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

Theses of a PhD Dissertation

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INTRODUCTION

Intellectual disability is still a major social, educational and health problem all over the world in the 21st century. 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).

However, 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 (PDD) or cerebral paresis (CP). 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 the intelligence of students with intellectual disabilities 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).

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. Though European level of legislation has started to protect the rights of people with intellectual disability (e.g. The Salamanca Statement on Special Needs Education, 1994); the UN Convention on the Rights of Persons with Disabilities, Article 24, Education, 2006 etc.), the everyday practice of social approach, inclusion, and quality of education of people with intellectual developmental disorder still varies from country to country -- 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 (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.

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, 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 (EASPD, Barometer Research, 2012).

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).

Experiencing the affective and cognitive needs of children with low intellectual performance, we chose one from the internationally available *socioconstructivist cognitive intervention programs* (Feuerstein's Mediated Learning Experience and Instrumental Enrichment Basic program /FIE-Basic/) and carried out a thorough intervention in a clinical laboratory for two years. The reason for our choice was that in Hungary we did not find any structured cognitive program that would systematically target fluid intelligence of children with intellectual developmental disorder. We have ensured cognitive-affective rehabilitation for 15 children born with intellectual disability and with other comorbid phenomena (autistic behaviors, obsessive-compulsive disorder /OCD/ and pervasive developmental disorder /PDD/) for 24 months.

As far as we know, in Hungary a thinking-skills program has never been applied with learners with intellectual disability which expicitely mediates cognitive and metacognitive strategies. 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 per child within two years). (Former studies have applied the program just for 7-10 month, not more than 40-60 sessions per child. These studies mainly focused on preschool children with *regular intelligence*.)

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 FIE-Basic) on children with atypical development.

THEORETICAL BACKGROUND

Brain Plasticity: The concept of brain plasticity is a very important fundament of our therapeutic intervention itself and on the level of psychological functions it may be called 'Structural Cognitive Modifiability' or SCM. Brain placticity is one of the most extraordinary discoveries of the 20th century (Doidge, 2007; Joja, 2013). 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 (LeDoux, 2003; Kleim & Jones, 2008). 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. 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).

Structural Cognitive Modifiability: In line with modern brain placticity research in the 21th century, the SCM model has viewed the human organism as open, adaptive and amenable for change since already the 1950's (Feuerstein, 1979). According to this, intelligence is viewed as a propensity of the organism to modify itself *when confronted with the need to do so* due to environmental demands (Feuerstein, Feuerstein, Falik & Bohacs, 2013). 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 model 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 (*Figure 1*).

Distal & Proximal Determinants of Differential Cognitive Development

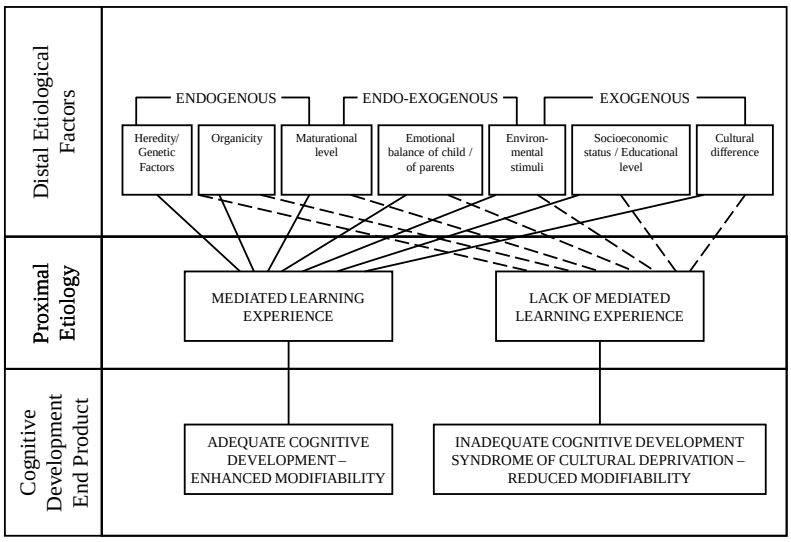

Figure 1. Distal and Proximal Factors of Differential Cognitive Development (Feuerstein et al. 2006 p 70)

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 that 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 12 criteria of MLE processes are thoroughly elaborated in the thesis.

Mirror Neurons: 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 (Rizzolatti & Craighero, 2004; Fogassi & Ferrari, 2007; Feuerstein, Feuerstein, Falik & Bohacs, 2013).

Dynamic Assessment: Due to the challenges of assessing children of minority origins or children with special needs, 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. 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). DA today is a rather complex field. Our thesis details and classifies the present DA systems.

