Contents

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ERDÉLYI PSZICHOLÓGIAI SZEMLE

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Prague, 30th October-1st November 2005

Part 2 - Specific papers on Behaviour, Implementation, Assessment & Activation, Mathematics, Parents

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Part **2**

Papers on specific topics

Cognitive Education and Behavior Problems

COGNITIVE PROCESSES AND THEIR INFLUENCE ON ATTENTION, BEHAVIOUR AND LEARNING IN GENERAL

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Abstract: Abstraction is a fundamental cognitive process, involved in every kind of learning. The word abstraction has a number of meanings; here it labels the process of dividing a whole into its parts, also in respect of directing attention to one aspect with, or one property of the whole, disregarding for the moment the other.

In different cases, where barriers for learning caused problems for children, I have seen a distinct correlation between a facilitated abstraction process and successful learning.

A number of researchers have worked within this field. Magne Nyborg, in his theoretical works, has given a more comprehensive approach, not only exploring this as a theory, but also with applications for teaching and learning.

This articles illustrates Nyborg's theory with the case of a ten year-old boy with serious behavioural problems. Facilitating multiple abstraction processes caused a positive change in learning and behaviour.

A issue in Nyborg's thinking is the primordial role of sense experience. The world around us is our source for perceiving, for experience, for learning. A number of sensations activate our previous knowledge, and by a process of mediation, it contributes in coding, the secondary process of experience. By means of this coding process, we are able to classify, to know what it is, that we perceive, and to label it by linguistic utterances of different kinds.

This paper wants to focus on some important cognitive processes and to consider their connection with the learning story of a boy with behavioural and attention problems.

Processes of abstraction and learning

The process of abstraction is something several authors put to the scene. I will here mainly refer to Nyborg, but the others in the literature list are among those who have also contributed to the field.

Nyborg's findings point to the process of abstraction as fundamental and involved in every kind of learning. He developed a model of teaching abstraction, called "concept teaching model", which he showed to be fundamental for providing mental prerequisites for abstraction. Details of this model are explained in Hansen (this issue).

The word abstraction has a number of meanings in literature; here it labels

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the process of dividing a whole into its parts, also in respect of directing attention to one aspect with, or one property of, the whole, disregarding for the moment the other[2].

A chain of abstractions, then, could be the multiple classification of a cup like this:

"*This cup consists of two parts; the bowl and the handle. The top and the bottom have round shapes, as we can pull a finger along the edge, round and round. The handle has a curved shape. The cup is made of stoneware; it has a blue colour, and a dotted pattern. It has a big size compared to an eggcup, and a small size compared to a mug. It has a large weight compared to a ball of wool, and a small weight compared to a feather. We use it for drinking, most often for drinking something hot. When we use it, it has its place on a table, and to be stored it has its place in a cupboard*".

Abstractions of this kind require analyses, or we could say they are analyses.

Point at the entity that has a round shape and a large size compared to the one next to it.

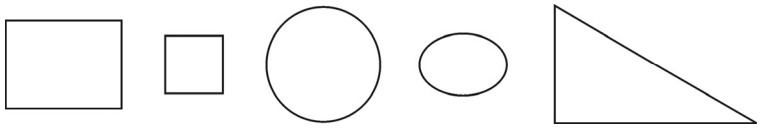

Figure 1.

Alternatively, more complicated:

Point at the entity, having a round shape, chequered pattern, and place to the left of an entity with a round shape and dotted pattern.

Figure 2.

[2] This would be the same definition of the word abstraction as qouted by J.S. Peirce, in his work "On a new list of categories": *The terms "precision" and "abstraction", which were formerly applied to every kind of separation, are now limited, not merely to mental separation, but to that which arises from* attention to *one element and* neglect of *the other.* (Peirce, 1868)

All these tasks require even more basic processes, like consciousness of partly similarities and differences, as well as discrimination. In the first task, you have to abstract or direct attention to the shape and the size of the figures. That implies a discovery of similarities and differences between the figures. It also implies a discrimination process of the figure having a round shape and chequered pattern, but not placed on the left of a figure with round shape and dotted pattern, in order to exclude it. In addition, one needs to discriminate and exclude the figure having a four-sided shape and chequered pattern, in spite of its place on the left of the round shape with dotted pattern, because of its shape. Such analyses one can make as simple or complicated as wanted – all depending on the intention.

The same processes work when someone discriminates between the letters b and d, and in many other tasks related to school subjects.

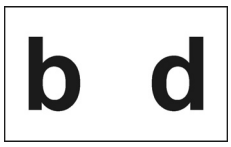

Figure 3.

The two letters are similar in most respects: in having two parts, one with a round shape and one with a straight line shape in a vertical position, similar in the height of the straight lines, and in the letters place on the writing line. The only difference is the vertical line's place related to the round shape.

We can also apply these processes to games, e.g. a Lotto-game where we give the children sheet with figures, and pick up and describe small cards with one figure on each. Instruction can be: "Who has a round shape with a blue colour?" The lucky one, then also has to describe: "I have a figure with a round shape and blue colour.

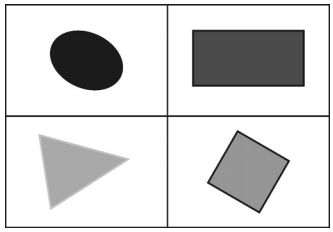

Figure 4.

For this, a more complicated game the instruction could be: “Who has straight line shapes with vertical position, blue colour, and the number four”. Again, the lucky one must describe: “I have straight line shapes with blue colour, the number four and vertical position.

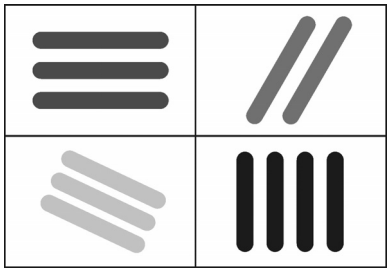

Figure 5.

The same processes come to work in matrix tasks like the one in figure 6. Here, we must consider the shape and the pattern. One of the figures below will fit into the structure of the matrix. The problem is to tell which one.

Children do like these tasks, and we can regularly see how children with low self-esteem raise their shoulders and experience their own competence, when we have provided tools for managing tasks like this, and they succeed on their own.

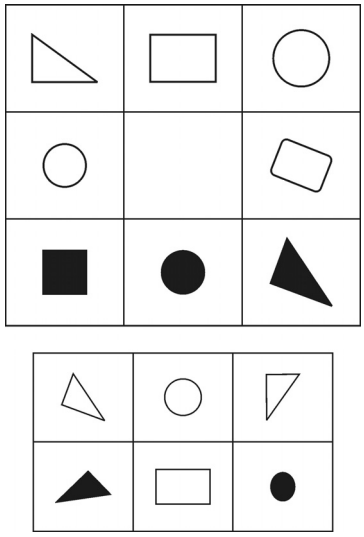

Figure 6.

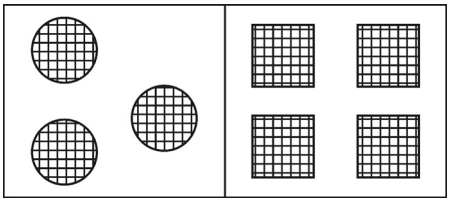

Figure 7.

The next example of analyse task you can see in the figure 7. Let the child watch the drawing of the second box, and answer the question: "Tell me what changes I make now". A correct answer would be: "You changed the shape and the number, but you did not change the pattern".

The task is a little different if we ask: "Tell me what is similar and what is different in the two boxes". It could also be a good idea to let the child fill in the second box, and then let the instructor tell what is changed and what is not. Alternatively, the child can draw in the first box, and the instructor decides how to change, and let the child tell. There are many possibilities, all of them requiring analyse processes.

There is a lack of research on working systematically with analyses like this[3], in connection with supporting concept learning of the concepts underlying such analyses, and of its effect on learning styles and learning strategies. Still, quite a number of teachers have made experiences like my own: these processes do change the children's strategies and styles, and enhance their learning potential.

An in-depth case study: Concept teaching with a boy with behavioural and learning difficulties

This was underlying my planning when I started to work with John, a boy with severe emotional difficulties and attention problems, causing also behaviour and learning problems. He had a very short attention span; no school activity should last for more than ten minutes. He often was tired, and had to have breaks where he could play very often during his day at school. The support system diagnosed him to have general learning difficulties.

[3] There is ongoing research, as Andreas Hansen works with his doctoral thesis in an area concerning also this.

He started at school at the normal age. He had a support team in kindergarten and from the first day at school he had 10 lessons a week designed to his needs, and in addition a school assistant for the rest of his lessons. In the first years, he spent about half of the lessons or more in the class, but as the behaviour problems increased, more and more of his time was in his own room, only now and then with the company of other children there. He struggled with reading. Phonological processing was complicated and he had relative ly few words ready as word-pictures. He resisted to do math, but gained quite some knowledge in the field. All his knowledge was difficult to assess because of poor cooperation in test situations.

The behaviour problems influenced his time at school to a large degree, and more than one teacher and assistant became exhausted by this, especially in his third year at school. When planning the fourth year the school director let three different teachers and two assistants take care of his lessons, in addition to another teacher in the classroom-lessons. This was when I started to teach John. I was responsible for his math lessons, and for teaching general learning abilities. That means I taught him four lessons a week.

My plan was to provide lessons with analysis activities in addition to mathematics, both to see how he could manage that kind of processes, and because I knew it could contribute to changing his learning style. For more than the first half of the school year I did not come into the position to do so. I also had a strategy to build upon his interests, which were dinosaurs at the time. We had good times together working with dinosaurs, but it gave no input to work with other tasks. In the second half of the school year I, more or less by accident, applied what we could call a learning cupboard, with 5 small doors, big enough to carry an A6 size card on it (figure 8). I needed this to provide his detection of similarities and differences in clock faces showing times, as learning how to tell the time had become an urgent task for him, not to be passed over by his younger brother.

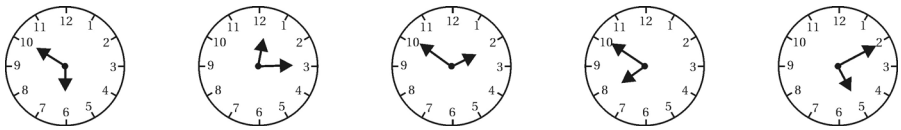

Figure 8.

The task to a set-up like this could be: ”Can you open the door with the clock showing quarter past something?” He would open the second door from

the left, and find a smiling face or a raisin there. For this boy a raisin showed to be a wonder. His motivation increased to unknown levels because of raisins behind the doors. He could also tell what hour it showed quarter past, namely quarter past twelve.

The task could also be "Can you open the doors similar in showing ten minutes to something?" He then would open the first, third and fourth door from the left, and again be happy to find raisins, and to tell that the first was ten minutes to six, the third ten minutes to two, and the forth ten minutes to eight.

The cupboard and cards showing the different types of times took him through the required processes to learn the categories of times we use to tell the time: five past, ten past, quarter past, twenty past, twenty-five past, twenty -five to etc. The Norwegian way of telling the time is even more complicated, but it did not take very long time to learn.

The cupboard showed to be a helpful tool also for analyses of other kinds. Such analyses contributed to a more flexible thinking and acting and it gave us strong indications that his learning potentiality could be less limited than earlier concluded, based on traditional assessment. His subsequent progress in learning multiplications, also by means of the cupboard, reinforces such an interpretation.

In work with multiplication, we made cards that could allow a set up like this (figure 9):

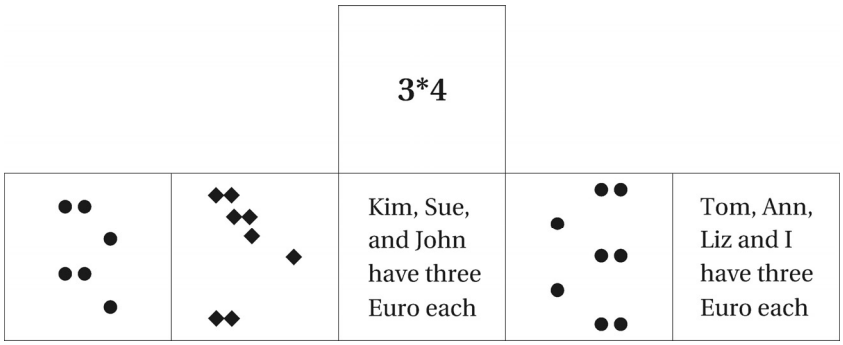

Figure 9.

A task like this also requires a set of abstractions or analyses. This time the categories to abstract and discriminate are those where you can use the multiplication 3*4 to calculate the number.

In a task like this, you will have to exclude the first, because the groups you can identify in the rows of dots do not have the same number. That means you cannot apply multiplication in general and hence not this particular case of multiplication. You also have to exclude the third, because there are mentioned only three persons who have three Euros each. You could use multiplication, but not 3*4.

The cupboard was a successful tool for the rest of the year. During this period, there was a remarkable decrease of difficult situations.

We have no scientific evidence for reasons for this. Still, it is possible to make reasonable inferences about why this worked so well, based on knowledge of learning processes. The first point is the effect of the raisin. However, if this was a mere S-R-relation, and John's processes like those of the rats of Pavlov, John would have lost interest in this after a short period, like he used to do for new activities. My consideration is that his persistent interest also has to do with the kind of task, and those tasks constraints upon his mental processing. The task forced him to do several abstractions and discriminations, and when the prerequisites e.g. by language was present, the situation required an adaptation that was possible for him, though demanding. Observing the boy, you could see how mastering (becoming compentent) created good feelings, self-esteem and motivation.

We could see a change in John's learning styles and strategies. It will be important to see whether changes are permanent, and how new teachers and a new school situation influence his learning styles.

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Part **2**

Papers on specific topics

Diversity and Curriculum Differentiation in the Classroom

A COMPARISON OF MAINSTREAM AND SPECIAL EDUCATION FOR TEENAGERS WITH DOWN SYNDROME: IMPLICATIONS FOR PARENTS AND TEACHERS[I]

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GILLIAN BIRD[1]
BEN SACKS[1]
TAMSIN ARCHER[2]

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Abstract: This article presents data from a research study designed to compare the achievements of teenagers with Down syndrome educated in mainstream classrooms or in special education classrooms throughout their full-time education. Progress is reported for speech and language, literacy, socialisation, daily living skills and behaviour. For all the teenagers, there is evidence of progress with age on all the measures except for communication. Communication continued to improve through teenage years for the included children but not for those in special education classrooms. There were no significant differences in overall outcomes for daily living skills or socialisation. However, there were large significant gains in expressive language and literacy skills for those educated in mainstream classrooms. Teenagers educated in mainstream classrooms showed fewer behavioural difficulties. Further, comparison with data published by these authors in an earlier study, showed no improvements in school achievements in special education over a 13 year period in the UK (1986-1999).

Keywords: Adolescence, Down syndrome, education, inclusive education, special education, communication, expressive language, receptive language, literacy, daily living skills, social skills, behaviour, specific profiles, adaptive behaviour

In 1987, two of the authors of this article published information on the development and lives of a large and representative group of 90 teenagers with Down syndrome. In some ways, the progress of the teenagers was disappointing – very few had made any useful progress at all with reading, writing, number and money, and social independence skills such as crossing roads and travelling alone were very limited. Most led rather isolated social lives and only 42% had speech that was intelligible to those meeting them for the first time (for example in a shop or café). The authors commented that their findings should not be taken as indicating what teenagers with Down syndrome could achieve, but rather, that the findings may be due to the nature of the

[I] This article was published earlier in Down Syndrome Research and Practice (2006) vol.9 (3), 54-67. Reproduced with permission from the authors

curriculum in special schools, low academic expectations, being bussed out of their own communities every day to school and social attitudes which did not allow children with Down syndrome into clubs and activities in their communities. In 1987 94% of the teenagers were in schools for children with severe learning difficulties (SLD), 6% in schools for moderate learning difficulties (MLD).

In 1988, as a result of this study and in line with legislative change towards inclusion in education in the UK, the Portsmouth team began to develop inclusive education in local mainstream schools for the children with Down syndrome starting school in the southeast part of the county of Hampshire. In the rest of the county most children with Down syndrome continued to be placed in special schools. The Down Syndrome Educational Trust funded a psychologist to work with the schools, parents and the Education Authority to develop successful inclusion. This work has provided a unique opportunity to compare the outcomes of special versus mainstream education for two groups of children with Down syndrome of similar backgrounds and ability. It enables us to test out our view that the teenagers in 1987 were underachieving and socially isolated as a result of segregated special education. Are the teenagers who have been included in mainstream education showing the predicted benefits of going to school with their typically developing local children?

Specifically, we hoped that included children would be more likely to have friends in the neighbourhood and better social lives as teenagers, with better social independence skills for getting around their communities, more friends and more involvement in clubs and activities, that their speech, language, behaviour and social development would benefit from being with typically developing peers and that their academic achievements would improve. Does the evidence demonstrate these benefits?

In 1999 we repeated the survey that we had carried out in 1987 with the current group of teenagers, including some additional measures. This enables us to compare the benefits of mainstream and special education for the 1999 teenagers and also to ask if, as a group, they are benefiting from changes in social attitudes and better education when compared to the 1987 teenagers.

Many of the results of the study were not as the researchers might have predicted, and the findings raise some important issues for parents and educators of teenagers with Down syndrome to consider.

The 1999 study

In 1999, information was collected for 46 teenagers, 28 in special schools (24 in SLD and 4 in MLD schools) and 18 in inclusive schools. The young people in the two groups were placed in mainstream or special schools on the basis of where they lived; they were from similar social and family backgrounds and were likely to be of similar potential abilities when they started school. The results we report are unlikely to exaggerate any advantages of inclusive education for the following reasons.

1. When we compared the progress of the two groups, to ensure that we were comparing young people of potentially similar abilities, the 5 'least able' teenagers from the special schools were taken out of the comparison group, before the two groups were compared. These five 'least able' teenagers are those with significantly more developmental delay and health problems than the rest of the group. Two of them have autism in addition to Down syndrome and 3 of the 5 have significantly high rates of difficult behaviours. These young people have had multiple difficulties since childhood, and children with this level of difficulty would not have been placed in mainstream classes in any part of the county at the time of the study.
2. The average age of the mainstream group is two years younger than the average age of the special school group. This would reduce the likelihood of finding higher scores on any measures for the total mainstream group, as we know from our 1987 study that the teenagers in all groups are likely to be progressing with age on the measures we used.

Full details of the samples used in the comparisons are used in Appendices 1 and 2.

It is also important to note that the teenagers in the mainstream schools have been fully included in age-appropriate classes in their local schools, supported by a Learning Support Assistant for the majority of the day. They have not been in special classes or resource rooms in mainstream schools and, usually, they have been the only child with Down syndrome or a similar level of learning difficulty in school until they reached secondary schools. In secondary school, some have continued to be the only teenager with Down syndrome, but some have been with one or two others with Down syndrome.

In both 1987 and 1999, the information was collected by surveys. In both studies, parents completed a questionnaire designed by the authors, the Sacks & Buckley Questionnaire (SBQ). In the second study, additional stan-

dardised questionnaires were also used, the Vineland Adaptive Behaviour Scale (VABS) and the Conners Rating Scales (CRS). The two main questionnaires (the SBQ and VABS) both contain measures of personal independence skills – *Daily Living Skills* – which include measures of skills in dressing, toileting, bathing, cleaning, laundry and meal preparation, also time, money, telephone use and road safety. They also both contain measures of speech, language and literacy skills – *Communication Skills*, and measures of friendship, leisure and social skills – *Socialisation Skills*. The Vineland Adaptive Behaviour Scale provides normative data which allows scores achieved on the scales to be translated into age equivalent scores. This is useful because it allows us to compare the progress of the teenagers across different aspects of their development. We would expect progress to be even for typically developing teenagers, that is, all skills will be at approximately the same age-level. Previous research suggests that we will find an uneven profile for teenagers with Down syndrome, with Communication skills lagging significantly behind Daily Living and Socialisation skills. The age equivalent scores also allow us to identify the extent of progress with age during the teenage years and this is illustrated in the first set of histograms in Figure 1.

Progress with age

The first two histograms in Figure 1 indicate that Daily Living Skills and Socialisation Skills can be expected to improve significantly as young people with Down syndrome progress through their teens (though with the caution that these figures are for different teenagers in each age group, not the same teenagers as they get older). When we look at the third histogram in Figure 1, for Communication Skills, we see significant progress for the oldest group of mainstreamed teenagers but no significant progress with age for the teenagers in special education. These differences in progress in speech, language and literacy will be explored in more detail in the next section.

The first important conclusion we can draw from this piece of research is that we can expect significant progress in all areas of development during the teenage years. There is no evidence for a 'plateau' being reached, or even a slowing of progress.

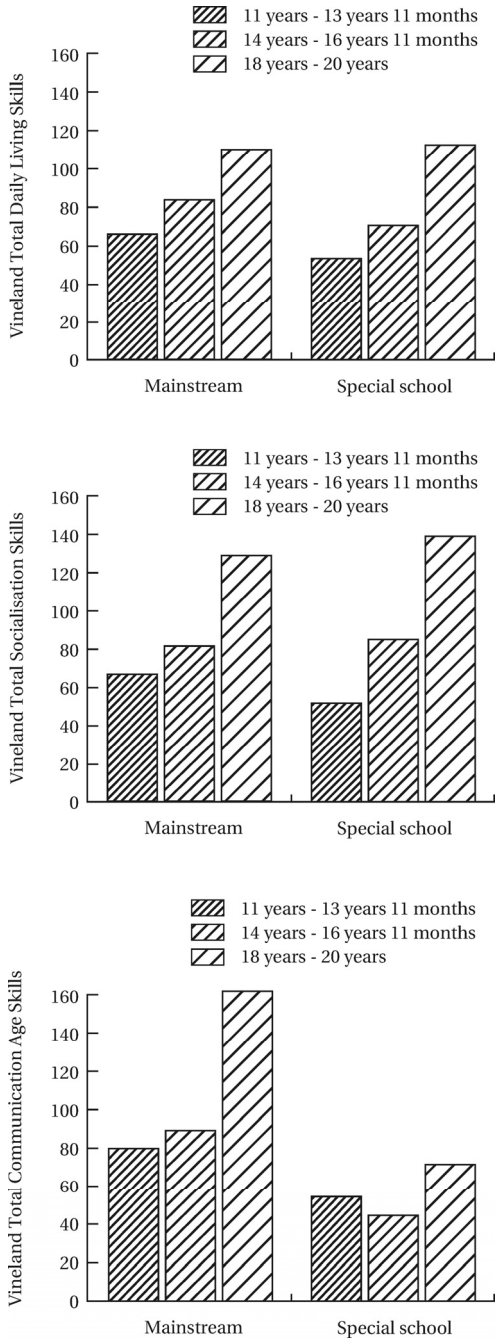
11 years - 13 years 11 months
14 years - 16 years 11 months
18 years - 20 years
Vineland Total Daily Living Skills
Vineland Total Socialisation Skills
Vineland Total Communication Age Skills
0
20
40
60
80
100
120
140
160
Mainstream
Special school

Figure 1.

The reader will also have observed that there are no significant overall differences in the Daily Living Skills or Socialisation Skills of the teenagers educated in special or mainstream schools, though there is a difference on one measure which contributes to the Socialisation Skills score - the Interpersonal Relationships Scale. This difference may be important and is discussed in more detail in the next section.

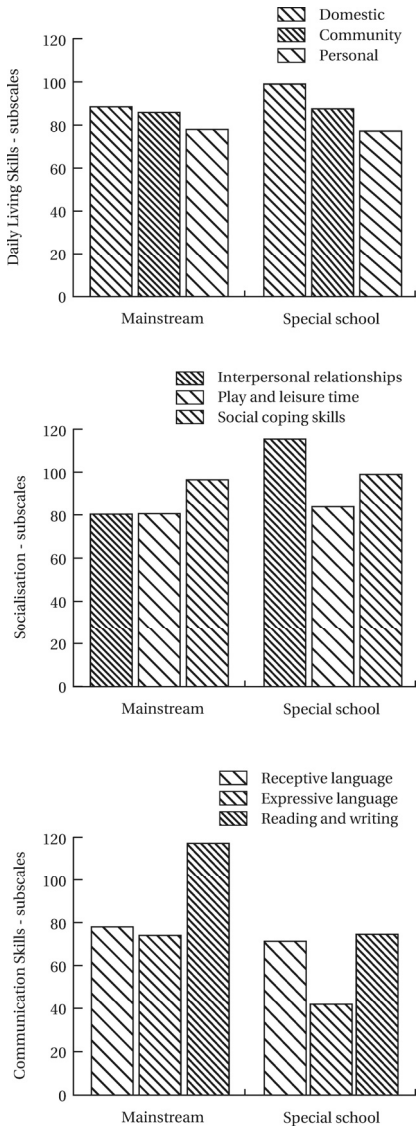

Figure 2.

A more detailed look

For each main scale on the VABS there are 3 subscales which contribute to that score and the information for these subscales is illustrated in Figure 2.

Daily Living

The first histogram illustrates that for Daily Living Skills the teenagers were performing at a similar level in personal and practical skills in the Domestic (e.g. preparing meals, cleaning, taking care of laundry), Personal (e.g. independence in toileting, bathing, dressing) and Community (e.g. staying at home alone, time, money, telephone and road skills) areas. It also illustrates that there were no significant differences in skills between the teenagers in the mainstream or the special school groups.

Socialisation

The second histogram, however, illustrates that for the Socialisation Skills measure there is a difference for the Interpersonal Relationships subscale, which covers social interaction, dating and friendship skills. There were no differences on the Play and Leisure (going to clubs, games, hobbies, leisure activities) or on the Coping skills (awareness of manners, social sensitivity and social rules) subscales.

On the Interpersonal Relationships subscale, the teenagers educated in the special schools scored significantly higher, largely due to differences in scores for the oldest age groups. The older teenagers in special education were more likely to have a boyfriend or girlfriend, a special friend and to belong to clubs than those from mainstream education.

This was the only measure of the many measures used in this research which showed a significantly better outcome for teenagers in special education.

The numbers of teenagers in the study are quite small – 18 in mainstream education and 23 in special education – so that further research is needed to explore the significance of this finding. However, one possibility is that the teenagers in special education have had more opportunity to develop mutually supportive, reciprocal friendships with peers of similar abilities and interests than those included in mainstream schools.

Communication

The third histogram in Figure 2 illustrates the results for the three subscales in the Communication Skills score. For the teenagers in mainstream schools, the results indicate that their receptive and expressive language is progressing at the same rate and that reading and writing is a specific strength and better than might have been predicted from their other language abilities. Their expressive language is 2 years and 6 months ahead of the special school group. Some 78% of the mainstream teenagers are rated as being intelligible to strangers compared with 56% in special schools in 1999 and 42% in 1987. For the teenagers in special education, their receptive language is at a similar level to those in mainstream school but their expressive language is more than 2 years behind their receptive language. Their reading and writing abilities are at the same level as their receptive language but significantly behind the reading and writing skills of the mainstreamed teenagers, the difference being more than 3 years.

It is possible that the improved expressive language of the teenagers in mainstream schools is linked to their reading and writing progress. Researchers suggest that expressive skills are delayed by hearing, speech motor difficulties, auditory memory and auditory processing difficulties. Therefore, it may be easier for young people with Down syndrome to learn vocabulary and grammar from written language, than from spoken language. In addition, phonics work plus reading practice may improve speech-motor production skills and speech intelligibility.

The teenagers being educated in mainstream classrooms, with the individual help of a Learning Support Assistant, will have received daily literacy teaching with their typically developing peers. They will also have recorded their learning in all lessons by writing it down and reading it – with whatever level of support was needed to achieve this. Therefore the level of engagement in literacy activities for all the teenagers in the mainstream classrooms will have been much greater than that experienced by teenagers in the special school classrooms.

Overall profiles

In Figure 3 the histograms show the overall results for the main developmental areas – *Daily Living, Socialisation* and *Communication Skills*. For the teenagers in the mainstream schools there are no significant differences in

the progress being made in each of these areas of development. Communication Skills are good, largely due to their progress with expressive language and literacy. For the teenagers in the special schools, their Communication Skills are significantly delayed relative to their Daily Living and Socialisation skills.

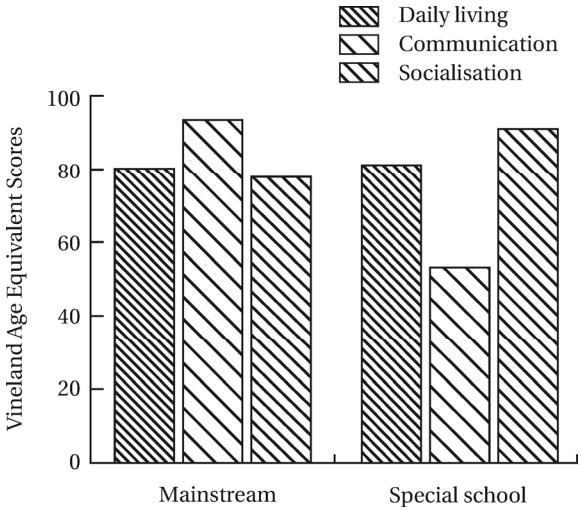

Figure 3.

As already noted, this special school profile is, in fact, the one that researchers would expect to see for teenagers with Down syndrome. A number of studies have found that speech and language skills, particularly expressive skills, are specifically delayed relative to both non-verbal cognitive abilities and to social and independence skills.

The results of our study suggest that it is possible to bring communication abilities in line with social and practical abilities for teenagers with Down syndrome, by including them in mainstream classrooms. The results indicate that a major factor may be the development of reading and writing and the use of literacy activities to teach and to support spoken language development.

Another major factor may be that the mainstreamed teenagers have been surrounded by typically developing competent spoken language users since they entered preschools at 3 years of age, and this spoken language and communication environment will have been very different to that experienced by the teenagers in the special schools. Almost all of the special school group have been in special schools for children with severe learning difficulties for

their entire school career and this means that they have been with children the majority of whom have very significantly impaired language.

Comparison with outcomes in 1987

Perhaps the most surprising and important finding of this study was the lack of progress in special school education between 1987 and 1999 (see Appensix 9). We confidently predicted that all teenagers would be doing better in the 1999 group as we know that the special schools have had higher expectations and more academic programmes in the past ten years than they did 15-20 years ago. However, we found no improvements in 1999, when compared with 1987, for spoken language skills, reading, general knowledge and overall school achievement – achievements were the same as in 1987. There were small gains in writing and number.

It is important to remind the reader that the children in the special schools were not less able than the earlier cohort. At the time that these children entered school there was very little mainstreaming where they lived and our data confirms this point, as in many areas of development their skills are the same as both the 1987 group and the 1999 mainstream group.

Our findings suggest that it is not possible to provide optimal learning environments in special schools and classrooms, however hard the teachers work. It suggests that learning within a typically developing peer group may be essential for optimal progress for two main reasons:

1. the typical spoken language of the peer group because this provides a stimulating language learning environment
2. the classroom learning environment and curriculum – the pace of learning has been much greater for those in mainstream because they have been in all academic lessons with individual support for their learning.

We can use the example of literacy to explore this further, the included teenager has had daily literacy lessons with his or her typically developing peers. The classroom curriculum is set for the mainstream children and their learning provides role models for literacy for the student with Down syndrome. He or she will be working with support within the class on individually set targets for literacy. A literacy lesson in a special school classroom will, of necessity, be very different. In the special school, the teacher will have per-

haps 6 pupils, all with significant learning difficulties, and will design a literacy activity for this group – 2 of whom may be autistic, two with severe behaviour difficulties and 2 with Down syndrome – all have significantly delayed speech and language and only three are able to write their names. Sharing a story together may be an appropriate literacy activity for this group of children, rather than formal literacy instruction. The aim of this example is not to criticise special schools – it is to try and give a real picture of the different demands and resources of the two situations and to try to explain our findings. The same comparison would apply to numeracy lessons in mainstream or special classrooms.

There were no gains between 1987 and 1999 in Daily Living Skills for teenagers in mainstream or special education and significant gains in Social Contacts and Leisure activities for both groups. We suggest that Daily Living Skills are mostly learned at home and therefore not influenced by school placement and, similarly, that the improvement in social inclusion reflects a general change in social attitudes and social acceptance in the community rather than school placement effects. Social lives out of school are also more likely to be influenced by families than schools.

Personality and behaviour

Another major area of developmental importance that was looked at in these Hampshire teenage studies was the extent of behaviour difficulties, whether any behaviour difficulties change with age and if school placement has any influence on behaviour.

We were aware from our inclusion support work that difficult or disruptive behaviour is a major cause for the breakdown of mainstream school placements. We were also concerned to find out if the demands of coping in a mainstream classroom actually increased behaviour difficulties.

Significantly difficult behaviour affects the learning and social opportunities of a teenager with Down syndrome and can create considerable stress for teachers and for families. Conversely, teenagers who can behave in a socially acceptable and competent manner will be more likely to have friends, to have active social lives and to be successful in work as adults, than those who do not.

Difficult behaviours need to be considered in relation to the helpful and socially sensitive behaviour and the positive personalities that are characteris-

tic of most teenagers with Down syndrome. Many references to the positive aspects of teenagers personalities were made by parents during the recent Hampshire survey, for example:-

"J. is a happy and content girl, very understanding, helpful and has a great personality - she brings out the best in everyone."

"He is happy and outgoing and lots of people know him so we talk to more people because of him."

"She is a wonderful, happy and most loved member of our family. She is kind, caring, happy and thoughtful."

"A. has a positive approach to life and brings that to the family. His caring nature and enthusiasm are infectious. I think he has made the family dynamics easier than they would have been, especially the teenage years."

"She is good company, always happy, funny and content."

"Good point is, he is a happy lad who is good fun and has taught us a lot."

"Very loving, trusting and happy boy - enjoys life and is very sociable."

"Our daughter brings more love, fun and laughter to family life and though she will never be 'academic' there are other qualities she has which cannot be measured."

"He is popular, friendly and non-judgemental… he has added another dimension to our lives."

"Brings a lot of happiness to our lives. Her disruptiveness – being rude or awkward – can cause parents and sister to get cross and upset."

The last quote highlights the fact that difficult behaviours occur only sometimes and do not define the person's character. Someone with a positive personality can be difficult at times and this would characterise most of the teenagers in the survey. However, this does not mean the difficult behaviours are not distressing when they do occur and most parents and teachers are pleased to obtain advice on how to handle them.

Several measures were used to collect information about any behaviour difficulties that the teenagers had. There were behaviour questions on the original Sacks and Buckley Questionnaire and a Maladaptive Behaviour Scale on the Vineland Adaptive Behaviour Scales. In addition, the Conners Behaviour Rating Scale provides measures of several different aspects of behavioural difficulties, hyperactivity, cognitive problems or inattention, oppositional behaviour and Attention Deficit/Hyperactivity Disorder-ADHD.

All the measures illustrated that difficult behaviours tend to improve with age for most individuals, with only one teenager over 18 years in the main-

stream schools comparison group having even a moderate level of difficulties. This strongly suggests that many of the behaviours reported for the younger teenagers may be linked to general cognitive delays and immaturity.

Our concerns about the demands of mainstream placements increasing behaviour difficulties were not confirmed. There was only one measure on which the teenagers from the different school systems scored significantly differently – The VABS Maladaptive Behaviour Scale – and these results are illustrated in Figure 4. The scores can be classified in terms of the severity of the behaviour difficulties. As the data below shows, significant behaviour difficulties only affect a minority. The teenagers in the mainstream schools were less likely to have difficulties, with 63% having no significant difficulties compared with 41% in the special schools, 25% having a moderate level of difficulties compared with 27% in the special schools and 12% (one in eight) having significant behaviour difficulties compared with 32% (one in three) in special schools.

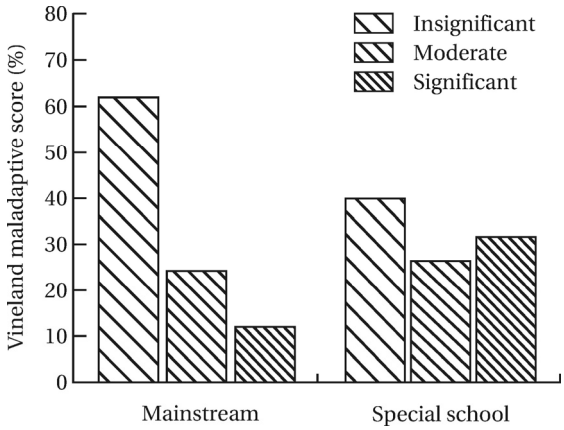

Figure 4.

The reader is reminded that the 5 'least able' teenagers in the special schools are not included in this comparison. Three of these 5 had very high scores for difficult behaviours and the remaining 2 had low scores.

This means that in the whole sample of teenagers, and the whole sample is representative of the full range of teenagers with Down syndrome, 26% (one in four) have some significant behaviour difficulties which will be probably causing problems at home and at school on a daily basis.

The Vineland Maladaptive Behaviour Scale predominantly includes ques-

tions about two main types of behaviour, those that may reflect anxiety and nervousness and those that reflect conduct disorder and poor attention.

On the Conners Behaviour measures, which focus on conduct disorders and attention difficulties, there were no significant differences between the levels of difficulties for the teenagers in mainstream or special schools. When the scores of the teenagers with Down syndrome are compared with norms for typically developing teenagers, the proportion of the total group who had serious difficulties was 16% on each of the Oppositional Behaviour, the Cognitive problems/inattention and the ADHD measure and 37% on the Hyperactivity measure. (The reader should note that some 5% of the typically developing population of teenagers of the same age will score in the serious difficulties range as defined by the Conners Scales).

The hyperactivity measures include, being always 'on the go', hard to control while shopping, runs about or climbs excessively in situations where it is inappropriate, restless in the squirmy sense, has difficulty waiting in line or taking turns, has difficulty playing or engaging in leisure activities quietly. The high score here may reflect immaturity and improve with age, as similar findings have been reported by other researchers and interpreted in this way.

The link between behaviour and poor communication skills

Similar to other studies, and the authors' 1987 study, there was a significant relationship between expressive communication skills and behaviour difficulties – the more limited a teenager's expressive language ability, the more likely he or she is to have behaviour difficulties. The implication here is that at least some difficult behaviours are the teenager's way of communicating when he/she does not have the language to do so. In addition, some behaviours may be the result of the frustration that arises when an individual is not understood.

Has inclusion achieved what we hoped for?

We stated at the beginning of the article that we hoped that included children would be more likely to have friends in the neighbourhood and better social lives as teenagers, with better social independence skills for getting around their communities, more friends and more involvement in clubs and

activities, that their speech, language, behaviour and social development would benefit from being with typically developing peers and that their academic achievements would improve, when compared with the teenagers receiving special education in segregated schools. Does the evidence demonstrate these benefits? The answer is "yes" for spoken language, behaviour, social development and academic benefits and "no" for the social inclusion benefits.

The language and academic benefits were greater than we expected. The big gains for the included teenagers were for expressive language, literacy and, to a lesser degree, numeracy and general academic attainments. The average gain for expressive language was 2 years and 6 months and for literacy, 3 years and 4 months. These age-related scores are based on norms for typically developing children who are expected to progress 12 months on the measures in a school year. Children with Down syndrome usually progress about 4-5 months on these measures in a year – they are making progress but at a slower rate than typical children. Therefore, considered in relation to expected gains, the teenagers in mainstream school have gained the equivalent of 5-6 years progress in spoken language and literacy when compared to the teenagers educated in special classrooms.

There were some gains in social development and behaviour. The teenagers in mainstream schools were more socially mature, with more age-appropriate social behaviour and more social confidence. However, the social inclusion gains were not as great as we expected. On the standardised measures there were no gains for the included teenagers and the suggestion of a disadvantage. There were no significant differences in social independence skills, social contacts, leisure activities and community inclusion. Parents were as concerned about the social isolation of their teenagers as they had been in 1987, even though there was evidence of some improvements for everyone since that time.

The benefits of having daily contact with typically developing children and teenagers in the local area, during the school day, did not result in more inclusion and friendships during the teenage years. In addition, the included teenagers seemed to be less likely to have special friends, boyfriends or girlfriends and a social life of their own in their late teens, perhaps as the result of having less contact with peers with similar intellectual disabilities or peers with Down syndrome in school.

What are the implications for parents and for teachers?

1. That all children with Down syndrome should be educated within mainstream classrooms to ensure that they are able to develop their speech and language to the level that is optimal for each child.

   The importance of speech and language development for cognitive and social development cannot be over emphasised. Words and sentences are the building blocks for mental development – we think, reason and remember using spoken language, either silently 'in our minds' or a-loud to others. Words provide the main source of knowledge about our world.

   Any child with speech and language delay will have mental delay (unless a signing baby in a deaf signing family, when sign will be as good as speech for mental development). In addition, speech and language skills influence all aspects of social and emotional development – the ability to negotiate the social world and to make friends, share worries and experiences and be part of the family and community.

2. That all children with Down syndrome should be educated in mainstream classroom to learn alongside their peers and to access the academic curriculum adapted to their individual rate of progress.

   Full inclusion in the curriculum leads to much better literacy and numeracy skills, and general knowledge. The level of supported literacy experience across the curriculum also provides an important support for spoken language development.

3. Our research indicates that it is not possible to provide a maximally effective learning environment in a special education classroom.

   Children with Down syndrome need to learn with their non-disabled peers with the necessary individual support to make this successful.

4. The social aspects of inclusion need to be addressed.

   Children with Down syndrome in mainstream schools need more opportunities to socialise with a peer group of children with similar levels of intellectual disability. This can be achieved by closing special schools and classes and including all children with learning disabilities in mainstream school communities – at present many children who

would provide this peer group in the UK are still in special schools. The children with Down syndrome have had a parent lobby and more of them are fully included than their peers with similar levels of intellectual disability. It can also be achieved out of school, by ensuring that children with Down syndrome have friends with similar disabilities out of school.

5. Friendships with non-disabled peers need more support within school communities.

   Teachers and parents need to do more to ensure that these friendships carry on outside school. We wish to see an improvement in understanding and support for teenagers and adults with Down syndrome in their homes, workplaces, shops and leisure activities as a result of inclusion. This is not yet happening and needs to be addressed within schools.

These are statements supported by the evidence, and the evidence of earlier reviews of the benefits of inclusion. No study has provided evidence for any educational advantages of special education, only disadvantages, and the practical daily living and social skills are as good or better in mainstream education. The only benefit seems to be contact with a peer group of similar disability – and, considering the significant disadvantages of special education, that need is better met out of school, and in better planned inclusion.

Our conclusions are uncompromising and if we are to achieve the full benefits of inclusive education for all our children we need to implement effective support and training programmes. We may also need some variety of provision. Most children with Down syndrome will benefit from the full classroom inclusion that we describe, supported by a learning support team. In many schools, a learning resource area which provides for small group work is needed for some children and can provide a place to meet the peer group with similar levels of intellectual disability.

If we include all children with Down syndrome and all children with intellectual disabilities, then some children may benefit from being in a resourced school. For those children with the greatest levels of disabilities, planning and providing for them may be best done within a specifically resourced school. This does not mean being educated in a special class or resource room – it means that we concentrate skills and human resources in some schools to develop the necessary expertise for successful inclusion of those with the great-

est needs. It also means that the children have access to a similar ability peer group as well as benefiting from being included in the mainstream community.

