
Raw Score	0	8	19
Cronological Age	2;8	3;8	4;8

Case 14

Dynamic Assessment Results

Case 14 Dynamic Assessment Results - Cognitive Abilities Profile

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	1	1,5	1,8	2,3	3
Perception	1,25	1,25	1,8	2,1	2,5
Memory	1,33	1,58	2,4	2,75	2,9
Language and Communication	1	1,5	1,75	2,25	2,75
Reasoning/Logic	1	1,58	1,33	2,8	3
Strategic Thinking/Metacognition	1	1,125	1,18	1,56	2
Behaviours Affecting Learning	1	1, 7	2,1	2,75	3

N. Not applicable/Not observed

1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response

Static Test Results

Case 14 Raven Coloured Matrices Results

Date	Pre-test December 2010	After 12 months of intervention, December 2011	Post-test after 24 months of intervention, December 2012
Raw Score	-	Not possible to administer, too complex	14
Cronological age	4;8	5;5	6;8
Percentile	-	-	25

Case 14 Peabody Passive Vocabulary Test Results

Date	Pre-test December 2010	After 12 months of intervention, December 2011	Post-test, after 24 months after intervention, December 2012
Raw Score	14	54	60
Mental age	3;0	6;0	6;6
Cronological Age	4;8	5;8	6;8

Case 14 Gardner's Active Vocabulary Test

Date	Pre-test December 2010	After 12 months of intervention, March 2011	Post-test, after 24 months after intervention, December 2012
Raw Score	8	24	38
Cronological Age	4;8	5;8	6;8

Table 14. Trog- test. Test for Reception of Grammar Pre- and Post-Test Results

Case 14	Pre-test December 2010	Mid-Term Test April 2012	Post-test December 2012
Number of blocks Completed	2	4	9
Age-equvivalence	under 2;0	3;0 years	5;0 years
Cronological Age	4;8	4;8 years	6;8 years

Case 14 Difer Test for Diagnostic Assessment of 4-9 year-old Children

Pre-test: Not possible to administer for the 4;8 year old child due to impulsivity and resistance.

	Raw Score		Level		Percentage %	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**	**Pre-test**	**Post-test**
Copying Parts of Letters	0	0	-	Preparatory phase	0	0
Phoneme Awareness (Difference between 2 sounds, 2 words)	23	36	Preparatory phase	Beginner phase	38	60
Vocabulary for Relations	7	14	Preparatory Phase	Beginner phase	29	58
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	3	12	Preparatory phase	Preparatory phase	9	21
Hypothetical thinking (if..then, therefore…)	6	12	Preparatory phase	Beginner phase	19	38
Relationships based on experience (It is sure that…?)	0	20	-	Advanced phase	0	63

Case 15

Dynamic Assessment Results

Case 15 *LPAD-Basic Assessment Results*

TEST	Maximum scores possible	Pre-Test		Post-Test	
		Indepen-dently	**With mediation**	**Indepen-dently**	**With mediation**
Spatial Orientation	62	62/40	62/49	62/50	62/62
Mazes	16	16/10	16/15	16/13	16/16
Visual transport	16	16/9	16/12	16/15	16/16
Concept Formation with Inclusion	40	40/23	40/33	40/30	40/40
Concept Formation with Elimination	30	30/16	30/26	30/22	30/30
Test of Inferential Thinking	6 and 10	6/6 and 10/10	6/6 and 10/10	6/6 and 10/10	6/6 and 10/10
Part-Whole	22	22/18	22/21	22/22	22/22
Functional Part - Whole	16	16/13	16/16	16/15	16/16
Progressions	12	12/12	12/12	12/12	12/12
Picture Sequence	18	18/6	18/14	18/18	18/18
Absurdities	10	10/7	10/9	10/8	10/10

Case 15 *Dynamic Assessment Results - Cognitive Abilities Profile*

Cognitive Abilities / Profile	BP	R1	R2	R3	PT
Attention	2,8	2,9	2,9	3,1	3,5
Perception	1,3	2,4	2,8	2,9	3,6
Memory	3	3,4	3,5	3,7	4
Language and Communication	3	3	3,5	3,7	3,9

Reasoning/Logic	3,1	3,3	3,5	3,8	4
Strategic Thinking/Metacognition	3,0	3,4	3,5	3,5	3,5
Behaviours Affecting Learning	3,1	3,2	3,3	3,6	3,8

N. Not applicable/Not observed
1. Not able even with help/support; or does not respond
2. Only able with help/support, not independent; or some response is given
3. Sometimes able to do independently (not consistently); or inconsistence response
4. Consistently and independently able/responsive

Static Test Results

Case 15 *Raven Coloured Matrices Results*

Date	**Pre-test August 2011**	**After 12 months of intervention, August 2012**	**Post-test, after 24 months after intervention, August 2013**
Raw Score	13	20	28
Cronological age	7;0	8;0	9;0
Percentile	10	50	50-75

Table 6.83 Peabody Passive Vocabulary Test Results

Date	**Pre-test August 2011**	**After 12 months of intervention, August 2012**	**Post-test, after 24 months after intervention, August 2013**
Raw Score	108	112	132
Mental age	10;0	10;6	11;0
Cronological Age	7;0	8;0	9;0