Metacognition: Metacognition is *the awareness of* and *the ability to control one's own cognitive activities (*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)". Differences between children with intellectual disability and mainstream age-equvivalent peers have been attributed to poorly established or partially developed strategies of children with intellectual disability (Belmont & Michell, 1987).

PARTICIPANTS, AIMS AND RESEARCH QUESTIONS

Participants of our study (N=15) were randomly chosen individuals from all parts of the country and from all socio-economic backgrounds. They had very different age, from 2;8 to 14;8. They had mild (n=5) to moderate intellectual developmental disorder (n=10) with very different etiology (genetic syndromes, cerebral paresis, perinatal brain injury and/or metabolic diseases). They presented very different, heterogenious atypical cognitive-emotive behaviours. Besides their atypical cognitive development, severe comorbid behavioural and motoric phenomena could be experienced. Nine of them presented autistic features (including auditory or tactile sensitivity), obsessive behaviour, severe ADHD and/or motoric dysfunctioning (dyspraxia, ataxia and hemiphlegia). Two children were diagnosed with ASD. All of them had problems with fine motor skills. 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.

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 main hypothetical questions of our experiment were 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). 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) 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 *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).

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 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).

METHODS OF THE EMPIRICAL RESEARCH

As for 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).

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* 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.

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). Our research is viewed as *multiple embedded case studies*, since in our study fifteen participants were followed and their development analyzed for a longer period of time (24 months). 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). 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. However, two of the main drawbacks of case studies are their vast demand of time and resources" (Szokolszky, 2004, p 507 and p 499).

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.

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* systems, the Learning Propensity Assessment Device-Basic of Feuerstein (Feuerstein et al., 2006) and the Cognitive Abilities Profile of Deutsch & Mohammed (Deutsch & Mohammed, 2010) besides normative tests. This let us clearly see

possible molar developments of the participants not necessarily indicated by regular testing procedures. This is absolutely not common in Hungary either.

RESULTS

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) 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

Raven Colored Matrices showed an increase in general intelligence of our atypical population by 29,37%p within the two year long intervention period (mean improvement). PPVT has indicated a 3 year 10 month growth in mental years within the two year long intervention time as a mean improvement for 14 cases. Analysis by test-statistics (Paired Samples T-test) 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 show significant changes (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

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.

A general, common experience of therapists, the external evaluator, caretakers and school staff was that children became intensively active verbally – they rapturously labelled objects and phenomena in their environment and presented costant comparative behaviour.
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.

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 possibly because of mirror neurons).

Hypothetical Question 3

According to Cognitive Abilies Profile results the domain of *reasoning* improved by 57,40%p within the 2 years (mean development). 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. 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

According to Cognitive Abilities Profile strategic thinking and metacognition have grown by 53,75%p in two years (mean improvement). 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’ as a mean growth.

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 as a mean growth. 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 the extension of FIE-Basic tool 'Orientation in Space' to more sensorial domains, and the development of a new tool aiming at time concepts for pre-schoolers.

Hypothetical Question 5

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 very intensive human figure development of the participants – as a „byproduct" of our intervention – prove to be surprising. It has been proved that the changes elicited by the program generalized to an other area, graphic education has not been included in our program. 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* – while our intervention targetted cognitive operations and emotive factors.

We note that 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 rich verbally (e.g. *„Dad has just got out of his car with his walking stick"; „A pastry-cook holding a sunshine cookie" 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).
Since no other intervention programs have been applied, MLE and FIE-Basic are the only responsible variables for the changes.

We can reach this aim – the acceleration of performance of children with moderate or mild intellectual developmental disorders -- by *human mediation*, by an approach where activation is neither motoric nor sensorial per se, but *highly verbal* and triggers abstract conceptual development and transfer. Our experiment has brought about intensive changes in human figure drawing development of the participants. Former analyses of the effects of the program have not examined this generalized aspects of the development.

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).

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 one year application of Bright Start Program with children with severe learning disabilities allowed 75 per cent of the intervention group to be recommended for regular classes versus only 25 per cent of the non-cognitive control group (cited by Kozulin et al, 2010).

FURTHER RESEARCH AND PEDAGOGICAL IMPLICATIONS OF THE FINDINGS

Our research has proved the usability of FIE-Basic, MLE and MST in case of a special population, children with moderate to mild intellectual disabilities. However, development of cognitive skills takes many years (Csapó, 2003; Kalmár, 2007; Nagy, 2009). 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. This process is much longer and just partial in case of the atypical population. We have accomplished a two-year long intervention with a large intensity. We believe, 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.

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. We want to emphasize the *need for dynamic assessment of children with retarded performance*. The same conclusion is outlined by *Kozulin* and his associates. (Kozulin at al, 2010). 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.

As far as we know, in Hungary a metacognitive 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.

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 research proves that the boundaries of human intellect can be enlarged in case of intellectual disability as well. 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 the challenges of everyday life.

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