There can be no single prescription for successful inclusion as the school systems in different countries and communities vary widely. The way to move towards full inclusion may be different in different communities and, importantly, different models may work equally well if the attitudes of the school community towards inclusion are positive and the aim is to seek the full inclusion of the child into the social and educational world of the school, while also meeting his or her learning and developmental needs.

Postscript

Some critics of our work have suggested that inclusion in Hampshire is 'special' and only successful because the Trust staff support the schools. In fact, from 1988, the teachers and the Trust's psychologists learned together year by year. It was the teachers in the schools who showed us how to make inclusion successful. We did not visit more than once a term on average, unless asked to help with a problem. We did not start workshops on inclusion for teachers until 1993 and they were based on sharing what we were learning from the teachers. The children in the study differ widely in ability, behaviour, social needs and family backgrounds. The children studied have been spread through some 25 primary schools (infant and junior) and some 12 secondary schools, in inner city, urban and rural areas – these schools are likely to be representative of schools across the UK.

For the past 9 years, we have been running training for inclusion throughout the UK and across the world and we see many, many examples of similarly successful inclusion everywhere. Our schools experienced problems at times, like all schools developing inclusion, but the positive staff attitudes towards inclusion and the support of the Education Authority meant that problems were solved – not seen as a reason to move a child to a special school. At transition points from infant to junior to secondary it was assumed that the children would stay in the mainstream system and everyone planned accordingly. On the basis of parental choice two teenagers moved to MLD provision for secondary education and two moved to mainstream from MLD at this point!

It may be important to note that these teenagers were included before the

introduction of IEPs (Individual Education Plans) or SENCOs (Special Educational Needs Co-ordinators) into UK schools. Schools are much better resourced to succeed now – though we do need to be sure that too much planning and special needs expertise does not result in lowered expectations.

We asked teachers to fully include the children in the class activities and told them we would help them to adapt once it was necessary. The children tended to surprise us all and fewer adaptations were needed in infant school than we had anticipated. There is the danger that an IEP could reduce expectations, depending on who writes it and their experience of working with children with Down syndrome in education. The children in this study also had no signing in their classrooms and, at first, no speech and language therapy service. They had to cope and make themselves understood in a spoken language environment and we encouraged teachers to use reading activities to develop their spoken language. We have no way of knowing how much this contributed to their significant speech and language gains, but we are very cautious about the current widespread use of symbols and signing in primary school years – for some children it is necessary and appropriate but not for all just because they have Down syndrome.

You might sum up our approach as focusing on children first – seeing children with Down syndrome as full members of the class and community and playing down differences. They do have special needs and teachers need to know how to address these but we still need to change public and professional attitudes so that they really do treat our children as children first. When we achieve this, we will really see the full benefits of inclusion.

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THE INDEX FOR INCLUSION

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Abstract: This article will explain the Centre for Studies on Inclusive Education (CSIE) Index for Inclusion, which offers ordinary schools a dynamic process of change allowing them to investigate their cultures, policies and practices by engaging in a series of indicators and activities that help set new priorities for school development and inclusive education. Information recently collected by CSIE about the Index in use across schools in England is also shared, along with feedback from a number of overseas countries.

The British Government placed the CSIE Index (2002 Booth & Ainscow) in all schools and local education authorities in England and Wales. It has also been translated for use in 35 languages overseas in countries in the North and the South, and adapted in English in four more.

The CSIE Index uses the social model of disability and rejects the medical model; it encourages a deep scrutiny of all activities in a mainstream school, and calls on schools to seek the views of teachers, pupils, parents and others in establishing new priorities in inclusive education.

Introduction

In an earlier publication "Inclusive Education: readings and reflections" (Thomas & Vaughan, 2005) we examined the key influences behind the moves towards inclusive education. The book features more than 50 extracts from key documents and classic texts, along with commentaries.

This first quote is written by us at the beginning of the book, begins to answer the question: 'What is inclusion?':

'Inclusion represents the confluence of several streams of thought, social and political as well as educational. Those moves to inclusion in fact come not from one direction – not, for example, solely from research about the effectiveness of special education and special pedagogy – but from several directions: from research, certainly, but more importantly from the imperative to greater social justice; from calls for civil rights; from legislation that prohibits discrimination; from the stimulus provided by original, distinctive projects started by imaginative educators; from the voices of people who have been through special education. All of these in their own ways have played their part in the changes that have occurred in the last quarter of the twentieth century and the first part of the twenty-first.

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'And if one is taking an international view, it is important to note that those varying ideas, while united in direction and general sentiment, germinated differently in different parts of the world. A social democratic political climate, for example, was a force behind the beginnings of mainstreaming in Scandinavia; communist local government played its part in Italy; the civil rights agenda was important in North America; and, more recently, an anti-discriminatory theme has figured largely in legislatures across the world.'

So what is the Index?

The Index for Inclusion is a unique set of materials, which support ordinary schools in a process of inclusive school development. The British Government placed a copy in every school and local education authority in England and Wales. The Centre has since sold a further 10,000 copies in the UK and overseas. It has been translated into 33 languages.

In 2004 , Centre for Studies on Inclusive Education (CSIE) published a new version for Early Years and Childcare settings; this, too, had the blessing of the UK Minister for Education. The authors of the Index are Prof. Tony Booth, Canterbury Christ Church University College and Prof. Mel Ainscow, University of Manchester, with Denise Kingston joining them for the early years and childcare version.

The authors were able to write the Index after extensive, Government-funded trials in schools and ground work by a team of people, brought together by Mel Ainscow and myself in the mid 90's. My role has been to coordinate that team over the years and to have responsibility for editing and production of the documents. I also look after all the translations and give training days, talks and workshops on the Index across the UK and overseas.

The Index is a process of investigation, which ordinary schools undertake in order to improve school attainments through inclusive practices. It does this for 100 per cent of pupils – not the so-called '2%' of disabled pupils, nor the '20%' often described as 'having special educational needs'. It's a process of self-review with ordinary primary and comprehensive schools looking at the three key dimensions in a school of: Cultures, Policies, Practices.

In the Index we ask you to think about:

- Creating inclusive CULTURES,
- Producing inclusive POLICIES,
- Evolving inclusive PRACTICES

The Dimensions are the real backbone, the deep structure behind the Index process.

Below each of these dimensions are a series of indicators and below each indicator is an associated set of questions for schools to ask themselves. The Index carefully and logically guides the user through this process. This work creates a lot of new and useful information for a school. New priorities for development are established as a result.

A number of levels appear in the structure of the Index?

Here is one example of an Indicator:

'There are high expectations for all students'

And then we get its associated questions…

Indicator A.2.1

1. Does every student feel that they attend a school in which the highest achievements are possible?
2. Are all students encouraged to have high aspirations about their learning?
3. Are all students treated as if there is no ceiling to their achievements?
4. Do staff avoid viewing students as having a fixed ability based on their current achievements?
5. Are students entered for public examinations when they are ready rather than at a particular age?
6. Are all students encouraged to take pride in their own achievements?
7. Are all students encouraged to appreciate the achievements of others?
8. Do staff attempt to counter negative views of students who are keen and enthusiastic or attain highly in lessons?
9. Do staff attempt to counter negative views of students who find lessons difficult?
10. Do staff attempt to counter the derogatory use of labels of low achievement?
11. Is there an attempt to address the fear of failure of some students?
12. Do staff avoid linking the potential achievement of one student to those of a sibling or another student from their area?

The Index process asks for further indicators and questions to be designed by the school.

Co-ordinating Group

One of the first tasks in the Index process, is the establishment of a Co-ordinating Group. Who should be in that Group?

- The head or deputy head of the school and 1-2 senior staff
- The School Development Planning Team might initiate the work with the Index
- Also in the Index Group is the Learning Support Co-ordinator
- The English as an Additional Language Co-ordinator
- And of course the Group should reflect the gender and ethnic composition of the school
- It should also have representatives of parents/carers, students, governors and non-teaching staff
- Lastly, the Index Co-ordinating Group will vary from school to school, and primary will be different to secondary.

The Index materials include ready-made questionnaires; a dozen different activities for members of a school community to undertake.

There are five specific phases or cycles of work, all of which are designed to build on the wealth of knowledge and experience that people in mainstream schools already have. And this full cycle might last a year.

However, the Index also challenges any school to move forward, regardless of how inclusive it believes itself to already be. At CSIE we say that an inclusive school is one that is on the move.

From the beginning, the language in the Index is deeply inclusionary, replacing the phrase 'special educational needs' with the term, 'barriers to learning and participation', a phrase now widely adopted across the UK from Government departments to individual classrooms. It invites a school to try and reduce those barriers, by undertaking a deep scrutiny of everything that makes up the life of a school and setting new priorities for development. The schools themselves design these priorities and locate them formally, in the school development plan.

Let me emphasise here that the Index process does not offer a blueprint for improvement and change; rather it offers change through investigation and scrutiny, by an individual scool.

The Index – and the process - are adapted by individual schools. It should be seen as flexible, not prescriptive.

The trials that we ran in UK schools before 2000 and the experience of many Index users since it was first launched, have shown that whatever comes up in a particular school turns out to be the right thing for action and change, in that school. This has been confirmed by further studies of the Index in use in England, recently undertaken by CSIE.

It is an on-going process, involving teachers, heads, students, support staff, parents and governors.

The cycle lasts about a year, though only a limited amount work can be achieved in that time. We strongly recommend a commitment to using it for 2-3 years, and more.

Thousands of schools are using it successfully and have been for 4-5 years. And they use it in different ways.

The Index is organic; it is democratic and works from the grass roots upwards. It does not offer a plan from above or outside – but facilitates the building of an appropriate agenda for inclusive school improvement and change, designed by the school's stakeholders themselves.

And importantly, the Index takes the social model of disability as a starting point. CSIE too, has worked to the social model for many years and is highly critical of the medical model of disability, which it describes as outdated and offensive to very many disabled people.

We produced the Index in a ring binder format to encourage local adaptation, amendment and photo copying by individual schools and education authorities. There is also a 6-page introduction to inclusion and to the Index, which comes with it.

Schools are encouraged to work jointly in clusters of say 3-5 schools, all of them using the Index, and also linking up with their education authority for support. We strongly suggest to teachers and heads: 'Don't do it alone'.

The key concept of a 'critical friend' is introduced to schools for the first time in the Index. This person helps a school in this work; a school can bounce ideas against them; evidence shows the critical friend to be a significant factor in fostering learning and change, amongst teachers. The gathering of students' views of how a school performs, is also a strong characteristic of the Index in action.

CONDITIONS OF TRANSFORMING THE SCHOOL ENVIRONMENT INTO AN INCLUSIVE SCHOOL

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Abstract: This contribution introduces the complexity of system changes in the inner school environment. If the school is supposed to realize the ideas of educational inclusion in practice (changes in the prefered social and organisational forms, pluralisation of teaching concepts, individualisation, differentiation of educational objectives and processes, didactic changes), these changes are necessary. Besides these aspects I will also introduce related innovations in teacher education – their preparation for the process of educational inclusion.

Keywords: assimilation, inclusive education, inclusive school, heterogenity of pupils, pluralisation of educational concepts, individualisation of educational processes and objectives, inclusive didactics, hollistic approach to human beings, communication.

Educational institutions in the Czech Republic, which is taking democratic shapes, are at present facing the challenge to fulfil the individually different demands of children and teenagers regarding the support of their cognitive, social and personal development. In order to respond to growing diversity of students in Czech school milieu (intellectual, social, ethnic, cultural, language, emotional, performance diversity etc.), we have been in the field of national educational politics during the last ten years trying to enforce inclusive educational concepts.

It seems that the democratisation process of the Czech educational system (in the year 2005 supported by new school legislation) has been showing in practice both the positive and the negative sides of its subsistence. On one side, we can register growing efforts to teach pupils with special educational needs together with non-disabled pupils in the main educational stream, and related growing numbers of integrated pupils in common schools (by groups or individually). On the other hand in Czech schools we can observe enforcing of selective mechanisms (obstacles in permeability of the system, intensified by accentuated role of entrance exams for higher education, selection in higher grades of elementary school, caused by the possibility of studying at elite academies, repeating the same grade due to poor school results ...). Efforts to integrate pupils with special educational needs are currently being

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applied by teachers in different areas of our school practice, as well as the related strategies of "coping with" a heterogeneous group of students. To us educationalists the use of the term "coping with" may sound unusual, but it illustrates that in these educational concepts which take into account the diversity of intellectual abilities and skills, or the variety of ethnic, cultural or language origin of the students, the teacher is more *assisting* the pupils in their learning process than *teaching* them. In Czech teaching practice we can still frequently find in common teaching of so called „handicapped“ individuals with intact students approaches based on assimilation that can be combined with ignoring of individual diversity or with positive discrimination. But for the future it is desirable that in the Czech Republic, schools with real inclusive profile should prevail.

Prof. Mel Ainscow, working at the Centre for Educational Needs, University of Manchester and co-author of "Index for Inclusion" (CSIE 2002), and also member of one of the most important groups monitoring school development within the field of inclusion, in local, national and international context ESI (Educational Support and Inclusion), published in 2001 *six approaches* which could help interested schools deepen inclusion (Polechová, 2003):

1. Make use of existing knowledge and experience: according to Ainscow‘s research shows that great numbers of schools practically use only a small fraction of educational methods and processes which are broadly known and accessible. A better use of existing know-how and creativity could be in this field a motor of progress. The ability of reflecting the experience of others and self-reflection are in this context also important which means that educationalists have to participate in mutual observations and conduct collective discussions.

2. Perceive the differences as learning opportunities. If a pupil doesn’t fit our prepared scenario, it means that he provides such feedback which was not expected by the teacher, and thus is surprising for him. In his improvised response the educator should make use of his experience. Diversity and surprise can be understood by the teacher as a learning opportunity. That’s why these incentives can be perceived in a cooperative milieu positively.

3. Exploring the barriers of active participation: When reflecting the existing working methods, we have to consider that certain aspects of pedagogical practice could become barriers blocking active participation of some pupils in the learning process. In this regard, Ainscow suggests being deeply interested

in class happenings. He mentions that a research in which he participated, illustrates how some pupils receive from their teachers subtle signals of being held for inferior students. Creating inclusive school environments is also about identifying these barriers and overcoming them in a way which will be supportive to the particular pupil. In this context, students´ opinions have proven to be an important source for discussions about inclusion.

4. Profiting from all accessible sources for learning support: In order to create a friendlier atmosphere in the class all accessible sources, including all human resources can be used. There are many options to achieve this goal: for example, applying working methods which make use of human resources in a more effective way, such as using closer cooperation between educators, assisting personnel, parents and even the students themselves. Some research conclusions have demonstrated that better use of interaction and mutual cooperation between children can contribute to creating a more inclusive class environment and that this will happen in a way which will consequently improve learning conditions for all children in the class.

5. Developing common language and vocabulary: To motivate teachers to develop more inclusive processes is difficult without mutual support and appropriate conditions. Traditional school organisation which doesn't provide many opportunities for educators to observe each other's work, is a big obstacle to inclusive school development. It makes impossible for the educators to develop their common vocabulary and ways of communication which would enable them to share their experience, ideas and reflect their work styles. It has become evident that progress in development of inclusive practice is related to the teachers having the opportunity to observe their colleagues working. The common analysis of video records showing their lessons plays an important role and is a very good strategy for supporting educational reflection and experiments.

6. Creating conditions for accepting certain risks: In difference to many other professionals, teachers have to do their work in front of an "audience". If they go to work on something new, it brings certain risks. Approaches discussed here necessitate a good working atmosphere and a safe supportive environment. That's why good school management is a central factor that can support inclusive school development. Inclusion requires more open relations and closer cooperation within the school (Polechová, 2003).

In the process of transforming schools into the state of inclusion we should revise the term "school normality". The Austrian educationist E. Feyerer pointed out during his lecture at The Faculty of Education of Charles University in Prague in the year 2003 the possible change in social esteem of school, as it could be seen in Austria since the 1990´s. For "normal" (common/regular) pupils had been in the selective school systems held for long time school without the presence of handicapped or "different" pupils. Nowadays – in the time of forming "flexible normality" – we admit that a school which accepts pupils with handicaps (integrates them) can stay normal. It is only a question of time, in future we will perceive as being normal (common/regular) only the schools which will open their doors to all pupils without making any difference, that means schools which will function without using any formal or practical selective mechanisms.

As Feyerer (2003) said, such a school "transnormality" can be understood as higher order normality and demonstrates a higher quality of the society as a whole.

In the Czech educational system, a continuous pluralisation of organisation forms and teaching concepts is taking place. Every elementary school is developing its educational program which is an application of the educational framework. The concrete educational program reflects special features of the school, its orientation (e.g. its relations with the local community, its location, specific tradition etc). Schools in the Czech Republic which now have the unique opportunity to profile themselves also as inclusive schools, should accept the key paradigms of inclusion including the changed perception of the pupil and of his successfulness in learning. They should accept *every child* taking into account his unique characteristics, interests, abilities and learning needs. If a pupil fails, they should look for barriers in their own system. The philosophy of the inclusive school is harmonious handling and equal approach to all differences in intellectual and physical abilities, to ethnic, cultural or language diversity. Using pupils' heterogeneity for social learning is a part of educational approach which accepts diversity of pupils and which doesn't attempt to suppress these differences by means of selective or assimilation strategies.

Together with the problem of conception of heterogeneity, there is another question in the educational process which needs solving. What shall we teach the pupils? What should be the *teaching contents*? What should be emphasized? Will advancing pluralisation of educational offers (programs) in the Czech system of elementary schools make it in the future at all possible to de-

termine obligatory teaching contents for a particular grade, a particular level, and a type of school? If we will have to give *every student* of a heterogeneous class the right of having individual different learning prerequisites which also develop in individual different ways and the right of reaching differentiated educational objectives in individual different ways, it is likely that it won't be. Heterogeneity of pupils requires first of all that the educator gives every pupil sufficient opportunity to develop and learn accordingly to his individuality (Hinz 1991, Feuser 1995). Almost 30 years ago (1978) Geppert already called for maintaining balance between individualisation and uniformisation of educational process. He recommended that educators should achieve this equilibrium in everyday teaching by differentiating educational offers, provided that they would sufficiently make use of individual assistance.

In teaching that will implement the idea of inclusion consistently, general contents and objectives will crystallize. These will serve as obligatory framework for everybody and they will be an important clue for determining concrete individualized and differentiated contents and objectives. Figure 1 presents a selection of general contents and objectives (Nagel, 2000):

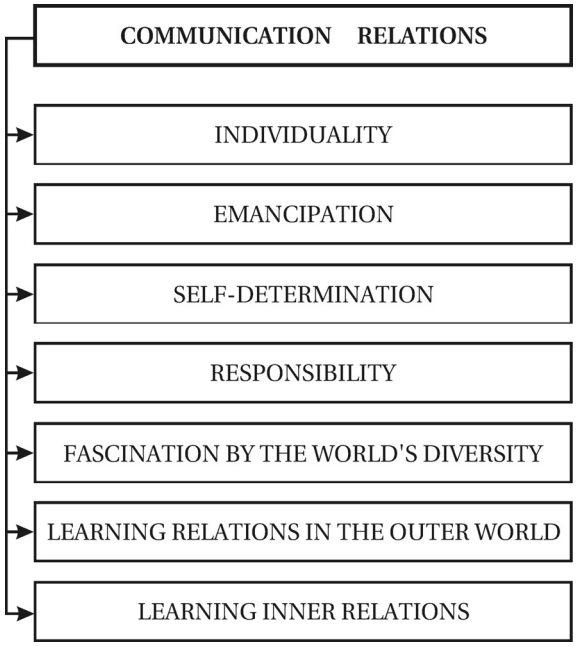

Figure 1.

This figure also documents that communication and learning are closely linked. Their being connected has influence on the learning objectives which can be classed as desired or generally accepted. *Communication* can be understood as a basic element of human existence, it consequently constitutes a central aspect of educational efforts. It is communication that shows us, educators, to what extent we succeeded in attracting pupils (e. g. pupils with heavy sensual or mental handicaps), or to what extent we could address above-average talented students. Effective communication is also in domestic publications on pedagogical theory (Pricha 1983 and 2000, Spilková 2005, and others) usually described as communication between participants of the learning process, where information doesn't flow just in one direction. The "information exchange" is mutual, that means information is transmitted between all actors – between the teacher and pupils, and amongst pupils. From a research point of view, communication is traditionally connected with verbal presentation, knowledge consultation, and related discussion which makes systematization and interiorisation possible. The importance of motives, emotions, attitudes, and experience exchange amongst participants of educational process – in other words the interhuman exchange – is in this context mentioned less frequently. Communication plays a key role in the inclusive environment since it secures its functioning, makes it dynamic and moving, but at the same time also maintains its consistency and stability. In an inclusive environment many opportunities for mutual communication of the pupils have to come into existence. This way the pupils will learn to listen to other individuals, respect them, evaluate them critically, accept criticism, discuss or lead a discussion and make their opinions and approaches count. At the same time they should also learn how to tolerate a different point of view of another individual resulting from his/her different life´s experience. All this necessitates non-directive communication on the educator's side.

Another priority for the teacher should be developing relationships which are closely connected with communication. Transmitting an ability of establishing long-lasting relationships can be understood as another central moment in the further development of an individual (Figure 1). Current society requires flexible individuals. Learning has become a highly differentiated life-long process. The inclusive school is bound to respond to this situation by keeping balance between diverse student needs so that their individual and also general (so called "key") competences can grow. It is obvious that key competences in education necessitate individual variations of realisation which have to be based on exact analysis of the life circumstances of each pu-

pil. But even these highly differentiated analyses don't mean that educators concentrate during the development of students only on the students themselves. The pupil remains a holistic individual that we, as educators, can get to know and understand only partially. That's also why educational diagnostics and evaluation of their individual learning needs have to be approached with maximum caution.

To become more particular about teaching contents and objectives, we can mention some suggestions for learning through action. Concretization represents one of the main tasks of the educator in an inclusive environment. The following enumeration of possible group activities shows especially those which go through the whole school life of the students. During these exercises the pupils are also learning (and teaching each other); these activities can be used for all students regardless of their age or grade. They contribute to the learning process and educators can choose from a vast range of possibilities of their particular application:

- Publishing class or students' newspaper
- Preparation of projects, working according to a plan
- running a school cinema
- running a school playroom
- running a photo workshop, theatre group and other hobby groups
- creating a posting space (product of communication)
- Hiking, biking and educational courses
- preparation and realisation of special trips
- running a school garden
- running a school workroom
- organising school festivals and shows
- running a school tearoom
- classes specialised in arts or sports organised by the students themselves

Since we implement only activities important for practical life which the student can master sooner or later by performing them independently or with assistance, teaching contents for learning through action are easier to choose. At the same time they contribute to the development of many of a student's competences. The fact that in this type of learning every pupil can work and learn specified and relevant learning contents at his own speed, facilitates differentiating the contents and objectives.

In order to break through the tight borders of a regular school morning, we could use a certain part of the morning lessons for teaching in thematically

integrated courses, mainly theoretical courses, and after we could proceed to solving tasks focused on "doing". This can be done in traditional teaching lessons or can be organised to teaching blocks or period teaching. These teaching settings are likely to enliven the school life and also to broaden the interpersonal communication and interaction in the teaching process. They can also increase the proportion of pupils' cooperation on a common subject in the sense of a "task" or "topic" recommended by Feuser (1995). Altogether we can state that we have to attempt to achieve in the case of each student general objectives, and at the same time concentrate on transmitting contents which, thanks to their general character, will support the maturation of the individual within the context of his cultural-historical development. This will give the students, in their development as human beings, opportunities to break away from their culture, or to get engaged through meaningful activity. For activities to be relevant, a "dialectical unity of sense and importance" (Strüver 1994) should come into existence. This unity will motivate the students to participate in activities which make sense for them and which can widen their horizons.

In inclusive didactics the educator has to modify and differentiate general educational contents and objectives with regards to the heterogeneity of the to him entrusted group. He will also have take into account, what students have in common as human beings (he will have to generalize) and what needs and abilities are individually different. Inclusive didactics can't provide descriptions of specific realisations because the educator will deal with different individuals for whom it isn't possible to put together and describe universal didactical procedures. We have learnt from Von Weizsäcker (1992) that modern culture is "a culture of will and reason", where reason could be defined as "an ability to gain discursive knowledge". In order to reach a discourse in learning and acquiring knowledge, we have to establish a relationship. A precondition for entering a mutual relationship with other individuals is communication. A relationship according to Adorno (1993) reflects retrospectively individual dissimilarity. Solidarity and mutual acceptance play here an important role, they are the preconditions for the possibility of bringing people closer together, and of harmonizing interpersonal conflicts which in the human plurality are natural and inevitable.

So, here we have reached in the program the thoroughly human and democratic inclusive school. The resulting didactical principle could read as follows: to make a person perceive consciously, that means that he/she feels how single elements form an entity and how he enlivens in the world fulfilling

himself. This "general didactics" as Nagel (2000) calls it, is a reaction to changed framework conditions in the inclusive school and at the same time an attempt to define a modern term of education. The term "education" is related to individuals with good intellect and physical dispositions, as well as for example to a student in a vegetative state following a traumatic brain injury, who has been just staring in front of himself for long months, who seems to have no more perceptive abilities and even whose death of bedsore is impending. Inclusive didactics can't even build on the continuous development of the learning process. Nagel (2000) characterises discontinuous learning process of the pupil as follows: "We give the child a backpack and send him into the world. At the beginning, the child doesn't want to explore the world but he/she starts doing so after all, faces failures, stagnates and starts anew. Life is not a continuum of pre-programmed contents. Rather than that, a surprise constitutes a part of the program called life." Therefore it isn't possible to find a universal recipe how to analyze individual learning prerequisites. A human being is to be perceived *holistically*, we have to attempt to be as receptive as possible. Only then, we can try to develop him at least partially according to his needs and current possibilities of development. For the teacher, this means to gain new knowledge with every pupil, an educator has to learn continuously.

When contemplating the character of inclusive teaching, it is necessary to mention the changed role of the teacher. The educator has to ask himself, who he exactly is for his students, what he wants and what he can achieve within a group of heterogeneous pupils. Begemann said in this context: "We can be guides in the learning process and offer the pupils various alternatives; we can encourage them, motivate them" (1999). Beside this we are of course interested in developing a social cultural identity within the school. That means that teachers shouldn't teach and set tasks, they should be a guiding element in the whole process. It is after all the child himself who constructs his knowledge and competences. Hillenbrand (1998) states that the borders of education often root in the educator. These reflections show that pedagogical caution is advisable. Begemann mentions in this respect as an example mathematics where the objective isn't to teach the pupil but to concentrate on the student's learning. The mathematics teacher in his conception prepares ideas, things, problems and tasks. The pupil solves them, and that is how he learns. The student himself becomes the central person in the whole process, not the teaching contents or even the teacher.

In the preparation of educators for common teaching of heterogeneous

student groups, social communicative skills (team ability, ability to cooperate with colleagues, ability to communicate with pupils) have to be practised. The educator has to be equipped with a complex set of emotional and cognitive abilities, such as tolerance towards dissimilarity, frustration tolerance, ability to anticipate, patience, justice, teaching ability, role distance and solidarity. Teachers should practice this type of qualifications consciously and systematically.

To the expected qualifications of a teacher should belong *readiness to cooperate with the students and to encourage them to cooperate with one another*. Teachers help the pupils, but they also let students help them. A precondition is mutual solidarity with the children, especially in case of disadvantaged students. Educators should support more cooperation instead of competition or contest. They should also evaluate the success of every student in the field of social learning. Teachers should concentrate on careful intervention and social support of less successful pupils, or of those who are lacking motivation in school work. Success and failure should be accepted by teachers as individually influenced variables.

Educators should reflect in their acting and behaviour the fact that not all people are the same, but they all have the same rights. One of the needed qualification features of a teacher is, last but not least, tolerance towards student diversity and understanding of a differentiated image of a human being which doesn't deny individual differences.

An educator needs a permanent positive feeling of his own value which constitutes a basic element of his/her self-image and self-assurance, and enables him to reflect himself /herself critically and evaluate his own norms and values, social needs (e. g. the need to be liked and to assert himself etc.) Only on the base of such self-confidence, can the teacher learn that he needs collegial support. This need shouldn't be seen as his deficiency.

A way of achieving educational confidence is auto education in the field of human sciences. These can be used for inclusive practice. In the last decades in international curriculum research, many projects have been realized which resulted in comprehensive inclusive training programs for educators. We can mention the curriculum "INTEGER" that was developed in the years 1997-2000 by 16 universities from 11 European countries, within the framework of the project CDI/Erasmus/Socrates which was bearing the same name. It offers 5 basic modules and 22 optional modules that can be used and adapted for the needs of all European universities providing pregradual teacher training. The educators can study principles and didactical fundamentals of inclu-

sive education, when learning the pedagogical fundamentals of education for everyone, analysing the conditions for human development and learning, social conditions for educational inclusion and models of supported learning, communication and cooperation.

The philosophical and didactical framework of INTEGER was also a base for creating an e-learning course called ODL: Inclusive. It was developed in the years 2000-2004 by ten universities from six European countries within the category Socrates II/Minerva projects. The course ODL: Inclusive has a discursive, modular structure, with a thematic axis constituted by thematic levels called: working field of interaction – reality criticism, selection and segregation and their common function; deficiency model and the categories "normality" and "segregation", by the model "competence" and the category "isolation" and "dialogue", by education for everyone and development-oriented didactics, by life and career perspectives. This course is a significant contribution to pro-inclusive teacher training in Europe.

Within the project EUMIE, whose orientation is similar, Ten European Universities (including Charles University Prague) developed in the years 2001 – 2005 a postgraduate learning program. This program offers further university education to educators, therapists, assistants to disadvantaged individuals, and to other professionals who participate in creating an optimal inclusive environment in educational or medical institutions, as well as in institutions providing support to disadvantaged people. Regarded as disadvantaged are individuals restricted in their autonomous life due to biological, psychological or social factors. The project team found the general basis for education of disadvantaged individuals in the conclusions of the Salamanca Conference (UNESCO, 1994):

..."*schools should educate all children regardless their physical, mental, social, emotional, language or other prerequisites. Schools should accept all children: handicapped, very talented, street children, working children, children from language, ethnic, cultural or other minorities, as well as children with other handicaps."*

The complex set of EUMIE modules provides a system of knowledge and methodology of inclusive education, together with abundant specific knowledge needed for carrying out professional research and independent scientific work in social and educational inclusion. Along the four obligatory modules (Education for everyone – inclusion in the human sciences discourse, Diversity as a value, Paradigms and research methods in inclusion, and European

and global perspectives of educational inclusion) the program is constituted by seven other optional modules. These concentrate on topics relevant for practical implementation of these theories. In the following eight, professionalisation modules the students themselves choose a relevant subject according to their interests and professional specialisation and consult this topic with their teachers. Participation in the professionalisation module requires completing an initial teaching/learning contract between the module leader and the student. This contract has to specify learning objectives; ways of documenting students' performance, literature and a detailed learning plan study of this module necessitates repeated individual consultations. The last two modules (the 9th and 10th) are specific, they take into account the current regional or national aspects of inclusive social practice.

Each of the EUMIE modules represents an entity, with regard to contents, teaching processes and objectives, as well as to countable outputs. This EUMIE structure makes it possible for the students to pursue their studies in an individualised manner and to achieve output qualifications on one of the three levels (master's degree in inclusive education, diploma or certificate). The mentioned programs try to achieve, in the field of transmitted competences of their graduates, similar objectives:

- Ability to acquire knowledge independently and to evaluate it critically, in the context of current scientific knowledge in social sciences,
- To solve specific situations independently and to answer questions in the field of inclusion,
- to link various perspectives of inclusive education (scientific point of view, political or practical point of view),
- to benefit from research competences and personal knowledge in their complexity, as well as to develop their own professional profile

These objectives can serve for university education of future teachers as valuable sources of inspiration and innovation. These educators will work in schools in the Czech Republic which are currently forming their inclusive profile.

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Experience in using the index for Inclusion

Schools have reported to us that it can be an extremely powerful process of investigation and development. For some, it reveals more issues than they are able to take immediate action on. Many schools have successfully incorporated it into their regular school development process.

In its short history (5 years) there is clear evidence of the Index's positive influence with UK Government Ministers and their Departments, local chief education officers, education administrators and professionals, schools, academics, parents and others.

The British Government has promoted it widely in its official documents to schools and education authorities. Here are some of the Government documents where it gets very positive support:

- 'Inclusive Schooling', DfES, 2001
- 'Working with Teaching Assistants', DfEE, 2000
- 'National Curriculum Handbook for Primary Teachers in England' DfEE, 1999
- 'Evaluating Educational Inclusion', Ofsted, 2000
- 'Inclusive School Design', DfEE, 2001'

We recently gave the New Zealand Government permission to reproduce the 6-page summary and distribute it to all schools in that country.

The Index is a radical document offering a radical process of school development, the result of which is an increase in inclusion.

The process begins by a local mainstream school establishing a Co-ordinating Group of say, 5-6 people; they begin to discuss definitions of inclusion; they all read the Index from cover to cover; they then get started with the detail of the Index process, using the practical activities from the book. And that is when the Group starts gathering information from all in the school.

Four basic elements

Let me summarise the Four Basic Elements to the Index:

1. Key concepts to support thinking about inclusive school development
2. Review framework: dimensions and sections to structure the approach to the evaluation and development of the school

3. Review materials: indicators and questions to enable a detailed review of all aspects of a school and help to identify and implement priorities for change.
4. An inclusive process to ensure that the process of review, planning for change and putting plans into practice, is itself inclusive.

Overseas Translations

Index for Inclusion (schools version, 2002)

- Albanian (for Kosova)
- Arabic
- Basque & Spanish (for Basque Country)
- Bosnian
- Brazilian Portuguese
- Bulgarian
- Catalan
- Chinese (for Hong Kong)
- Croat
- Danish
- Dutch
- Finnish
- French (Quebec, Canada)
- German
- Hindi (India)
- Hungarian
- Japanese
- Maltese
- Norwegian
- Portuguese
- Romanian
- Serbian
- Spanish (UNESCO in Chile)
- Spanish (Spain)
- Swedish
- Urdu (& English in Pakistan)
- Vietnamese
- Welsh

English versions in:

- Australia (Melbourne, Perth, Queensland & Tasmania)
- Canada
- New Zealand
- South Africa
- United States

Translations of the Early years & childcare *Index*

Index for Inclusion. Developing learning, participation and play in early years and childcare (Booth, Ainscow & Kingston, CSIE 2004)

- Albanian
- Arabic
- Bosnian
- Croat
- Danish
- German
- Hungarian
- Serbian

Examples of feedback

This has come from schools and Local Education Authorities (LEAs), during research by CSIE into the use of the Index across the UK and overseas.

Here are a few **priorities for change** created by ordinary schools then, after a short time of using the Index.

1. Introducing rituals for welcoming new students and staff and marking their departure.
2. Making lessons more responsive to diversity and establishing staff development activities to bring this about.
3. Introducing clear management and career structures for teaching assistants.
4. Improving physical access in the school for disabled students and adults.
5. Integrating all forms of support within the school.
6. Developing collaborative learning amongst students.

7. Promoting positive views of ethnic diversity in teaching and displays.
8. Improving communication between the school and parents/carers.
9. Improving the reputation of the school amongst local communities.
10. Increasing the involvement of students in decision-making about school policies.
11. Revising anti-bullying policies

Schools also said that the Index process also:

1. Brings together different groups in the school community.
2. It is a rich source of ideas (particularly the feedbacfrom teachers prompted by the 44 indicators and 500 questions).
3. Gives structure to speaking about massive the issues of inclusion.
4. Good for awareness raising and bringing equal opportunity initiatives together.
5. The questionnaires provide excellent focus for information gathering.
6. Underpins the whole school development process.
7. Creates discussion of difficulties, which would not otherwise have happened.

The Indicators Questionnaire in the Index is one of the most useful starting points for a school's Index Coordinating Group to begin gathering information and can be developed as excellent workshop material to be used by all stakeholders in a local early years/childcare setting or a school.

There is now a growing international network of people working with the Index materials in local settings, discovering that this document can help them with the development of inclusive education in schools and in early years and childcare settings. A new book on some of this international practice is being compiled and edited by the main author of the Index, Tony Booth (email: tjb4@canterbury.ac.uk).

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Part **2**

Papers on specific topics

Cognitive Assessment and Activation as Tools for Inclusive Learning

NYBORG'S CONCEPT TEACHING MODEL APPLIED IN ORDER TO POSITIVELY CHANGE PREREQUISITES FOR LEARNING AND FACILITATE INCLUSION

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Abstract: This article is divided into two parts. The first part explains central aspects of Nyborg's theory of learning and corresponding educational practice. The second part focuses on the educational practice with emphasis on experiences with the application of a Concept Teaching Model in combined educational settings. A major notion in Nyborg's theory is that ability to learn, in a general sense, is dependent on prerequisites for learning in terms of what has been previously learned/stored in a Long-Term-Memory. This presentation will explore this notion by providing an answer in accordance with the aforementioned theory to the following two main questions: 1. Which kinds of previous learning may be assumed to transfer positively to further learning and to thinking? 2. Which processes, in the learner, may be assumed to be involved in such transfer? Central in the corresponding educational practice is the application of a Concept Teaching Model (the CTM). By means of the CTM children are taught Basic Conceptual Systems including belonging basic concepts (regarding Colour, Shape, Size, position, Place(ment), Pattern, Direction and Number etc.) integrated with oral language skills and to a generalized and transferable level. In the next stage these Basic Conceptual Systems serve as tools for performing important analytic codings or multiple abstractions. In this way they function as prerequisites for the teaching/learning of more complex concepts and conceptual systems, for the teaching/learning of school subjects and skills of different kinds as well as for facilitating communication in general.

Keywords: Theory of learning, concept teaching model, basic conceptual systems, analytic coding

Central aspects of Magne Nyborg's theory of learning and corresponding practice

| Introduction

Magne Nyborg (1927–1996) pedagogist and professor at Oslo University, Norway, did extensive research on learning difficulties. He developed a comprehensive theory of learning and a corresponding educational practice. The latter in close collaboration with colleagues.

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Nyborg's theoretical and empirical work has resulted in the following instruments for educational thinking, planning and teaching practice:

A. A theoretical model of a learning person – the PSI-model (Person-Situation-Interactions during learning) – which is a depiction representing central parts of his theory of teaching/learning, cf. the explanation of central aspects of the theory in this article.
B. A Concept Teaching Model (the CTM)
(cf. the brief explanation in this article).
C. A survey of Basic Conceptual Systems – the BCS-model
(cf. this article).
D. A model for the teaching/learning of skills
(not described in this article, cf. Nyborg, 1993).

Throughout his research, which stretched over more the 30 years, Nyborg focused upon how teaching in school could be improved, so that the pupils' general ability to learn could be facilitated. And – a major notion in Nyborg's educational thinking is that ability to learn in a general sense is dependent upon prerequisites for learning in terms of what has previously been learned and stored in a Long-Term-Memory. In his search for what might be important prerequisites for learning, Nyborg asked himself the following main questions:

Which kinds of previous learning may be assumed to transfer positively to further learning and to thinking in terms of what is learned?

As a result of his research Nyborg argues that concepts about, and conceptual systems concerning, classes of phenomena, may be considered major instruments for positive transfer; that is, especially when they are involved in principles, explanations, definitions, rules, laws, equations, etc. In particular have Basic Conceptual Systems (BCSs) including basic concepts integrated with and symbolised by language skills**,** proved to be important in positive transfer.

That is because they, when adequately taught/learned by means of the Concept Teaching Model, have proved to become bases for analytic coding[2] or multiple abstractions in all further learning, both in further concept and in skill learning. Later in this article you will be given the opportunity of per-

[2] According to Nyborg analytic coding is synonymous with multiple abstractions or multiple classification.

forming analytic coding of a letter by directing your attention by means of some of the mentioned Basic Conceptual Systems.

Another main question, asked by Nyborg and closely related to the preceding one, was:

Which processes, in the learner, may be assumed to be involved in positive transfer?

The answer to this question is to be looked for in Nyborg's construction of a general theoretical model of a learning person in dynamic interaction with his environments, the so-called PSI-model. By means of this theoretical and depicted model, Nyborg argues that the process of analytic coding (cf. the example of analytic coding of a letter below) and thinking processes, are dependent upon what has previously been learned/stored in a person's Long-Term-Memory (LTM). In his theory LTM is divided into three main structures, which Nyborg views as important prerequisites for performing analytic coding, and accordingly for positive transfer, for learning:

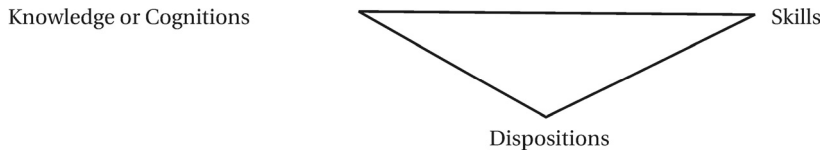

Figure 1.

To the left you'll find symbolised the **knowledge or cognition structure** with 4 kinds of cognition at rising levels (images of specific phenomena – concepts about classes – systems of concepts – propositionally[3] organised meanings). To the right you'll find the **structure of skills**, which includes both non-verbal and verbal skills of all kinds and. According to Nyborg verbal skills seems to play an important role as symbolising and organising factors in the learning of cognitions/in knowledge acquisition. The third structure is **dispositions for becoming emotionally and motivationally activated** by what is sensed, remembered or thought of by the person at each moment. This third factor may also considerably modify the transfer process; in other words hinder or facilitate the process. These three LTM-structures are of course mutu-

[3] That is, concepts and conceptual systems sequentially organised by means of symbols ordered by grammatical or other syntax to prepositional meanings. Sequentially organised experiences.

ally necessary for each other as well as usually activating each other. And to repeat – they constitute the LTM bases for transfer to further learning as well as are the bases for thinking – and preferably, for positive transfer to further learning and for more optimal thinking.

The strategy of Concept Teaching including the application of the Concept Teaching Model (The CTM) aims at modifying and changing all the three LTM structures and at teaching children strategies for learning (Nyborg, 1993).

The difference between numerals, words and other symbols – and concepts of classes

In Nyborg's theoretical framework there is a distinction between **numbers, words and other symbols,** on the one hand, and **concepts of classes,** on the other hand. The former category mentioned may be looked upon as a naming of or as labels for concepts of classes and other kinds of meanings.

Concepts of classes are defined as learned/stored knowledge about **partial similarities** between different members of classes (that is within-class similarities – for instance between (all) members of the class DOG). Knowledge about **partial differences** between members within classes is also central, making it possible to identify and distinguish between sub-groups belonging to the class (in this case differences between sub-groups of dogs). This second criterion makes it possible also to constitute a conceptual system of related class concepts; organized by names of sub-groups and – in this case – by the super-ordinate name DOG. Finally – as a third criterion – concepts of classes should also include knowledge of **partial differences** between the classes to be learned about and other classes with which the class in question can be confused (in this case the differences between dogs and, for instance, cats or other kinds of animals).