Case 15 *Gardner's Active Vocabulary Test*

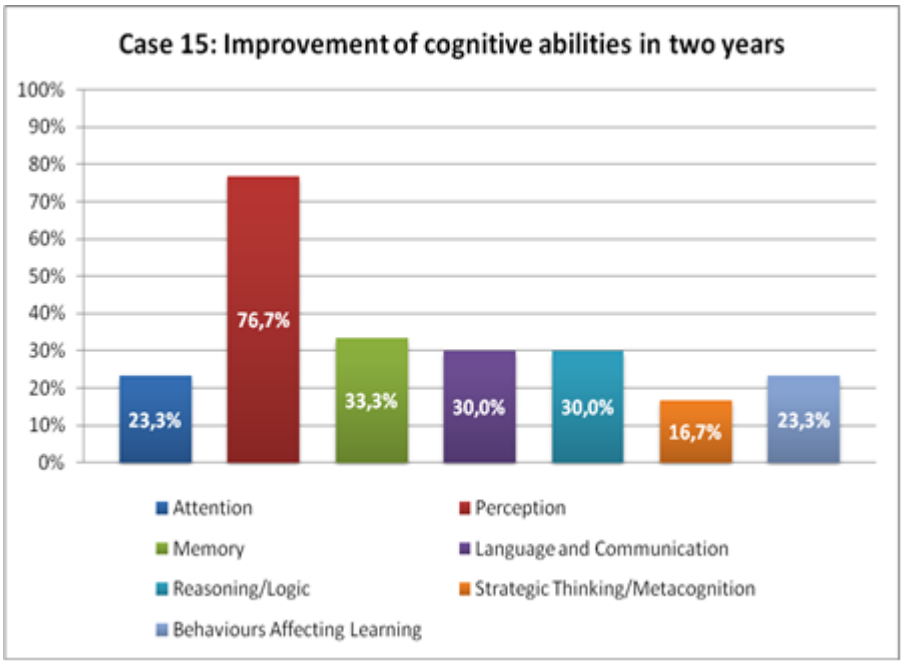
Date	**Pre-test August 2011**	**After 12 months of intervention, August 2012**	**Post-test, after 24 months after intervention, August 2013**
Raw Score	55	60	71
Cronological Age	7;0	8;0	9;0

Case 15 Difer Test for Diagnostic Assessment of 4-9 Year-Old Children

Case 15	**Raw Score**		**Level**		**Percentage %**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test,**	**Pre-test**	**Post-test**
Copying Parts of Letters	5	16	Preparatory	Advanced	21	67
Phoneme Awareness (Difference between 2 sounds, 2 words)	42	60	Advanced	Optimal	70	100
Vocabulary for Relations	28	44	Preparatory	Advanced	48	76
Basic Numeracy (Counting, mathematical operations with sticks, recognising numbers)	29	43	Preparatory	Advanced	50	75

Hypothetical thinking (if..then, therefore…)	15	26	Beginner	Final	47	81
Relationships based on experience (It is sure that…?)	16	28	Advanced	Optimal	50	88

When copying parts of letters the content and position usually has been precise, however he had difficulties in juding size of the letters.



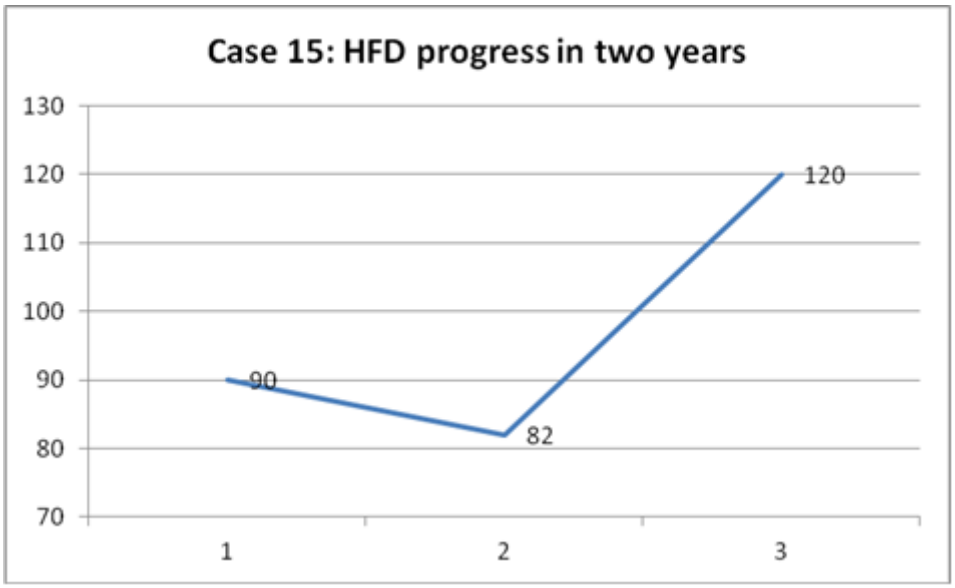


Figure 83. Human Figure Drawing of Case Nr 15 in Two Years According to the Goodenough-Harris Drawing Test (DQ and Number of Drawings)