Concepts of classes can be learned (1) by observing members of the class to be learned about as well as by also observing members of classes that easily can be confused with that particular class, or (2) concepts can be merely learned by definitions heard or read. The outcome of such "definitional" learning will highly depend on the learner's conceptual understanding of words and other symbols used in the definition. Finally, concept learning can take place (3) by some kind of combination between learning by observation and learning by definition.

Two kinds or two sub-groups of concepts and conceptual systems

Nyborg also distinguishes between two kinds or two sub-groups of concepts and conceptual systems, a little simplified it's possible to talk of:

Sub-group 1: Basic concepts and Basic Conceptual Systems, e.g. concepts regarding Colour, Shape, Size, Number, Position, Place etc. (representing attributes of and relations between wholes and their parts).

Sub-group 2: More "complex" concepts and conceptual systems (e.g. regarding whole phenomena and their parts such as whole plants, animals, persons, objects and events such as trees, horses, rooms, boats, towns and to go, to dance etc.).

The first mentioned sub-group of concepts and conceptual systems are called basic because they – according to Nyborg – are necessary in order to learn the latter and more "complex" group of concepts and conceptual systems based upon analytic coding or abstractions.

A survey of names for Basic Conceptual Systems and some belonging concepts – the BSC-model

1. **Colour:** Red, blue etc.
2. **Shape:** Linear shapes: straight-lined, bowed/curved, angular etc.
   Surface shapes: round, triangular, four-sided etc.
   Spatial shapes: spherical, cubic, prismic, cylindrical, etc.
   Shapes named according to the look of the object, like egg-shaped etc.
3. **Position:** Vertical, horizontal, sloping, sitting, kneeling, lying etc.
4. **Change in colour, shape, position…** etc.
5. **Size(s):** 1. dimensional- , 2. dimensional- and 3. dimensional sizes in relation to … and their measure units.
   (e.g. for line sizes: great/small/greater/smaller etc. length, height, breadth, depth in relation to… .)
6. **Place:** Placed on, under, at, over, beside, to the left/right of…etc. Also placed first, second, behind, between, in front of etc. in a row.
7. **Direction:** From the left to the right, upwards etc.
8. **Number:** Small/large etc. number in relation to… Number of ones, of

tens, to increase/decrease numbers etc. (Also exact numerals symbolising numbers).

9. **Sound/phoneme:** /a/, /f/, /g/ etc.
10. **Surface attributes:** Smooth, rough, glossy, matt, sandpapered, painted etc.
11. **Surface Pattern:** Dotted, striped, checked, flowery etc.
12. **Substance:** Wood, glass, metal, plastic, leather etc.
13. **Attributes of the substance:** Hard, soft, elastic, firm etc.
14. **Weight:** Great/heavy, small/light etc. in relation to… Also precise measures of weight.
15. **Speed/movement**
16. **Time**
17. **Temperature:** Cold, warm, boiling hot T, freezing cold T etc. Exact temperatures.
18. **Use or function:** To drink from, to sit on, to write with etc.
19. **Smell:** Nice, nasty, smell of food etc.
20. **Taste:** Sour, sweet, bitter, apple-taste etc.
21. **Value**

It's especially important to teach the 12–13th first listed Basic Conceptual Systems by means of the Concept Teaching Model. The most of the others can merely be taught in a more traditionally way by naming the concept and conceptual system (heavy Weight, sour Taste etc.) in relation to children having experiences from the near surroundings.

The Concept Teaching Model (the CTM)

The Concept Teaching Model is divided into 3 different phases that are named according to the processes that in particular are represented in each phase. However, a fourth and basic process named analytic coding underlies the learning in all of the three phases. Analytic coding refers to the process by which a person analyses and selects the proper feature to be learned about during the work in the three phases, in the following example roundness named as round shape (Hansen et al., 2002).

Phase 1: **Selective Association** (the SA-phase)
First the teacher presents:

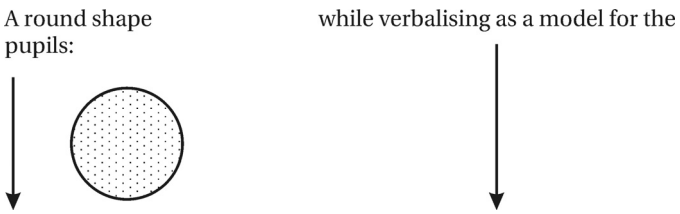

Figure 2. "This figure has a round shape (because...)"

Then the pupils are asked and helped to do the same verbalisation while inspecting and touching the round shape.

Afterwards the teacher presents and the pupils make varied examples of objects, drawings etc., which are similar in having a **round shape** with various degrees of roundness. At the same time the teacher systematically vary other features of the examples such as Colour, Size, Pattern, Place etc., to help the learning person detect and abstract **roundness** as the adequate feature.

Phase 2: Selective Discrimination (the SD-phase).

In this phase the teacher will present examples of objects or drawings etc. like:

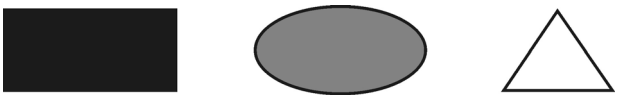

Figure 3.

The task of the learning person is to point out or otherwise identify the figure which has **a round shape** and – of course to answer **a round shape** – and preferably as part of a sentence, if questioned about the shape of the figure.

In the last part of this phase the pupils are asked to point out or identify by themselves figures in the surroundings or tell about figures elsewhere that are having **a round shape**.

Phase 3: Selective Generalisation (the SG-phase).

During this phase detected **partial similarities** (in this case round shape), which have repeatedly occurred during the work of the preceding phases, are described and made verbally **conscious** by means of symbols and language skills.

Example: The teacher presents situations with examples of objects or drawings etc. that vary in many ways while asking: "in which respect[4] are these figures **similar**?"

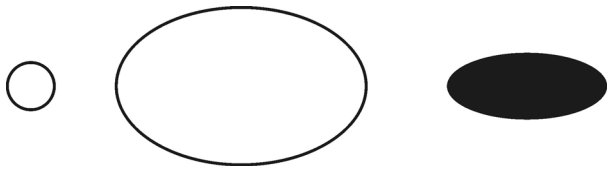

Figure 4.

An appropriate answer would be: "they are similar in having a round shape." Thus the detected partial similarities are mediated and made "verbally conscious" through an inductive conclusion.

Of course this illustrated way of answering must sometimes be learned through several examples and by imitating the teacher and other pupils' repeated verbalisations. In spite of this, for pupils with severe verbalisation problems, one must sometimes still be satisfied with a shortened phrase reflecting what has been detected and abstracted, like: "similar in – round shape."

In order to secure success for children on this task the teacher in advance has to teach and make the children aware of the difference between the concepts of "complete similarity" (being complete alike) and "partial similarity" (being partial alike) thus mediating verbal tools that may help them to direct their attention in the search of partial similarity.

Several educational principles underlie the Concept Teaching Model, but they will not be discussed here.

Some comments to the strategy of concept teaching applied vis-à-vis children from the age of 5 and upwards

1. The emphasis in the first stage is on the teaching of Basic Conceptual Systems such as Colour, Shape, Position and Change, including the selected basic concepts.

[4] This can be asked in other ways, eg. "in what way are these figures similar/what are all these figures similar in?"

2. The teacher is making use of concrete and semi-concrete materials in a very methodical way to give children the opportunity to learn concepts by "discovering and putting into language detected similarities (and differences)" between/among different members of the class to be learned about. Examples of for instance round shape are exposed to the children via very different objects or drawings. In this way, the children will not only be exposed to prototypical examples, but to a rather well representative sample of the class, rendering generalization and transfer more possible (Hansen, 2003).

3. Oral language skills are used in a unique way in order to help the children to learn and organize their experiences into Basic Conceptual Systems (BCSs). This is done by repeated use of, for instance, the sub-ordinate label round in close connection with the super-ordinate label SHAPE = Round SHAPE. In this way BCSs in many children are formed years ahead of what would have happened without this kind of verbal mediation. This learning of BCSs is very important because it forms the basis for directed and self-controlled attention in terms of analytic coding, which may be looked upon as a crucial factor in subsequent learning.

4. In the very start of the teaching of a new concept the teacher is usually modelling the answer, before he start asking questions as part of a dialogue. In other words, concept teaching is not a technique dominated by asking questions (in many content areas) without knowing whether or not the children have had the opportunity to experience and thus will be able to come up with a proper answer that will expand the learning as well as give the children a feeling of mastery and success.

5. The teacher is very specific in giving feedback to the children in accordance with what they actually have been performing, for example, "You said that brilliantly." "This drawing is very good." "You did that nicely." For children with manifest general learning problems the teacher also will actively make them aware of what they have been learning: "Yesterday you weren't able to draw a round shape and today you did this nicely." The intention is to help the children become aware of their learning and positive changes. Toward the end of lessons the teacher challenges the more able children to reflect on what they have learned, how this fits into or can be related to previous learning and how it can be of future use in or outside school.

6. It is important to emphasis once more that the teacher in the third phase (Selective Generalisation) challenges the children to come up with an inductive conclusion, putting into words and thus making conscious what they have abstracted during the preceding teaching/learning.

7. The children are exposed to repeated training in performing analytic coding by means of (names for) Basic Conceptual Systems. As has been stated, the process of analytic coding has a central position in Nyborg's theory of learning. In this kind of concept teaching, training pupils in performing analytic coding (see example of analytic coding of a letter below) in terms of learned Basic Conceptual Systems is emphasized as a means to help inefficient learners learn how to learn.

In the training of analytic coding, the teacher should first make use of well-known objects that the children of that particular area are familiar with, such as a chair, a hammer, a ball, a mug, a pot. The children should also be invited to bring objects to school with them, such as things, drawings or photographs that would be suitable for analytic coding. Training in analytic coding can also be performed by means of material developed for this task, e.g. Anna Games (Sønnesyn, 1999).

8. Basic Conceptual Systems are deliberately applied in the teaching/learning of more complex conceptual systems as well as in the teaching/learning of school subjects and skills of different kinds.

Analytic coding of a letter by means of (names for) Basic Conceptual systems

Below you will have the opportunity to experience how it's possible to have your attention directed very precisely towards different and characterising features of the letter L by means of (names for) Basic Conceptual Systems. This is an example of analytic coding applied in the teaching/learning of letters.

Possible answers[5] to the questions are to be found at the bottom of this page.

L

A. How many parts is it possible to say that this letter consists of?

[5] A) This letter consists of (the number of) two parts.
B) They both have straight-lined shape.
C) One is in vertical position; the other in horizontal position.
D) 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.
E) The letter is used as a symbol for the phoneme /L/ and is articulated "la".

B. What shape do the parts have?
C. What positions do the parts have?
D. How are the parts placed in relation to one another?
E. What is this letter a symbol for in reading and writing?

It is my experience that 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.

The teaching of more complex conceptual systems – also as part of school subjects

The principles of the CTM-model can also be used for teaching/learning more complex concepts and conceptual systems (of whole objects and events such as rooms, boats, towns and to go, to dance etc.). Basic Conceptual Systems are the bases for this learning. At the same time one may train children in being a kind of "small researchers" in asking themselves questions like:

1. In which aspects are all rooms (doors, windows, gardens, roads, rivers, mountains, towns etc.) similar?
2. How can rooms be different?
3. What can rooms be mistaken for?

The answers to such question may considerably help the pupils in their construction of precise and verbally conscious meanings hierarchically organised into conceptual systems. To master this kind of inductive approach to learning the pupils need extensively training.

It can be argued that Basic Conceptual Systems including basic concepts are needed for teaching/learning school subjects in general as well as for learning skills of different kinds. In other words – Basic Conceptual Systems are tools for learning in different areas and at different levels of learning. This can easily be illustrated, by turning, for instance, to the teaching/learning about the Solar System, and the logic of this is as follows: Besides using three-dimensional models, pictures and sometimes data-programs in teaching persons about the Solar System, the outcome for the learner is heavily dependent upon his understanding of the teacher's use of sentences loaded with Basic

Conceptual Systems concerning Colour, Shape, Position, Place, Size, Direction/Movement, Temperature, Surface, Substance, Weight, Time and so on. In other words Basic Conceptual Systems are central with respect to learning about the Solar system.

The example concerning the Solar System will probably illustrate how dependent a learning person – in other words all of us – is on mastering and applying basic concepts and Basic Conceptual Systems as tools for communication and as prerequisites for further learning at increasingly higher levels (deliberately or in a more "automatic" way).

This also seems valid for persons with learning difficulties: Having gradually – via concept teaching – learned the conceptual bases for and the strategy of performing analytic coding, many of them will become betters learners in a broad sense; in other words – they become more intelligent.

Report of a case study: Concept teaching applied in a combination of special and regular educational settings in primary school

| Design

A double single case quasi-experimental design; with the cases each serving as their own controls.

| Subjects, grade levels and duration of the study

The study lasted for two years – from May/June 1998 until May/June 2000. The two children, a boy whom I call Steinar and a girl called Astrid, were pupils at grade 2 and grade 3 in this period (6–8 year olds).

| A brief description of Steinar before the study

Steinar was referred to the Educational-Psychological Services in October of his first years at school because of learning problems and delayed development in gross- and fine-motor functioning. He was born two months too early and was delayed in his language acquisition.

He was inattentive and had problems with his concentration compared

with children of his own age. Sometimes he had a tendency to "enter a dream world of his own", as the teachers put it. He had problems in establishing social relationships with other children and didn't show any initiatives to participate in play with others. He also had problems in understanding numbers and in remembering letters. He had great difficulties in writing numerals and letters.

| A brief description of Astrid before the study

Astrid was referred to the Educational-Psychological Services a year ahead of school because of delayed language development. When she started in grade two, her teacher described her as a child with relatively great problems with verbal communication and fluency, that is, she used incomplete sentences and had problems in finding words/mobilising words. She also had problems in establishing social relationships in and outside school. She seemed to be insecure and participated very little in the common activities in class. In addition she displayed some problems in understanding numbers and had problems with remembering letters. She had a tendency to withdraw sitting literally in her own thoughts, thus loosing her concentration.

Frequency of application, the experimental treatment and educational setting

Most of the pretesting took place in May 1998. The concept teaching started in the first part of September 1998 and lasted for almost two years until May 2000. In this period the children received on an average between one to two lessons a week with the teaching of Basic Conceptual Systems and selected concepts.

The following selection of Basic Conceptual Systems was taught/learned according to the principles of the Concept Teaching Model (the CTM): Colour, Shape, Position, Size, Place (both spatial and sequential related concepts), Direction, Number, Sound/phoneme, (Surface) Pattern, Use or function. The children were also taught some concepts within Weight, Smell and Taste as well as well as within Time and Temperature as conceptual systems – without the application of the CTM, but with the precise and combined naming of both concepts and conceptual systems (e.g. heavy Weight, nice Smell,

sour Taste etc.) in relation to the children having experiences from the near surroundings.

Within the lessons of concept teaching the teacher were recommended, as a second important kind of activity, to train the children in performing analytic coding. The teachers were also encouraged to deliberately apply Basic Conceptual Systems as tools for the teaching of school subjects.

A three-stage-model for concept teaching applied in a combination of special and regular educational settings

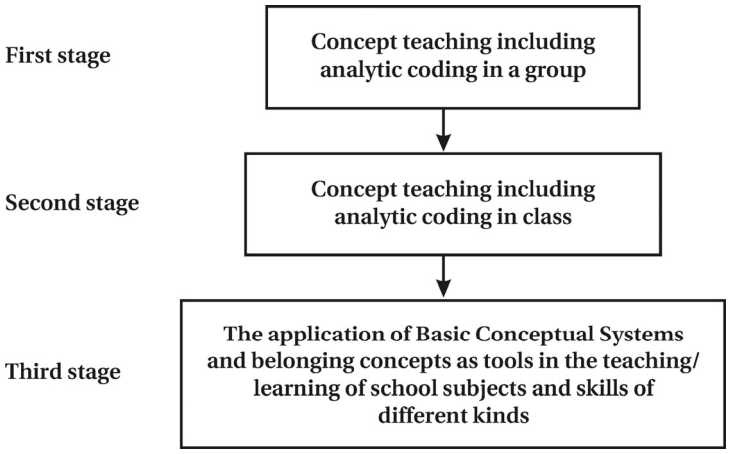

Figure 5. The three-stage-model

The concept teaching of the two children took place in a small group combined with a certain degree of regular instruction in the classroom according to a plan for changing their prerequisites for learning as well as for helping towards a better inclusion.

In the first stage the Basic Conceptual Systems were taught the two children in a special educational setting outside the classroom in a group consisted of themselves plus two or three of their classmates, the latter persons changing from time to time. In this way more and more of their classmates would have the opportunity to experience the two, who originally probably were perceived as children with learning problems, as competent learners at more or less the same levels as themselves.

In the second stage Basic Conceptual Systems were taught through a shortened version in class (18 children), giving the children the opportunity to demonstrate in the class as a whole skills in these tasks at the same level as their peers. This teaching was also done by the children's teacher of special education.

In the third stage the children's class teacher deliberately applied learned basic concepts and conceptual systems as tools for the teaching of different school subject and in different settings[6].

The program of concept teaching for the two children also had a link into their homes by means of the children bringing with them sheets with concepts tasks to be solved in co-operation with their parents. These tasks corresponded with examples of tasks that the children in advance had solved in the SA-, the SD- and the SG-phases according to the principles of the Concept Teaching model. At home it took only 2-8 minutes to solve the tasks, and both the children and the parents were guaranteed success.

The aim of this co-operation was that the children should have repeated opportunities to demonstrate mastery and some of their concept learning for their parents, so that they would become aware of the children's increased performances and competencies. At the same time, I hoped that this arrangement could give the parents a chance to become (even more) conscious about the basic conceptual systems in order to, hopefully, make use of them when helping their children with their homework.

Some findings at the end of the training period

A) Changes with regard to prerequisites for learning in terms of basic concepts and Basic Conceptual Systems as well as the children's capability in performing analytic coding: According to the teachers' observations and evaluations the two children made very good progress both with regard to "mastering" Basic Conceptual Systems as well in their capability of performing analytic coding, cf. the children's positive changes in scores from pretest to posttest in the ITPA-test results presented in table 1.

[6] This third stage of the implemented strategy led to a frequent application of the learned Basic Conceptual Systems that helped the transfer of learning from the first two stages as well as added quite a lot of time to the application of the experimental strategy of concept teaching.

B) Changes with regard to the level of functioning in school subjects: At the end of the study the children had made very good progress and were achieving "normal" learning results according to their teachers observation and on Norwegians tests of reading, writing and mathematics.

C) Changes with regard to pretest-posttest results on some well-known international tests:

Children		
	Astrid	**Steinar**
Age[7]	6-7	7-1
WISC-R		
Pretest IQ	94	65
Posttest IQ	101	76
RAVEN		
Pretest	19	12
Percentile	50	5
Posttest	28	16
Percentile	75	5
BENDER		
Pretest[8]	7	18
Percentile	50	< 5
Posttest	1	6
Percentile	70–80	10
ITPA/Verbal expression		
Pretest	10	13
PLA[9]	< 4-1	4-3
Posttest	27	32[10]
PLA	8-0	9-6

Table 1. Pretest-posttest results on WISC-R, Raven, Bender and on ITPA/Verbal. expression – a study of effects of Concept Teaching lasting for two years

[7] Age at the time of the pretest
[8] The lower score, the better results and the reverse.
[9] PLA = Psycholinguistic age
[10] 30 points = PLA 9-6 yrs.

Some comments to the development of communication skills in group and class

At the start of the study (grade two) the two children, and in particular Astrid, almost didn't talk in class, the teachers reported. During the lessons with concept teaching in a group the children learned the Basic Conceptual Systems to a verbally very conscious level. At the same time the activities and the interactions between the two children in question and the others in the group (including the teacher) led to much dialogical training, and Steinar and Astrid improved much in this sense.

In the very first lessons with concept teaching in class the two children in focus acted so to say as models for their peers as to the verbalising of detected partial similarities (eg. "They are similar in having vertical position"). They were also just as active verbally as the rest of the class during these kinds of class lessons.

In the beginning of the study in grade two the two children's level of active participation were limited to the group- and class lessons with basic concept teaching. During the first year of the study this changed gradually ending up with the two children communicating with and speaking more or less as much as the rest of the class regardless of activities or subjects. At the end of the study the teacher of special education and the class teacher both to a large degree attributed this positive development to the strategy of concept teaching and to what the children had experienced of mastery in the three mentioned stages.

The class teacher's description of Steinar and Astrid by the end of the study

Steinar had almost no problems left with learning, nor problems with verbal communication. Socially he had developed to such an extent that he was barely recognisable. He had developed good relationships to the other pupils in class and was able to collaborate with all his mates. He had very few problems with his concentration and was able to work on his own. He had also improved with regard to gross- and fine-motor skills, but had some problems with producing a good handwriting. Still he could be a bit "dreamy", but only for short intervals.

Astrid had almost no learning problems left, as the teacher saw it. She had improved very much with regard to communication and had almost no prob-

lems left with participating in class in this regard. She had developed good social relationships to her mates even though she was a little careful in her social initiatives. She was able to work on her own and was concentrating well.

Closing comments

By the end of the study the class teacher regarded Steinar and Astrid as children who had no need for further special education, my view being that Steinar in spite of his positive development still had need for special education, that is in terms of further basic concept teaching including training in performing analytic coding in combination with self-instructional training, especially with regard to performing different tasks involving visual-motor performance. In spite of my recommendation Steinar was not given additional special education during the year following the study.

However, summing up the status for the children one year after the end of the defined training period, it's possible to conclude that Steinar and Astrid had continued their positive learning of school subjects. Thus it seems possible to conclude that the positive learning "careers" the two children had entered during the two years of the study period had continued.

It's of course impossible to be sure of how much of the observed improvements of the children can be attributed to the implemented experimental approach of the reported study. There are, however, reasons to believe that concept teaching as implemented through the three described stages contributed significantly to the positive development of the two children in different evaluated target areas.

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DYNAMIC INTERACTIVE APPROACH IN ASSESSING AND ENHANCING COGNITIVE FUNCTIONING IN CHILDREN WITH SEVERE LANGUAGE DISORDERS

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Abstract: In 2000 the Centre for Cognitive Development of the Diego Portales University (Santiago de Chile) started with a clinical service for children and adolescents with developmental disorders. Since then we have worked with about 180 children with a diagnosis of genetic disorders (e.g. Down syndrome), children with autistic spectrum disorders, learning disabilities, and attention-deficit/hyperactivity disorder (ADHD) varying in age range from 4-18. In many cases the etiological diagnosis is unclear and they can be described by various cognitive, affective, motivational, linguistic and motor dysfunctions. One of the reasons for consulting is certainly an increasing level of frustration/and expectations of the children's families, with regard to potential of development and learning.

The present work introduces some preliminary outcomes of current research which main goal is to analyze the relationship between quality of mediated interaction and enhancement of communication and self-regulation abilities in children with a severe language disorder, using a variety of interventions.

The perspective used in this research has been the theory of Structural Cognitive Modifiability and Mediated Learning Experience developed by Reuven Feuerstein. The present study is a qualitative single case study systematizing a large group of interactions between mediators in charge of the intervention program and two children with Down syndrome and autism spectrum diagnosis.

Interventions are based on three universal criteria of mediation: intentionality and reciprocity, transcendence and meaning. We observed many significant changes in the development of communications skills and its impact on self-regulation processes, which have been prompted by these three parameters.

The results suggest the possibility of significant modifiability of development of communication systems in children with serious language and communicational disorders through a consistent mediation. However, an aspect that remains to be studied is the internalisation of the learnt communicating strategies, their autonomous using in similar contexts and transfer to other, different contexts.

Keywords: Cognitive development, language disorders, self regulation, structural cognitive modifiability, mediated learning experience, learning propensity, mediation criteria.

Introduction

From a general overview on development, where individual and contextual factors must be considered, the human being undergoes an evolution ac-

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cording to his/her structure, capacities and functioning, adapting to the context and social-cultural environment, so that each person has the propensity to change and makes progress in his/her development. When capacities show deficiencies and abilities are impaired, there is nevertheless a unique development process in which any achievement will be significant and particular to every individual and his/her history or context.

When we meet a child with a developmental disorder, differences between him/her and others may seem obvious, even if he is younger. This happens with the development of functions of social – communication processes in individuals with severe language problems. Although they can show pre-verbal behaviours, the interest of sharing attention and their own experiences with others is not as obvious as in typically developing children.

The development of intentionality and the motivation for sharing with others mainly depends on the quality of interaction between adult and child. This is often offered in a deficient way, due to incapacity to pass on the meaning of objects and events, which are around the child and a failing attention process between adult and child together.

A pattern often observed in clinical work with children, who present an important cognitive developmental impairment, is the necessity to be able to shorten the existing barrier between parents' expectations and the children's possibilities towards short term changes. The severity of learning and/or communicative disorders, associated to diagnoses such as autistic spectrum disorder, Down syndrome or pervasive developmental disorders requires that the evaluation of the potential of change formulates a clearest as possible intervention project with respect to the type of mediation required to produce greater benefit developing that potential. It also should indicate where mediation must be directed, so that its impact on the cognitive structure allows triggering a stable and more and more independent process as compared to the original conditions in which the mediation was offered.

When some causes have been determined, assumed or are not viewed as being amenable to change, and if a condition is severe, with extreme degrees of damage or impairment, then the expectation of change is minimized or abandoned. Many children with Down syndrome or autistic spectrum have been early diagnosed declaring that their condition is considered as immutable and fixed, so any effort to enhance their learning will not produce development. Parents many times receive implicit messages that hardly anything can be done to modify the course of life. Even in the case of a child with autistic spectrum disorder, it may lead toward an exacerbation of the symptoms,

which may have been transient, making it a pervasive phenomenon. These conventional theory and practice lead to one conclusion: a passive acceptance of conditions of disability, dysfunction, and limited potential for adaptation.

Starting from a perspective of modifiability, on the other hand, an active approach is adopted as towards the possibilities of change, in which functional limitations are not considered as absolute limits. In recent decades increasing evidence has become available of the plasticity of the brain, which functional and microanaomical organisation is not finished at birth, but is largely dependent on experience and activation (Lebeer, 1998) In this view it is crucial that a significant other, whether parents or other educators, provide opportunities for mediated learning experiences and interactions that allow the child to develop its potential and gradually build psychological tools which are needed for higher cognitive development and learning (Kozulin, 1998)

Feuerstein e.a. (2002) state that a more dynamic *approach* is needed than the static traditional diagnosis, which do not ask if children can or cannot learn, but *how* learning processes should be elicited. Haywood & Lidz (2006), present a dynamic approach in evaluation as a valid option that provides unique information about modifiability of the learner in terms of its strengths and weaknesses. At the same time, it has the potential to establish more effective bridges to daily learning situations than static traditional procedures, being more concerned about *how* than *what*. Although the traditional thought prioritizes product over processes, observing a final product *(a child's actual response)* gives only limited information about how that learning was produced. Feuerstein's approach called LPAD (Learning Propensity Assessment Device) is a systematic dynamic method that supplies extensive information, necessary for a deeper understanding of the learning process, even more in children with special needs.

The purpose of our work is to look at our own practice in order to see the type, frequency and amount of mediation that is needed to provoke structural changes in those cognitive functions responsible of the quality of learning process. Using the LPAD to assess the learning propensity and creating conditions for modifiability -enhancing environments and interactions, we have shaped an intervention program which is being applied in our clinical area. We present now two case studies of children with language disorders associated to a PDD and Down syndrome diagnosis. Our purpose is to have a clearer and more valid view on potential and to get samples of the nature of inter-

vention which most benefit communication and self regulation abilities. In other words, we are looking for evidences and samples addressed to answer the following questions:

1) What cognitive functions must be mainly stimulated to improve communicational abilities in a child with a language disorder?
2) What cognitive functions must be mainly stimulated to improve self regulation process in a child with a language disorder?
3) Are mediated learning interactions a way to enhance those processes?
4) What are the criteria, type and moment of mediation that better produce changes in the manifest level of functioning?

Theoretical background

Our work is based on the theory of Structural Cognitive Modifiability and Mediated Learning Experience (MLE) developed by Reuven Feuerstein (Feuerstein & Rand, 1975). So we will offer a brief review of the basics of it.

| Feuerstein's theory of Structural Cognitive Modifiability

Modifiability can be understood as a *leap* from the predicted levels of development, manifested in changes that do not follow the natural course. Piaget's theory of developmental stages of the cognitive process suggests that these stages are inevitably and sequentially age linked, hindering the observer to state signs of potential and modifiability. In Feuerstein's view, much of the underlying cognitive process described in the Piagetian stages of development is amenable to change. The individual has the potential to integrate, assimilate, and acquire higher and differential levels of functioning, with much less hindrance than Piaget had assumed. These changes occur irrespectively of the three traditional conditions that have been considered barriers to change: the *etiology* of the condition; the *critical period* or age of its onset; and the *severity* of it. (Feuerstein, Rand and Hoffman, 1980).

The theory of Structural Cognitive Modifiability (SCM) describes the unique propensity of human beings to change or modify the structure of their cognitive functioning to adapt to changing demands of life situations.

| Environmental influences on Human development: Mediated Learning Experience

Mediated Learning Experience (MLE) describes a special quality of interaction between the child and an individual, called the *mediator*. It is considered as the *proximal factor* of human modifiability, which can moderate the influence and impact of such *distal factors* as genetic predisposition, organic impairment, or educational deprivation (Feuerstein & Rand, 1975).

To distinguish MLE interactions, Feuerstein proposes twelve criteria, of which the first three - intentionality and reciprocity, meaning, and transcendence - must be present for a learning experience to qualify as a mediated learning experience. They are called *universal criteria of mediation*.

Intentionality and reciprocity

Intentionality transforms any interactive situation from accidental into purposeful. Reciprocity refers to the mediator's willingness to see the students at the "same level" and to be attentive to their responses. By constantly focusing on the child's state of attention, problem solving strategies, mistakes, and insights, the adult infuses the learning situation with a sense of purpose and intentionality.

Meaning

The mediation of meaning represents the energetic, affective, emotional power that will make it possible for the mediational interaction to overcome resistance on the part of the learner and thereby ensure that the otherwise "neutral" stimuli acquire additional emotional, social and cultural value, which will be experienced better by the learner (Feuerstein, 1988). In accordance with these important conditions of learning, Greenspan e.a. (1997) found that an initial affective caregiver-child relationship is the basis of cognitive development and communication.

Transcendence

An interaction that provides mediated learning must transcend the immediate needs or concerns of the learner going beyond the here and now, in

space and time. Transcendence as a mediating criterion provides not only for the anticipated widening of cognitive factors in the information under question, but assumes the constant enlargement of the learner's own need system and his/her dynamic, continuous change.

| Pre requisite of thinking: Cognitive functions

Cognitive functions are described as the mental prerequisites of thinking operations and any other behavioural function (Feuerstein e.a., 2006). They underlay those mental and psychological behaviours responsible for the learning process, divided into the phases of the mental act. They reflect the quality of the process of input (feeding data into the cognitive system), elaboration (establishing relationships between the pieces of information) and output (issuing the conclusions reached). These conditions must be universal i.e. they underlay any operation, irrespective of its content. They also must be accessible to be detected, described and controlled operationally to enable the individual to observe and intervene in a focused and systematic manner. Thus, they then represent the *target of mediation* and the clearest focus of cognitive modifiability.

It must be considered that in childhood acquisition and development of cognitive structures, learning and socialization skills occurs simultaneously with maturation of the neurophysiological structures.

Research population

In working with children and young people with complex developmental disturbances, in many occasions the first *challenge* consists in overcoming confusion and frustration that families carry. Frequently they have done a long route in looking for clues to understand and guide their children's learning. Negativistic prognostic *labels* imposed by standard diagnosis usually have left recognizable traces in their expectations and in the way they interact with the child, hindering expression of potential. At present, about two hundred children have been assessed by the professional team and a group of them has benefitted from an intervention program. Within the large and varied number of clinical diagnosis there are two increasing ones –PDD and Down syndrome.

Cognitive dysfunctions in children with autistic spectrum diagnosis

The term "autism" raised by Bleuler originally, was reintroduced by Kanner and Asperger referring to children with a kind of schizophrenia who tended to isolate of the social world to dive into themselves interacting to their own fantasies and thoughts and with severe difficulties to establish social relationships (Frith, 1996)

Nowadays it is more customary to talk about "autistic spectrum" (DSM-IV manual). However, this definition is rather broad and hence nowadays children are included in this diagnostic category who vary widely in levels of functioning. This has created some confusion, addressing parents and educators in not a few occasions towards treatment programs.

According to Feuerstein, a child with autism usually grows up with a resistance to mediation and therefore a lack of mediated learning experience shaped mainly by his/her biological system (Feuerstein, Falik and Rand 2002). Therapy should therefore be directed at mediating deficient cognitive functions. Ruffman, Garnham and Rideout (2001), in a study about the relationship between social understanding and the influence of glance fixing in self perceptive control processes, found that children with autism have difficulties to fix glance, which does not allow them to make certain perceptions at unconscious level that are critical for a good comprehension of the social communication process. A hypothesis is therefore that a perceptual deficiency in the *input* phase of the mental act is going to disturb the organization of social information as well as communication, cognitive and emotional processes of the child. This is sometimes referred to as the Theory-of-Mind model, which states that the child has difficulty in understanding the viewpoints of others (Hill & Fritt, 2003).

| Cognitive dysfunctions in a child with Down syndrome

Speech and language are complex and present many challenges to the child with Down syndrome that need to be addressed through a comprehensive approach to speech and language treatment. Communication skills are important and contribute to inclusion and integration. Communication includes not only speech, but also facial expressions, smiles, gestures, pointing,

high five signs, and alternative systems such as sign language and computer-based systems. Children and adults are more likely to interact when they can understand and be understood. At home, in school, and in the community, a functional understandable communication system facilitates relationships. Although there are common speech and language problems, there is no single pattern of speech and language common to all children with Down syndrome. Many children with Down syndrome have more difficulty with expressive language than they do with understanding speech and language, that is, receptive language skills are usually more advanced than expressive language skills. Certain linguistic areas, such as vocabulary, are usually easier for children with Down syndrome than other areas, such as grammar. Sequencing of sounds and of words may be difficult for many children. Many children have difficulties with intelligibility of speech and articulation. Some children have fluency problems. Some children use short phrases, while others have long conversations. All of the speech and language problems that children with Down syndrome demonstrate are faced by other children as well. "Children with Down syndrome have a range of specific learning difficulties that, combined together, make learning to speak in sentences very hard to achieve. Although their expressive language difficulties are greater than their comprehension difficulties, they do have delays in developing comprehension that may be made worse by hearing loss" (Buckley & Bird 1994). Children with Down syndrome may also have processing difficulties that affect their perception of words, even if they do not have a hearing loss. They typically have auditory short-term memory deficits that impact their ability to remember what they hear. This can effect all areas of instruction including language development, reading, math, etc. "Language supported by symbolic movements, such as sign, gesture or finger spelling, and by visual methods, such as pictures, symbols, words, and sentences (multisensory methods) will help the children to remember information." (1994).

Feuerstein et al. point out that the most important aspect of working with a child with Down syndrome is not only to provide him/her with models for imitation, but also equip the child with the necessary verbal, motor and conceptual tools for learning (Feuerstein, Falik and Rand, 2002). This means that is it important to lead his thinking to the internal processes involved in his /her own cognitive functioning (*insight*). Goals are oriented to 1) establish an autonomous schema to understand not only the activity but the context, inhibiting the tendency to behave by repetition or imitation, and to 2) overcome the isolated perception of reality where each event is considered without a

frame of reference. Mediation must be addressed to this target and it should be accompanied with a clear interaction that provides what is needed to differentiate the own process to the others. From this perspective, it is possible to hypothesize that mediation of deficient cognitive functions in the three phases of the mental act –*unsystematic and impulsive exploring, lack of spontaneous comparing behavior, episodic grasp of reality*, and *egocentric communication modality* it will enable the child to have more clues to understand the context, and what is expected of him in order to reach a goal and how to regulate his own behavior

Methods: the intervention program

We start with an intensive interactive assessment of the child, based on the principles and instruments of the Learning Propensity Assessment Device (LPAD) (Feuerstein e.a., 2002). Direct observation and analysis of the process and its cognitive components used at solving problems allow us to identify those cognitive functions that can be modified, the type of intervention that is required to obtain such modification, and how much mediation is needed to extend the change to new situations. This battery is especially indicated to evaluate learning processes in three groups of populations: (1) students that still have not developed some cognitive functions, but for whom development is presented as accessible with a systematic mediation; (2) individuals in whom cognitive functions have been severely affected by internal or external conditions; (3) individuals at risk of never reaching an adequate functioning because they present with severe dysfunctions impeding development.

Others instruments have been taken from Feuerstein's Instrumental Enrichment Basic program (Feuerstein e.a., 2006) and we also have used some educational non-structured games worked through the dynamic assessment principles

The principles basically are first to collect information on basic ways of functioning (the "pre-test"), then to mediate in order to teach principles or behaviours ("learning phase"), followed by again an assessment of modifications (the "post-test"). In many cases there is not a linear application of these three phases, but a continuous cycle.

Once the analysis, conclusions and orientations are discussed with the family and the school team, a period of systematic intervention takes place. In both phases, the program includes two 1 ½ h sessions a week. Two examiners

lead all the sessions using the mirror room, which allows professionals and parents to observe the intervention from the other side without interfering in the process. This condition enables parents to get some samples of mediation and to encourage them to look at micro changes in order to recognize them in their child and to value them. All the sessions are filmed in order to have a clear and complete register of the interventions. Once a week the professional team has a working meeting in order to analyze the quality of the mediation offered, to register changes that have been possible to observe, redefine targets, and to find new ways to increase the impact of the mediation process. For this purpose the Profiles of Modifiability and its parameters are used (Feuerstein e.a., 2002) for the organization, description and a deeper analysis of observations and remarks which have been done in the different sessions. The school observations and the register of parents' meetings are included in its analysis and interpretation. Once a month two separate working meetings are organized with the parents and with the school, in order to share our preliminary conclusion and suggestions and to permit the transfer to the environments, creating or developing an active attitude towards the child.

Case studies

| V., a child with a pervasive developmental disorder

V. was referred to us at the age of 4 years and 5 months. He had been diagnosed with a severe communication disorder within the autistic spectrum associated with congenital heart disease (Ventricular Septal Defect -VSD) that required surgical repair at the age of two months; auricular deformities and vision impairment. So far no genetic precise etiology has been confirmed. He was attending a regular pre-school and he was receiving at the same time a speech therapy support twice a week. However, both experiences were not seen as successful as it was expected by the family. It seemed that they had not enough insight in how learning processes occur in a child with that diagnosis. Nevertheless, his parents felt that he was making some progress, although it was hidden or not expressed because of the communicational barriers.

V.'s communication skills, at the onset of the assessment, consisted in about ten words he could recognize in a familiar set of pictures. He had

learned to associate them and to use for expressing himself through a unique sound –"*ta*", independently of the various intentions he could have. During the first interview, we realized that the mother has invested a great effort in order to increase V.'s potential, creating a wider system of needs. That was oriented to enrich his verbal repertoire and also to integrate him into interactive games and social situations. There was neither a formal and complete test battery application nor scores, although V. was encouraged to work on some item taken from the Peabody test (PDMS-2, subtest: stationary, grasping, visual-motor integration) and a pragmatic protocol based on Prutting and Kirchner (1987) was used.

V. was initially observed and assessed for ten hours in four working sessions. From the first contact, we observed some behaviors that show us his desire to communicate and make contact, but using a limited repertoire of skills to do so. In fact, he rarely made intentional visual contacts with the assessor in the course of the first two sessions. However he did so with his mother using gestures and his own *sound word*. He also produced some voice inflections and repetitions depending on his interests. Speech was constant and repetitive; some times he interrupted it, keeping silent and abandoning any toy or concrete material which had been given to him. He was usually making stereotype movements with his body or hands. It was not easy to take him out of that kind of absence, nevertheless at the moment something was mentioned relating to his mother or grandmother, he immediately turned back to us or to the material he was touching.

Perception	General knowledge	Quantitative	Following instructions	Perceptual and functional relationships	Perceptual tracking
Identification of simple figures	Part-Whole Progressions	Counting Dots	Spatial orientation	Part-Whole Functional Part-Whole	Labyrinth

Table 1. Areas of cognition assessed by LPAD-Basic instruments used with V., a child with autistic spectrum disorder

The assessment started to explore those conditions which would permit to establish an effective and longer contact and basic interaction with the child. For this purpose, we used some LPAD-Basic instruments in order to assess both his level of functioning and modalities of operations and problem solving behavior, in the areas of perception, general knowledge, quantitative, fol-

lowing instructions, perceptual and functional relationships, perceptual tracking.

These instruments allowed to us to assess the accuracy, clarity and consistency of the perceptual process; basic knowledge and quantitative concepts, evaluation of spatial orientation through following directions; perceptual Gestalt, classifying and categorizing, the recognition of geometrical figures, ordering and sequencing through the modality of pictures and puzzles; perceptual tracking and motor planning; grasping and reacting to incompatibilities and absurdity.

Mediation of intentionality and meaning were the way to initially create eye contact with the mediator. Telling stories in which his mother or grandmother were the protagonist, were the way to establish communication, because he was so enthusiastic about them that V. started to address them to us. Increasing attention span and ability to focus attention unhindered by peripheral distractions were our principal goals of mediation in order to enable him to increase the period of time attending a task. The ability to distinguish critical stimuli from the background was also mediated. The required mediated intervention was strongly concrete in those situations where he had to manipulate more than two objects. The mediation process was then oriented to explore the presence of mental tools that would enable him to understand simple instructions and to follow them. We started using most meaningful stimuli, i.e. pictures of his parents, grandparents, younger sister and/or mediators' faces and gestures. The content consisted of different emotions he had to identify on its specific and proper features according to close experiences and context. Later on, we kept the same instructions but moving further away to events and people not related to his own and restricted system of needs.

Mediation process

Criteria	Moment	Strategies
Intentionality and reciprocity	Before letting him to be involved in the task	Physical control of his head, affective contact, holding
Meaning	Before and during the learning process.	Telling stories related to V.'s family and connected to the situation
Regulation of behavior	Before and during the learning process.	Increasing inflexion and intensity of the mediator's voice

| M., a child with Down syndrome

M. was referred at the age of five years and eleven months. He is the second of three children. He was attending a regular pre-school kindergarten. He also attends to a Down syndrome foundation for a supporting program in speech therapy and preschool programme three times a week.

In the first session M. presented to us as a child with rather good speech and a great capacity to define the problem in different tasks by his own. He was able to be concentrated the first minutes of the activity. Nevertheless the path of his functioning was perceptual and leaded by his own motivations, giving evidences of a strong lack of self control and planning behavior and constantly manipulating the adults who were around him.

He refused to be involved in activities which were not in his need system, inserting a strong barrier between him and the examiner. He showed himself as a skilful performer but he was extremely used to act by repeating conducts without understanding. We used some tasks taken from LPAD Basic instruments in order to assess a variety of cognitive functions and mental operations in different modalities and with an increasing level of complexity and abstraction.

Perception	**General knowledge**	**Quantitative**	**Following instructions**	**Perceptual and functional relationships**	**Seriation**	**Memory**
Basic Complex Figure Drawing test	Part-Whole Progressions	Organization of Dots	Spatial orientation	Part-Whole Functional Part-Whole	Progression of Pictures	Functional associative recall

Table 2. Areas of cognition assessed by LPAD-Basic instruments used with M., a child with Down syndrome

Mediation was initially addressed to the following cognitive functions: attention span; restraining superfluous conversation; ongoing improvement in temporal orientation and understanding and estimation of the passing of time; sequencing events in terms of a logical or time progression; spontaneously comparing behavior; planning behavior.

Mediation process		
Criteria	**Moment**	**Strategies**
Intentionality and reciprocity	Before letting him to be involved in the task	Make a written plan and check list
Transcendence	Before and during the learning process	Discussing other situations it would possible to be applied
Regulation of behavior	Before and during the learning process	Role playing

Results

In this first year of intervention it has been possible to recognize dramatic changes in V.'s behavior, which are mostly in the input cognitive functions domain and the motivational and affective area. At the present moment, V. has increased his verbal repertoire using three or four meaningful and appropriate words in those situations when he wants to be involved in or when he does not, establishing an objective and effective connection with the other through visual and/or tactile contact, transforming the primitive "*ta*" in a different code to communicate himself, his wishes and basic emotions, showing himself warmly, indifferent or angry. The attention span increased, enabling him to follow a same activity much longer than the beginning of the treatment and increasing the tolerance to frustration. He also has learned during a directed task to restrain superfluous and non-pertinent conversation. These changes have impacted his functional structure remaining stable in time and resisting to the variation of original conditions where the first learning took place. In this sense, V. knows now to whom to address his looking and greetings, deciding to do so from the consideration whether a person belongs to his familiar system or not. The role of the adult has been changed in a certain way, passing from the constant concern for taking the initiative investing energy, time and different means to establish an interaction with V., to the one who has to pay attention to his desires and attempts for communicating his emotions. The way to reach all these outcomes was always the same: to invest a great mediation before allowing him to act, being explicit in communicating one's intentionality and especially giving a personal meaning to each activity, task or situation where V. must be involved, focusing his attention to the me-

diator's face or to the relevant part in concrete stimuli. The mediator must emphasize the tone curve of the voice, even using music to do so, according to the proper communicative intention or specific emotion that he/she wants to transmit. In our opinion there are meaningful samples of changes suggesting that the modifiability has been deep and structural, and has created a few new behaviors and learning in others fields of V.'s functioning.

Features of manifest level of functioning	**Samples of changes**
Limited repertoire of skills to express himself	Verbal repertoire was increased (No, right, Mom, Dad). He decide to whom address his attention
No one meaningful word ("ta")	Using a unique sound - word ("ta") with different intentions according to his current emotions
Need of using an alternative communication system	Using words in appropriate context
Repetitive speech	Restraining superfluous and non pertinent conversation
No visual contact	Visual and physical contact to communicate with others
No focusing. 2' Attention span	Attention span rises up to 10-15 minutes
High distractibility	Increasing tolerance to frustration

Table 3. Sample of meaningful changes in V., a child with autistic spectrum disorder

After ten months working with M., it is possible to state a relevant sample of changes, enhancing cognitive functioning prerequisites and self regulation of behavior abilities (table 4). This may offer the possibility to go ahead in his learning process, which was very interfered because of his high distractibility tendency and a low level of reasoning in his performances. M. has been enhanced with a larger repertoire of cognitive strategies and principles to understand a problem or a given situation, which enable him to establish a plan before acting.

Mediation also enabled M. to be more attentive and willing to be open to an analytic process, investing more time to observe and gather information. It is important to point out that mediation was given from a concrete and physi-

cal manner in the first sessions towards a more abstract verbal mediation in the last period of treatment. Mediation of intentionality and transcendence before initiating an activity was the *key* to get reciprocity from him and to create those conditions to work for a longer period of time, accepting other proposals and making conscious efforts to keep his behavior under his own control.

Features of manifest level of functioning	**Samples of changes**
High distractibility	Increased attention span
Loquacity and non pertinent conversation	Restrain superfluous conversation during the activity by himself
Used to act by repeating and without understanding	Invests time to understand the different steps of the activity
Lack of self control	Makes a plan before acting
Non planning behavior	Follows the sequence a working session
Low tolerance to frustration	Increased tolerance to frustration
Restricted motivation system	Enhanced internal motivation

Table 4. Examples of meaningful changes in M., a child with Down syndrome

Discussion

With the help of a dynamic interactive assessment, based on Feuerstein's LPAD, it has been able to show significant samples of learning propensity in children with severe language, communication and cognitive dysfunctions. The LPAD, is a set of tools and mediational intervention strategies to assess the propensity to acquire a richer cognitive repertoire, searching for those conditions needed to provoke critical changes in different dimensions of human functioning. Its dynamic, interactive, systematic, yet flexible approach not only permits to observe the learning process directly, but also to create opportunities to activate and mediate the use of psychological tools not yet available in the cognitive repertoire. The two learners that we have referred to, have benefited from these mediational processes to modify behaviors that previously had been assumed to be permanently deficient. Classic functional assessment, using standardized scales, merely focuses on deficiencies and often concludes too hastily that absence of function means permanent loss. It is

often based on a static, deterministic model of development. But the absence of a learning phase in classic assessment precludes possibilities to look for possible changes. There is never enough time to look for them. On the other hand, mediated learning experience for children who have not yet acquired cognitive functions demands more attentive and systematic interaction. It is necessary to work at eliciting and evidentiating micro changes in order to make children, parents and educators enough aware to appreciate the long course of structural modifiability. Certainly, in the limited time of assessment (altogether 15 hours in the first phase, plus twice weekly sessions of 1 ½ h) changes are still not stable because of the strong and numerous deficiencies they have. Despite this, the outcomes obtained at the present time suggest that dynamic assessment and intervention point to the capacity of human modifiability and can offer a concrete and hopeful way to overcome the obstacles and resistances in families and educational institutions.. This yields much more relevant information for parents and teachers, whereas classic assessment often ends with superficial information and negativistic prognosis.

Mediation of intentionality and reciprocity, meaning and transcendence, establishes a reciprocal interaction with the child, stimulates motivation, enlarges its needs' system and generates new habits and behaviors in children whose parents and teachers often do not expect.

One of the difficulties is to know whether and how these new behaviors may be transferred to other contexts, and become a structural cognitive change, so that they are used independently by the child; and how to make them more resistant to the transformation of original learning situation where they have been mediated.

Another difficulty is the qualitative nature of the whole process, in data gathering and reporting. The whole is entirely dependent on the quality of the mediational interaction process, thus on the examiner. This may be a strong as well as a weak point. The strong point is that excellent mediators may bring about significant changes. The weak point is the lack of objectifiable quantified operationalization of test results and mediation. Case studies have little value when it comes to an evidence-based approach. Because of the very relational character of the cause of change – i.e. mediation – it is not reproducible in a deterministic way, as one would apply any technique. However, the evidence base could be enlarged when research is done with more single case control studies like the ones presented. Moreover, because of the very educational qualitative and flexible nature of the mediated learning process, flexibility of procedures and reporting are inherent and essential. Quantifiable

operationalisation or standardization risk to bypass these essential characteristics, which may harm the process.

It seems to us that through dynamic mediated assessment a way is given – besides offering a better mediated learning experience - for a more coherent interaction with family and educational system. So far, our target to elaborate mediated guidelines to parents and teachers, so that environments and interactions can be enriched; and through the movement from passive to active attitude, it is possible to change the pessimistic view of development towards a stronger belief system in human modifiability.

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Part **2**

Papers on specific topics

Learning Mathematics in a more Cognitive Way

MATHEMATICS FOR EVERY ONE: A PILOT PROJECT OF TEACHING MATHS TO CHILDREN WITH INTELLECTUAL IMPAIRMENT

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Abstract: This is an empirical report about mathematics education for children with intellectual impairments in the Netherlands, Czech and Slovak republic. The process and a method of maths teaching are described, which is based on mediated learning experience. Based on a successful "pilot" project with a child with Down syndrome, it has been generalized for similar children.

For a lot of children with intellectual impairments, as for children with Down syndrome, it is hard to do mathematics. So very often it is not done. But in life mathematics is really important, e.g. in cooking, public transport, shopping and social games.

The author has a daughter with Down syndrome to whom she taught mathematics. After having successfully completed high school, she started to teach maths to other children with intellectual impairment and also these children learned to do mathematics.

Despite affluence of maths programmes for special needs children on the existing market, she had not found an optimal method so the author designed one of her own. Having experience with Feuerstein's Instrumental Enrichment Programme, she introduced the elements of Feuerstein's theory in her approach.

The method starts with counting and goes beyond 100. The operations of plus, minus, multiplying, dividing, time, using money and measurement are all part of this method. Every small step is learned separately. There are always a lot of exercises. Because of these very small steps, the method has a lot of effect. It is presented in separate pages one can take out; the original page is never used. Very often the child has to do a page again.

There are a lot of math games. Every child likes them and does maths without realizing that it is doing maths.

With this method a lot of children, who were described as never being able to do math, make sums, even over 100, and without counting on their fingers. They became able to pay in a shop; they know the time and are able to do recipes for 2 to 4 persons.

Mathematics for every one

Every child should have the right to have the opportunity to learn mathematics. In many cases school inclusion doesn't mean that there is also inclusion in mathematics education. The only reason why we don't teach our retarded children how to use math is that we suppose that they aren't able to learn to do so.

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| Why is mathematics also for children with intellectual impairment so important?

Beside school inclusion, inclusion in daily life is the most important. In many circumstances in life you need mathematics. Even for a simple jumping game, you have to know the numbers. In my opinion it is essential to take part in games.

An example. Margaret was 18 years old when she started with maths. She didn't know a single sum. According her school, she would never be able to do maths. Now she is playing a game. She now knows that six added by six is twelve. She is able to handle money. She learned to do so in a game with real money. For example, when she has to pay thirty three euros. She has learned to take 20 added with 10 is thirty, added with 2 and one Euro.

When do we use maths in daily life?

- To shop
- To read time. What is the time, how long do I have to wait for the train?
- To pay: in a shop, but also during a game, do I have enough money with me?
- To cook: how to adjust recipes and the number of persons for dinner, to measure, to weigh.
- To use a telephone
- To play games
- To do sports: to swim four lanes, running hundred meter, the score is 5 to 2
- To play music;
- To travel: the bus number, time of departure of trains.

Prerequisites for learning mathematics

To learn math one must meet certain conditions. These conditions apply to the child, teacher, the environment and the method

| Conditions for the child

What are the most essential conditions which a child has to fulfil in order to learn maths?

To be systematic. When a child isn't able to work systematically, maths is not possible

Concentration. If a child is not able to concentrate itself for a longer time, learning maths is not possible.

Motivation. The child has to be motivated to learn. If there is no motivation to learn maths, it could start to be motivated to please the teacher, for example for a compliment. At a later point there will be a motivation to do maths.

Independent. Children who are totally incapable of doing something autonomously, will achieve little in maths. They will remain dependent on support by a teacher or other person, without finding a solution of their own.

Good behaviour. Many children have behavioural problems to such an extent, that learning and particularly maths is not possible. For example children who always enforce their own will, who don't listen, who play during lessons and won't sit quiet. In short, children who are not cooperative in carrying out instructions, are hard to teach.

Memory. A bad memory, temporary as well as long term, auditory as well as visual, makes maths more difficult. When doing sums often, there has to be recognition of numbers. A lot of sums have to become automatized.

Visual and auditory perception. Children who have difficulties in vision and hearing, (especially when teachers don't notice this) will have more problems in using maths. Often these problems aren't recognised enough.

Talking. When a child doesn't pronounce numbers clearly, a teacher can't judge if the answer is correct. For example in the Czech language the numbers 3 and 4 sound often almost similar. This problem can be solved by letting the child point the number that it really means. This is far better than having to guess what the child means.

Visual discrimination. The child has to discriminate between numbers for example between the 2 and 3, the 2 and the 5, the 6 and the 9.

Writing. It is possible to start maths even when the child is still not able to write. This is possible by sticking numbers and Velcro. One has to consider that learning maths in this case is harder. However a lack of ability to write can never be a reason not to start learning math.

All the above mentioned prerequisites are subject to modifiability, i.e. they are basic cognitive functions which can be activated. A child can learn to become more systematic, more autonomous, more disciplined, more intrinsically motivated, expand its memory capacity, visual discrimination, etc.

| Conditions for the teacher

What are conditions which teachers have to fulfill?

Expectations. What is the teachers' objective? Does he believe in the possibility that the mentally retarded child is able to learn maths? Many times I got the message: "This child isn't able to learn math," without even trying to do so.

Meaning. The teacher has to motivate the child, by showing the child the usefulness of math. Also he has to reward, to offer a challenge, to organise games with regard to maths and to show, for example in a shop what the purpose of maths really is.

Adaptation to each child. The teacher has to adapt his method and teaching program to the individual child. Sometimes these are minor adjustments, but in other cases new materials have to be explored.

Systematic. Math teaching demands a systematic approach of teacher and child.

Tutoring method. There are stimulating ways of giving maths. The teacher has to take in consideration the child and its situation, the use of right materials, games, to shop, and so on.

| Conditions of the environment

The environment consists of parents, grand parents, siblings, relatives, trainers, but also the normal daily social system, such as the baker and the butcher.

To think positively. All participants have to believe in the possibilities of the child, otherwise it is almost impossible to learn maths.

Stimulating attitude. A good environment should be stimulating, and support actively the use of maths in daily life.

Stimulate the use of mathematics in daily life. Especially in the family the child has to realise the use of counting and maths while functioning normally. This is why it is important too to take your child along while shopping, preparing the table and divide cookies. Expose the child to all kinds of normal life experiences and mediate these experiences to them.

Learning to behave well. The family, especially the parents, will have to take care that the behaviour doesn't work counterproductive to learning maths. That is why parents should not spoil a child, take care that appointments are kept and the child will follow instructions.

All people involved should work in the same way. This doesn't apply to maths alone, but also for behaviour in general.

| Conditions of the method

Small steps. Sometimes very small steps are need, especially with young children or older children functioning on a lower cognitive level. Sequence of steps: a right order of steps is needed. Do not skip steps at any time! Explain every step separately and work with the learned matter. In each step introduce just one new part. In most maths books usually more steps are practised at the same time. For example the sum 14 added by 3 is a different kind of sum than 3 added by 14. The last example is a new step.

Systematic. Obviously every method of teaching maths needs to be systematic. Surprisingly this is often missing. Many repetitions are needed. In most methods there is a lack of rehearsal. Lots of different exercises, variations on the same theme, are mandatory. There have to be lots of different exercises and plenty of materials to practise.

Bridging 10 (for example 8+5 and 13 – 7). Most methods deal with this, but it is very important to always use the same systematic method. For example, always divide numbers in parts so you can handle them in an easy way. The child experiences security.

First understanding then generalization. Eventually the child has to be able to know a lot of sums by heart, such as all sums below 10.

Flexibility. Very often you have to change the way of teaching, in function of the child' understanding.

No counting on fingers. When one starts counting on fingers it is almost impossible to end this. It is better to use materials such ass blocks.

Method

We composed a maths method called "**Mathematic step by step",** especially made for children with learning problems. The book has been composed in Dutch and translated into Czech language.

| Chapter 1

Look whether the child is able to start learning maths. Is the child's behaviour adapted, does he talk, is he able to count and does he understand what he is doing?

Check if the child has the ability of visual discrimination. Does the child recognize numbers, even if they are offered in a different way?

Understanding numbers. Often children can count but don't understand exactly what they are doing. Check the understanding of numbers.

When there is no understanding of numbers, I start with this exercise: "Here Sam is learning the number 2. I tell him only to colour when there are two. When he masters this, do the same with three, and so on.

Teaching to write is instructed separately, not during maths lessons. Also in the process of learning how to write, there has to be a lot of repetition and many more practice than in the case of a normal child.

| Chapter 2

Counting 1 to 6 is done in different ways. As the child is not able to write very well at this moment, use plastic numbers or stickers. Even older children or adolescents who do not yet know how to count, can still learn to do so. For example, Jitka, at the age of 20 is very proud that she can count a little. There are always a lot of games you can use to activate this. If you're able to count to six it is possible to help while doing shopping.

| Chapter 3

Counting till ten, but now with dots. Encircle the right number. It's getting more abstract. The figures have been replaced by dots. Again a lot of different exercises and games. Who is able to count till ten, will be able to use a telephone.

| Chapter 4

Add and subtract one and to learn to split in subgroups. To learn the symbols +, -, = and the definitions to add, to subtract and to part. With help of the arithmetic ruler (with and without numbers)it is easy to make the sums.

| Chapter 5

Sums till ten, adding, subtracting and parting. Starting with sums from 2.

2 = 2 + 0	2 – 0 = 2	2 + 0 = 2
2 = 1 + 1	2 – 1 = 1	1 + 1 = 2
2 = 0 + 2	2 – 2 = 0	0 + 2 = 2

First the sums are separated, then mixed.
After the 2 all the other numbers are done.
First separated, then mixed and then mix of all sums done before.
There are a lot of games in the book.

| Chapter 6

Numbers till a hundred. All numbers from 10 till 100 are learned, their writing, pronunciation and value. Here I use a bingo game with numbers till 100. Take one block, read what it says and the one that has the number may place the block on his board. In Dutch the number 31 is pronounced in a different order 'éénendertig" than 31 in English or in Czech (třicet jeden). It is very difficult to understand the difference between speaking and writing.

| Chapter 7

Sums between ten and one hundred. One of the most important parts of maths, often a very difficult part for children with intellectual impairment. In this chapter the number ten is exceeded. The numbers are split in parts which can be easily added or subtracted.

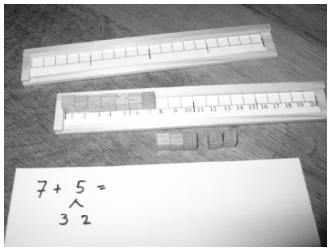

Figure 1. Example of bridging 10 using splitting and arithmetic ruler. 7 + 5 = ?

In the example of 7+5 =? (Figure 1) we use the arithmetic ruler in explaining the adding of the numbers seven and five. The number seven is completed till ten. To do this you need three blocks. The five blocks in this example are divided in three and two bocks each. 7 + 3 = 10 10 + 2 = 12

In this example I subtract numbers surpassing the tens. First I subtract till ten and then I continue subtracting the remaining number.

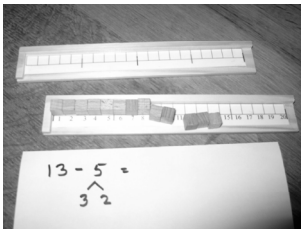

Figure 2. Subtracting across 10.
Using blocks and arithmetic ruler

13 – 5 = 13 – 3 = 10 10 – 2 = 8 On the arithmetical ruler. When the child has had sufficient practice with these exercises, one often sees that it will become able to join many games!

| To multiply

On the arithmetic lat (reaches till one hundred) designed by me, multiplying with numbers is easy to learn by every child.

| To handle money

The ability to handle money is an important factor to function on a normal social level. To handle money well is not problematic to learn, provided that one teaches this matter in small pieces and with the right method. Even children with a limited ability to learn maths, can learn how to pay.

| The clock and reading time

To travel independently, one has to be able to use the clock. It is very difficult, but not impossible, to learn to infer e.g. that when it is 25 past 6 on a watch and the train is leaving at 18:32, one has to wait another seven minutes.

| Fractions

In practice fractions are not as hard as everyone thinks they are. Provided they are explained step by step, with a lot of practical examples (like splitting up a cake). Fractions are not more difficult than adding or subtracting. Sometimes one hears sceptical remarks such as "Do people with intellectual disability need fractions?" Of course, they do, but it all depends on the level of activation and functioning one wants (or believes is possible) to obtain. A good example is music in which half a note is of even length as two quarter notes. Two quarter notes are of even length as four notes divided by eight.

Case studies

So far we have worked with 50 children in the Netherlands (age 3-30, 50% Down syndrome and 50% PDD) and about 50 in the Czech and Slovak Republics (age 3-30, 100% Down syndrome). In the Netherlands parents are increasingly requesting inclusive education, but many meet a harsh resistance. It is not yet customary (see Lebeer, this volume). The children in the Czech and Slovak republics, especially the pre-school age ones, have only recently started integration into mainstream schools. In all children it has been possible to teach mathematic principles with some success. Sometimes already at a relatively advanced age. For example, Jill, a child with Down syndrome, aged 12, did not know how to do a simple mathematical operation such as 2+2; she did not know how to read the clock. She started to do sums below ten. Her teachers stated, that she would never be able to learn maths. In a short time she learned a lot and now she is studying happily at a regular high school in the section "vocational training". To measure, to weigh, to read and transform recipes are all part of normal life. Jill is one of her class, she knows what the time is, she is able to assist in a shop; she joins her sister in playing games, in short she takes an active part in social life. Without learning to use maths this couldn't have been possible. Recently she said "Maths is all around you".

Conclusion

Inclusion in life, joining others, to be part of a regular group without being able to use maths is very difficult. This pilot project demonstrated that it is possible to learn maths and be part of the regular group even for children and

adolescents with moderate to severe intellectual impairments, who are usually considered incapable. A lot of the students in the groups didn't know how to use maths; they were also not expected to do so by others. The conquest of maths has given them a sense of achievement and joy.

Of course, the next phase would be to do a more systematic research on effects, specificity and efficacy of this approach, in order to enlarge the evidence base. There are many methods for special needs on the market, some of which claim to be highly effective. It is very well possible that, more than the specificity of the method, it is the attitude and energy of the mediator and environment which are the most decisive factors.

CREATING RIGOROUS MATHEMATICAL THINKING: A DYNAMIC THAT DRIVES MATHEMATICS AND SCIENCE CONCEPTUAL DEVELOPMENT

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Introduction

Several longitudinal studies are being conducted to demonstrate the efficacy of a new paradigm for accelerating and deepening the creation of higher-order mathematical thinking and mathematics and science conceptual development. The paradigm operationalizes constructs of a theory of rigorous mathematical thinking (Kinard, 2000) through Feuerstein's Instrumental Enrichment (FIE) program with Mediated Learning Experience (MLE, Feuerstein, 1980). This paper presents the paradigm and some initial results from one of the studies that targets inner-city youths who have experienced previous academic failure and possess the so-called traits that are presumed to place limits on individual difference (see, for example, Hernstein and Murray, The Bell Curve, 1994).

The Mathematical Thinking Dynamic

Kinard (2000) defines rigorous mathematical thinking as the synthesis and utilization of mental operations to:

- derive insights about patterns and relationships;
- apply culturally derived devices and schemes to further elaborate these insights for their organization, correlation, orchestration and abstract representation to form emerging conceptualizations and understandings;
- transform and generalize these emerging conceptualizations and understandings into coherent, logically-bound ideas and networks of ideas;
- engineer the use of these ideas to facilitate problem-solving and the derivations of other novel insights in various contexts and fields of human activity; and,

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- perform critical examination, analysis, introspection, and ongoing monitoring of the structures, operations, and processes of rigorous mathematical thinking for its radical self-understanding and its own intrinsic integrity.

Theoretical Construct I

A construct of this theory is that rigorous mathematical thinking is a dynamic that structures a logical framework and an organizing propensity for numerous socio-cultural endeavors through its discovery, definition, and orchestration of those qualitative and quantitative aspects of objects and events in nature and human activity. The enigma of the apparent universal intrinsic pervasiveness of order, structure, and change is continuously intriguing. It is through mathematical thinking that the human mind can attempt to discover and characterize underlying order in the face of chaos; structure in the midst of fragmentation, isolation, and incoherency; and, dynamic change in the context of constancy and steady-state behavior. Mathematical thinking structures and creatively manipulates growing systems of thought as change, order, and structure are defined and uniquely moved through a process of conceptualizing to depict and understand evident and underlying patterns and relationships for each situation under examination.

Mathematics is the study of patterns and relationships. In modern mathematics, such study is facilitated by culturally derived devices and schemes that were constructed through and are driven by the mathematical thinking dynamic. These culturally derived devices and schemes are synonymous with Vygotsky's conceptualization of psychological "tools" (see Kozulin, 1998). Kozulin, in elaborating on Vygotsky's conceptualization, stated, "Psychological tools are symbolic artifacts – signs, symbols, texts, formulae, graphic-symbolic devices – that help us master our own 'natural' psychological functions of perception, memory, attention, will, etc." (Kozulin, 1998).

Symbolic devices and schemes that have been developed through sociocultural needs to facilitate mental activity dealing with patterns and relationships are mathematical psychological tools. The structuring of these tools has slowly evolved over periods of time through collective, generalized purposes of the transitioning needs of the transforming cultures (see, for example, Eves, An Introduction to the History of Mathematics). Both the creation of such tools and their utilization develop, solicit, and further elaborate higher-order

mental processing that characterizes the mathematical thinking dynamic (see Figure 1). Mathematical psychological tools range from simple forms of symbolization such as numbers and signs in arithmetic to the complex notations and symbolizations that appear in calculus and mathematical physics such as differential equations, integral functions or Laplace Transforms. Mental operations that are synthesized, orchestrated and applied which characterize mathematical thinking are presented in Table 1. Evidence of the logical framework and organization of modern mathematics is reflected through both the hierarchal nature of its system of psychological tools and sub-disciplines and the progressive embodiment of the conceptualization process from simple arithmetic through mathematical physics.

Mental Operations that Characterize Mathematical Thinking
Abstract relational thinking
Structural analysis
Operational analysis
Representation
Projection of visual relationships
Inferential-hypothetical thinking
Deduction
Induction
Differentiation
Integration
Reflective thinking with elaboration of cognitive categories
Conservation of constancy in the context of dynamic change

Table 1.

Mathematics, with its system of psychological tools and mathematical thinking dynamic, is the primary language for basic and applied science. Language provides the vehicle for the formulation, organization, and articulation of human thought. Science is a way of knowing – a process of investigating, observing, thinking, experimenting, and validating. This way of knowing is the application of human intelligence to produce interconnected and validated ideas about how the physical, biological, psychological, and social worlds work (American Association for the Advancement of Science, 1993). Scientific thought processes comprise cognitive functions, mental operations, and emerging conceptualizations associated with this way of knowing to under-

stand the world around us. The psychological tools of mathematics and the mathematical thinking dynamic provide the vehicle and energizing element to promote the processes of representation, synthesis and articulation – a language for scientific thought at the receptive, expressive, and elaborational levels. The American Association for the Advancement of Science states in Science for all Americans (1990) that "mathematics provides the grammar of science – the rules for analyzing scientific ideas and data rigorously."

Since mathematical thinking synthesizes and utilizes a spectrum of cognitive processing that advances onto higher and higher levels of abstraction, it has to be rigorous by its very nature. Kinard and Falik (1999) delineate the following as elements of rigor:

| Fundamental Elements of Rigor

- Sharpness in focus and perception
- Clarity and completeness in definition, conceptualization, and delineation of critical attributes
- Precision and accuracy

| Systemic Elements of Rigor

- Critical inquiry and intense searching for truth (logical evidence of reality)
- Intensive and aggressive mental engagement that dynamically seeks to create and sustain a higher quality of thought

| Higher-order Superstructures of Rigor

- A mindset for critical engagement
- A state of vigilance that is driven by a strong, persistent, and inflexible desire to know and deeply understand.

The high level of abstraction, logical integrity, and organizing propensity of mathematical thinking imbue it with an overarching usefulness and applicability that pervades and drives numerous fields of human endeavors including natural and social sciences, agriculture, art, business, engineering, history, industry, medicine, music, politics, sports, etc. The dependency of science on

mathematical thinking was voiced by Plato around 390 B.C.:

> "…that the reality which scientific thought is seeking must be expressible in mathematical terms, mathematics being the most precise and definite kind of thinking of which we are capable. The significance of this idea for the development of science from the first beginnings to the present day has been immense."

Theoretical Construct II

Rigorous mathematical thinking engineers and formulates higher-order conceptual tools that produce scientific thinking and scientific conceptual development.

Theoretical Construct III

The constructs of the theory are operationalized through a paradigm that consists of MLE and FIE, along with a unique blend of the operational concept of rigorous thinking (Kinard and Falik, 1999), the appropriation of culturally derived psychological tools as described by Kozulin (1998), and Ben-Hur's model of concept development (1999).

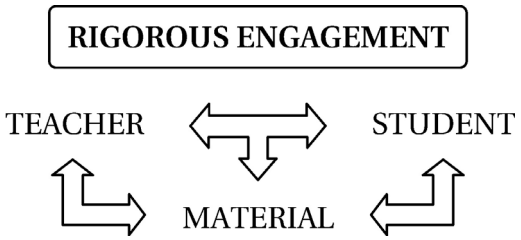
The Paradigm

Creation of rigorous mathematical thinking and mathematical-scientific conceptual development is structured and realized through rigorous engagements with patterns and relationships (see Figure 2). The structuring and maintenance of the engagement are engineered through MLE. Professor Reuven Feuerstein defines MLE as a quality or modality of learning that requires a human mediator who guides and nurtures the mediatee (learner) using three central criteria (intentionality/reciprocity, transcendence, and meaning) and other criteria that are situational (Feuerstein and Feuerstein, 1991). The learner is mediated while utilizing the comprehensive and highly systematic sets of psychological tools of the FIE program to begin realizing the six subgoals of the program: correction of deficient cognitive functions; acquisition of basic concepts, labels, vocabulary, operations, and concepts necessary for FIE; production of intrinsic motivation through habit formation; creation of task-

intrinsic motivation; and, transformation of the learner's role into one of an active generator of new information.

During the realization of these subgoals many of the psychological tools of the FIE program are appropriated as mathematical psychological tools, as delineated by Kozulin (1998), using the MLE central criteria. As the learner acquires and utilizes these mathematical psychological tools to generate, transform, represent, manipulate, and apply insights derived from patterns and relationships, rigorous mathematical thinking is created. As mathematical thinking is unfolding, the learner is rigorously mediated to utilize his/her day-to-day perceptions and spontaneous concepts to construct mathematical concepts. During the process the learner is mediated to utilize his/her mathematical thinking and conceptualizing to formulate scientific conceptual tools to build higher-order scientific thinking and science concepts.

The FIE program provides rich avenues through which concept development can emerge within the learner according to the five principles of mediation practice described by Ben-Hur (1999). These five principles are: practice, both in terms of quantity and quality; decontextualization; meaning; recontextualization; and, realization.



External/Internal Environment
of Student and Teacher
Lesson/Content

The interactions developed through rigor are dynamic (exciting, challenging, and invigorating), interdependent, and transformative. When these bidirectional interactions permeate each other to produce dynamic reversibility throughout the channels of interaction, rigorous engagement has been initiated.

[Developed by James T. Kinard]

Research Results

Data were produced through pre- and post-cognitive testing, analysis of audio and video taped sessions of the interventions, case studies of students through their journals of reflection, and "talk out loud about your thinking" by students as they performed tasks and solved problems.

| Pre- Post-tests in a Logico-verbal Modality

Logical Reasoning-Inference Test, RL-3

Parallel pre- and post-versions of Logical Reasoning-Inference Test, RL-3, developed by Educational Testing Service (Ekstrom, et al., 1976), were administered for each intervention. Each item on the test requires the student to read one or two statements that might appear in a newspaper or popular magazine. The student must choose only one of five statements that represents the most correct conclusion that can be drawn. The student is instructed not to consider information that is not given in the initial statement(s) to draw the most correct conclusion. The student is also advised not to guess, unless he or she can eliminate possible answers to improve the chance of choosing, since incorrectly chosen responses will count against him/her.

Ekstrom et al. (1976 and 1979) defined the cognitive factor involved in this test as "The ability to reason from premise to conclusion, or to evaluate the correctness of a conclusion." These authors further stated: "Guilford and Cattell (1971) have sometimes called this factor "Logical Evaluation." Guilford and Hoepfner (1971) pointed out that what is called for in syllogistic reasoning tasks is not deduction but the ability to evaluate the correctness of the answers presented. This factor can be confounded with verbal reasoning when the level of reading comprehension required is not minimized.

The complexity of this factor has been pointed out by Carroll (1974) who describes it as involving both the retrieval of meanings and of algorithms from long-term memory and then performing serial operations on the materials retrieved. He feels that individual differences on this factor can be related not only to the content and temporal aspects of these operations, but also to the attention which the subject gives to details of the stimulus materials."

Three FIE-MLE practitioners, first independently and then collectively, analyzed test items on RL-3 for their required use of cognitive functions and operations to be performed successfully by the student.

The following is a summary of their work.

The student must engage in logical reasoning which requires abstract relational thinking at various levels of complexity. The student is required to interrelate data from the statement(s) with data from potential conclusions to ensure total coherency – that is to conserve constancy in relationships and meaning at various levels of complexity and abstraction. The linkage between the sources of information (the statement(s) and the potential conclusion) is established or denied through inferential thinking – a bridge that requires abstract relational hypothetical thinking to construct, with the underlying supports of precision and accuracy. The statement(s) and the conclusion are in a specifics-to-general or general-to-specifics relationship. The student's thinking must conserve relationships and meaning as it transforms their expressions into higher levels of abstraction in order to encompass broader spectra of abstraction and complexity and vice versa.

The primary cognitive operation required throughout each version of the test is abstract inferential relational thinking with various levels of complexity. This operation's required deductive and/or inductive thinking is created while the student draws from his/her repertoire of prior knowledge to do further relational thinking to provide the logical evidence for the evaluation of the validity of the conclusion. The range of the cognitive functions and operations for the pre-test was comparable with the range for the post-test, although not sequenced item by item.

The test is indeed in a logico-verbal modality with a demand in language use and an embedded requirement of reading comprehension at various levels of abstraction and complexity.

| Pre- and Post-tests in a Figural Modality

Visualization Test - VZ-2

Parallel pre- and post-versions of Visualization Test, VZ-2, developed by Educational Testing Service (Ekstrom, et al., 1976), were administered. The authors of the test define the cognitive factor as "the ability to manipulate or transform the image of spatial patterns into other arrangements."

The instrument used in this research is the Paper Folding Test – VZ-2. The student is instructed to imagine the folding of a square piece of paper according to figures drawn to the left of a vertical line with one or two small circles drawn on the last figure to indicate where the paper has been punched

through all thicknesses. The student is to decide which of five figures to the right of the vertical line will be the square sheet of paper when it is completely unfolded with a hole or holes in it. The student is admonished not to guess, since a fraction of the number incorrectly chosen will be subtracted from the number marked correctly.

Two FIE-MLE practitioners analyzed each item to determine the cognitive processing required to successfully perform the task and choose the correct answer. A summary of their findings is given below. The student must integrate the use of relevant cues and the sequencing of figures to mentally define and restructure the components of the field onto a unified spatial presentation through visualization. There has to be a high level of conservation of constancy in size, shape, orientation, and location in the face of spatial and temporal transitions. The output requires projection of virtual relationships with precision and accuracy. Both the pre- and post-test increase, to the same degree, in difficulty from the first to the last item. The latter items require intensity in conserving constancy with very high levels of novelty, complexity, and abstraction. These items require deep internalization, integration, and structural and operational analyses.

Data for RL-3 and VZ-2 are presented in Table 2 and Figure 3. The pretests were administered prior to the initiation of the intervention. The posttests were administered at 25 hours of intervention. Notice that the gain scores were positive for most students on both tests. These results demonstrate that cognitive dysfunctioning is being corrected and the mental operations of abstract relational thinking, inferential-hypothetical thinking, induction, deduction, integration, structural analysis and operational analysis are being developed. These mental operations help to characterize the mathematical thinking dynamic.

Emerging Conceptualizations and Mental Operations

A concept and mental operation that is highly fundamental to mathematical thinking is conservation of constancy in the context of dynamic change. The development of this concept and mental operation was initiated from the first sheet of the first instrument, Organization of Dots, of the FIE program.

The paradigm structures practice for the learner to develop and utilize this concept and operation in the defining, characterizing, transforming, and ap-

plying aspects of patterns and relationships through pictorial, figural, numerical, graphical-symbolic, verbal, and logical-verbal modalities. The learner must experience the emerging of each mental operation and each concept through the same rigorous protocol cited above.

A big idea that is being developed in this project is the nature and types of mathematical functions. Supporting concepts that are being mediated as emerging foundational elements to mathematical functions are: dependent and independent variables; interdependency; relations; patterns; functional relationships; rate; recursion, etc. This paradigm addresses all of the algebra standard for grades 9-12 along with expectations recommended by the National Council of Teachers of Mathematics (2000, see Table 3).

The concept of a mathematical function began to emerge when students began to verbalize their insights. The following is a sampling of these insights.

| Student Insights

Student #1: "So when we look back at page 1 of Organization of Dots, the cultural attributes of a square are in a functional relationship with each other to form the square."

Student #2: "Each characteristic of the square, then, is an independent variable."

Mediator: "Is there another type of variable?"

Student #2: "Yes, the dependent variable, the square itself. The square is a function of its parts and their relationships."

Student #1: "There is another point now that we are going beneath the surface, trying to go deeper. Sides of the square – the opposite sides are parallel to each other. If I am standing in the center of the square I will be in a lot of parallelism. Where did it come from? The opposite sides. The parallelism is a dependent variable. It depends on the equidistance of the opposite sides. It is a function of these independent variables. There are two functions embedded here – the square and the parallelism."

At the writing of this paper, the psychological tools of four FIE instruments had been appropriated and were utilized by students to create mathematical thinking. The four instruments are: Organization of Dots and Orientation in Space I, Adult Version, Analytic Perception, and Numerical Progressions. The

concept of mathematical function with independent and dependent variables was experienced through most pages and through all modalities. Students are beginning to represent higher-order functional relationships – linear, quadratic, and exponential functions – and manipulate them within the rules of logic and relate them in terms of expressing various empirical and scientific realities. They are using mathematical thinking to characterize, quantify, and further understand growth, decay, surface areas and changes in surface areas of, for example, a cube of melting ice, molecular motion, etc. Many are becoming fluid in articulating their thinking through reflection and elaboration of cognitive categories.

At this point, 85% of the students are developing a profound love for doing rigorous mathematical thinking. Secondly, most students demonstrate task-intrinsic motivation and a competitive spirit when doing inductive thinking to construct generalizations. When one student was mediating the class to understand why his plan of action worked to perform a task that required mathematical thinking, he said, "use your mental operations to play with the options. Enjoy using your mental processes to create different strategies. Have fun organizing and reorganizing your cognitive functions and operations as you work through the problem."

Examples of students' work are presented below and in Figures 4 and 5.

Just prior to the writing of this paper, students were asked to write their perceptions of mathematical thinking based on their experiences in the class. This is a collection of some of their responses.

"When you have to synthesize, develop, direct, orchestrate Mental Operations that have inside of them Cognitive Functions. A concept of using Mathematical Terms to solve everyday problems in life. Identify and visualizing at all times. A conscious awareness of issues, complications and processes where you precisely connect the proper mental operations to the issue or equation."

"Mathematical Thinking: The construction of mental operations to gain in site about a pattern or relationship and represent them by symbols."

"Mathematical thinking is a serious engagement in developing an analytic perception at all times. It also is a mental operation that helps you gain insight about patterns and relationships."

"Mathematical thinking is a conscious awareness of issues, complication and processes where you precisely connect the proper mental operations

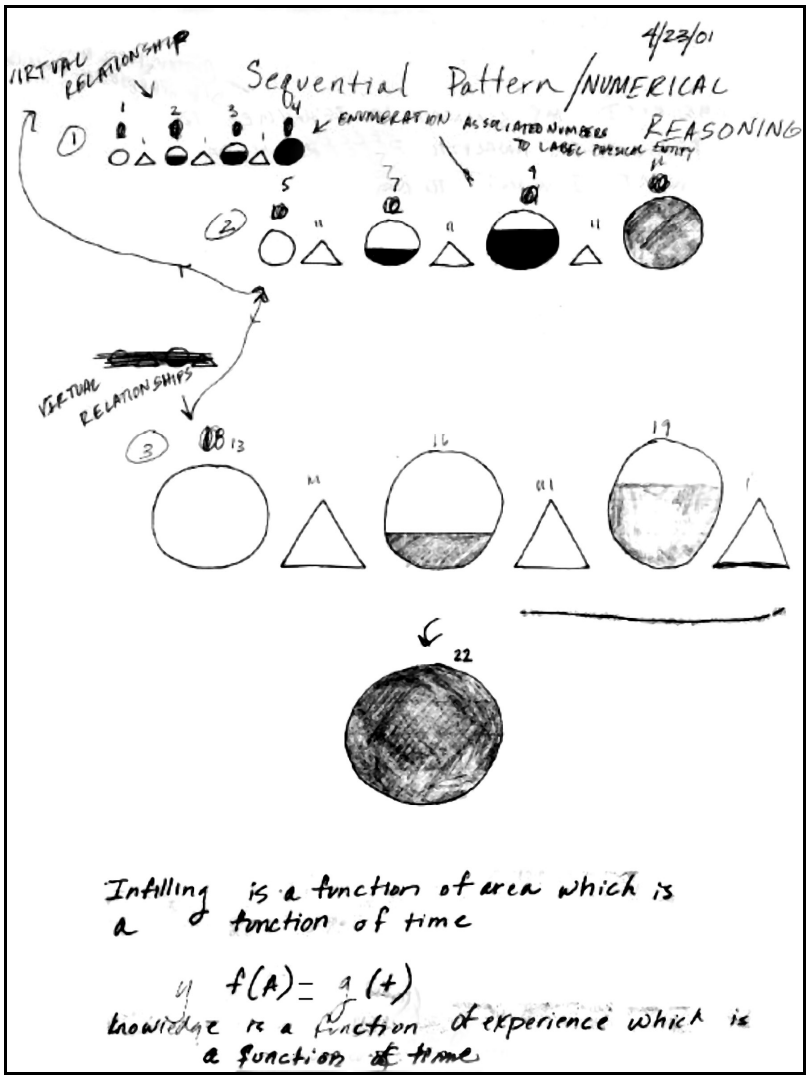
through analytical perception to illustrate the correct answer to the issue or equation. Get the construction of mental operation."

"Mathematical Thinking is a process using your cognitive functions and sociological tools to apply and figure out tasks that relate to everyday situations as well as equations."

"Mathematical thinking is the conscious act of relating comparing and finding patterns and sequences of events through numerical symbology, everything has a number. Therefore there must be some law or order underlying it all which can be made into an equation every time to benefit our mental and physical states."

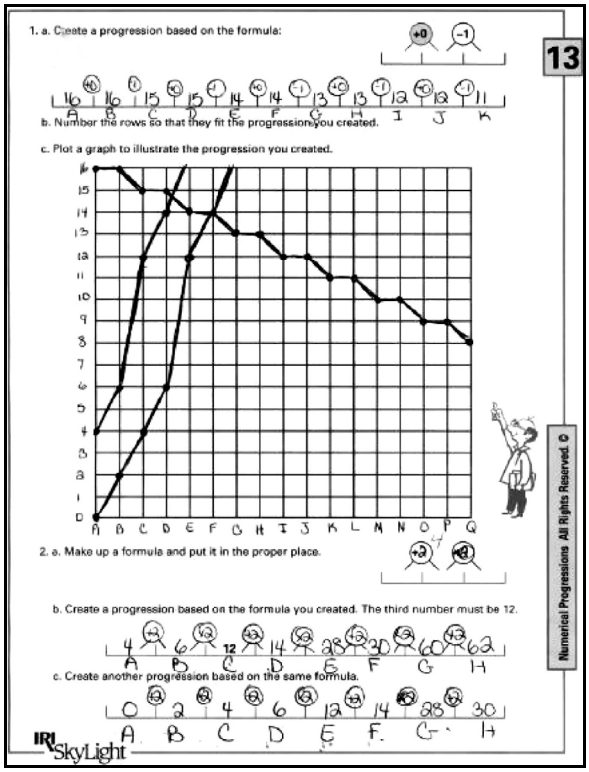
"Mathematical thinking: In definition, it is similar to an injustice to the concept. Many thoughts come to mind since correlation as we know it is based on mathematical thinking. For example, natural life processes pack, which causes life in a result of mathematical thinking in animate action. The specifics of this process show you how the structure of your inspiratory system and it parts work together in a systematic sequential pattern for you to function. This begins to start cycles which allows one to experience more and develop higher orders of mathematical thinking as one lives."

"Mathematical Thinking is a group of cognitive functions used to prove thought fundamental and all life related situation deal with laws and actual facts."



A sample of a student's work when doing higher-order mathematical thinking: Developing and transforming insights about relationships between relationships and mathematical functions.

Note: This work was produced spontaneously by the student when working on a task far remote to it. It is only though deep structural thinking that such transcendence could be made.



Example of a Student's work showing how he is using mathematical thinking to traverse modalities (Numerical, Graphical, Logical- verbal) as he does deduction and induction.

"I was relating the graph, with its horizontal and vertical axis, coordinates and numerical modalities, to a company on the stock market's (Ex. 2-C on Graph) growth within the first 17 months (graph represents profit in $10,000's and also times passed, months). In the first month, you have nothing, you borrow from banks, promoting your product, trying to get investors to invest in your stock, Gain is Break Even to Minimum profit. (A,O) In the second month you make 20,000 profit, and the third and the forth. What we barely realize is that 100% profit is being made in each and every month, though $20,000 profit seems little at the time. But as you have more money to invest, your profit will also, in this case be better."

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THE DEVELOPMENT OF MENTAL STRUCTURES: (ISO)MORFISM AS A RESEARCH TOOL

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Abstract: Using the Theory of Generic Models, the development of the mental structure "Family" with the key concept 'mother' is decomposed into four stages. Comparison of two or more similar structures (isomorphism, homomorphism or affinity) plays a decisive role in this development. Some of the ideas found within the Family structures are generalized. A set of problems used for educational and diagnostic goals are presented.

Keywords: mental structure, development, concept 'mother', structure 'Family' isomorphism, homomorphism, affinity, theory of generic model, education, diagnostic.

Introduction

During last ten years a lot of efforts were spent on research of process of development of cognitive, namely mathematical, structures in pupils' and students' knowledge in the Czech Republic (Jirotková, 1998, Kratochvílová, 1999, Stehlíková-Jirotková, 2001, Hejný, 2001, 2003, 2004a, 2004b; Kopáčková, 2002, Hejný-Kratochvílová, 2005). A long term research with profound findings of creating mental algebraic structure was done by Stehlíková (2004).

Term *mental structure* is here understood as a many layers dynamic net. We can understand knots as notions, relationships, schemes, formulas, examples, methods, solving strategies, algorithms, arguments, hypothesis,…The net connects all of the knots together – as thick is, as higher quality it has. The net organize and hierarchies each of the knots.

A goal of our study is investigation of the birth and development of one particular mental structure in a child's mind. This structure is called FAMILY.

Methodology

The idea to use the structure FAMILY as a non traditional learning environment was in our experimental teaching for the first time used in the fifth

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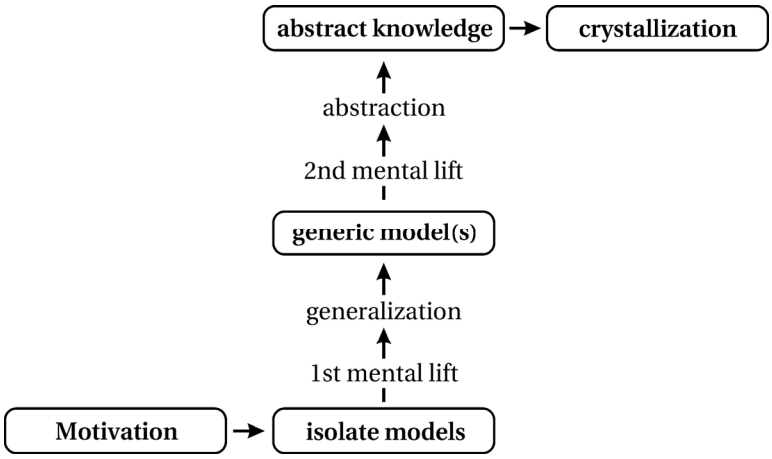
grade in 1977. Eight years later it was used as one of diagnostic tools to evaluate quality of cognition of 8 to 12 years old pupils. At the same time we realized first experiments of how pre-school children understand concepts like *mother, grandmother* or *father in law*. Only in last 5 years we realize a more systematic research in this area. Some results of the research are presented in this paper.

Material for the research comes either from our experiments (clinical interviews or class discussions) or from occasionally gained stories received from colleagues.

As a tool for the analysis of the research materials we used the theory of generic model. This theory will be briefly described. For more detail see e.g. Hejný-Kratochvílová (2004).

The process of gaining knowledge as a sequence of stages

Our model of the process of gaining knowledge starts with motivation which is regarded as a tension between the existing and desired states. The core of the process is created by two mental lifts: The first one – the generalization – turns particular experiences to the generic model and the second one – the abstraction – change this model to abstract knowledge. The whole process can be described by a scheme.



Generalization – first mental lift

Models of a new piece of knowledge are coming to mind gradually and have a long-term perspective. For instance, the concepts of fraction, negative number, straight line, congruency or limit develop for many years on a preparatory level. This process of changing isolate models to generic model can be divided into four sub-stages.

1. The first concrete experience appears in individual's mind.
2. A gradual coming of other isolate models which
   are with no linkage so far.
3. Some models begin to refer to each other and create groups.
4. Finding out the core of the „sameness".

This stage ends with the creation of the community of isolate models (which consequently cease to be isolate). In the future, other isolate models will come to a individual's mind, but they will not be at birth of the generic model. They will only differentiate it in more detail.

Abstraction – second mental lift

The generic model is created from the community of its isolate models and has three basic relationships to this community:

1. it denotes both *the substance of this community*
   and the core of relationships between individual models
2. it is an *example* or *pattern* for all its isolate models, and
3. It is the root of the future *abstraction*.

The first relationship denotes the construction of the generic model: It is created by the first mental lift, the generalization. The second denotes the way the model works. The third relationship points to the next stage in the cognitive development.

Comparison of two close structures

If we compare two objects, situations, events, collections,… searching uniformity and diversity will get our attention.

For comparing structures mathematics use terms: Isomorphism or homo-

morphism. Both these terms will be carried over to our didactical considerations. We even add one more term

– Affinity. For the determination of these terms two tools will be used:

a. mutual assignment of elements of one structure to elements of the other structure and

b. internal organization principles common to both structures.

1. Two structures with the same organization are called isomorphic. At the same time, they can differ in many aspects. For example a room-structure of our flat and a plan of this flat are completely different objects, but if we consider a room organization only, we get the same information.
2. Each isomorphism has two components. An *assigning* component defines 1-1 mapping of elements of the fist structure to elements of the second structure. A *structuring* component defines relations which are common to both structures.
3. Isomorphism is the most immediate form of similarity of two structures. Homomorphism preserves the structural component to a large degree but the assigning component reduces from 1-1 to n-1 mapping.
4. An interconnection is even weaker, if assignee component is missing and structural component is preserved only in a certain stage. Such a free connection of two structures we will call an *affinity*.
5. Grasping of affinity of two structures use to be demanding, because particular cases of affine structures might differ a lot. The common feature of all affinities is the fact, that a person familiar with one of these structures will be able to understand the second structure easier.
6. The first more demanding structure a child starts to grasp even in age of two is a structure of family relations which we are going to call FAMILY. Here we focus our attention.

Stories about developing structure 'family'

Objects of structure FAMILY are created of the following notions:

Mother, father, brother, sister, grandmother, grandfather, uncle, aunt, cousin,… (1)

Story 1. Almost 3 year old Tina meets her grandmother after a long time. She hears her mother to address her grandmother as ‘mother’. Tina sharply

says to the grandmother 'you are not the mother, only my mother is a mother!'

Story 2. Almost 3 year old Ivan asks his mother: "Why does Barbara (girl living next door) have two mothers?" His mother is surprised and answers that everybody has only one mother. Nobody has two mothers. Barbara's mother is an Aunt Lucy. Ivan is not happy about that. He heard aunt Lucy saying 'mother' to Barbara's grandmother. Ivan's mother found it funny and wanted to explain him, that Barbara's grandmother is mother of her mother. After she saw that boy had not understood, she added: "Your grandmother from Brno is my mother too and your grandmother from Smíchov is your father's mother". Ivan did not say anything. But it was more than obvious that he was confused.

Story 3 contains 2 parts. Both of them concern 3 year old girl Jana Ros and Mr. Kirk Pery, older, silver hair man. Kirk's son Alec and his wife Dana are childless. During one visit of Pery's family at family Ros, Jana asked Kirk, if he has a grandmother. He responded: "No, I do not have any. They both died a long time ago. One died even before I was born." Jana was quite surprised but she stopped asking.

After the visit was over, Jana's mother said to her husband: "Mr. Kirk is a good father". This sentence provoked Jana to address her mother. Jana said that uncle Kirk is not a father but a grandfather and she also asked about Kirk's grandmothers. Jana's mother, that was actually telling us this story, found the cause of the confusion. Jana under the term 'uncle Kirk's grandmother' understood 'a wife of grandfather Kirk' not the Kirk's grandmother. First the mother discussed with Jana the question whether the Uncle Alec is a father if he has no son, nor daughter. Jana agreed that the Uncle Alec is not a father. In spit of this Jana reject the idea that Kirk is a father. He was definitely a grand-father. However, after one week Jana accepted this concept and understood that a grandmother is mother of her mother and that Kirk is a father of Alec. Jana's mother was not able to tell us the time Jana accepted the correct concept of terms (1). She only confirmed that this change was definitive.

Comments. In the first story Tina is surprised and irritated when her mother addressed her grandmother as 'mother'. A word 'mother' within the Tina's family context is a name of one particular person, the Mother. This egocentric comprehension was disturbed by her mother's saying. It was not only an informational interference. Mother means a security for a child. This security was attacked by mother's words. Hence Tina was aggressive.

Ivan, when talking about the second story, is also in the same situation of insecurity. The only reason is that this story is not about his mother. Ivan is also surprised of unexpected usage of the word 'mother'. The boy is convinced that there is only one mother in every family. He does not see a grandmother as someone's mother.

The third story is in some sense opposite to the second story. Ivan was not willing to admit a role of mother to his grandmother and Jana calls Mr. Kirk a grandfather even he does not have grandchildren. Jana sees her family in 3 generations: children, parents, grandparents. Alec is according to Jana a father even he is childless and Kirk is a grandfather even he does not have grandchildren. Jana's interpretation is not wrong, because a term 'grandfather' is used in the Czech language for an older man in general.

The analysis takes us to a generalization of the examples. The process of understanding of the FAMILY structure by a child aged 2 to 10 will be decomposed into 4 stages.

Four stages of mental development of a family structure

The stories described allow us to characterize initial stages when a child develops cognitive structure FAMILY. We can see here two stages and the entrance to the third one. Stages can be characterized according to child's understanding of the key concept of this structure, the term 'mother'.

In the *first stage* 'a mother' means 'my Mother'.
In the *second stage* 'a mother' is the central person in every family.
In the *third stage* 'a mother (of a person X)' is a relation; it is a woman having at least one child.

These three stages will be deeply analyzed and the fourth one will be added.

The first stage of cognition of FAMILY structure is reduced on cognition of members in our own family. If we ask a 1 year baby about her mother, he/she will turn his head to her own mother. A child would behave the same way if we ask about his father, grandmother,... Words "mother", "father", "grandmother", "grandfather", or Brno's grandmother are names of concrete persons, individuals. We should write these words 'Mother', 'Father',... as proper names. Words 'brother', and 'sister' are exceptions in cases when a child has more of them. In such a case these members of the family are identified by

names. If a child has the only one sister, parents call her using first name so the word "sister" is only alternative name for a certain person. We can call this stage *individual*, because words (1) name individuals.

The second stage begins with cognition that also other children have a mother and a father. Barbara, next door, uses words (1) to identify other persons. Child finds out, that there is also 'Barbara's mother', Radek's mother besides 'Mother' (as 'my mother'). Thus the shift from the first to the second stage changes interpretation of words (1). These are not more names of individuals, but family positions. In the context of a family a word 'mother' names one person only, a mother of children of the family. There is one mother and one father in every standard family possibly also grandmother(s) and grandfather(s). These words split to three age categories, three generations: children, parents, grandparents. A mother belongs to the category 'parents' and a daughter to the category 'children'. Thus mother can not be a daughter. Similarly father can not be a son and grandmother can not be a mother. It would be against child's framework of understanding age categories. We call this second stage *generational,* because words (1) name persons according to generational categorization

Mental shift from the first to the second stage is the *re-structuring* of the existing knowledge of a child. Discovery that Barbara also has a mother is not a new piece of knowledge which will be added to existing knowledge. At the same time it is extinction of a former piece of knowledge that 'mother' means my mother.

Ivan from the second story is in the second stage of understanding structure FAMILY. He knows that Lucy is Barbara's mother, but he is surprised by the fact that Barbara's grandmother is also a mother. He did not find out, that his mother has also a mother. We can see a bigger contrast by using terms standard versus generation when talking about the third story. It is unacceptable for Jana to consider older man Kirk as a father. She considers him as a grandfather in spit of the fact that this man does not have any grandchildren.

Jana finally got a point that also an old man can be a father and she does not insist on generational categorization. As Jana's mother confirmed, this relational stage occurred in Jana's mind quite fast, during one week, maybe during a day. Jana already knows that every person has mother and father but not everybody has brother, sister or daughter, son. She knows that her father is her mother's husband and her father's mother is a grandmother. Realizing these relations is the germ of creation of the fourth stage of the structure FAMILY.

The fourth and the last stage, called *structural* is focused on further development of this structure. Namely it concerns:

- Further concepts (niece, mother-in-law, nephew, ...)
- Discovering general laws (every man has two grandmothers, my brother's mother is also my mother, ...)
- Cognition of families with non-standard relations.

Through disintegration of process of cognition into four stages, we try to discover structure FAMILY in more detail. Fourth stage seems to be too wide and its further examination will probably cause its decomposition to new stages.

Didactical comments

A. Different stories telling by adults are motivation for building a structure FAMILY in a child's mind. A mother can tell for example about a fact, how her mother taught her to cook when she was a child (child's comment: "it was a long time ago, when my grandmother was a mother"). When talking about this story telling there can appear other important information concerning time flow: idea that all people get older the same rate and their age difference is not depended on time. If a mother is 3 years older than her brother, uncle Erich, she was still 3 years older when there were children.

B. When talking with a child about family relations, we develop in his mind not only understanding a family structure but also his/her relational thinking. Strongly effective are games in which dolls, teddy bears, dogs, are defined as members of one family. Some relations like aunt, uncle, and niece can appear here in a natural way. At the beginning a child models his own family and later on he/she uses fantasy to spread it by bringing new persons more frequently brothers or sisters. It is obvious, that a child interested in family tree of royal families or in making a family tree of his own family, finds a deep view in the structure of FAMILY.

C. The given four stages description phylogeny of structure FAMILY can inspire similar decomposition of phylogeny of some other structures, preferably those depending on time or topography. Interesting is a structure of a rich set of word problems in teachers' minds.

We finished a preparatory consideration aiming to show how a structure develops in child's mind by using example of FAMILY. Some arithmetical structures will be mentioned further.

A story about isomorphism of two family structures

Our next goal is examination of the process of birth, growth and establishment of a concept isomorphism of two Family structures. Let us start with a story.

Story 4. Mr. Pond often talks with his eight years old son Emil about many things. One such discussion started Emil with the interesting observation.

Emil 1: Father, do you know that Nowak's family is the same as our family?
Father 1: What do you mean the same?
E2: Well, they also have older girl and younger boy. We also have older girl, Rea. I have two grandmothers, but only one grandfather and Michael has it exactly so. .
F2: Well, but they live on the ground floor and we live on the third floor.
E3: It does not matter. We count only who lives there. Do you understand?
F3: Well, this is interesting. (Father thinks what could help to develop this conversation). They have Verona (a dog) and we have only Lola (parrot).
E4: (After a while). Well, we are not the same. We are almost the same.
F4: If we consider only human beings without animals, we are the same.

Comments. Emil discovered (maybe his first one) isolated model of isomorphism. He certainly noticed similarity or dissimilarity of furniture layout in our dinning room and in our aunt's dinning room, similarity or dissimilarity of arranging cars on different parking places, layout of desks in different classrooms, or grouping buildings on suburbs. In none of these examples, there was a web of relations connected mutually like in examples of family relations. A family structure if concerning a net concentration of relations is the most complicated, because it enables to make such a relation like 'a son of my father's uncle' etc.

A boy found out, that he and Michael have only one older sister and no brother, one mother, one father, one grandfather and two grandmothers. His other friends have different family structures. Similarity between his and Mi-

chael's family he found interesting. We expect that a in the near future Emil will be more sensitive to similarity and dissimilarity of families and that he will develop one or more generic models of the structure FAMILY.

Emil knows, that Nowak's family (**N**) and Pond's family (**P**) have 7 members and they are mutually assigned to each other

son **P** (Emil) ↔ son **N** (Michael)	daughter **P** (Rea) ↔ daughter **N** (?)
father **P** ↔ father **N**	mother **N** ↔ mother **P** (2)
grandmothers **P** ↔ grandmothers **N**	grandfather **N** ↔ grandfather **P**

The consideration about a wrong assignment dog **N** ↔ parrot **P** yields elimination of animals from the families. Emil did not include animals to families (animal **P** ↔ animal **N**).

Emil's description of similarities between families is not an isomorphism. His description is done from the point of view of children generation and this brings a sort of discrepancies:

a. In the generation of children Emil noticed an age difference, but in the parent's generations and grandparent's generation he did not mention an age difference at all;
b. Emil did not consider grandmothers as individualities, but as a couple;
c. He did not mention that his grandfather and Michael's grandfather are grandfathers from the same side. And we do not know whether this is true. If the father in the discussion with his son asked for the individual mapping of two grandmothers, Emil might come with the grandfathers' correspondence.

Process of understanding of isomorphism

As any other isomorphism also that one discovered by Emil has two components.

- The *corresponding* component is described by relations (2) and
- A *structural* component considers organization of comparing families and is formulated through relation like: "grandfather has a wife", " one grandmother do not have a husband", "mother has two children", "father's mother has two siblings", "my father's sister has a brother" etc.

After a child realizes a corresponding component and a structural component, he/she has a first understanding of isomorphism. We can define it by using mathematical language:

There is a 1-1 mapping between two structures **N** and **P**. For any arbitrary pairs of corresponding elements **N1** ↔ **P1** and **N2** ↔ **P2** a relation between elements **N1** and N2 is the same as a relation between elements P1 and P2.

An idea of isomorphism of structures in child's mind is developed step-by-step. First, it appears only a part of it – only some elements and some relations. We could see that family similarity discovered by Emil does not concern the whole structures, but only those relations referring him and Michael. We can call this similarity as a *partial isomorphism*. Such an isolate model of partial isomorphism is the first stage while developing a notion of isomorphism in man's mind.

Blurry boundaries of comparing structures are a typical feature of a partial isomorphism. Certain elements and certain relations of a structure are perceived by a child precisely, but some of them only superficially. Emil perceives clearly everything what he is talking about: 7 members of each family and family relations among him or Michael and other members of the families. He is sure that a floor a family lives on is not a part of isomorphism (his reaction was immediate), but in a matter of animal he hesitates. Even he is not talking about it; we assume that he is aware of some other family relations not just concerning him or Michael. For example a fact, that both parents in the both families are husband and wife. It is also obvious, that he does not realize relations between parents and grandparents.

Next stage in the development of the concept 'isomorphism' is based on an elaborating of a partial isomorphism. A child clarifies which elements do and which do not belong into a comparing structure. A child also discovers new relations among structure elements.

Considerations about similarities of structures are accompanied by considerations about structures dissimilarities. We have not mentioned it in the story 4, but we can say according to our other experiments, that Emil perceives structural similarity of families **N** and **P** after consideration families with structures different from his own family.

Conclusions

The concept of FAMILY can be used for educational and diagnostic aims. In both cases a set of suitable problems is required.

Problems for 5-7 year old children. During the face-to-face interviews with children aged from 5 to 7 we considered only 'standard' families.

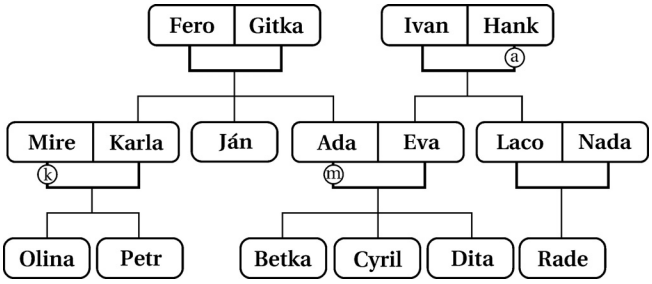
Our experiments proved that children are able to understand our question better if it starts with 'Does XY has a…?' instead of 'Who is..?' Thus we asked e.g. 'Does your father have a son?' and after a positive answer we asked: 'Who is it?' In majority of cases the second question was not necessary, since a child define a person in question by him/herself. .

If the child became familiar with a question 'Does XY have...?', we started to use 'Who?' questions. Here are some questions used in our experiments.

Who is mother of your brother/sister?
Who is brother/sister of your father?
Who is grandmother of your brother/sister
Who is mother of your father?
Who is daughter/son of your father?
Who is daughter/son of your grandmother?
Who is daughter/son of your grandfather?
Who is husband of your grandmother?
Who is grandson/granddaughter of your grandmother/grandfather?

Some children solved these problems quickly and correctly, some of them had serious difficulties. But even bright children were not able to overcome egocentric position and solve questions of the following type: Somebody from your family said "*My daughter is Michaela*". Who was it? The most frequent answer to such question was *Michaela is my sister* or *I am Michaela*. Only one out of twelve 6 years old children grasped such questions and answered these correctly.

Class discussions. Environment FAMILY was used in experimental teaching in 3rd to 5th grade. To avoid possible social difficulties with children from incomplete families we created step by step our own genealogical tree consisting of 17 names.



Here are some questions used in our experiments. Symbols **X** and **Y** stay for unknown persons, symbols **X**♂ and **Y**♂ (or **X**♀ and **Y**♀) stay for unknown male (or female) person from our genealogic tree. In each of these questions it is necessary to find all solutions for **X** and **Y**.

1. X♂ has 5 grandchildren;
2. X♀ has two granddaughters;
3. X has one sister;
4. X is nephew of Y♀ and father of Y has one son;
5. X is son of Y♀ and X has one brother and no wife; 6. X♂ is cousin of Y♀ and they have one common uncle.

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A COGNITIVE APPROACH TO MATHEMATICS EDUCATION

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Abstract: The early gaps in children's cognitive abilities may not necessarily be large, but inattention on the part of mathematics teachers to those gaps bears severe consequences in the children's future learning. What makes it difficult is that known fact that it is always possible that the difficulties students have with mathematics are masked by the appearance of rote learning, because students who are not developmentally ready to learn certain concepts have little recourse but to memorize and reproduce what they are told. It is therefore critical that teachers recognize the importance of a cognitive approach to mathematics education and regularly analyze their students' errors and their students' learning. In this paper I first analyze the cognitive challenges of mathematical thinking, particularly at the primary school levels. Then I offer the example of number sense to illustrate how the number sense is cognitively challenged.

The importance of cognition in mathematics cannot be underestimated. From kindergarten on, the typical mathematics curriculum involves six critical cognitive operations and structures.

a. conservation
b. representation;
c. allocentric thinking;
d. spatial abilities and the sense of time,
e. projection of virtual relationships, and
f. self-regulation, focused, and systematic exploratory behavior;

These six critical and highly interdependent cognitive operations and structures develop in children gradually, through mediated manipulation and movement among objects, from infancy and beyond childhood. These operations and structures are briefly defined below:

Conservation

Conservation refers to the cognitive ability to judge changes through logical deduction rather by appearance (Cockcroft e.a., 2002). It is manifested in the conception of *number* that is flexible enough to include all the possible

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variations of what is countable, how it is arranged, and how it is counted: "all fours are 4". This concept of numbers is involved not only in quantifying objects, but also in equating different denominations of money, measurement, and time. Another example of conservation involves naming geometrical forms, and understanding "volume" without association to shape. Conservation and, eventually, the related schema of transformation lay the foundation of all the reversible operations of mathematics.

Representation

Conservation cannot exist without *representation*. The cognitive tools of representation include beside visualization, also language, concepts, and symbols. Thus, representation frees our thinking about objects from our perception. What Numeration involves symbols; geometry involves language and icons etc. Furthermore, representation permits the thinker to *discriminate* input information, *manipulate symbols* rather than reality itself, and *communicate*.

Allocentric (non-egocentric) thinking

Allocentric- thinking is manifest in the ability to differentiate between self and the world to represent the world from *different points of view*. It permits us to relate objects in time and space using an *objective* frame of reference. In fact it allows us to think mathematically, because mathematical thinking is essentially allocentric. Terms such as "more", "less" etc., are truly relative only when they are conceived of objectively. Clearly, allocentric thinking is a necessary condition for conservation.

Spatial and temporal sense

The *sense of space and the sense of time* depend upon conservation, representation, and allocentric thinking. Young children first make sense only of the topological properties in space (enclosure, inside space, outside space,

and proximity)[2]. Later they start to develop the Euclidean sense of space as they use *allocentrical* terms of relative size to describe the relationships among. Only at the end of this developmental journey (normally around the second and fourth grade) children can preserve the properties of distance, angles, and straight parallel vertical, horizontal and diagonal lines (Piaget & Inhelder, 1948).

Children's early concept of time is normally confused with space. They do not attribute the longer distance accomplished by moving objects to high velocity, but to longer time of the movement, and they understand "old" as synonymous with "big". For them time is discontinuous and not uniform (this is why in their minds adults stop aging).

Projection of virtual relationships

The relationships between units and groups and the basic operations with numbers are fundamental in early mathematical thinking. Where these relationships are projected, particularly without manipulating objects, they can be referred to as *virtual*. Comparing and projecting such relationships are perhaps the most critical consequences of allocentric thought. For example: a math problem may state that Don is 3 years older than Elsa, or that Jamal is younger than Jo by 4 years. Before a child can determine which numbers to add the child must understand these relationships. Projecting virtual relationships permits the child to prioritize, sequence, and identify patterns

Self-regulation (cognitive, behavioral and emotional)

Mathematical thinking, particularly as in problem solving, requires the ability to set goals for the relatively long- and short-term, prioritize them, and estimate which would be easy and which would be difficult to attain, and monitor and regulate progress. The quality of such self-regulation is increasingly challenged by the mathematics curriculum.

[2] The topological space can be thought of as a model of the environment constructed on a rubber sheet. As the sheet is stretched in different directions, the relative distances and directions between locations may change, but the basic layout and the sequence of places along a route are preserved intact.

It is now appropriate to consider for example the case of the development of children's sense of natural numbers.

Children's Sense of Natural Numbers

Normally, children younger than 5 years tend to confuse the quantity of objects with the amount of space these objects occupy. For example, they would point to a longer pattern as the one with more objects even if it contains the lesser amount. This naive sense of quantities changes as children learn to count using numbers. Numbers have two attributes, *ordinality* and *cardinality*. Ordinality refers to the ordered set of numerical terms ("one", "two", "three"…). Cardinality refers to quantity the number represents. The following table defines five principles that children must learn to construct the mathematical number sense:

Principles of counting:	**Significance**	**Cognitive challenge**
Ordinal principle I: Stable and complete order of numeration (e.g., "twelve", "thirteen", "fourteen", etc…)	The language of a numeration determines how well children understand the base structure, place value (units, tens, etc.), and later also arithmetical operations.	Cultural (language) differences in numeration systems correlate positively with the types of errors made by 3 and 4 year old children (Miura e.a. 1993). These differences impact children's ability to count, their memory span, and eventually their cognitive representation of numbers.
Ordinal principle II: One-to-one correspondence between a number and an item to be counted.	The analysis/categorisation of sequence facilitates the coordination of the concept of number with the concept of groups.	Besides verbal fluency (automaticity), and memory, counting requires coordination that preschool-children may still be lacking even when they understand the concepts involved (Gleman & Meckin, 1983).

Cardinal principle I: The last count represents the whole.	Counting is the trivial of addition (+1).	The emphasis is on the need to ensure that the whole group is counted, each member only once: A need for precision.
Cardinal principle II: Any order of counting results in the same number	The emphasis on the flexible concept of group. This flexibility forms the foundation for the two basic properties (for addition and multiplication) the associativity and commutativity	The flexible mechanics of counting requires systematic and organized input. It requires conservation of a constancy (number) over changes (in the configuration of the group)
The abstraction principle: Any kind, or mixed kinds of objects can be grouped and counted	Numbers are conceptualized as versatile tools for problem solving	Numbers are projects of virtual relationships

The five principles of counting, their learning significance and cognitive challenge (Ben Hur, 2002)

Counting helps children explore the relationships between numbers and establish the basis the arithmetical operations. Learning to categorize what has been counted vs. what is yet to be counted, teaches children to coordinate their perception and their actions. Understanding that the strategy they choose for counting does not affect the result helps them reinforce their conservation schema and enables them to develop the intuition for the associative and commutative properties of the two basic operations (addition and multiplication). Ultimately, counting becomes a useful tool they learn for solving problems.

A cognitive approach to teaching mathematics requires that teachers not only know the instructional challenges, but also that they know how to mediate them. For this reason it is important that teachers of mathematics study the work of Reuven Feuerstein, and the example of Feuerstein's Instrumental Enrichment. This work provides effective strategies and a particular program that are aimed exactly at the development of these critical cognitive challenges.

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CONCEPT BUILDING PROCESS IN 3D GEOMETRY

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Abstract: Tasks aimed at the classification of a group of tactilely perceived geometrical solids make pupils think about the solids and learn them in different way than is usual when visual perception is involved. Pieces of information about attributes of solids which are gathered by tactile perception come to the mind gradually and are hierarchised. The first substantial phenomenon which a pupil notices is called the dominant one. Which phenomenon a pupil perceives as dominant or whether a pupil perceives only a global attribute of a solid is projected into his/her way of manipulation with the solids. On the basis of the analysis of video-records of some 10-11 years old pupils' solution of the tasks we describe some mental processes, mechanisms, related to the structure building process of geometrical knowledge. In the paper we present some findings of our on-going research into the learning and structuring of knowledge about 3D solids by pupils.

Keywords: 3D geometry, cognitive mechanisms, tactile perception, structuring of knowledge, concept building process

Genesis of the research

The research aimed at concept building process in 3D geometry started in 1994 under the guidance of M. Hejný. We focused our attention on pupils of age 6-10 years, on the investigation of their understanding of geometrical concepts and the possibility of developing this understanding. We posed the following questions to ourselves: In what way do the early phenomena of the geometrical world emerge from the real world? Through which perception channels does the 3D world come to the pupil's mind? How is the information, which is carried by touch and sight, coded in a pupil's mind? How are the given mental representations handled? What are the qualitative types of pupil's geometrical images and how are these verbalised? Special attention was paid to the construction of mechanisms, for instance the mechanism of classification of 3D objects. We constructed the mechanisms of tactile selection and classification of geometrical solids and the mechanisms of control of tactile selection and classification (Jirotková, 2001).

Since 2001 the author has been collaborating with G. Littler and some of

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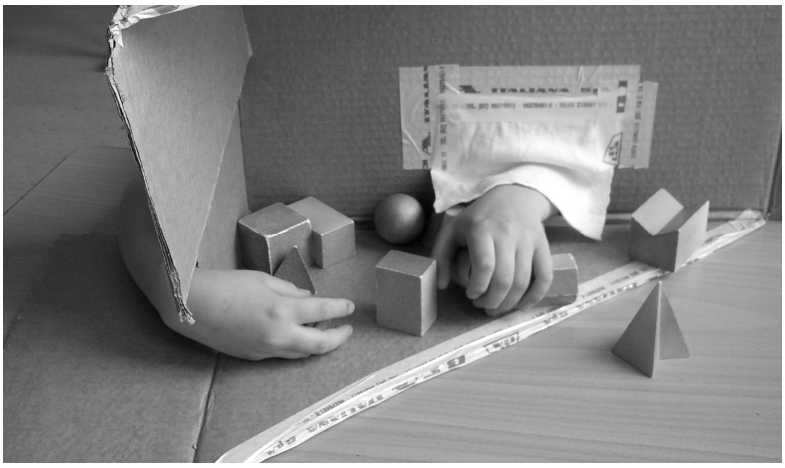
the experiments were undertaken in Great Britain. The aim of these experiments was to discover the mechanisms that direct the process of structuring geometrical knowledge, and looking for phenomena which would enable us to characterise the linkage of a pupil's communication about a certain situation and their manipulation with solids when only tactile perception was involved. Pupils manipulated with solids which were hidden in an opaque bag. The course of manipulation was then estimated and constructed only on basis of the result of the task and of the pupil's communication (Jirotková, Littler, 2002, 2003).

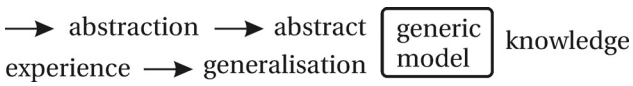
The need to observe and to record pupil's manipulation with solids and the need to avoid our speculation when constructing the cognitive mechanisms led us in 2004 to change of the experimental material. We used the open box (see the figure) so that we could observe and video-record pupil's manipulation. Pupils were also challenged to verbalise their perceptions and to describe their solution of the given task. It enabled us to monitor what means of verbal communication they use to express the certain attributes of solids. One of the current finding was the identification of three different types of manipulation with solids when visual perception was excluded (Littler, Jirotková, 2004; Jirotková, Littler, 2005).



Theoretical framework

Our understanding of the concept of structure is based on the approach of Hejný (2002, 2003) and Van Hiele (1986).

It is possible to depict the Hejný's theory of the learning process, theory of generic models (TGM) describing building of internal structure of mathematical knowledge (IMS) by the following diagram (Hejný, Kratochvílová, 2005):



The first experience with a mathematical phenomenon creates in one's mind isolated models of future abstract knowledge. These create isolated knots in the cognitive net. On the basis of more mental activities one finds common attributes of several isolated models; isolated knots in the mind start to link and by the process of generalization the generic model is created in the mind. The generic model is a kind of universal representation of the group of isolated models and an inevitable stage on the way to the abstract knowledge. The quality of knowledge is determined by the density of the cognitive net, which is the amount of relationships between particular piece of knowledge.

Van Hiele (1986) published a theory in which he classified five levels of insight for 3-D geometry the second level of which was split into two sub-levels by Pegg (1997). We are giving the three levels which apply to primary school pupils, the subject of our experiments..

Level 1: *The solid is seen as a whole and usually as a specific shape. The* properties/attributes of the solid play no part on the recognition of the shape.

Level 2A: *The shape is identified by a single attribute rather than the whole shape.*

Level 2B: *The solid is recognised by several of its properties/attributes, which are seen as independent of each other.*

Level 3: *The attributes are considered logically and the relationship between them recognised*

In the case study, which is cited in the paper, the process of structuring the geometrical knowledge of a 10–year old pupil in the context of the solved task is described applying the three epistemic actions, which are the constituents of the dynamically nested RBC model of abstraction (Schwartz, Hershkowitz & Dreyfus, 2002a, b), namely 'Recognizing', 'Building-With' and 'Constructing' (Schwarz, Hershkowitz & Dreyfus, 2002b, 83).

Constructing is the central step of abstraction. It consists of assembling knowledge artefacts to produce a new knowledge structure to which the participants become acquainted. *Recognizing* a familiar mathematical structure

occurs when a student realizes that the structure is inherent in a given mathematical situation. ... *Building-With* consists of combining existing artefacts in order to satisfy a goal such as solving a problem or justifying a statement.

We consider three different levels of quality of mental picture of a perceived solid, which reflect the extent to which the pupil is familiar with it. For this purpose we applied Vopěnka's approach to geometry. In his study, Vopěnka (1986) introduces the concept of a 'personality' of a geometrical object, and his approach enabled him to give a deep analysis of the genesis of geometrical thinking. In a simplified way a solid (geometrical object) is considered as a 'personality' for the individual if s/he can associate the image with the name of solid, can describe some of its attributes, is able to recall the solid on the basis of a verbal description and in different positions and sizes, can represent it by a model or drawing, can recognise solids which are in some way related to it and describe the relationship. It means that the pupil has built both an internal structure within the particular solid (s/he recognises its vertices, edged, faces, their number and their relationship) and s/he is able to create a simple external structure, for instance, to find certain solids in the group of solids which are connected by some common attribute with the given one. From a first look at the pupil's manipulation it was obvious, which solids the pupil had already known – to these s/he paid only little attention, and which solids were entirely new for him/her – these were perceived thoroughly.

The pupils in our research were not starting to build knowledge from a zero base, they had some knowledge about solids from their experiences in and out of school. The three levels of the quality of the mental picture of a perceived solid are: 1. the solid is a 'personality' for the pupil, 2. the solid is unknown to the pupil, however, the pupil perceives some relationship between the considered solid and another solid which is a 'personality' for him/her, 3. the solid is entirely new for the pupil (Jirotková, 2001; Jirotková, Littler, 2005).

Our long-term research leads us to believe that the structure which pupils build up in their minds, related to solids through visual and tactile perception, depends mostly on their life experience and not to the school experience. In general the primary school mathematics textbooks do not offer many activities leading to creating geometrical structure. The solids, which are usually introduced to pupils by the age of 10-11 years, are the cube, cuboid, pyramid, cone, cylinder and sphere. The pupils learn them individually without possible connections between them.

Relationships and differences of the world of arithmetic and geometry

For deeper understanding of the cognitive process in geometry we studied relationships and differences of the school arithmetic and geometry applying the method of comparative analysis (Hejný, Jirotková, 2004). Here we focus our attention particularly to objects with which these disciplines work and to the tools which are used for the work.

1. Objects

A: The society of basic arithmetical objects, natural numbers, is strongly interlinked. Each individual of this society is characterised and defined by its position and relationship to other numbers. Cancellation of the existence of just one individual would lead to collapse of the whole society. Independence of the arithmetical world to the real one enables more abstract manipulation with numbers. Nevertheless the support of the real world is still important for the arithmetical world also in the abstract stage. Early disconnection of these two worlds can lead to the situation that pupils' knowledge is mechanical and pupils' understanding of the mathematical world might be distorted.

G: The society of geometrical objects contrary to arithmetic of natural numbers does not have a sharp boundary. It is the matter of the observer's opinion if a particular object is considered as an inhabitant of this geometrical world. Geometry does not have any tool by which it is possible to create all geometrical objects. No universal link exists by which any two objects are connected. The world of geometry seems to be the world of remarkable individuals. It true that some of these individuals create well defined and organised set (regular polyhedrons, non-convex polygons,...), however the organization does not relate to the whole society of geometrical objects. Geometry offers to pupils first of all the space for his/her creativity. Pupils' creativity in the world of arithmetic is aimed at the discovery of various regularities and relationships between already existing objects. In geometry the pupils can discover new objects with which s/he has never met.

2. Tools

A: In arithmetic, as we are aware, all numbers of the set can be created from the number 0 using the operation "adding 1", and then quite naturally other arithmetical operations (adding, subtracting, multiplication, division) or relations (ordering, divisibility, ...). Using equations it is possible to extent the set N_0 to sets Z and Q. In the world of arithmetic such tools exists by which it is possible to build up and structure this world from only one element (number 0) and one operation (adding 1) with the help of the language of logic and sets.

G: The pupil penetrates to the world of geometry through such phenomena which s/he considers as a geometrical 'personality'. One of the first such a personality is a square. First the child sees the object in various situations and hears its name. Then s/he is challenged to create the square from matches. If s/he cannot see any square around and solves the task correctly then his/her mental image comes out from his/her mind. We can say that the concept of square is understood by the child as a personality. The child then starts to perform mental operations. An example of it is the internal representation of the manipulative activity building a tower from building blocks, rolling a ball, folding a paper and actions like oriented motion of arms, legs or the whole body. Mental images which are created in the course of these activities are consequences of the process of interiorisation of a phenomenon which is called the attendant phenomenon of the object by Vopěnka (1986, p.26). For instance the child builds up a tower from cubes. It falls sometimes and sometimes does not. The repeated manipulative experience creates such knowledge in the child's mind that the tower will be firm if the faces of the two neighboring cubes coincide exactly. The child is not able to verbalize this knowledge and does not know any expressions by which it could be described. This is knowledge in action which includes a germ of the future concept face as an attendant phenomenon of the cube.

| Experiment

The following task was used as the tool of our experiment:

Sort the solids into two groups, using only tactile perception, so that at least all the shapes in one of the groups have a certain common property.

Materials: The following 13 solids were used: cube, square based prism, rectangular prism, triangular prism, non-convex pentagonal prism, hexagonal prism, square based pyramid, truncated rectangular based pyramid, non-convex pentagonal based pyramid, tetrahedron, cone, truncated cone and cylinder.

Scenario: The pupil was asked to sit down in front of the screen behind which there were 13 solids. There were arm-holes in the screen through which the pupils could manipulate the solids but could not see them. The task was given to the pupil and their understanding of it was verified. S/He was then asked to put their arms through the holes and to carry out the task.

When the pupil indicated they had completed the task s/he was asked to formulate the criterion s/he had used to separate the solids into two groups. The groups were then taken from behind the screen so that the pupils could visually perceive them. The pupil was asked whether or not s/he wished to change the selection after visual perception. The pupils' manipulation of the solids behind the screen as well as their communication was video-recorded. The experimenter did not enter into the child's work.

The experiment was carried out with nine 10-11 years old pupils, three boys and two girls from an inner city school in the UK, three boys and one girl also from an inner city school in CZ.

The record and the protocol of experiment was the basis for our analysis.

| Analysis of the task

The solids used in this task were deliberately chosen to cover three types of solids: 1. those the pupil would meet in school as part of the geometrical syllabus or in everyday life such as cube, cuboids, cone, tetrahedron and pyramid; 2. more unusual solids such as triangular and hexagonal prisms and truncated pyramid which might be known in some form from everyday life; and 3. two solids namely those with re-entrant angles, non-convex pyramid and prism, which we considered the pupils would not have met.

The basic set on which the task is constructed is the Cartesian product of the set of solids and their attributes. The task challenges the pupils to make a structure, a subset of the Cartesian product.

The pupils' geometrical knowledge is based on their real life experiences which differ from pupil to pupil therefore we expected to meet a variety of reactions and different solutions. Two types of classifying the solids into two

groups were anticipated (Jirotková, 2001). The first type is *complementary classification* in which the pupil finds an attribute A, common to all the solids in one group and the other group is simply its complement, characterised by not having attribute A. The second type of classification is *attributal* in which each of the two groups is described by a certain property and each single element can be classified unambiguously to particular subgroup. In the learning process we usually start with the complementary classification and only later on the attributal classification appears. It enables to pupils to grasp gradually new concepts. If we introduce all nine groups of words (nouns, verbs, ...) in the Czech language at the very beginning it would be nearly impossible for most pupils to understand the grammatical structure.

Visually one can get immediate information about the individual shapes of a set of solids and their mutual relationships. In this task, the pupil is familiarising him/herself with a group of solids using tactile perception only, perceiving the solids one by one. Tactile perception gives information on which the mental image of a shape is created. How quickly and how precisely the image is created depends to a certain extent on what geometrical phenomena are committed in the pupil's long-term memory. It could be for example a set of solids like cuboids, pyramids or some attributes of solids like regularity, non-convexity. Some geometrical phenomena could be associated with tactile perception like a prick, sharpness, smoothness etc. A particular geometrical phenomenon, the image of a solid, can be considered as a 'personality' (Vopěnka, 1986). If comparison is needed, only a small group of solids can be perceived at any one time, which is why intensive collaboration with the short-term spatial memory is required.

| Solution of the task

The table below indicates the solids finally chosen by the nine pupils to be in their selected group. For each pupil, UK1-5, CZ1-4, the first line shows his/her tactile classification (T) into two groups, one is marked with # and one is blank. The second line shows the pupils' choice when they had visual perception (V) following the tactile classification. These two groups are marked with * and blank. Six pupils described the group marked with # or * by a common attribute – complementary classification. Pupils UK4, CZ3 and CZ4 described both groups – attributal classification.

		cube	squared based prism	rectangular prism	truncated pyramid	triangular prism	non-convex pentagonal prism	hexagonal prism	square based pyramid	non-convex pentagonal based pyramid	tetrahedron	cone	truncated cone	cylindr
UK1	**T**	#	#	#	#	#	#							
	V	*	*	*	*	*	*	*	*					
UK2	**T**	#	#	#	#	#			#					
	V	*	*	*										
UK3	**T**	#	#	#	#	#			#					
	V	*	*	*	*	*	*		*					
UK4	**T**	#	#	#	#	#	#	#	#					
	V	*	*	*	*	*	*	*	*					
UK5	**T**	#	#	#	#									
	V	*	*	*	*									
CZ 1	**T**	#	#	#	#									
	V	*	*	*	*									
CZ 2	**T**						#			#				
	V						*			*				
CZ 3	**T**	#	#	#	#	#	#	#	#	#	#			
	V	*	*	*	*	*	*	*	*	*	*			
CZ 4	**T**	#	#	#	#	#	#	#	#	#	#			
	V	*	*	*	*	*	*	*	*	*	*			

The pupils' verbal criteria for their tactile classification were as follows:

UK1: They all have a square base, not triangular.

UK2: I put six on one side and the rest on the other. (He first selected according to a criterion, but he forgot this when confronted with solids he did not know and placed the rest randomly). When given visual sight of the solids he changed his criteria to 'Cube or cuboid'.

UK3: This group has got square and rectangular bases and this group has got other bases.

UK4: This group has got rectangular or square faces at least. This group has got triangular or circular faces.

UK5: My group has only got quadrilateral faces. The other group may have quadrilateral faces but they have other faces as well.

CZ1: They have eight vertices. But they cannot be only squares. They can be any quadrilateral. I put aside all which were squares, rectangles, cubes and

cuboids, then I added another shape which was like a not successfully made pyramid as if something was chopped off. The others I put on the other side.

CZ2: These solids had a piece bitten out from them.

CZ3: I put all rounded on one side and edged on the other side.

CZ4: If it was rounded or if it had a circle I put it here, and if it had edges then I put it in the other group. She created the group shown above but described the complementary group because it was easier to do so.

Some interesting cognitive phenomena

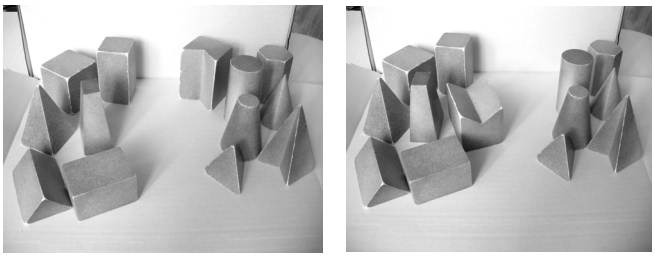
'Four-sidedness' as a criterion for complementary classification. From the verbal descriptions above it can be seen that the presence of squares and rectangles on a solid was perceived as a dominant feature of certain solids in most of the pupils' minds. Some of pupils focused their attention to the squares which were the base of the solid. The face on which the solid stood was considered as a base of solid.

Global perceptions as selection criteria. We know from our previous research that both 'edgeness' and 'roundness' are easily tactilely perceived and these global attributes. Often these two attributes are understood as polar attributes. That means that one group consists of edged and the other group consists of round solids. Two children used this criterion for attributal classification (see CZ3, 4). Similarly non-convexity is a dominant global attribute for some pupils. The boy CZ2 used this classification criterion and he solved the task in the shortest time.

A 'personality'. The cube, square based and rectangular based prisms were picked out by both the UK and CZ pupils and we observed that very little tactile perception was necessary. We consider this was because they were able to quickly bring a correct mental image from their long-term spatial memory to match that they had got from tactile perception. In other words these solids were most likely personalities for these pupils.

Confrontation of tactile and visual perception. It may happen that tactile and visual perceptions create different images about a solid. We identified this phenomenon when pupils wanted to change their tactile classification after visually checking it (see UK1-3). When the pupil UK1 perceived the hexagonal prism tactilely, a feeling of 'roundness' dominated, when she perceived the square based pyramid 'pointedness' or 'triangularity' dominated. When she perceived these two solids visually, she noticed the presence of a rectan-

gle or a square and replaced them both in the group of 'four-sided' solids. The pupil, UK2, restricted the group of six faced solids into cuboids. The number of faces of a solid is not dominant attribute when the solid is perceived visually. Interesting situation happened when the pupil UK3 started to look at his groups. The position of the non-convex prism changed. First the pentagonal face was on the top and when perceived visually it moved on its side. The change of position of the solid influenced the pupil's understanding of the solid and it caused the change of classification. (See figure.)



Change of the classification criterion. Two pupils were solving the task noticeably longer that the others. Pupil UK2 first classified the group intuitively into 'round' and 'edged'. The criterion was chosen probably after perception of the first dominant attribute. However, the pupil had to solve conflict when the hexagonal prism was perceived. He did not know where to classify the solid. It seemed to him most likely a little bit round and a little bit edged. He had to change his strategy of the choice of the criterion and he started to manipulate the solids more carefully. Finally he choose analytical attribute, the number of faces, as classification criterion. The pupils usually change the criterion when they perceive the solid with both attributes which characterize both groups (e.g. the cone is both 'pointed' and 'round') or does not have attribute of any of the groups (e.g. triangular prism is neither 'triangular' nor 'rectangular'). The solution of the second pupil we will describe in detail.

| Process of tactile classification – case of Adam (CZ1)

We now cite a case study of pupil Adam (CZ1). We chose Adam because, first he took the longest time over the task (approximately 3 times longer than

the others), second, he started by attributal classification and then after creating four groups had to give it up and change to complementary classification. In the case study, the description of our observations, taken directly from a video-recording, is written in italics and split into six stages applying RBC theory. In the comment we interpret what was going on in the pupil's mind. We are fully aware that our interpretations are mostly speculations. We find the right for the speculations in our long term experience with the problem. Moreover, we believe that these speculations are very useful for us because they help to develop our sensitivity to the identified cognitive and communicative phenomena.

Evidence 1. - Looking for criterion ('Building with'). *Adam takes the non-convex pentagonal pyramid, puts it back. He takes both pentagonal and square prisms, puts them aside and then back. Then he takes solids one by one as they come to hand. Some of them he tried to grasp at once, some of them he perceived as a whole briefly, he perceives their gestalt, some of them he manipulated carefully, moved them in his palm, touched their vertices with his fingers.*

1. he took pentagonal pyramid → put it to **L**
   (the group on left hand side),
2. cuboid → he put it to **R** (the group on right hand side),
   he touched some of its vertices,
3. rectangular prism → **R**, he compared it with cuboid
   and puts both cuboids one above the other.

Comment 1. Adam's initial familiarisation of the solids took quite long time. He first chose 5PY. This caused a distinct tactile sensation which recalled the image of a pyramid and its characteristic, 'pointedness'. This was the first selection criterion for group **L**. The criterion was initiated by perception and resulted in the recall of particular geometrical phenomenon from his long term spatial memory, the pyramid. When he chose the square based prism, it became the carrier of the characteristic for the second group **R**. Rectangular prism was put into this group and then by placing the two solids one above the other, he expressed what these solids had in common. It seemed that the type of classification at this stage was attributal, pointed solids (**L**) × cuboids (**R**).

Evidence 2. – investigative manipulation ('Construction')

4. *Adam perceived four solids at once (cube, pentagonal pyramid, tetrahedron, triangular prism), he then checked both groups **R** and **L**, each by*

one hand and then he returned to the four solids taking two solids in each hand. He put these down and tried to perceive how the groups of solids were arranged on the table.

5. *He took the non-convex prism but seemed not to know where to put it. Then he took the non-convex pentagonal pyramid in one hand and compared it with non-convex pentagonal prism, which he held permanently, by careful touching. Quite clearly he perceived the vertices of the prism and he paid special attention to the vertices of non-convex angles. Finally he touched the vertices of the pyramid with his right hand and after marked perception of its apex he put both the pyramid and the prism into* ***L****.*

Comment 2. When Adam perceived non-convex pentagonal pyramid, it was obvious that it was entirely new solid for him. He perceived its gestalt and its dominant characteristic (pointedness) was put into his short-term memory. When he perceived the prism he recognised that it was not possible to put it to the group **R** together with cuboids and started to compare it with non-convex pyramid. However, there was the 'pointedness' characteristic in his short-term memory which did not allow him to put these two solids together in **L** immediately. In other words he could not put the non-convex prism into existing structure. Both solids were new for him and thus when perceiving them he did not know on which of their characteristics to focus his tactile investigation, which their analytical attribute to put into his short term memory, so he had to use an 'external memory', that is he held a solid in each hand. Finally he realised they had a common attribute, non-convexity, so he put them together in **L**. We can derive from Adam's manipulation that he perceived this phenomenon as an analytical attribute (not global) of each solid which he perceived in a different way for each solid. For the prism he perceived two non-convex angles on opposite faces and for the pyramid just one. His noticeable perception of the apex of the pyramid indicated that he was not very happy having to give up his first criterion, break his first structure and build up new structure in which non-convex pentagonal prism fitted. The new structure building property was non-convexity. It was apparent that Adam replaced the aim to solve the task by another aim to investigate and to learn new solids.

Evidence 3. – using the new structure ('Building with')

6. *truncated cone* → ***L***
7. *tetrahedron* → ***L****, he checked of all the shapes in this group,*

8. *triangular prism – it laz on the table like a 'roof', it slipped from his grasp three times, then he carefully perceived the vertices by pairs of corresponding parallel faces. He put it to **L** but immediately took it out. After a new check of all the shapes in this group he put it back in **L**.*

Comment 3. The classification of truncated cone and tetrahedron into **L** can be explained by his return to the original criterion 'pyramidity' which was recalled by 'pointedness'. His hesitation when manipulating with 3PR was probably caused by the domination of a rectangular face. The structure of the solids in **L** was not as firm as before and solids were not linked to each other. The type of classification seemed to be changed into the complementary one.

Evidence 4. – confirmation of structure ('recognition')

9. *Adam put the cube directly into **R**, face to face with the SPR.*

Comment 4. It was obvious that the cube was a 'personality' for him, as well as for most pupils of this age, so he knew in which group to place it without any hesitation. He did not need to check the solids in the group **R**, because they were personalities form him as well.

Evidence 5. – establishing a new structure
('Building-with and 'construction')

10. *He considered the hexagonal prism for a long time, turning it, touching all the vertices of a face at the same time with his fingers. He put it back without making a decision, then picked it up again and put it in the **R** group for a while and finally placed it between the two groups **L** and **R**, creating a third and new group **N***

Comment 5. It was clear that hexagonal prism was also new for the pupil and his tactile perceptions were not linked to such geometrical images which would enable him to classify it. As in the case of the triangular prism and later the square based pyramid, the perception of rectangular/square faces dominated, which led the pupil to classify the hexagonal prism first in group **R**. However this group is seen as strong in the pupil's mind and all solids are mutually linked by their attributes hence the hexagonal prism could not remain in group **R**. He could not put it into **L** because he did not succeed in linking the hexagonal prism with the non-convex pentagonal pyramid so he had to establish the new group **N**.

Evidence 6. – constructing new knowledge

11. *again non-convex pentagonal pyramid - he perceived all vertices carefully and placed it now into **N**.*

12. *cylinder – he hesitated where to put the cylinder and so replaced it on the table as if he created the new fourth group.*
13. *square based pyramid - after touching its base he placed it in **R** but immediately took it out and compared it with the cylinder and placed them both into **N**.*
14. *truncated pyramid – he took it and investigated its attributes quickly, and placed it in **R** without any hesitation.*
15. *he put all the shapes from L to N*

Comment 6. By placing truncated pyramid in **R** he restructured this group. The initially strong relationship was loosened from 'right-angledness' of each face of the solids was loosened to 'four-sidedness'. We knew that the pupil was quite sure about the concept quadrilateral and that the scale of his images about it included trapezium. It seems that the newly created group **N** was linked only by the property 'cannot be placed into the group **R**' (see CZ1). The creation of this structure, no matter how weak it appears, was accompanied by a careful investigation of the new solids. Thus his final classification is complementary which reverses his initial intention to classify the groups attributally.

Conclusion

This study is part of our long-term on-going research on various aspects of primary school pupils' understanding of 3-D geometrical phenomena. As a research tool we have used series of tasks focused on classification of a group of geometrical solids and which were modified in different ways to meet the aim of the particular experiment. In this paper we mentioned one of them which was developed so that we were able to observe the pupil's manipulation with solids and to estimate the pupil's insight and understanding of 3D objects in comparison with the his/her communication. The results showed that we can identify three types of manipulation with solids, which relates to three levels defined by Van Hiele (Littler, Jirotková, 2004). **1.** The pupil perceives the solid tactilely as a whole, perceives its gestalt without any attempt to focus on any attribute. Perceived characteristics are verbalized by words "it is small, smooth, round, edged, ..:". **2.** The pupil's tactile perception of the attributes is done more or less randomly and is described by words: "there is a circle, triangle, square, ..." **3.** The pupil feels the attributes of the solid systematically and attributes like vertices or edges are deliberately counted. The re-

lated communication is: "the solid has got two triangular faces, 8 vertices, 6 edges, ...".

In addition, we found that the tasks used in our research, which were initially developed for diagnoses, have considerable value as educational tools. Beside that they contribute to the development of communicative skills particularly about the tactile perception, which does not appear in the school geometry at all, they develop such abilities which are required when solving other mathematical tasks and which are considered as a part of pupil's mathematical culture. The need to communicate about the solids made the pupils investigate solids more carefully and thus develop the ability to classify, to find common and different attributes, the ability to choose an effective solving strategy, the ability to formulate clearly their mental images and statements, and to work with the oral information about particular geometrical situation.

Our future research will be aimed at typologising the structure building processes and applying it to different mathematical contexts such as 2-D geometry and arithmetic, and looking for new phenomena and mechanisms when investigating 3D objects.

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CLASSIFICATION AS A TOOL FOR ACQUIRING KNOWLEDGE

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Abstract: The most substantial deficiency of mathematical knowledge in our students is the formalism of their knowledge. The students' memory stores knowledge as more or less isolated principles, precepts, formulas, algorithms, definitions and statements. Any interconnection or structure is missing. The worst problem is that the students feel no need to structure their knowledge and often disbelieve that they are able to do it. The basis of our research is to focus on these problems. The purpose of it is to identify and analyze cognitive and meta-cognitive functions which participate in building mathematical structures and to show the ways of diagnosing and re-educating misconceptions. The aim of this contribution is to provide concise information about one of these functions, which is classification. By classification, we mean: 1) a type of organizing a set of objects and phenomena; 2) a cognitive process which realizes such organization of objects and phenomena; 3) a cognitive function which a person uses during this process. In this contribution, we shall mainly focus on the latter two meanings of "classification".

Keywords: association, distribution, gallery, classification criterion, classification game, cognitive function "classification", class of partition, universe, ordering, outer classification.

Introduction

Classifying belongs to common thought processes. In school mathematics, students learn: that whole numbers are divided into three groups: positive, negative, and zero; that natural numbers are one-digit, two-digit, three-digit…; that triangles may be acute-angled, right-angled, obtuse-angled; etc. Such classifications are normally just transmitted to students and they are to accept them. Only occasionally may the students create their own classifications. First real need for classification normally happens so late as at higher secondary school when the students solve for example parametric equations, absolute value equations. All teachers are well aware how many problems these types of equations cause the students. We assume that one of the reasons for the difficulties is caused by insufficient preparation for the process of classification.

In order to develop the cognitive function of the students, it is necessary to

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motivate them to activities in which this function is manifested. In our case, it means to motivate the student to classification processes. They are, roughly speaking, of two types. Either the students should systematize/structure an area of their mathematical knowledge, or the students should systematically organize a set of cases which are all the possible outcomes of a situation. We should add that the process of structuring knowledge tends to generate new notions.

Classificatory situation and its definition

Definition 1: Let M denote a set. The finite disjoint partition of the set M into subsets T_i, $i = 1, \ldots, n$ shall be called *outer classification*. Symbolically, this may be written down as: $M = T_1 \cup T_2 \cup \ldots \cup T_n$. A constituent part of the outer classification is also a rule, instructions, or a condition which clearly denotes every class of the partition. In other words, this condition will decide without ambiguity which class every element of the set belongs to. The condition (sometimes it is either a set of conditions, a prescription, or several prescriptions) shall be called *classificatory criterion*.

Definition 2: Classificatory situation consists of:

1. A finite set G, which will be called *a gallery*; its elements will be called *objects*.
2. *Classificatory criterion* κ - a prescription which denotes a disjoint partition of the gallery G into mutually disjoint subsets $G = T_1 \cup T_2 \cup \ldots \cup T_n$, which we call the *classes of the partition*.
3. *Universe* U of objects from which the objects of the gallery are chosen.

The terms defined above shall be exemplified in the following four illustrations.

Illustration 1: In how many different ways can we read the word “abracadabra” if we start from letter A_z (the start of our journey), then we follow any zigzag course in the rightward and upward direction, so that we get into the letter A_k (the end of our journey), see Figure 1. This problem represents a combinatorial situation which may be solved by means of classification. Classification is a common problem solving strategy for solving combinatorial problems. In this type of problems, the text only denotes the universe, but the universe is so numerous that the method of identifying all its elements is impracticable. In order to gain insight the solver identifies a few elements of the

universe and this group than functions as a gallery of the given situation. The key to the solution is to discover the organizing principle which then clarifies the whole universe.

A	D	A	B	R	A_k
K	A	D	A	B	R
A	K	A	D	A	B
R	A	K	A	D	A
B	R	A	K	A	D
A_z	B	R	A	K	A

Figure 1.

In most cases, this principle is the classificatory criterion. If the student is unable to find the criterion, the teacher may simplify the problem by providing the student with all the elements of one of the partitions.

Illustration 2: Students were familiar with the classification of triangles by angles into acute-angled, right-angled, and obtuse-angled. There were some triangles drawn on the blackboard and the teacher asked the students if anyone could find all the obtuse-angled ones. Alice pointed to three triangles. Two of them were obtuse-angled but the third was acute-angled. Alice was probably confused by the fact that this triangle lay next to an obtuse-angled one (see Figure 2).

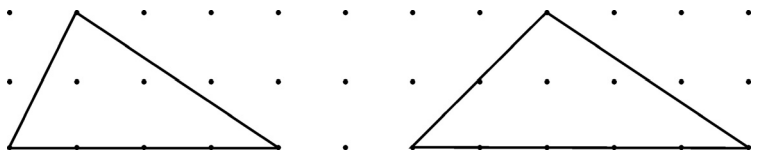

Figure 2.

Alice was asked to show the obtuse angle in the left triangle. The girl clearly did not understand. A question was then asked how we decide if a triangle is obtuse-angled. She said that it was “somehow squashed”. The next question of the teacher was if she could say what an obtuse-angled triangle was. She said that it was: “a triangle with one obtuse-angle”. However, she did

not know how to use the definition in a given concrete case. In this episode, we can see all the three entries of a classificatory situation. The collection of the triangles on the blackboard represents a gallery. The phenomenon "the size of the largest angle in a triangle" is a classificatory criterion which divides triangles into three groups acute-/right-/obtuse-angled. The universe is the set of all triangles. It seems that the student understands the prefixes acute-/right-/obtuse- in the whole situation. The episode shows that it does not always have to be the case.

Illustration 3: In workbooks for Grade 3, we found the following problem. Using lines with arrows mark which number belongs to which box.

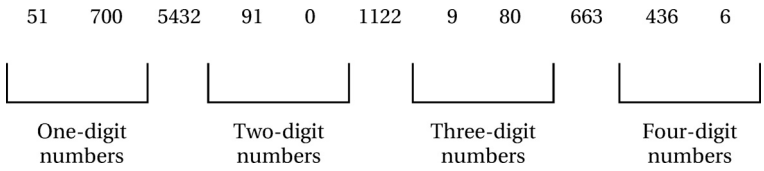

Figure 3.

In this problem, the gallery is represented by the numbers in the upper row, and four classes of partition are represented by the boxes in the lower half of Figure 3. The criterion is the number of digits of a given number.

There are four-digit numbers at most appearing in the problem. There could be a natural extension to five-digit, six-digit, …, n-digit numbers for any n. We have not seen any such possibility in the previous problem with classifying the triangles. The possibility of naturally extending the universe is specific for this illustration.

Illustration 4: The Universe U is a set of all pairs of distinct straight lines in space. The classificatory criterion is the "mutual position of distinct straight lines". U is divided into three classes T_1, T_2, T_3, which are called 1) parallel lines, 2) intersecting lines, 3) and skew lines.

The cognitive function of "classification" as a research tool

The above illustrations concerned the classifications (the galleries, criteria, universes) which are related to mathematics in primary and secondary

schools. We are now going to focus on non-school situations which we use as a research tool, because thus school attainments do not affect the results of the experimentation.

Illustration 5: Let us choose a six-element gallery G = {husa, hříbě, kotě, kůň, myš, pes}[2]. Criterion κ_1 "according to the grammatical gender in Czech language" shall divide this group into three subgroups each having two objects: masculine {kůň, pes}, feminine {husa, myš} and neuter {hříbě, kotě}. Criterion κ_2 "according to the number of letters" shall divide the group into three subgroups: three-letter words {kůň, myš, pes}, four-letter words {husa, kotě} and a five-letter word {hříbě}. Criterion κ_3 "according to the class of the vertebratea" divides the gallery into mammals {hříbě, kotě, kůň, myš, pes} and birds{husa}.

With criterion κ_1, the universe may be the collection of all nouns (in nominative singular) of the Czech language. The universe may be a set of all words in Czech which consist of three, four or five letters. With criterion κ_2, the universe may be enlarged by all the rest of Czech words, but then it is necessary to increase the number of classes so that there would be a class for every word. Similarly with criterion κ_3, the universe may be all the vertebratea and there must be a class for every vertebrate.

Illustration 6: Let us choose a twelve-element gallery from first names in the Czech language:

G = {Anna, Erika, Jana, Arnošt, David, Aleš, Dita, Eduard, Judita, Dušan, Josef, Emílie}.

This gallery may be used as starting point for finding information for problem solving (it may be used as a research tool). The task is: Find a criterion according to which we may divide the gallery into 1) two classes each having six objects, 2) four classes each having three objects, 3) three classes each having four objects. The solution of these problems may be found at the end of the contribution. Another problem from this area is: Find a criterion according to which the gallery divided up into the following classes:

a) {Arnošt, David, Dušan, Josef}, {Anna, Dita, Jana, Aleš, Judita, Eduard}, {Erika, Emílie}
b) {David}, {Anna, Dita, Erika, Jana, Judita}, {Aleš, Arnošt, Dušan, Emílie, Josef}

[2] Translation:{goose, colt, kitten, horse, mouse, dog}

Illustration 7: A task (especially for teachers) may be a challenge: create a problem dealing with classification which shall involve such and such conditions. We shall show some examples:

A. Design a gallery consisting of six elements from geography, so that they could be arranged into six cells of a table 3 x 2 according to two criteria: row criterion: (three objects of the upper row constitute one class and three objects of the lower row constitute another class) column criterion: (every pair of objects in one column create a class).

B. The same problem shall be solved for the area of a) grammar, b) literature, c) music, d) jobs, e) flowers, f) animals, g) sport, h) any area you choose.

The mentioned tools (solving classificatory problems and posing them) were used in February 2004 in two two-day seminars for primary school teachers. The seminars were run as a workshop. One month in advance, the teachers got the set of problems which they were supposed to give their students and bring the students' solutions to the seminar. The main focus of the workshop was supposed to be 1) problem posing for different age groups (including motivational stories and fairy tales) and 2) analysing the students' solutions which the participants were to bring. In the preparatory part of the workshop the teachers were asked to solve some of the more difficult problems in order to make the participants of the workshop acquainted with the problematics.

Unclear ideas of some teachers about what is classification

We are going to describe what happened during one of the workshops, namely the second one, where there were about 30 teachers present. The participants were given the problem described in Illustration 6 with gallery G that includes 12 names. The teachers were divided into six groups and were asked to find as many solutions for each case as possible. Having finished solving the problems, we wanted to devote some time to didactical analysis of the solutions obtained by the participants.

For part 1) every group brought in the criterion "sex" and at least one more criterion. Eventually, more than twelve different criterions were found. Eight most interesting ones are described below:

A) There are pair names for the original name: Dušan - Dušana, Emílie -

Emil, Erika - Erik, Jana - Jan, Josef - Josefína, Judita – Juda / the pair name does not exist: Aleš, Anna, Arnošt, David, Dita, Eduard;

B) The name starts with a vowel/consonant;
C) The name starts with "A" or "D"/ "E" or "J";
D) The name ends with a vowel/consonant;
E) The name includes/does not include the letter "L" or "N";
F) The name includes/does not include the letter "D" or "Š";
G) The name is/is not in the calendar[3] in March or December.

Some solutions provoked great discussion between the groups. It became clear that some participant of the workshop see the solutions of the problem as a competition which group would find the most solutions. And so there appeared objections against solution A) that the names Dušana and Juda do not appear in the calendar; solution E) one colleague said that the solution is forced. More important critique appeared for another solution which was brought in by the third group. It was as follows:

H) We will order the names alphabetically and the first six names will be put into the first group: Aleš, Anna, Arnošt, David, Dita, Dušan; and the rest will generate the second group.

Some participants argued that this was not a classification but they could not exactly formulate the reason why they thought so. Most participants found this solution to be correct. The plausibility of the solution strengthened when one colleague said that classification H) is the same as classification C) and there had appeared no objections against classification C).

For part 2) every group brought in the criterion: starts with the letters A/D/E/J and there were 7 other correct solutions and an incorrect one. We will not go into detail here.

For part 3) four out of six groups brought a correct solution:

I) the number of letters in the name is 4/5/6.

There appeared also other solutions, one of which started a long discussion. It was described in the following way:

J) "I have three classes. I take the names starting with "A" and put one in each class. I will do the same with names starting with "D"; then the same procedure with names starting with "E" and "J". Thus we have four words in each class."

[3] In Czech calendar it is possible to find that each day is devoted a certain first name, eg. December 24 is devoted the first name Eva.

The opponents found a good argument against: How do you know if Anna belongs to the first, second, or the third class? Then the authors improved their classification saying that they would first put the words in alphabetical order and then incorporate them into the classes. The opponents did not find the improvement sufficient but this time they were not able to find convincing counterarguments.

Afterwards the participants were invited to choose a gallery of six objects (e.g. picture, symbols, words…) that would be understandable to students in Grade 1 or 2 of primary school. It was desired that the objects should be organized into a table 3 x 2 according to a certain row and column criterion. One of the groups provided Table 1. The solvers added that for children there will not be words but pictures instead. A half of the participants considered the solution to be a good idea, the rest of the participants did not speak.

Motýl	Mravenec	Veverka
Květ	Tráva	Strom

Table 1[4]

Having been asked by the participants, the authors of the gallery formulated criteria according to which the objects were ordered into the rows and columns: "the row criterion divides the objects between animals and plants, the column criterion connects the pairs of objects which belong to each other." A participant said that in the second row there are the "habitations of the animal", another participant said that it was "such a nest".

| Comments on the situations from the workshop described above

A. Solution H) part 1) presumes that the elements of the gallery are firstly put in order – in this case it is alphabetical order. This type of organizing is suitable for example in telephone directory but it is not a classification. It is *ordering*. We understand it is a rule according to which one can decide which element precedes which element. This relation must be transitive, i.e. must satisfy the condition that if A precedes B and B precedes C, then A precedes C. (The order relation belongs between the basic concepts of the set theory.) Ex-

[4] motýl=butterfly, mravenec=ant, veverka=squirrel, kv t=flower, tráva=grass, strom=tree

amples of ordering: natural numbers may be ordered according to their size as in the example about Czech words being put in alphabetical order. An example of non-ordering: seven days in a week (they repeat periodically), all commodities in a grocery "ordered according to their price" (two different commodities are of the same price).

B. Controversial solution J) of part 3) was based on the principle of *distribution*. If I am supposed to distribute six jam cakes and nine cheese cakes to three children, then every child is going to get two jam and three cheese cakes. This is fair. The important part of this type of organization is that I make no difference between two cheese cakes and so I cannot clearly say which cake will be given to which child. It means that according to our definition this is not a classification.

C. In the proposed gallery, six objects are such that they could be ordered into 3 x 2 table, the solution provided by the teachers is based on *matching* two elements which are semantically connected. The gallery could be enlarged by three more words, forming gallery G_1 = {křídla, kusadla, květ, motýl, mravenec, ocas, strom, tráva, veverka} and students would probably organize the nine words into a table which would look like Table 2[5].

	?	**?**	**?**
Živočich	Motýl	Mravenec	Veverka
Rostlina	Květ	Tráva	Strom
Část těla	Křídla	Kusadla	Ocas

Table 2. In this arrangement, every line creates a class. Its name is written in the left column (animal, plant, part of body). However, the words in each column can hardly create a class. They are grouped on the basis of semantic affinity, or so *association*.

From the three mentioned deformations of the concept of classification, association is the nearest to classification. Here it is subsequently possible to find a name common for all the groupings (as the authors of the problem tried to prove with more or less success).

[5] křídla=wings, kusadla=mandibles, květ=flower, motýl=butterfly, mravenec=ant, ocas=tail, strom=tree, tráva=grass, veverka=squirrel; živo ich=animal, rostlina=plant, část těla=body part

Classificatory game "Guess and pay"

One of the possibilities which allow us to develop students' classificatory abilities is the game proposed here called "Guess and pay". It is a game which may be played with students since Grade 3. The basis of the game is a table which includes a certain number of objects organized according a row and column criterion. The following illustration might help to clarify the point:

Boris	Josef	Aleš
Božena	Judita	Alice

Table 3.

In table 3 there are six names inserted according to these rules:

1. In the first line, there are male names, in the second female names.
2. The names in the first column start with "B", second column with "J", and third with "A".

If we swapped the two lines, we would again get a well organized table. Even if we swapped the columns in any way, the table would still be well organized: according to a row or column criterion. This type of a well-organized table will be the basis for the game which is introduced below.

Example: Player A (informant) creates a well-organized table (e.g. Table 3) and offers player B (questioner) the set of all the objects in the table, **the gallery**, and then an empty table (Table 4), the fields of which are marked by letters.

Gallery: Alice, Aleš, Boris, Božena, Josef, Judita

A	B	C
D	E	F

Table 4.

Player B is supposed to insert the objects into the table created by player A (Table 3). In order to solve the task, player B needs some information from player A; s/he must pay for them. There are three types of information. They are the answers to one of the four possible questions:

1. In which field is this object? (Player A points to an object in the gallery.)

2. Which object is in this field? (Player A points to a field in table 3.)

3. Is this object (points to the object) in this field (points to the field)?

4. Is this the table I am looking for? (B shows a table where all the fields are filled in)

Player A answers the questions truthfully and player B pays for the answer. For answer to questions 1 or 2, s/he pays 5 points, for answer 3, s/he pays 1 point. For an affirmative answer to question 4, there is no payment but for negative answer, player B pays 10 points.

Game 1: Let us have a look at a real game played by two Grade 6 students. Radka is the informant, Lenka asks questions.

Lenka 1: "What is in field A?"	**Radka 1:** "There is Boris, you pay me 5 points."
Lenka 2: "What is in field B?"	**Radka 2:** "There is Josef. You pay me another 5 points."

After the discussion Lenka accurately filled in table 4. She solved the question for 10 points. In the return match, Radka then solved the problem for 5 points because she progressed more sensibly:

Radka 1: "Is Aleš in field A?"	**Lenka 1:** "No, he is not. You pay me 1 point."
Radka 2: "Is Alice in field A?"	**Lenka 2**: "No, she is not. You pay me 1 point."
Radka 3: "Is Boris in field A?"	**Lenka 3:** "No, he is not. You pay me 1 point."
Radka 4: "Is Božena in field A?"	**Lenka 4:** "Yes, she is. You pay me 1 point."
Radka 5: "Is Alice in field B?"	**Lenka 5:** "Yes, she is. You pay me 1 point."
Radka 6: "Is this the table? (Table 5)	**Lenka 6:** "Yes, it is. You don't pay me anything."

Božena	Alice	Judita
Boris	Aleš	Josef

Table 5.

It is clear that Radka was more successful in the game than Lenka. She used a more successful strategy.

Challenge 1: Try to describe the most successful strategy possible for this game. The reader who solves the challenge supposes that s/he knows everything about the game and expects us to increase the number of the fields in the table. Of course, it is possible but there is another possibility to make the

game more difficult. This possibility is not as obvious as the previously mentioned one and we are going to present it in the following challenge.

Challenge 2: We are playing with a gallery where we change one name: instead of Aleš we will use the name Albert. The new gallery is thus: Alice, Albert, Boris, Božena, Josef, Judita.

Boris	Josef	Albert
Božena	Judita	Alice

Table 6.

The player who was guessing was lucky because in the first question, he found out that Boris was in field A. When he asked if Albert was in B, he got the negative answer. Then he asked if the solution was Table 6. To his immense surprise, he got a negative answer again and had to pay 10 points for it.

What would you recommend to the disappointed player? How should he proceed?

In the following text, the answer to this question is revealed, so if you do not want to spoil the pleasure from your own discovery, you should not read any further and first find your own solution.

The mystery is that the new gallery has another row criterion which he did not take into account. It is the number of letters in the names. The informant used just this second row criterion and so she put the five-letter names into the first row, and the six-letter names into the second one. The table which she made had the opposite position of the names Albert and Alice.

Of course it is possible to find more criteria and swap the words even more substantially, but this should be left up to the reader to take up the challenge.

Conclusion

The ability to structure is significantly affected by the following functions: the ability to classify, the ability to establish a hierarchy, to schematize, to reveal relationships (searching for isomorfisms). This article is a short report about an experiment on one of these abilities only and that is the ability to classify. The other functions shall be dealt with subsequently.

The promised solutions for illustration 6

1) male/female names; 2) the names start with a/d/e/j; 3) the number of letters in the word is 4/5/6.

a) the number of consonants is higher than/the same as/lower than the number of vowels;

b) the last letter is "d"/"a"/different from both "d" and "a".

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Part **2**

Papers on specific topics

Counselling for Inclusive Education

"HOW TO MAKE SENSE" THE POSITIVE SELF-ESTEEM METHOD - AN EXAMPLE OF CONSULTATIVE COUNSELLING AND PEDAGOGICAL PRACTICE FROM PPR AARHUS, DENMARK

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Abstract: In the following paper we will present the PS method – an example of how you in a simple and applicable way can work with the resources and strengths of the pupil and/ or the professionals around the pupil.

The method is based on the systemic approach. In this paper we give a short introduction to the appreciative inquiry from which view the method has been developed. Then we describe how you can work with positive mirroring in order to raise the self esteem of the pupil.

The paper is the result of five years of working with the method in special classes and lately also in the mainstream school.

The appreciative practice and the consultative approach are becoming more and more common in the process of the inclusive school in Denmark. This is an example of one way to work inclusively.

Background

In the Danish education system within the field of special needs education we are trying to implement a systemic approach where we focus on relations and resources. Our aim is to train ourselves and our pupils in spotting what works and not be busy identifying what doesn't work.

This way of understanding the process of learning is in a dialogue with many years of teaching practice in analysing and explaining the needs. This change of paradigm in the educational context – and in the society generally – has had and still has great impact on the way we qualify new teachers, the way we update 'old' teachers and the way we deal with children with special needs.

Why do we see this change in the professional world of human development and change? One of the explanations might be, that we do not have enough resources any more and therefore we are compelled to develop new

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ways of understanding the process of learning. Ten-20 years ago, when you worked with a child with special needs, you were supposed to describe the difficulties and perhaps even document with a diagnosis and then you would most probably get more financial resources and different kinds of support to the child. Today these kinds of resources are not available in Denmark any more, among others due to the fact that we exclude more and more children and the expenses here are rising dramatically.

Apart from an economical aspect of excluding we also discuss the ethical perspective here. All research shows that children and human beings generally profit from being part of, and living in, a 'normal' environment. However there will always be a minor number of children with difficulties so severe that they would profit from attending special schools with specific professional competencies. But some of the children we presently exclude from the mainstream school are thought to develop better and faster if it was possible to keep them in the mainstream school.

Thus the inclusive school is what we are working at on a political, ethical, economical and educational level. In order to find a relevant theoretical, methodical and practical basis for including more children we have chosen to focus on a systemic and appreciative perspective. This means we try to find coherence in the balance between the following focus:

From	To
Exclusion	Inclusion
Child	Relations
Problem	Appreciation

AI Appreciative Inquiry

When we talk about and work in an appreciative context our view at the human being is based on the following assumptions (Cooperrider, Bateson, Maturana, Lang et. al.):

- In a group or in an individual there is always something that works otherwise it wouldn't be there
- What we choose to focus on is what we become good at
- What we choose to focus on becomes our reality
- Reality is created in the present moment and that there are many realities

- Reality is created through words
- People are more secure in the process of change if they expand what they already can do
- If we bring something with us into the future it should be the best from the past
- It is important to acknowledge that people are different and that there are just as many ways of understanding as there are people
- Change and learning is primarily nurtured through a positive approach.

When we meet pupils, parents and colleagues in an appreciative way we have a special focus on exploring what works and in what way we together can get more of this. What happens when we succeed, who does what, in what way, together with whom, where and for how long? When we try to solve problems and are focused on what doesn't work, we look for reasons, explanations and ways to act. This is a simplified model of the two ways of understanding and working:

Problem solving	**AI: Appreciative inquiry**
Identifying the problem	Appreciating what already works
Analysing the reasons	Dreams and hopes for the future
Planning actions and initiatives	Dialogues about how we can fulfil our dreams
Idea: There is a problem to be solved	*Idea: There is a mystery to be explored*

When we work within the area of appreciation our language changes and we choose to use different words:

From	**To**
Needs	Resources
Problems	Possibilities
Complaints	Hopes
Focus on individuals	Focus on relations
Monologues	Dialogues
Training	Development

The statements we use when we choose to work appreciating are also different:

The process of problem solving	**The process of appreciative inquiry**
Nothing I can do	Let us look at alternatives
I am like that	I could consciously choose another attitude which gave me different possibilities for behaving
I get so mad	I choose to be happy and do control my feelings
They don't want me to do anything	I show what I can
I can't	I want …
I'm not allowed	I am also responsible
If just …	I prefer …
Idea: We need resources and our possibilities are limited	*Idea: Our resources are limited but let's use them the best we can. And let's help each other*

In the process of appreciative inquiry it is extremely important how we use the language. The questions we choose to ask resolve the answers we get. We have a great responsibility in the type and quality of the questions we put in that they determine what kind of context we are creating. Our questions should be asked out of real curiosity, put in positive words and be motivating for an atmosphere of growth, change and learning.

Conclusion

The most nurturing and optimizing environment for learning and change is a positive and appreciative approach. Relations where people are allowed to and invited to mirror each others qualities and competencies are the most healing context for further development and growth. The more you talk about and work with an appreciative approach to communication, to relations, to teaching and to life itself, the more you become what you are focused on and the more you implement the appreciation.

And then again: What you give comes back to you. A metaphor on this is that people always turn towards the light and warmth like the sunflower. Helios was the name of the Greek Good of the Sun and this phenomenon is in the appreciative approach called the heliotrophy.

An Indian tribe is said to have cultivated the heliotrophic principle:

'If one of the young men in the tribe has broken the rules of the tribe, he will not be punished. Instead all the elders of the tribe gather in a circle and the lawbreaker is put in the middle. Then all the old men begin to tell stories about what they think the young man is doing well and previously has done that was good. Everything is told, all the details about the young man's life that can be appreciated, are mentioned. The storytelling is not over until everybody has told everything about the young man that was seen as courageous, fantastic, brave, humorous, imposing…

It might take days.'

The story is inspiring because it shows us that we actually have alternatives in our professional tool-bag or rucksack. We can choose in what way we want to meet the pupil, what side of the person's profile we want to focus on. Sometimes we have to use the analysing and problemsolving approach, especially when we want to get more financial or personal resources or if our aim has a more political than educational character.

In order to include as many children in the mainstream school as possible, we have to learn how to make most and best use of:

- The potential and the resources already in the pupil
- The relations and network around the pupil
- The potential in the environment in general, also the physical potential

We are learning the art of possibility in order to create the best mental, educational and physical 'greenhouse' for learning and change. We are learning how to highlight, nurture and develop the qualifications and competences of the pupil currently. We are learning how to mirror our professional qualifications and competencies in the process of teaching, coaching and counselling.

Through many years of working with the appreciative approach when relevant, we have seen pupils, teachers and counsellors thriving and growing in the process of mirroring what works - or in other words: AI makes sense as it gives us more positive quality of life both professionally and personally - and who doesn't want that?

The following is a description of the PS Method, a simple, concrete and applicable way of working within the appreciative field.

"The Positive Self-esteem Method"

A pedagogical way to work appreciatively with one child, a group of children or the team of adults working with a child.

The PS method is an entrance to start working appreciatively with children and/or the adults from a verbal and visual foundation. The method is developed within the area of education for children with special needs. Through clarification, video-recordings and dialogue we put focus on the resources and the competences of relation of the child and/or the adult working with the child. The method is simple, concrete and applicable within the pedagogical practice.

We have worked with the PS method for four years now and we have a lot of experience with the method. We have had 90 children through PS-courses and we have tried courses with groups of children, adults, a kindergarten-child and a whole class from a mainstream school.

The letters PS stand for Positive Self-esteem, which we find are key words to put focus on when you work with children with special needs – especially the group of children with social- and emotional problems. Often they have such a negative understanding of themselves so they don't dare to believe that anyone cares about them. This fact influences on their motivation for working with the subjects in the school or their relations to other children or adults. They have to protect themselves against suffering more defeats so they don't take any risks concerning challenging their own self-esteem. So when we work with the PS method our target is to raise the self-esteem of the child by making the child see and verbalize his/her own resources. We let the child have a look in the positive mirror so he/she will experience to be reflected according to his/her resources and NOT to the problems or troublesome behaviour which is general use.

Background of the PS Method

Christina Hostrup, teacher and Marianne Katborg, social worker worked together in a special needs class for children with social and emotional problems. They were inspired by different methods from the cognitive therapy and had good experience working with these methods in the classroom – e.g. self-registration and agreement books made by the child and the teacher together. These methods made the children more aware of their own actions. Another source of inspiration was The Marte Meo-method (Aarts, 2000) where you use video-recordings to put focus on the positive situations in a relation e.g.

mother/baby. Christina and Marianne wanted a useful tool to work with raising the self-esteem of the child through a look in the positive mirror. It was important that it was a tool that was simple, concrete and clear so it didn't mean a lot of extra work. So they invented the PS Method which today represents a way of thinking and get inspired from.

The starting point of The Method begins by looking at a problem with a child but as soon as a PS course starts you focus on the resources of the child.

The Method is built on the child being able to spot the places on the video-recording where he is good and even dare to say:"There I'm good"

The Method is a structured course where you make short video-recordings (10 minutes) of the child in the classroom or in the playground. The team of adults working with the child analyse the tape in order to find all the good spots. Then the child analyses the tape together with an adult in order to find all the good spots.

Going through a PS course

1. Make an assessment of the child.
2. Inform the parents.
3. Inform the children.
4. Video-recording in the classroom (or where it is most relevant).
5. Analyse the video-recording within the team.
6. Analyse the video-recording together with the child.
7. Repeat 4 + 5 + 6 (It's necessary to let the child have at least two recordings in order to get used to watch himself/herself on TV which is rather vulnerable. Also to get used to focus on the positive spots – most children connect video-recordings with something like hidden camera, where you focus on all the bad things maybe in order to prove something!)
8. Evaluation of the PS course together with the child.
9. Evaluation of the PS course within the team.

Ad. 1

The assessment is a paper to clarify the problem, the targets and the resources of the child. The targets are divided into two: a long-term target and a short-term target which is directly connected with the PS course. The resources are very important in order to plan a successful video-recording. It's

also an important exercise to the team to try to repeat the resources of a child who causes mostly negative pictures.

An example of an assessment:

| Assessment of: D. (boy, 11 years)

What is the problem?

- D. has huge conflicts in the break
- D. goes beyond the limit of other children and adults
- D. threatens and gets violent
- D. is not able to read the other children or adults
- D. feels misunderstood and treated unfair.

What is the target?

Longterm: that D. gets able to read other people and control his behaviour.
Short-term: that D. gets able to choose spots from the video-recording where he is good

Which are the resources of the child?

- nice and kind
- charming
- creative
- is already in a positive development
- is able to apologize
- wants to improve
- profits from praise
- is able to praise others
- wants to get in touch with other children/adults
- is able to play with different children.

Ad. 2

Next step is to inform the parents and even better – get them to cooperate. It is very important that the parents support the course and since it will be parents who often are met with complains about their child they will appreciate that someone wants to focus on the resources of their child.

Ad. 3

It is important to inform the children in the class carefully – let them ask questions and have a look into the camera e.g. At this point it is a good idea with a little exercise to get used to focus on the positive things:

Play-camera: The children continue the work in the classroom and one adult sits down with a paper and a pen and "play camera" – makes observations. You have to see a least one good thing about each child and also agree with one about the teacher. This takes about 10 – 15 minutes with 8 children – it could be things like: raises his hand before talking, concentrates, listens carefully, takes pains to be good, patient, contributes to the good atmosphere e.g. Then the adult tells the class what the "play camera" has recorded – and here you can be sure of absolute silence.

Ad. 4

The video-recording is at most 10 minutes – then you'll typical find 20-30 good spots. It's also the limit for how long the child can concentrate on the task – this is hard work. It is a good idea with a break or a possibility for relaxing for the child right after the recording. The situation you record will always have to be connected to the problems and the targets. E.g. the boy D. from the assessment will be filmed in the playground in the break. His teacher will help him to plan the break so he can succeed (knowing his resources.) – where will he be, what will he do with whom, what if something goes wrong…etc. Then we will see a boy we maybe never have seen before, but very important to know that this boy exists. It's like giving the child a present: show me the best part of yourself.

Ad. 5

The team will now watch the 10 minutes video-recording together. They will stop the tape each time the see a good spot and write take it down on a paper just to register how many good spots do they see within 10 minutes. They will then choose some spots they want to show to the child. This will typically be situations related to the targets.

Ad. 6

Analyzing the video-recording together with the child is a very important part of the whole PS course. Here you have to have at least two adults present. One will concentrate on the conversation with the child and the other will observe what happens during the conversation. How does the child react, what does he/she answer, can he/she choose good spots on the tape, can he/she explain the good spots which the team has chosen, how is his/her body language, comments etc. This is at the same time a unique possibility to get to know the child better.

Before you start watching the tape it's very important to reach a shared definition of the word "GOOD" eg.:

Teacher: "Now we'll watch the video-recording of you in the playground D. You'll have to look for all the good spots to see how many you can find. We (the teachers) have already watched the tape and we found a lot. But tell me D. – how are you good in the break at the playground?"
D: "It's something about having fun together and make it nice to be there"
Teacher: "Yes. And what can you do to help having fun together"
D: "If I talk nicely to the other children"
Teacher: "Yes. Could there be other things?"
D: "If I play with the other children instead of fighting them."

Etc….

The teacher and the child watch the video-recording together and talk about the good spots. At first it will be the spots that the teacher has found.

Teacher: "I have chosen this situation. Can you figure out why?"
D: "No"
Teacher: "How do you look in your face?"
D: "Happy?"

Teacher: "Yes. You are smiling – it means you contribute to the good atmosphere. Will you also choose this situation?"
D: If no then ok, and they continue watching the tape – if yes…
Teacher: "How good do you think you are here on a scale from 1 to 10?"

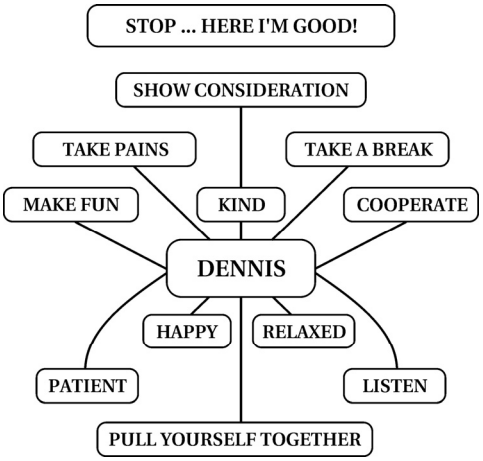
D. has a paper with a scale in front of him. He puts a mark at the number he finds correct – eg. 5

Teacher: "You give yourself 5 – what should happen to make it 6?"

To work with this scale will give you the possibility of some assumptions. You will get an idea of how the child values himself, what he values most and by talking about the scale you might also find out why he values as he does. Also for the child it is an important paper. It's a definite task in a maybe difficult situation.

Ad. 8

After two weeks there will be an evaluation together with the child in order to keep all the good situations in mind and make them permanent. The child will receive a diploma which he can take home and put up on his/her wall. Often the teacher wants a copy in the classroom. It is a good idea to invite the parents to this evaluation – they get very proud. On the diploma it is important to use the same words as you used in the conversation with the child. eg.



Ad. 9

Finally you evaluate within the team with focus on: Where did we succeed? What did we do in order to succeed? What do we do in the future to get more of this?

You can also consider if it's a good idea to follow up later. And how do we get it spread out to the rest of the team? To the rest of the school? To the rest of the parents? etc.

After working with this method for four years new developing possibilities appear. The PS method is also suitable for working with the team where you change the focus from the child towards the adults. You make video-recordings of the teacher and then you find all the good spots on the tape in relation to the fields the teacher wants to focus on in order to develop.

It's also possible to work with groups of children with this method – then it is very important to be aware of the ethics when you watch the video-recordings with more children together. There must be certain rules because you are very vulnerable when you represent yourself on video. But at the same time it is a very good exercise to cooperate on finding common values and spotting them on the video together. When you evaluate a PS course with a group of children the group will receive a group-diploma to put up in the classroom.

The PS method has also been tried out with a kindergarten child and with a whole class of 24 pupils – both courses have fine results in connection with the value of focusing on what works instead of focusing on the problems. The idea of putting up a positive mirror together with the visual entrance creates possibilities for working inclusively instead of excluding. By focusing on all the things that work and describe them with words these become reality.

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Part **2**

Papers on specific topics

Parent Training and Involvement in Early Childhood Inclusive Programmes

DEVELOPING FRAMEWORKS AND TOOLS FOR THE ANALYSIS OF PARENT-CHILD INTERACTIONS AND THEIR IMPACT ON CHILDREN'S SELF-REGULATION

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Abstract: This paper presents a preliminary analytic framework for the analysis of parent-child interactive dynamics taking place during an intervention programme oriented to foster a self-regulated approach towards academic tasks in primary school children who present difficulties in learning at school. The overall aim of this study was to explore the extent to which and the ways through which the quality of parent-child interactions and the incidence of metacognitive talk and strategic behaviours among parents and children changed while the participants were engaged in homework and study-related activities especially designed to foster metacognitive awareness. Primary school children (aged 7-10 years) showing low levels of academic achievement and self-regulation in the classroom context and parents presenting consistent difficulties when supporting their children's learning at home were selected for the study. During 7 parent-child sessions parents and their children were encouraged to work together on a series of academic tasks using a problem-solving approach involving task definition, planning, strategy monitoring and use, and evaluation (King, 1991). As part of the programme parents were invited to watch the videos of the sessions and to reflect upon them with the researcher using the Video Stimulated Reflective Dialogue methodology (Moyles and col. 2003).

Following a microgenetic approach to the data (Granott and Parziale, 2002) the analysis of parent-child interactions proposed in this paper focuses on elements such as the cognitive level of the interaction, the degree of shared responsibility over the task and the contingency of parental support.

Keywords: Metacognition, self-regulation, scaffolding, microgenetic approach.

Introduction

Today there is wide recognition that self-regulated performance is variable and highly context-dependent (Boekaerts, 1999). Scholars working within a socio-cultural perspective have provided consistent evidence that social interactions taking place between adults and children in the classroom context and the home environment have a significant impact on children's development of self-regulated learning (Perry, 1998; Moss, 1990, and Shumow, 1998). Acknowledging the influence of socio-cultural factors in self-regulation is particularly significant in the case of children who experience difficulties in learning at school (Kershner, 2000).

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Studies concerning the academic performance of children who experience difficulties in learning at school have consistently shown that these students, regardless of their heterogeneity and specific difficulties, tend to display low levels of metacognitive knowledge about person, task, and strategy variables; are likely to have a limited repertoire of strategies from which to select when facing academic tasks, and show deficient regulation of their cognitive activity and/or motivation during task performance (Sugden, 1989; Booker Loper and Murphy, 1985, and Butler, 1998). Encouragingly, intervention studies with the same population have also provided evidence that self-regulated performance is modifiable and sensitive to instruction, especially when the intervention involves explicit instruction of cognitive and metacognitive strategies; scaffolding and feedback by a more expert adult or peer, and transfer of responsibility from the more expert to the novice (Swanson, Hoskyn and Lee, 1999).

From a different line of inquiry, research on the impact of parent-child interactions on children's metacognitive development has provided evidence that parents can play an important role in the development of children's self-regulated approach towards tasks especially when they: (a) actively share the responsibility of the task with the child, (b) shift the responsibility of the task to the child when he or she is ready to perform independently, (c) encourage dialogues seeking a shared understanding of the task, and (d) contingently model the use of cognitive and metacognitive strategies (Gauvain and Rogoff, 1989; Radziszewska and Rogoff, 1988; Moss, Parent, Gosselin and Dumont, 1993). Research on parental tutoring styles in naturalistic and laboratory settings have also shown that, even when parents may have many different resources to encourage their children's self-regulation, they tend not to be aware of the scaffolding strategies they use and how these strategies relate to the emergence of planning and monitoring skills in their children (Rogoff, 1990; Wood, 1998; Garton, 1992; Tizard and Hughes, 1984, and Beveridge, 1997). Granott (1993) has contributed to show that parents and other adults can engage with children in interactive dynamics characterised by adult dominance and lack of joint decision making which can actually restrict opportunities for children to develop learning. Parents are also likely to be unaware of these dynamics.

Most of the studies that have assessed the impact of adult interactive styles on children's cognitive performance have explored relationships between parent-child interactive dynamics during single decontextualised problem-solving tasks and children's subsequent independent performance on similar tasks. Studies that have explored the impact of parent-education programmes have also based their conclusions in pre and post intervention analysis of parent-child interactions and on children's pre and post assessment outcomes (Shumow, 1998). Little attention has been paid so far to the microprocesses of change in family interactive styles that occur session by session in the course of an intervention and the specific ways through which these changes lead to the intervention's outcomes.

A methodological approach able to account for those fluctuating and contextually-based processes of change occurring every time individuals are exposed to similar learning situations is the microgenetic approach (Granott and Parziale, 2002). Microgenetic methods focus on the analysis of microprocesses of change in abilities, knowledge and understanding taking place while individuals engage in specific learning tasks. Through the use of highly dense observations of individuals engaging in similar tasks during short time spans, microgenetic studies have contributed to the understanding of the path, rate and breath of change, as well as the interactive processes taking place between specific contexts, task demands and social dynamics occurring among the individuals who participate in the learning tasks.

Following a microgenetic approach to the data gathered (Granott and Parziale, 2002) this study aims at exploring changes at the micro level (session by session), identifying which are the specific paths through which parents become more effective scaffolders of their children's self-regulated learning and what are the factors that impact on the emergence and the quality of the changes taking place in the interactive dynamics. The microgenetic analysis of data seems particularly suitable for the exploration of features such as the cognitive or metacognitive level of the interaction established between parents and children and the contingency of parental support.

Methodology

| Participants

A total of 17 families from three schools in Santiago, Chile participated in the study. The children (8 girls and 9 boys ranging from 7 years 2 months to 10 years 9 months) attended third, fourth and fifth grade classrooms. All the children in the sample were achieving below the average of their year group in the curriculum areas of maths and language and all of them were showing lower levels of self-regulated performance in comparison to average achievers in the same classrooms.

Parents of all these children reported having difficulties when studying with them in the home environment and expressed that they needed guidance to improve the quality of support given by them at the time the study started. Within existing variability, initial patterns of parent-child interactions were mostly characterised by adult dominance and control over the task with limited opportunities for the children to elaborate on strategies. Parents' educational levels ranged from completed secondary education to graduate degrees with the majority of the parents having completed undergraduate degrees. Most of the parents were professionals. Family participation involved 9 dyads (mother-child) and 8 groups (mother-father-child).

| Procedure and Design

The study was structured in three phases or stages involving an intervention programme sandwiched between an initial and a final assessment of the children's self-regulated performance.

The intervention programme included 6 sessions where parents and their children were encouraged to carry out study-related activities in the areas of reading comprehension and mathematical problem solving. Metacognitive awareness and strategic development were fostered by encouraging the participants to: (a) define in their own words the purpose of the tasks; (b) look for relationships with previously performed tasks; (c) discover the best strategies to solve the tasks or learn new ones; (d) monitor the use of the selected strategies; (e) evaluate the relative efficacy of the strategies learned, and (f) assess the quality of their overall performance (King, 1991). In each session strategies for approaching the tasks were suggested. Activities were structured so that they encouraged turn taking, providing explicit opportunities for the par-

ents to model the use of suitable strategies. Each parent-child session was video-taped and a copy of the video was given to the family for observation. Activities took place every fortnight.

Analytic Framework

Two theoretical models and two preliminary coding schemes have been developed by this study as an initial way of exploring the impact of the quality of parental mediation on the emergence of children's self-regulated performance in the context of academic tasks.

| Theoretical Models

In order to account for the relationships between parental mediational style and children's opportunities to develop self-regulated approaches towards academic tasks the study has developed two models which applicability will be tested against the study's data. These models represent two different patterns of relationships between the following elements: (a) the degree of collaboration among the participants and the level of shared responsibility over the task (Granott, 1993); (b) the type of cognitive demand implied in the adult's scaffolding (Wood, Bruner and Ross, 1976); (c) the degree of contingency of adult support (Wood and Middleton, 1975), and (d) the extent to which children have opportunities to engage in strategic performance and metacognitive discourse (Hartup, 1985) (See Figures 1 and 2).

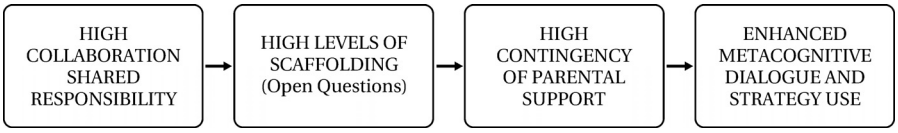

Figure 1. Pattern of Interaction Based on High Levels of Collaboration

Figure 1 illustrates a pattern of highly collaborative interaction between parents and children. Because collaborative interactions are characterised by shared decision making and responsibility over the task, parents tend to use open questions which seek to achieve a joint understanding of the task and an agreed plan to carry it out. These questions provide opportunities for the

child to define goals and to elaborate on suitable strategies, fostering a self-regulated approach towards academic tasks. Collaborative interactions are also characterised by contingency of parental support. Within this pattern of interaction parents are likely to model the use of strategies when noticing lack of expertise on the part of the child and are also likely to withdrawn support when noticing that the child is able to perform the task independently.

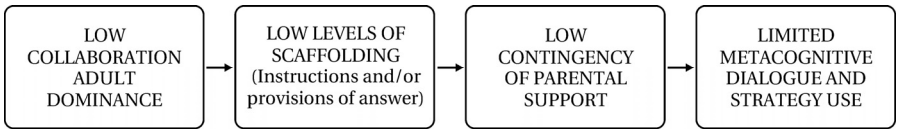

Figure 2. Pattern of Interaction Based on Low Levels of Collaboration

In interactions characterised by poor collaboration between parents and children, parents tend to be in control of the task, providing less opportunities for children to manipulate materials and contribute with their ideas. Children are generally instructed about the correct way of performing the task, leaving very little space for them to elaborate on task attributes, demands and suitable strategies. Consequently, this type of interactive dynamics tends to limit the children's opportunity to self-regulate their cognitive efforts. High levels of adult dominance often prevent parents from listening to their children's proposals and difficulties, resulting in the provision of support which is not necessarily contingent to the children's understanding of the task (See Figure 2).

Evidence from previous studies supports the suggestion of these models as possible frameworks for analysing the relationships between the quality of parental mediation and the development of self-regulated approaches on the part of the children. When exploring interactive patterns of mothers and their gifted and normally achieving children, Moss (1990) found that mothers of gifted children were more likely to engage with their children in metacognitive talk and were less controlling in terms of their children's behaviour. Conversely mothers of normally achieving children were more likely to verbalise at low levels of scaffolding and spent more time managing behaviour. More recently, an intervention study by Shumow (1998) showed that, after participating in a parent education programme that included information about children's cognitive development through newsletters and systematic conver-

sations with the researcher, parents significantly reduced the level of control and increased the opportunities for children' s planning when working together on maths problem-solving tasks.

| Coding Schemes

In order to assess the applicability of these models of interaction, the study has developed two preliminary coding schemes. The first one of these coding schemes aims at analysing the cognitive level of the different scaffolding strategies used by the parents. The second coding scheme has been developed to categorise the children's level of understanding of the task and of their response to parental mediation.

Coding the Level of Parental Scaffolding

Based on previous studies of parental scaffolding (Radziszewska and Rogoff, 1988; Gauvain and Rogoff, 1989; Freund 1990; Moss, 1990; and Shumow, 1998) and on a grounded approach towards the data gathered during the programme (Charmaz, 2000) a series of seven scaffolding levels were identified with level 1 representing the least cognitively demanding step characterised by episodes where the adult answers the questions posed by the activity or solves the task for the child and level 7 representing the most cognitively challenging step characterised by the adults' use of open questions or comments referring to cognitive and metacognitive aspects of the task (see Table 1).

SCAFFOLDING LEVEL	DESCRIPTION AND EXAMPLES
Level 7 **Open questions** **Or Metacognitive** **Comments**	Questions that ask the child to elaborate answers (can refer to cognitive or metacognitive aspects of the task) or comments referring to aspects of metacognitive knowledge and strategic control. **E.g.:** *'Do we always read with the same purpose in mind?'* *'Can you tell me how you solved this problem?'*
Level 6 **Rephrases open questions or metacognitive comments**	The adult rephrases questions or comments allowing a better understanding on the part of the child. **E.g.:** *If the original question is 'What are the best strategies to solve this problem?' the adult might ask 'What are the tricks we could use to solve this problem in the best way possible?'*
Level 5 **Breaks down questions or task goals**	The adult uses subquestions and prompts the child to identify a series of steps that can lead him or her to accomplish the final goal of the task. **E.g.:** *If the task goal is to create a plan for understanding texts, the adult might ask:* *'If we are reading for understanding what is the first thing we need to do?'* *'What can we do next?'*
Level 4 **Relates questions, task goals or task contents to previous and meaningful experiences**	The adult relates the content or goals of the task to situations that are meaningful for the child. **E.g.:** *Given a mathematical problem-solving task the adult might say: 'Do you remember what we did when we had to give sweets to all your friends at the school party?'*
Level 3 **Provides clues**	The adult provides hints or clues to trigger the child's thinking processes. Includes non-verbal behaviours that prompt strategic actions. **E.g.:** *'When we start learning a poem we always do something at the beginning …can you remember what is it?'*
Level 2 **Provides alternatives of possible answers**	The adult provides the child with different alternatives of possible answers. **E.g.:** *'If we get stuck when reading out loud, we can: read the word in silence and then out loud, separate the word in syllables and reread it, or skip it and continue reading to figure out what the word might be'.*
Level 1 **Provides answer or solves the task for the child**	The adult gives the answer to the question or solves the task for the child.

Table 1. Levels of Parental Scaffolding

Coding the Child's Level of Understanding

The grounded analysis of transcripts and excerpts of video data has lead to the development of a preliminary coding scheme to represent the children's level of understanding of the task and of their responses to parental mediation. This coding scheme comprises a four level scale that ranges from level 0 characterised by no opportunities for the child to express his/her understanding of the task to level 3 characterised by clear understanding of the task or the parent's questions (See Table 2).

RESPONSE LEVEL	DESCRIPTION
Level 3	The child shows clear understanding of the questions or tasks goals. Evidence of understanding are complete, reflective answers contingent to the adults' questions.
Level 2	The child show partial understanding of questions or task goals. The child might provide short answers which do not consider all relevant variables or sources of information. The child might also show a limited repertoire of strategies and previous experiences restricting the depth and breath of his/her answers.
Level 1	The child shows no understanding of the questions, comments or clues posed by the adult. The child might automatically repeat adults' comments or imitate adult's actions after instances of modelling.
Level 0	The child is not given opportunities to answer questions or accomplish the task goals. The adult takes most of the responsibility for the task.

Table 2. Children's Levels of Understanding of the Task

Illustrative Examples of the Application of Codes

In order to illustrate the suitability of these coding schemes in relation to the data gathered, three coded excerpts from the intervention sessions are presented here. These excerpts were selected because they are clear examples of the existing variability in family interactive dynamics and because they are

representative of the type of changes which occurred in those interactive dynamics throughout the sessions. Two of these excerpts present the interaction of two different families engaged in the first session of the programme. The last excerpt shows interactive dynamics of one of these families during the third session.

The term *move* has been chosen as the unit of coding (Boyatzis, 1998) and has been defined as each one of the participant's turns in the interaction including parents' and children's utterances as well as non-verbal behaviours such as facial expressions and indicative gestures.

Parents' moves have been coded using the levels of scaffolding while children's moves have been coded using the levels of understanding. Qualitative features of the parents' scaffolding strategies have been categorised using Tharp and Gallimore's (1988) Means of Assisting Performance (See Appendix 1). These categories have been used only when parental scaffolding seems to be better characterised by its attributes rather than its level.

Case 1 Session 1: *An example of contingent scaffolding at a high level of cognitive demand*

Table 3 presents a full transcription of a three minute excerpt of video of a group (father, mother and child) interacting during the first session of the programme. The first column on the left of the table represents the sequence of moves while the third and the fourth columns respectively represent the codes for the parents' scaffolding level (SL) and for the child's level of understanding (LU). The second column presents a verbatim transcription of the dialogue taking place among the participants. Non-verbal behaviours are described in brackets.

As shown in Table 3 these parents were operating at a high cognitive level. The scaffolding strategies used by them ranged from level 7 to level 3, with level 7 moves accounting for almost half of the coded moves of parental scaffolding. The analysis of the transcripts reveals that the main way these parents were encouraging their child's participation and learning was through the use of open questions either related to the task's goal or to previous and meaningful experiences for the child. The table also shows that during this brief interaction the child progressed in her level of understanding of the task (Moves 1to 9; 10 to 19, and 20 to 32)

MOVE	DIALOGUE	SL	LU
1	**M:** (Reading the activity) Welcome to this first activity. The goal of this session is to think about the following questions: What do we read for?	7	
2	**C:** (Looks at the mother with 'clueless' expression)		1
3	**M:** What do we read for? Do we always read with the same purpose in mind?	7	
4	**C:** Nooo		2
5	**M:** (Continues reading the activity) What types of questions are normally presented in reading comprehension activities? Which are the best strategies to understand the meaning of a text? (Mother focuses child's attention by touching her arm)	7	
6	**C:** Understand the text, read before saying: Noo, I don't understand!		2
7	**M:** Very good, you mean the first thing we have to do is actually read the text before saying: I don't like it! It's too difficult! It's too boring! (child laughs and hides behind the mother acknowledging that the adult is illustrating an attitude she frequently adopts)	4	
8	**M:** But you…What do you read for?	7	
9	**C:** I read so I can…because…so I can… I don't know		1
10	**F:** For example, Why do you come to school?	4	
11	**C:** To learn how to read		2
12	**F:** O.K., what else do you do at school, besides learning how to read? What else?	4	
13	**C:** I study		2
14	**F:** And what other things do you learn?	4	
15	**C:** French, Spanish…		2
16	**F:** In general you come to school to learn, but besides learning what other things do you do at school? Do you only come to learn? What other things do you do at school?	4	
17	**C:** I play		2
18	**F:** You play too! You come here to have fun because learning is fun, isn't it? Or is it boring?	4	
19	**C:** Is fun		2
20	**F:** So now, when you read… Why do you read? When you come to school…do you read? What do you read for then?	7	
21	**C:** To learn		2
22	**F:** Yeah, but when you read CONDORITO (comic book)? Do you have fun?	4	
23	**M:** When you read your book about jokes, nursery rhymes and other things…	4	
24	**C:** Ooh, yes! (insight)		3
25	**M**: Why do you read it?	7	
26	**C:** Because it's fun!		3
27	**F:** And for example when we need to put together one of your big games, the handyman shop	4	
28	**F:** What comes in there? A sheet with…	3	
29	**C:** Instructions		3
30	**F:** So why do we read instructions?	7	
31	**C:** To know things before start asking questions		3
32	**F:** Exactly! So we read instructions about how to build something and we are not going to use what we learnt somewhere else.	7	

Table 3. Case 1 Session 1 (Duration 2:42)

Interactions between the parents' levels of scaffolding and the level of understanding reached by the child are clearly represented in Figure 3.

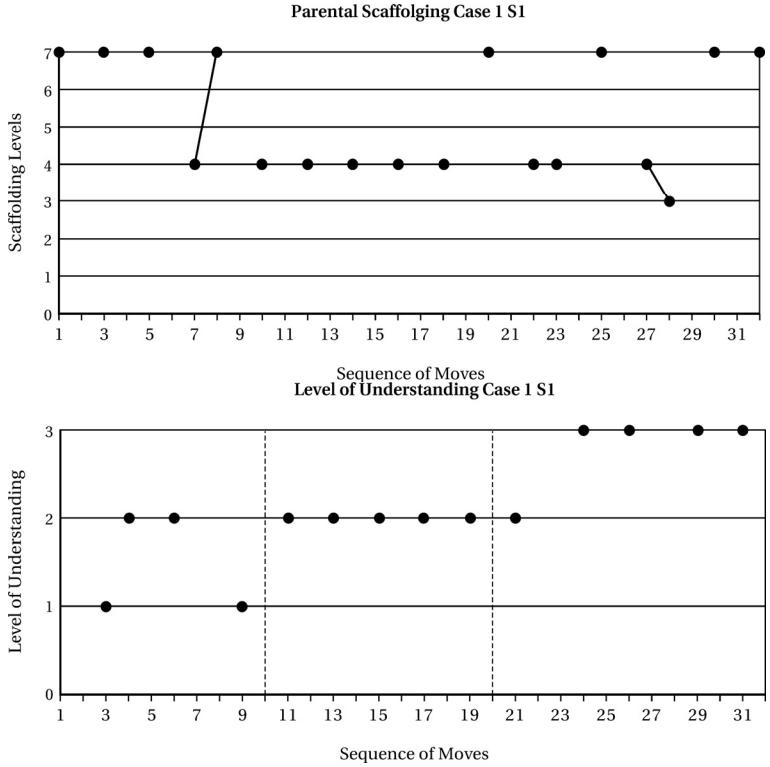

Figure 3. Parental Scaffolding and Children's Level of Understanding - Case 1 Session 1

Three episodes within this excerpt can be identified through the joint analysis of the graphs and the transcripts: (a) an initial episode characterised by low contingency marked by high cognitive demands on the part of the parents and low levels of understanding on the part of the child (moves 1 to 9); (b) an episode of contingency at an intermediate cognitive level where parents keep relating the task's question to experiences familiar to the child and where the child keeps providing partial answers (moves 10 to 19); and (c) a final episode of contingency at a higher cognitive level characterised by the parents' use of metacognitive questions and by a clear understanding on the part of the child (moves 20 to 32). These episodes have been segmented in the transcript.

Case 2 Session 1: *An example of poor contingency and scaffolding at a low level of cognitive demand*

Table 4 presents a very different pattern of interaction of a second group (father, mother and child) interacting during the same session of the programme.

MOVE	DIALOGUE	SL	LU
1	**M:** Can we go now to the next question? (c is leaning on his father as the mother reads the question from the activity sheet)	-	-
2	**F:** O.K. What is the next question?	-	-
3	M: What strategies can we use to understand texts? (reading the activity)	**7**	
4	**F:** You are really good at this! What kind of strategies?	**7**	
5	**C:** Aa.. (interrupted by the father)		**0**
6	**F:** It means what kind of things do we do to understand?	**6**	
7	**C:** To understand… (interrupted again)		**0**
8	**F:** First read the text	**1**	
9	**C:** Read the text		**1**
10	**F:** Then?	**7**	
11	**C:** Read it several times		**3**
12	**F:** Mmmh (not very pleased)…yes, reading it more than once can be a technique. The other thing is… (brief pause) underline!	**1**	
13	**C:** Underline the things (interrupted)		**1**
14	**F:** Or highlight if the texts are too long. (Pause) Highlight the important events, as you say, remember the names of the main characters, that's a strategy as well. (child leans on his father again) Understand the meaning of what you are reading. What subject am I reading?	**1**	
15	**F:** Do you understand? (Pause) Yes or no?	**2**	
16	**C:** Mmhm (yes)		**1**
17	**M:** When you are in your classroom do you lean on your friends like that?	-	
18	**C:** No	-	-
19	**M:** And why…?	-	
20	**C:** Because I want to be with my daddy		-
21	**M:** Why don't you sit up straight? I'm serious, this is work.	-	
22	**C:** O.K. (sitting up straight)		-
23	**F:** Let's continue with the next question	-	
24	**M:** Elaborate a plan that might help you to perform reading comprehension tasks (reading the activity)	**7**	
25	**C:** Reading comprehension…a plan…		**1**
26	**F:** A plan… what do you need to do? (child is interrupted)	**6**	
27	**F:** Read the headings, first thing!	**1**	

28	**C:** Yes and if I don't understand them, read them again and remember what they mean.		**3**
29	**F:** Then, in order to follow your plan you must…take notes…	**1**	
30	**C:** Yes take notes		**1**
31	**F:** Of relevant facts	**1**	
32	**C:** Yes, that as well		**1**
33	**F:** Instead of highlighting them you can write them down, you might have a plan Oh! That's interesting and then (he makes the gesture of writing)	**1**	
34	**C:** That's interesting (imitates father's gestures)		**1**
35	**F:** You can also make a summary, this text that is big, I can make it smaller, that's also a plan to understand better.	**1**	

Table 4. Case 2 Session 1 (Duration 2:16)

In this case the parental level of scaffolding was characterised by sudden jumps from level 7 (triggered by the task) to level 1. Most of the parents' moves were located at the least cognitively demanding level of scaffolding, reflecting the parents' difficulties in raising the challenge for the child even after responses that reflected adequate levels of understanding on his part. In response to this style, the child's level of understanding of the task remained at a low level.

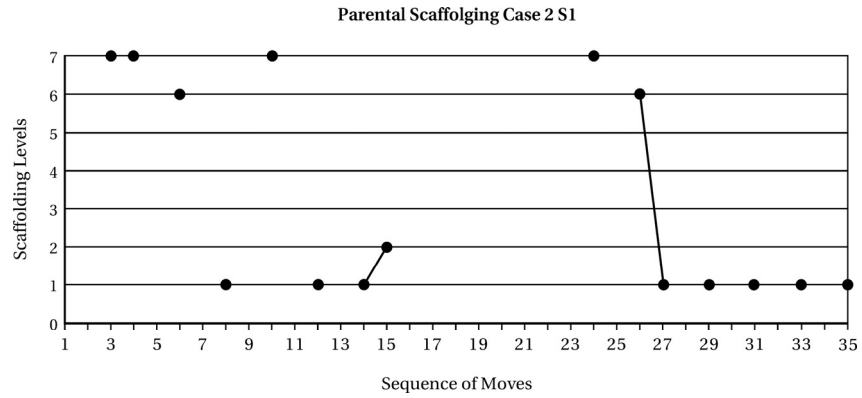

Figure 4 a. Parental Scaffolding and Children's Level of Understanding – Case 2 Session 1

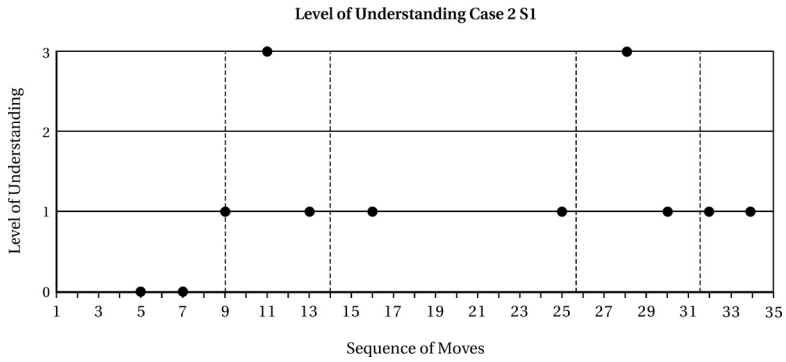

Figure 4 b. Parental Scaffolding and Children's Level of Understanding – Case 2 Session 1

Figure 4 clearly illustrates how the lack of challenge and opportunities reflected in the parents' interactive styles hindered the child's opportunities for reaching higher levels of understanding of the task.

The joint analysis of the graphs and the transcripts allows the identification of two clear episodes of poor contingency where the father was not able to raise the level of scaffolding after the child showed clear understanding of the task's question (moves 9 to 14 and moves 26 to 32). The appearance of code 0 in relation to the child's responses illustrate that within this excerpt the child was interrupted and did not have the chance to verbalise his thoughts. The interaction illustrated by this excerpt is characterised by adult dominance and by a directive style that reduced the opportunities for the child to elaborate on strategies. Another relevant feature of this interaction is the time invested by the mother in managing the child's behaviours (moves 17 to 23). Patterns of interactions similar to the ones observed in this excerpt have been previously reported by other researchers exploring interactive dynamics and their impact on children's performance (Moss, 1990 and Shumow, 1998).

Case 2 Session 3: *Parent's raising the level of their scaffolding strategies and their child's level of understanding*

In order to illustrate the extent to which the coding schemes are able to account for changes in the interactive dynamics throughout the sessions a third excerpt is presented. Due to the low cognitive level of parental scaffolding and the lack of contingency observed in Case 2 during the first session an excerpt of the interactions of the same family working on the third session of

the programme was selected and coded. Table 5 shows the transcription and codes applied to this excerpt of video data.

The analysis of the transcripts reveals that by the third session these parents were actively attempting to raise the level of scaffolding using more open questions and clues instead of providing answers. The qualitative analysis of parents' utterances and actions revealed that many of the parents' behaviours during this clip were better described by characterising the *type of scaffolding* instead of the cognitive demand involved in the scaffolding steps. Using Tharp and Gallimore's (1988) Means of Assisting Performance as a categorisation (see Appendix 1), it was possible to observe that during this excerpt of video these parents were engaged in a series of strategies oriented to encourage their child's independent performance such as: monitoring, providing feedback, praising achievement and re-directing the child's attention towards the task.

The analysis of the child's responses to the parents' changes in their scaffolding strategies shows that by the third session the child was able to reach higher levels of understanding and independent performance (See Table 5).

MOVE	DIALOGUE	SL	LU
1	**C:** They are marine animals		**3**
2	**F:** Can you mention another characteristic?	**7**	
3	**C:** 'Most…oof…theeem' (F holds the page for C) WAIT (C erases). **C:** …are…meat…eaaa…ters… MOST OF THEM ARE MEAT EATERS. (C verbalizes at the speed of his writing) (F nods approving what C has done)		**3**
4	**M:** (Monitors the quality of the writing)	**7 MO**	
5	**F:** Can you find another important characteristic?	**7**	
6	**C:** Here they say…(C interrupted)		**0**
7	**F:** Here's the text (reaching the text)	**3**	
8	**C:** Here they talk about defence mechanisms (C raises the volume of his voice so he get to be heard by F)		**2**
9	**F:** Here's the text (Placing the text in front of C)	**3**	
10	**F:** What is another important characteristic of marine animals?	**7**	
11	**C:** That they can breathe under the water? (C looks at F asking for approval)		**3**
12	**F:** (Nods)	**FB**	
13	**F:** Can you imagine if they couldn't breathe under water? They would (pause) …die	-	
14	**M:** They drown	-	

15	**F:** They drown (F continues holding the page for C) That's a very important characteristic!	**CoM PA**	
16	**M:** (Points to another characteristic in the text)	**3**	
17	**F:** And you can number your items, one, two, three (pointing at the text C has written)	**7**	
18	**M:** And also they are…(M waits and distance herself from the text)	**3**	
19	**F:** (Continues monitoring C as he numbers the items) Here two and here three!	**MO I**	
20	**C:** (Gets distracted)		**OT**
21	**F:** Continue	**CoM AT**	
22	**M:** What else do they have?	**7**	
23	**C:** (Appears to be writing) (F holds the page again)		**OT**
24	**M:** (Greets person passing by)	**OT**	
25	**C:** Who's that?		**OT**
26	**F:** I don't know	**OT**	
27	**M:** Miss Noelle		**OT**
28	**F:** What else? Number 4 what is the fourth characteristic (hand gesture calls for C's attention)	**7**	
29	**C:** I have no idea		**1**
30	**M:** Noo? You don't remember? (M approaches the text)	**3**	
31	**F:** Here it is! Read! If you don't know go back to the reading (F approaches text as mother points out to the paragraph were the information is provided)	**7**	
32	**C:** (reading) 'However if they ask you, you can, can, can you can say that they are marine animals		**2**
33	**F:** You already answered that	**FB**	
34	**C:** 'And they are verte…brate (C continues reading until he realises that he found the information missing)		**3**
35	**F:** They are vertebrate!	**CoM PA**	

Table 5. Case 2 Session 3 (Duration 2:38)

The joint analysis of the parents' and the child's responses presented in Figure 5 shows that this interaction was not only characterised by higher levels of parental scaffolding and higher levels of understanding on the part of the child, but also by the presence of episodes of contingency of parental support which were absent during the first session.

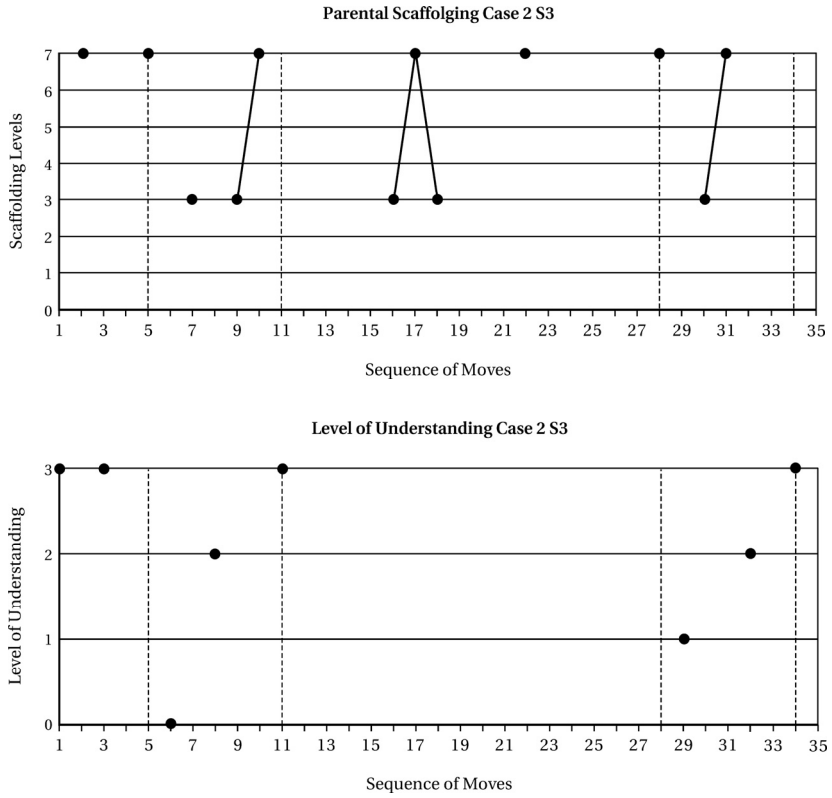

Figure 5. Parental Scaffolding and Children's Level of Understanding – Case 2 Session 3

The sequences of moves marked in the graphs (5 to 11 and 28 to 34) clearly illustrate that by the third session parents were more attuned with their child's level of understanding and, therefore, there were more able to provide responsive and contingent support.

| Discussion and Emerging Issues

The intention of this paper has been two fold. The first aim has been to illustrate how the analysis and understanding of the emergence of a self-regulated approach towards learning tasks requires the development of theoretical and analytic models able to account for the contextual factors that impact on the learning situation (Butler, 2002). In order to accomplish this goal the paper has presented two preliminary models of the relationship between

collaboration, parental tutoring styles, and children's opportunities for engaging in self-regulated activity. This paper has given special emphasis to the role of parent-child interactions in the emergence of self-regulation in the specific context of academic tasks.

The second aim of this paper has been to illustrate the extent to which the coding schemes developed so far are able to account for the relationships between parent-child interactions and children's self-regulation following a microgenetic approach. The analysis of three excerpts of video data has provided encouraging initial information about the adequacy of these coding schemes for representing elements of the parent-child interaction such as the cognitive level of the interaction and the contingency of parental support and how these elements impact on the children's level of understanding and participation in the learning tasks. These trials have also shown that through the use of these coding schemes it is also possible to appreciate transitions across sessions as well as differences across cases. While the results from these preliminary trials seem to support the use of these coding schemes as adequate tools for representing the phenomena being studied, their overall suitability needs to be tested against larger sets of data.

Results derived from this initial application of the coding schemes seem to be consistent with evidence from previous research studies exploring the impact of parent-child interactions on the development of self-regulated learning. There is a growing body of evidence supporting the idea that shared decision making, active use of questions and sensitive and contingent support on the part of the parents positively impacts on the children's self-regulated performance (Freund, 1990, Moss, 1990, and Shumow, 1998).

The illustrative application of these codes has already raised interesting issues that need further consideration. The joint use of both coding schemes has allowed the identification of episodes of *high* and *low contingency,* each one characterised by a distinct pattern of distance between the child's level of understanding and the cognitive level of parental support. The identification and use of episodes of high and poor contingency as units of analysis could eventually provide a measure for assessing the quality of parent-child interactions throughout the sessions.

Another emerging issue that has been raised as a result of these trials is the overall adequacy of categorising parental scaffolding primarily in terms of its cognitive level. As illustrated in Case 2, parents can engage in a series of actions that are better described as different *types* of scaffolds instead of different *levels* of scaffolding. This situation raises the need for accounting for the

quality as well as the level of scaffolding as relevant variables for assessing the quality of parental support.

This paper has focused on an initial step of the analysis this study is aiming to carry out. The overall goal of this research is, on the one hand, to assess the ability of the intervention programme to introduce changes in parent-child dynamics that positively impact on children's self-regulation in different contexts and, on the other, to identify which are the patterns of interaction leading to positive changes in terms of children's self-regulation. Further questions that need to be addressed by this study are related to: the relationships between interactive dynamics and incidence of metacognitive dialogues among parents and children; the relationships between parental reflective processes and changes in interactive dynamics across sessions and the incidence of transfer of a self-regulated approach towards academic tasks across contexts on the part of the children.

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Appendix 1

CODES	EXPLANATIONS
MOD (Modelling)	**Modelling** Offers behaviour for imitation (should be coded only after imitation has taken place)
CoM (Contingency Management)	**Contingency Management**
CoM- PA	Praises achievement
CoM- SL	Sets Limits
CoM - AT	Re-directs attention towards the task
MO (Monitoring) *	Monitors the quality of child's performance
FB (Feedback)	**Feedback** Provides information about the accuracy of outcomes and appropriateness of strategies through comments or questions.
INS (Instructing)	**Instructing** Gives instructions (at different cognitive levels)
QUE (Questioning)	**Questioning**
QUE- Asses	Questions that assess the other participant's knowledge
QUE- Assist	Questions that assist the other participant's thinking processes
QUE- True	Questions related to aspects of the task that have not been clearly understood
CoS (Cognitive Structuring)	**Cognitive Structuring**
CoS I	CoS I - Refers to mediation which seeks understanding of the content and procedures involved in the task
CoS 2	CoS 2 - Refers to the mediation of metacognition and involves questions and principles related to general learning processes /Reference to learning)
Off Task (OT) *	Parents and/or children direct attention to elements of the situation other than the task or engage in conversations which are not relevant to the task

Table 1. Coding Scheme based on Tharp and Gallimore's (Means of Assisting Performance) (1988) * The categories Monitoring and Off Task were included in the light of the data gathered.

INCLUSION AND THE ROLE OF PARENT INVOLVEMENT

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Abstract: By the means of this case study we aimed to demonstrate how inclusion in general schools promotes the development of children with special needs. For this purpose a case of inclusion of a child with cerebral palsy in the general pre-school classroom, which implements the Step by Step program in Latvia, was investigated. The main concepts of the case study are 1) inclusive education and 2) parent involvement, where parent involvement is an indispensable component of inclusive education. Results of the case study are summarized in this article. Analysis of the experience testifies that participation in Step by Step Parent Education program helped parents to get free of stereotypes, and convinced them that inclusion in general schools is possible for their child with special needs. Parents' active involvement in their children learning, which was stimulated by parent education program, promoted social, emotional and cognitive development of their child.

Keywords: inclusive education, children with special needs, inclusion, parent involvement

Introduction

In this study we aimed to demonstrate how to promote in students, as well as adults, the acceptance of diversity, which exists among human beings, and how to provide one of the basic human rights – equal access to qualitative education.

Lack of knowledge about people with special needs and lack of communication experience with them is the reason of intolerant attitude towards these people and ignorance of their human rights, what can be explained, firstly, by the lack of parent education, and secondly, by the decades long and still continuing practice of isolation of children with special needs in separate special schools. Bernard (2000) states that to overcome this practice the society needs to accept diversity in society and to respect equal rights of each individual:

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those are the values, which underpin the sustainable development of society. Inclusive education is the precondition for pupils to develop shared values around social justice by practicing them in everyday life in their classrooms and their local communities.

It was the Step by Step program, which drew the attention of educational institutions to inclusion of children with special needs in general schools in Latvia in the end of 90-ties. Though the issue of inclusion is in the focus of the professional and broader society discussion since then, much work is to be done in this area, and the experience of the Step by Step classrooms can serve as a good practical example.

A single definition is yet to be accepted by educational professionals and in the policy level. However from the variety of the existing working definitions we find it most appropriate to our organization's mission is the conception described by Villa & Thousand (2000), which explains active participation of children with disabilities and typically developing children in the same classroom as the dominant feature of the inclusive education.

Aim, research question and methodology of the case study

Considering the resistance to the inclusive education, the best practices could serve best as the evidences of its efficiency. Therefore the aim of this case study is to investigate the experience of a successful inclusion.

According to Bronfenbrenner's (1979) conceptualization of "the ecology of human development", which is influenced by factors operating in different systems levels, the focus of this study is on the factors of the microsystem (the classroom practice) and of the mesosystem (the interrelations between home and school).

The research question of this case study is: What is the impact of inclusion and parent involvement for the development of a child with disabilities? To answer it, we aim to demonstrate a good sample of practice.

Because the process of inclusion has features that distinguish it from subject and methodology research, the empirical study was chosen to understand the process and its consequences. To examine inclusion from an ecological perspective the following qualitative research methods were used: observation; interviews with parents, interviews with teachers and other caregivers; questionnaires; teachers' portfolios; photos, video materials.

| Analyses of the following issues has been provided during the study:

- Results of inclusion of a child with special needs in general education during the period of four years in the Step by Step program in pre-school;
- Role of parent education and involvement in the inclusive program.

| Local background of the study

One of the thorough studies of the historical background of development of education of children with special needs is made by Dreimane (2000). In an historical overview she describes the stages of special education from the first special schools to the first inclusive education initiatives in Latvia. Education of children with special needs in Latvia is traditionally carried out in special educational institutions. Till the 50ies of the 20th century special education was obtainable in special education institutions only for children with visual, hearing or intellectual impairment. During the soviet period the number of special schools increased. The approach to organization and methods of education was purely medical, "corrective" when more attention was paid not to the child but to the `defect`. At the end of 90-ties single innovative schools and single teachers initiated inclusive education samples in schools. Still the practice of inclusion is rare, and it is based more on teachers' initiative.

For several years a good experience exists of cooperation among special schools and general schools when the special schools offer methodological and practical help to teachers, parents and children, who are integrated in comprehensive schools. It is planned that in future, besides their direct tasks of special education, the special schools will carry out the functions of consultative centers more and more. However, the strong tradition of special education prevails in the structure of the educational system of Latvia and what is even more dangerous and more difficult to overcome – in the people's minds.

In Latvia the definition of education for children with special needs is defined by the Law of Education (1999) as "general education with a focus on practical skills for children with mental and physical disorders, as well as with psychosomatic and severe somatic illnesses."

Not only children with physical or mental disorders are included in this category but also those with serious behavioral and social problems. It means that sometimes physically and mentally normally developed children, who

only need some special support to achieve the standards of primary education, are sent to special schools. There are several categories of children, for whom the special education provision is not defined at all. The education policy experts have included in these categories children with wildly spread learning difficulties such as, dyslexia or attention deficit; disorders of psychological nature, for example, "non-organic failures in developmental strivings", affective disorders and other syndromes, which are recently discovered and included in the classification of special needs.

The dominant role of special schools in education of children with special needs is connected with increased unemployment and the economical problems in Latvia during the last 15 years. Poor families and those living in the rural areas are not able to provide appropriate care and medical help for their children, as it is available in special institutions. Thus it is the interest of a family to leave the child in the special school. About two thirds of children attending special schools come from families with low income, who cannot pay for medical treatment, and to buy suitable clothing and food for their children. In the countryside there is also lack of public transport from home to school that deepens the social problems of family of children with special needs.

The problem of education policy is also that the responsibility about children with special needs is very fragmentized and scattered. There is a lack of co-ordination among several ministries, which are responsible for the people with special needs (Ministry of Welfare, Ministry of Health, Ministry of Education and Science, Ministry of Family Affairs). This non-integral approach brings to:

- accent on institutional care financed by state versus support to family;
- little attention paid to integration of people with special needs in society;
- the activities in the area of special education are merely orientated towards teachers' training. The education of parents remains in the competence of NGOs.

One of the traditional points of view, which still exist, and which makes inclusion of children with special needs more problematic, that is `what takes place in schools or pre-schools is out of parents` competence. The Step by Step education program in Latvia breaks the traditional opinion about the role of the family in the process of education. It initiated a completely different parents-school co-operation model based on building harmony between

the child's home and school life and creating conformity between how the child is educated at home and at school, which brings the common understanding and approach to development of a child with special needs.

Case study: a child with cerebral palsy initiating a transformation towards inclusive education and parent involvement

To investigate the problems typical for family of children with special needs and how the parents strive to solve them, we chose a family from a Step by Step school with a child with mental development disorders and physical disability caused by cerebral palsy.

The family had been chosen for several reasons. Firstly, the child has been successfully included in mainstream pre-school for two years when we started the study; secondly, the parents have highly valued the positive impact of the inclusive classroom on their child's development. They themselves have been interested and open to co-operate with the case study team.

| Family background

The child is 7 years old. Her diagnosis is cerebral palsy as a result of birth trauma. Till the age of six months she was fed with the help of a nasogastric tube. When she was 9 months old she smiled at her parents for the first time. She started to hear when she was 11 months old. She cannot walk, and stays in a wheelchair. The child has a sister who is 3 years old. She is a normally developed and healthy child. Both sisters attend the same pre-school.

Her mother remembers:

"After the delivery we received medical treatment in a hospital in the capital city Riga for two months. During the first year we spent in the hospital every second month. Later we got treatment in Children's Clinical Hospital. Now we go to the sanatorium once a year, where we get a lot of good medical services, for example, art therapy, swimming pool, pearl baths etc. She enjoys swimming. Till the age of three we went to the sanatorium 3-4 times a year but now only once and it is much too little and very bad for her."

The mother continues:

"Doctors have given hope that it can be probably possible to restore her basic functional abilities. At the moment we have started a treatment course with a specialist in Moscow. We travel to Moscow regularly. He checks the health and the changes in her development every time, and advices me what is the next step I should do with my child. According to his advice we have to do different procedures for six hours a day. We do all that on our own. I always try to find something new and appropriate for us but I never take my child to a procedure, which she dislikes and cries. Many mothers are affraid to change the plan of prescribed procedures not to disappoint the doctors. For me my child is the most important criteria."

The child's family lives in a middle-size city, where there are several comprehensive schools and pre-schools. In the distance of about 10 kilometers from the city there are two special schools for children with special needs what is typical for the special education system of Latvia.

Taking care of a child with special needs causes different problems for the family because of the minimal support of the state and municipal social and medical services. Parents need financial support as well as information on how to promote their child's development, they need to develop practical skills of how to care for the child, they need psychological help to save parents themselves, too, of falling into depression. First months, years is an especially tough period for parents while they are learning how to handle and cope with their child's problems. Such kind of psychological support is available in the capital and the bigger cities but not in the case of smaller cities and towns like those where the family lives.

Though the state allowance is differentiated for families with children with disability, it is far from covering real costs, which these families face, in order to provide their children necessary medical treatment and other services. The child's mother considers:

"We lack auxiliary devices. We can rent them from a hospital but only one device at a time. Now we rent walkers (we cannot afford to buy them because of the high cost), though we need one more device, and I wanted to rent it. I saw it in the storage but the regulation says that you can take only one thing at a time. Why - I don't know. All the time I am looking for new contacts through the Internet with hope to find a possible clinic which could help my child. We started relationship with a clinic in Germany. They have a good offer for her but we

lack money for that. Medical remedies are also very expensive, we have to pay full price. As we do not have constant work, we cannot ask for any refunding from tax institutions, too."

Each local government according to its financial possibilities support family with low income by providing children with shoes, sport equipment, learning materials, free lunch, etc. This kind of support is based on the income level of a family, and does not take into account the specific needs of the disabled children.

The child's mother does not work. She takes a distance course in a university and takes care of the children. Mother earns a little money as a babysitter. The baby is taken to their apartment. As the disabled child needs a special care her father, too, does not have a constant job. He owns a minivan (they need it to transport the child) and earns some money by providing transport service on individual requests. The family lives together with the mother's parents in an apartment block building (the building is still without a wheelchair ramp). Both parents have stressed during the interview that the family is strongly supported financially and morally by the grandparents.

| The choice of school

Traditionally pre-school age children with special needs used to stay home or were sent to special institutions till they reached the school age. Only after the political changes parents have become gradually brave enough to look for another opportunities for their children at their families settings. More willing and more prepared to accept these children in their classrooms proved to be Step by Step schools in Latvia where parents participate at parents education program and are involved in classroom and school activities.

The mother tells:

"When I took my child outside for walks I noticed that she liked other children. She always followed children with her eyes, and it seemed that she was trying to find a friend. Also children were very kind to her, always trying to make friends with her. So I thought probably it could be a good idea if the child had a chance to visit a kindergarten at least a couple of hours a week. My choice was a Step by Step pre-school. I made an appointment with the director and asked her if it could be possible at all. She offered me even more: my child was allowed not only to visit the pre-school from time to time but also to attend it regularly. Of course, I accepted the offer."

At a staff meeting of the pre-school it was officially announced that there would be a child with special needs in their school. At that time the school had classrooms, which worked with Step by Step program and other programs (now the whole pre-school applies the Step by Step). Those were the teachers of a Step by Step classroom who expressed their wish to have the child in their classroom.

The mother continues:

"We went to the pre-school every day and stayed there for about 2-3 hours. At the beginning I stayed with my child but following the teachers` advice I started to leave her with the children. Afterwards I always asked teachers how the day had gone. My child loves to go to the pre-school. When the children of her classroom changed (they entered primary school) her younger sister was moved to her classroom, and now it is even safer for the disabled one. Children of her class always wait her to come. When she is ill or in sanatorium children always ask for her."

The pre-school is located in the center of the city. They have 290 children; three of them are children with severe special needs. All teachers, administrators and nurse of the pre-school regularly attend the Step by Step teacher training seminars and workshops. They have obtained philosophy, principles and teaching methods of the program. The pre-school started inclusion of children with special needs in 1999. It is notable that both parents acknowledged that Step by Step program is better for their child with special needs, because it is based on respect to each child personality.

| Parent involvement

All the interviewees have noted the changes that the included child has overcome due to her inclusion in general pre-school. They also mention the changes that happened to the adults: the parents and others.

One of the teachers of the child's classroom tells:

"At the beginning her mother stayed with her in the classroom. They stayed in the group for 2-3 hours. Gradually the child gained interest in other children, and started to follow them attentively. Children were full of love and willing to help her. If she needed help they always were there for her. Gradually her mother was engaged in activity centers with other children. She helped to prepare teaching materials for the activities. When the child got used to other chil-

dren the mother did not stay with her for all time. When she came to pick up the child we always had a talk about how she felt, what she liked, etc."

The nurse remarks:

"The openness of the child's mother and trust to us has been of great help. We have discussed the child's medical problems openly. I highly appreciate her enthusiasm, energy and motivation to work with the child."

The change towards inclusion was not easy. The former teacher assistant of the classroom refused to work in an inclusive classroom. The teacher assistant who volunteered to replace her, shares her impressions:

"I came to this group with the aim to help the child and her teachers. She likes me. At the meal times when I bring something from the kitchen she smiles and waits to be fed. Then she wants a snack. She has a good appetite. When she hears the noise of dishes she becomes attentive."

There were difficulties, which the staff met when the peers of the disabled child had to leave to primary school, and the pre-school had to make a decision about her. The teacher tells:

"She has become much braver within the first year. But she is not satisfied with the group of the younger children. She cries and weeps when she stays alone for a longer time. In such a way she openly expresses her wish to be together with her peers. Probably it was not the right decision to leave her in the same room but with much younger children for the second year."

It is obvious that the development of the child has progressed: her portfolio, photos and videotapes, observations and interviews with teachers and parents have proved the dynamics of her development.

Socio-emotional development

The child started to attend the pre-school when she was five. At the first months of her staying in pre-school she sat stiff and did not respond to what happened around her, she did not show any emotions. Director of the pre-school characterizes:

"She has been attending our pre-school for two years. At the beginning she was indifferent and apathetic. She looked tired and sleepy, did not respond to

other people. Now she shows interest about the surrounding, she is interested what the others are doing, especially peers and the adults she knows. However she keeps distance toward strangers: she examines, listens, sometimes smiles, but sometimes turns away."

The nurse describes the child's growth:

"At the beginning the child was apathetic, she did not respond to others. Now she is more outgoing and open. She feels well in the company of other children, she responds adequately and smiles. Her eyes are sparkling now."

The child was shy and quiet, but she was curious and interested in the new environment. It is evident that the inclusive classroom environment which is rich in materials, books and displays had played a certain role to attract her attention and influenced her participation in the classroom life.

The child likes when children and teachers communicate with her. She likes if you speak to her, show her something or tell her a story. Three months after she started to attend pre-school she participated at the school's Christmas party together with other children of her classroom. Though she is afraid of louder noice, she was smiling and happy.

However her teachers and parents noticed that she liked the older children more - her peers who had left to primary school since September. Now she is in the same classroom but with younger 3-4 year-olds. Her younger sister takes care of her. Sometimes when she wants to play with the disabled sister, she is even jealous to other children and says, "This is my sister, I want to play with her.' The nurse and the teachers have come to the conclusion that having a sister in the same classroom has a two-sides impact. On the one hand, it was easier for the included child to overcome the separation from her former classmates having her sister besides her, but on the other hand, the communication and the built relationships with her peers would have been more beneficial for her further socialization and other areas of development. This only proves how important is to foresee the impact of all possible factors in physical and social environment for each child but especially for children with special needs. The classroom observation, which was done during this study, shows how important it is for the child that she has stayed with the same teachers and the teacher assistant who love her and try to do the best for her.

| Physical development

The physical development of this child after she joint a mainstream pre-school has improved. She moves her body to the direction of sounds; she tries to reach toys and crayons on the table of her wheelchair. As she likes music, teachers included music lessons in her Individual development plan. With the help of her mother who usually participates at these lessons, she tries to move in dance. She waves her body and hands when listening to musical instruments and the other children's singing.

Fine motor coordination has also developed. She has started to work better with her hands. She is able to pick up things from wheelchair table. She likes activities with manipulation: she can grasp and hold them and insert them in the appropriate space. It's difficult for her to draw, but as she can hold a crayon or a brush, with the help of an adult she draws lines and bows. Her teacher assistant tells:

"By holding her hand I help her to draw lines on paper"

The inclusive classroom where parents are allowed to participate in classroom activities, and where teachers and teacher assistant are willing and knowledgeable about how to help a child to foster development, plays a crucial role.

| Cognitive development

When the child entered the pre-school classroom at the age of five she did not speak. In the second year of inclusion she learned to pronounce words "mummy, daddy, granny". She likes to communicate with children, the teachers and the teacher assistant. When she wants to tell something, she actively pronounces separate syllables. Her understanding of language is on a much higher level: now the child understands either Latvian or Russian and properly reacts to what is said. When somebody is talking about her granny she always smiles.

The teachers had found and recognized her strengths and try to build the foundation for her future development. One of the evident areas of her potential for future development is her interest in music. During music lessons she performs different movements with her arms, together with her mother or a teacher; she moves her head and expresses her delight. She likes to listen to different musical instruments. The Music teacher considers that the child has

a good musical hearing. Another area of her interest is drawing. She is very interested in colours. She enjoys bright colours and objects in bright colours, especially bright scarves.

Her attention is now more stable. She likes to play different table games, where things have to be moved or inserted, and can spend 10-15 minutes playing with them.

Development of parental skills in an inclusive educational program

The case study demonstrates that parent's education provides purposeful and meaningful parent participation in the process of inclusion and education of their children with disabilities in mainstream education. Based on the knowledge and skills acquired at parent training and on their personal experience of inclusion of their children, parents' attitudes towards the community also changes. On the other hand, due to the involvement of local officials and mass media in the activities of parent education, the attitude of the community towards people with disabilities and their family gradually change too.

At the beginning of the integration in a mainstream school, the parents of the child in the case study felt ashamed for their child with disability as they had been isolated from the community for many years. Her mother writes in her notes:

"Some people have the attitude 'why should we help such children with special needs if the society will never get any benefit from them. It is much more reasonable to give the money to our "normal" children."

By joining the Parent education program, parents of children with disabilities assure that their problems are in great deal similar to the problems of other people. The mother acknowledges that support and understanding of the other people is crucial:

"Physicians who do not work with my disabled child are usually quite indifferent and consider that there is not much use to treat her. Our family physician is very helpful, and she never refuses. In the kindergarten everybody is welcoming and understands us."

Parents are concerned about the lack of empathy in society, about violence that children watch on TV and in computer games, that business and

money becomes the main virtue of human life. Though children with disabilities have been included in the Step by Step classrooms since 1999, parents' interviews show that they consider the Step by Step teachers to be an `exception of the rule`:

"Integration of the people with disability in society is in the hands of their own. The state support is far from what we could expect."

When the parents of this case took their child to pre-school for the first time and saw how welcoming and open the teachers and the other children were, they got encouraged and trustful. They saw that their child could play with other children, enjoy different activities, laugh and get what only a peer can give to a peer.

The Grandmother shares her thoughts:

"I have come to the conclusion that it is not right to keep such children at home. They have to be taken out in the society. Society should get used to it that not all people are the same, that there are different people who need support and help. People will never think about other person's pain until they see it. None of us is protected from suffer and trouble."

By participating in the learning process of their children in Step by Step classrooms parents obtain practical knowledge and skills how to help their child to learn. Experience of the case has proved that parents' support is outstandingly important, especially at the beginning of the inclusion. On the other hand parents should be aware that their child is learning and their role in many cases will be to observe, to stimulate, to motivate, to encourage but not to do everything for him or her. As one of the Step by Step teachers who work in inclusive classroom concludes that is to be kept in mind when working with children with disabilities:

"To rely on a child's ability to do much more by each step in his or her learning, to notice each newly developed skill and to promote that a child repeats it and practices that is the only way how to promote learning of the children with disabilities. When a child obtains a new skill we, the teachers and the parents, should keep in mind that it is a step he or she has made to independent learning and living."

Regular participation in classroom activities and communication with teachers provide parents the opportunity to follow their child's development. It is ensured by everyday conversations with teachers, by opportunity to be

introduced with teacher's reports, child development charts and portfolios. The both side information and participation at different training events has influenced also teachers` attitudes and everyday work. The feedback made by teachers at the end of the training testifies that

"Children can't be neglected or discriminated by excluding them from school or by sending them to a special school because they have a physical disorder or learning difficulties. The social meaning of inclusion is that all children obtain education, which helps them to create relationship with the surrounding society and prepare them for life."

"I liked that the aims of the training were clearly defined from the very beginning – to change the attitude towards children with special needs. It is good that we had a team from my school that participated at the training. Now we can promote this kind of attitude and thinking, and what is most important – the inclusion in our school and share our experience with others."

At the same time the teachers are realistic and recognize that inclusion is a long-term process:

"We have to remember that inclusion is a creative and not an easy process, and it will give proper results in time."

| What's next

The future education of the children, who have been included in the general schools depends on many factors: the accessibility of the next educational level and of the proper medical services, the state and municipal support to the family, tolerance and acceptance of diversities by the whole society.

Regarding the future plans the mother tells:

"This fall I am going to take the child to a special school. They have good specialists and possibilities to promote her development. In a mainstream school she will not get attention enough, and it will make her nervous. I am concerned that the special school is so far away from our home. School bus will take her to the school and back every day. But if something happens, it will be difficult for me to get to the school. Besides there is no elevator in the school, and it is a really hard job for teachers to carry her up to the second floor. There will be only four children in her classroom and two teachers. It is good. Every

child has an individual program. She will stay there for 9 years. We visited the school. She liked it. Studies will be free of charge."

This story illustrates precisely the reasons why the special school has been chosen for the child as well as her family's concerns. It is typical in Latvia that the special schools are in distance of 15-30 km from the cities, not equipped to have children with movement disorders, but they have small-size classes and specialists.

Reflection

Parents are the first and most important teachers of their children. Therefore they have rights to choose the most appropriate educational program for their children, and on the other hand, their responsibility is to contribute as much as they can to the education and development of their children. Involvement of parents in their children's education and development may give positive results even in very serious cases like the one we presented above. The case study has showed the positive impact of parent involvement in education of the child with disabilities.

In this case study we presented an experience of one family. The parents' selfless fight for their child's development has helped their child to cope with her developmental disorders for the first five years of her life. Joining the inclusive pre-school helped this family to open the doors to the local community and society step by step. The story evidentiates how important for a child with disability it is to be among his or her peers, to enjoy play and communication. The speed of development of each child's is individual, not always corresponding to certain standards especially of those children who have different developmental and learning problems. The teachers of the inclusive classroom, which experience has been explored, did not expect the child to meet general national standards, instead they have followed patiently the slight and slow changes in her development, shared them with the parents and worked toward the next individual development steps: gradually, patiently and consequently.

During the study we have assured once more that each case of inclusion is different and seeks for different decisions. The observed child's rejective attitude being together with the group of younger children makes us, and her teachers to think about the efficiency of leaving the child in the same class for another year. The reasons were underpinned by the will to have the same

teachers. But will her being with much younger children than she promote her development?

Differentiated educational programming for children with special needs is being worked out in Latvia during the last years. If a child cannot cope with these programs, special programs without compulsory components, standard tests and centralized exams are worked out. However, to implement any program teachers need to possess a set of certain pedagogical instruments. It is recognized as a need by the staff of the school, which experience has been investigated in this case study, that the teachers need special training to be able to promote more intensively students' cognitive development. This conclusion comes out of the analyses of observation records, interviews and questionnaires of this study, too. The teachers have admitted as a challenge for their work in inclusive classroom the lack of specific knowledge how to educate children with extremely specific learning difficulties. They build their methods and content of how to promote the development of the disabled child mainly intuitively or as one of the teachers said:

"I seek the answers in my heart, but I'd like to have some scientifically approved tools, which I know, could give much better results. But I don't know them."

This honest reply demonstrates clearly the gaps in the teacher pre- and in-service training as well as the further directions for the development of the teacher pre- and in-service training programs. Though the results of inclusion investigated by this case study and much more practical samples of the other inclusive Step by Step classrooms has been positive, we should also be aware that the changes are still very unstable because of various reasons. Besides the positive factors of inclusion on the child development, it reveals also the problems to be solved at the state and community level to help children with special needs to be integrated in society from their early years and on during their adult life. The majority of society is still rather resistant to inclusion of children with special needs. Neither society nor teachers and schools are ready to accept it as a general rule, that children with special needs are included in general schools. Society does not show much interest in accepting of these children and adults and is quite reluctant about their integration. During the past decade parents and other concerned groups have devoted considerable effort to the recognition and implementation of the inclusive education. However, the reality remains that the educational system is too rigid to reach all children's needs and rights of education.

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PARENT'S TRAINING IN ACTIVATION OF COGNITIVE DEVELOPMENT AND OTHER SKILLS OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS FROM BIRTH TO 6 YEARS

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Abstract: Support and teaching of parents activate cognitive development of their children, 3 teaching models: (i) Critical stage after birth (0-1 month), individual crisis therapy; (ii) Stage of acceptance (1month -2.5 years), individual up to small groups of parents – learning of basic interaction (mother/father and child), positive feelings, motivations, stimulus, motor development... Program: Portage, Love in hands, video- training, orofacial regulation therapy (ORT Castillo Morales therapy); (iii) Stage of group activation (2.5 – 6 years), complex support of child development, inclusion to peers groups (building social and artistic skills), preparation for success of school inclusion (prevent inclusive failure). Program: speech therapy, ORT, social and artistic therapy, PIT method as training for Feuerstein´s method. Methodical workshops for parents and teachers (publications and newsletter).

Keywords: children with Down Syndrome - early interventon, child development, parents' empowerment, cooperation of parents and professionals, methodical workshops – "mini-courses"

Global trend

- Linkage of experts knowledge with parental experiences is the most effective way to positively influence the development of children with disability.
- Early intervention should start as soon as possible after detection of a disability in order to reach the maximum effect.
- Cognitive development depends on the development of fine and gross motor experience, language, emotional and social relationships between the child and mother or other members of the family (this support should be offered at the start of child's development)

A brief historical sketch

In my report, I draw from my own experiences of many years. I was a di-

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rector of the first kindergarten for children with disability in the period before 1989 in Czechoslovakia and thereafter a director of special kindergarten and a Special Pedagogical Centre (SPC). After 1989 profound changes have happened in society and have opened us to the world.

The Education law that was valid in the Czech Republic until 2005 arranged special pedagogical care for children with disability for children from the age of 3 years. Up to age of 3 years, the child was in the hands of health care professionals (pediatrician, nurseries, , etc.).

Only the Education Act from the year 2005 (ACT No. 561, of 24th September 2004 on Pre-school, Basic, Secondary, Tertiary Professional and Other Education) has allowed early intervention for children from 0 to 3 years. The decree n. 72/2005 about providing consulting services at schools and educational consulting organizations establishes also educational organizations (like Special Pedagogic Centers) as providers of early intervention.

In spite of this, several SPC's started to offer early intervention before that law had been voted. Especially, this problem became interesting and important for some institutions of social care and centers created by civic associations where some special pedagogues started to work. Practice came before a law.

After the velvet revolution, new ways of working with children with disability just after birth have begun to appear in our Republic. We have come to know of early intervention. During apprenticeships abroad (the Netherlands, Germany, Denmark), we have seen that a team of specialists (psychologists, rehabilitation workers, special pedagogues, physicians, pediatricians and social workers) takes care about children with disability and they cooperate on the child's development.

The teamwork with parents was evidently different. We recognized that parents abroad are accepted as partners of professionals. Parents initiate the organization of parents-groups and present themselves actively (they publish their own magazines, organize meetings, organize skilled actions etc.)

Thanks to those new pieces of knowledge, in our country, non-profit, non-governmental organizations started to work (like The Association of Parents and Friends of Children with Down Syndrome under supervision of the professional SPC "Child") mainly focused on specific type of disability.

Suggestions for those activities were obtained by our parents on a week-long trip with the „Wandering bus" to Bavaria. Their participants were not only parents and members of specialist teams, but also delegates of ministries and reporters. The European program PHARE supported this trip.

Also we could obtain and read the specialist literature and magazines from Germany and Great Britain, it began to be accessible. A large help was given to us from the organization Lebenshilfe from Germany.

And so, also our parents started to tell about co-operation with various therapists. They started to invite them at their campaigns and some specialists began to become their partners. Today, the parental organizations search new therapies for their children and also financial means (sponsors, grants). They contact experts from varied specialist fields from the Czech Republic, but also from abroad (Germany, Slovak Republic, the Netherlands, Great Britain) and established with them relations by written but especially personal contact in favor of their children.

New trends caused also new problems to solve

After obtaining experience abroad and also on the basis of their own experience, both groups (parents' movement and professionals - therapists) began to become aware that activation of a child with disability can produce a positive influence on development, if their relationships are based on mutual trust and co-operation. Nobody is superordinate.

But the parent himself needs to obtain the elemental specialist knowledge of the therapy or method that is done by the experts in order to apply it correctly at home.

On the other hand, experts should make a maximal effort to observe parental instructional methods to children and he should utilize these pieces of information positively during the therapeutic process (the positive should be supported, the negative should be corrected). He mustn't forget the individuality of every child, although the problem (or kind of disability) may be the same.

Unfortunately, that all is well known theoretically, but practically it is not like that everywhere. Lots of experts don't like to accept parents as partners. On the contrary, some parents often are not capable (due to stress, personal challenges, etc.) to identify which offered therapy or method is useful for their child or they (without help of experts) do not manage to pursue the right kind of approach. But the parents' right is to choose the therapy, which they accept as suitable and useful. Then they will learn easier doing that therapy.

Reflection about linking specialist knowledge to parental experiences

Factors and circumstances which have an influence on this linkage between specialist knowledge and parent's experience, in my experience, are

1. **Information**, which the parent acquires by personal contact from a specialist he chooses on the basis of a medical expert's or parent's advice or with the assistance of information literature (e.g. publication "Dear mum, dear dad", magazines, e-mails etc.).
2. **Parent's decision** regarding thenecessary therapy. Parents are able to make such decision just after controlling the period of crises evoked by the child's birth and detection of a disability. The offer of specialist centers (SPC and others) and the first person (usually therapist) who talks with parents are very important. It depends on therapist's ability to explain the method of a therapy and his empathy to a parent's state of mind. He should be the mediator of contacts with other parents of children with the similar kind of problems. This attitude is called individual crisis intervention.
3. **Training of parents.** The parents should become acquainted with the essential aspects of a therapy and apply them correctly, because otherwise the effect is minimal. Therapists have to explain to parents that it is needed to individualize for every child. Parents can refer to the therapist with confidence if they have some problems or something isn't clear. In practice, parents complete a mini training focused on their child. Every therapy has a common specialist basis, but also lots of variations which should be utilized individually according to the condition and needs of every child.
4. **The personality of a therapist.** It depends on his personal qualities and specialist and psychological knowledge. He's a professional and has to realize that he has to win the parents' support. He also has to listen attentively to parents and to utilizetheir experiences and support their activities. He helps parents in searching other and suitable therapies focused on their child, he can advise parents how to deal with stress etc. He supports the establishment of parents' groups and cooperates with their activities (he leads courses or therapies).

Individual forms of „mini-courses" which were effective in SPC „Child" and the Association of Parents and Friends of Children with Down Syndrome

Thanks to the close co-operation between the Centre for Special Pedagogical Needs and the Parents' Association of Children with Down syndrome, we have understood that in the period immediately after birth the most important helpers for new parents are otherfamilies with a child with DS. Caring parents know what helped their babies, what were their children's shortcomingsand they can advise other parents who haven't had any experiences with the birth of a child with DS.

Parents in cooperation with doctors, psychologists and pedagogues elaborated a brochure „Dear mum, dear dad" [**1**] in the year 2000 with support of a grant from the Ministry of Health of the Czech Republic and secured its distribution into all maternity hospitals in our republic.

Families, in whom a child with DS is born, find here the basic information and contact addresses of organizations providing early intervention.

The SPC „Child" in Prague 8 offers individual therapies to parents of children with DS:

- Program "Love in hands"
- Orofacial regulation therapy of Castillo Morales
- Vojta´s neurodevelopmental training method
- Portage Parent Training Program
- PIT method Mathematics for children with DS (Engels, N., this volume)
- Global reading method – as a tool for developing communication skills

Individual preparation for school integration in the pre-school and early school period is secured by following several methods. Itsmain provider is the Association of Parents and Friends of Children with DS):

- Feuerstein´s Instrumental enrichment method. The courses of this method are available for experts as well as parents
- Development of communication skills and speech therapy (with SPC)
- Occupational therapy – development of fine motor skills (with SPC)

Social consultancy offers trained mothers individually or trough lectures (Association)

Group forms of „mini-courses“ – activities for children and their parents

Not only individual therapies have been effective, but we have also seen satisfactory results in working with groups of mothers and children in early life.

Danish therapists trained special pedagogues in the SPC in the program “Love in hands”. This therapy is performed individually (during the first contact with families) but also in groups of children if their parents are interested in.

The therapy helps parents in accepting their child with disability warmheartedly. The mother learns how she should stimulate and initiate her child. Group forms of this program have one advantage: mothers overcome their stress resulting from the child’s disability. Mothers make relationships, advise each other, and don’t stay alone with their problems. Father’s participation is welcome.

As children grow up, the activities are enlarged to music-therapy, various motor skills and speech exercises.

Between 2 and 3 years, the child is brought into a group, with it’s mother’s presence once a week. After a certain time, the child comes there without direct attendance of its mother; it depends on the child’s individual development. During those activities, the children develop their social relationships in little groups, not only among the children, but also relationships with special pedagogues or psychologists. Children also practice varied individual activities – training fine and gross motor skills, speech, doing music-therapy etc.

Then the children are ready for integration into kindergarten in age range between 3 and 4 years. This period is an opportunity for mothers to be in close contact with future teachers and to obtain advice on how to work with the children at home.

Intensive courses in winter and summer have a similar point of view, regarding contact with other families or professionals. They are organized by parents from the Association, who often invite foreignexperts, for example: Netty Engels, the Netherlands (lector of Feuerstein´s method and a mathematics’ programme), Eva Matějičková, Slovakia (therapist of ORT), Maria Šustrová, Slovakia (pediatrician, consultant in health care).

Meeting families from different places of the Czech and Slovak Republics, sharing information and experiences about upbringing and direct contact with therapists are the most important factors of those stays. They are signifi-

cant especially for families who don't live in the vicinity of urban areas.

In the Czech Republic, new parents' groups, clubs and associations, have been created, all aimed at children with Down syndrome. They organize activities for children and families in their regions.

All "parent's training" introduce their children to the integration into kindergarten, then into elementary school or special school.

In addition the Association of Parents and Friends of DS organizes annual meetings of families from the Czech Republic, lectures and courses designated for parents or for specialists, supports methodical lectures for teachers from kindergarten and basic schools.

Also the publication of a journal PLUS 21 by the Association is very significant. PLUS 21 is issued 3 times per year. It contains original or translated articles, information about activities of the Association and other organizations, own opinions and parent's experiences, essays and reports about inclusion of people with DS into the community life etc. This magazine is intended not only for parents and professionals, but also for general public.

The Association has established contacts with similar organizations in Great Britain, Germany, Poland, Slovakia, and the USA and participates in common conferences abroad.

During all those activities, parents have been linking up with therapists, specialists, physicians, special pedagogues, also teachers in elementary schools. That is beneficial not only for our children and their parents, but also for the whole society.

Final comment

Professionals in the SPC are employed and by a state institution. The Association of Parents and Friends of Children with DS is a non-profit association. It's possible to finance it only from grants and sponsorships. It isn't easy to obtain these financial means. So mothers do lots of work in the Association as volunteers, but with love and big self-sacrifice.

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I N C L U E S

CLUES TO INCLUSIVE AND COGNITIVE LEARNING ENHANCEMENT IN SCHOOLS

European Comenius Network Project

The INCLUES project wants to create a network of educational professionals and parents working towards the realization of inclusive & cognitive education.

Inclusive education is defined as providing adapted, individually tailored education for all children in peer & age-related groups, across a variety of needs, abilities and levels of competences. It provides the necessary support within the normal classroom. It involves teaching children with learning difficulties (whatever their origin – social or disability) together with "normally" learning children.

Cognitive education aims to activate basic cognitive skills (involved in learning basic academic skills, as well as social, motor, artistic and emotional adaptive learning), in order to develop the capacity to learn how to learn, to find the "clues" of learning. Hence the name IN-CLUES.

The INCLUES network has been co-financed by the European Commission within the Comenius Programme, from 1 October 2003 until 31 December 2006.

Objectives

Long-term objectives are:

1. Transforming teachers' attitudes and classroom practice, so that they would appreciate more and start developing hidden learning potential of pupils, create more successful learning experiences and competencies and therefore exclude less
2. Promoting cognitive education as an instrument towards inclusive education.
3. Re-educate teachers to teach in a more process-oriented way: *develop* basic prerequisites of thinking, which are (mental) instruments to de-

velop *autonomy* in order *to learn how to learn*.
4. Transforming school systems, curricula, and teacher training, by infusing them with a cognitive and inclusive dimension.
5. Promoting innovative didactic approaches which address the child's individual differences
6. Promoting more dynamic systems of evaluation & assessment

Target group

Educational professionals (teachers, educational psychologists, special educational needs teachers, rehabilitation professionals, etc.) & parents working with children who are educationally at risk of exclusion from the mainstream = children with learning difficulties regardless of the "distant" causes (can be ethnic minority, disability, or socio-economic deprivation).

Activities

1. Web-based discussion forum & quarterly newsletter
2. Collection & web publication of meaningful experiences
3. Collect & exchange information regarding didactic methodologies & educational materials dealing with inclusive and cognitive education
4. Organize regional and international seminars
5. Promote the organization of local workshops
6. Monitor local progression with implementing inclusive and cognitive education
7. Translation & dissemination of relevant teacher and pupils' materials
8. Network meetings with a limited number of experts
9. Editorial work: publish a series of special issues of a professional journal on the subjects of dynamic assessment, cognitive & inclusive education, a book and a DVD
10. Lobby on national/regional levels with educational authorities and main actors

Outputs

1. Interactive website www.inclues.org
2. Selection of relevant experience, theory and programmes regarding

cognitive activation & inclusion
3. List of criteria for assessing inclusive education related to cognitive activation
4. Translation of teachers' guides regarding cognitive & inclusive education : Index for Inclusion translated into Dutch and Hungarian, Inside book translated into Spanish, Latvian, Czech. Concept Teaching translated into Latvian, Dutch
5. Two Special issues of the Transylvanian Journal of Psychology on theme of dynamic assessment, cognitive activation & inclusion
6. Guidelines for curriculum transformation of teacher training at undergraduate and postgraduate level
7. DVD containing videoclips, texts and other materials on models of good practice about inclusive and cognitive education
8. Local/regional support centres for research, training and awareness raising on issues of Inclusion and Cognitive Education
9. International inter-university Master's degree in Cognitive & Inclusive Education

Expected impact

1. Recruit at least 2 schools per partner willing to run pilots in inclusive & cognitive education & mediational teaching strategies
2. Reach out to at least 1 Teacher Training College/country who will include new approaches in undergraduate studies, thus forming about 1200 new teachers
3. If 2 psychologists/partner choose to go for a thorough dynamic assessment training and implement it with children, this might make a change for hundreds of children in the end
4. Involve at least 2 educational policy makers per partner, by inviting them to become involved in advisory committees on building inclusion policy
5. 2000 educational professionals participating in seminars and conferences
6. 1000 teachers participating in training modules on cognitive & inclusive education
7. Expansion of network to 25 partners

Partners

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