Teaching basic conceptual systems

by means of a concept teaching model

in order to improve children's prerequisites for learning

A study of Effects of Concept Teaching for Children with Learning Difficulties, undertaken 1998-2000 (2001)

Andreas Hansen

Harstad University College and Educational-Psychological Services of South-Troms, Harstad, Norway.

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Address: Reirstubben 9, N-9403 Harstad, Norway.
E-mail: andhanse@online.no

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Teaching basic conceptual systems by means of a concept teaching model in order to improve children's prerequisites for learning.

A study of the effect of Concept Teaching in some target areas undertaken 1998-2000 (2001).

Andreas Hansen

Harstad University College and Educational-Psychological Services of South-Troms, Harstad.

This paper is divided into 2 sections and some closing comments. The 1st section explains very briefly core parts of Magne Nyborg's theory of learning and the corresponding educational practice upon which the experimental intervention (the training) of this study to a large degree is based. The 2nd section focuses mainly on the study and possible effects concerning changes among 5 children in pre-requisites for learning, changes in their levels of functioning in some school subjects as well as changes in results on tests such as the WISC-R, Raven Coloured Progressive Matrices, the Bender Gestalt Test and ITPA/verbal expression. Some experiences concerning concept teaching as a strategy applicable both in special and in regular educational contexts in order to help towards inclusion are also put forward.

A theory of learning and a model for concept teaching.

The experimental intervention of this study to be reported of is to a large extent based on the theoretical and empirical research of the late Magne Nyborg from Norway and some of his collaborators, including myself.

First in this paper I will therefore try to answer some core questions about Nyborg's theory of learning and his Concept Teaching Model (the CTM), such as:

1) What is the core of Nyborg's theory behind the application of the CTM?

2) What are the main characteristics of the CTM?

3) How can learned Basic Conceptual Systems (colour, shape, position, number etc.) including Basic Concepts be utilized as tools and prerequisites for subsequent learning?

What is the core of Nyborg's theory behind the application of the CTM?

Throughout his research, which stretched over more the 30 years, Nyborg focused upon how teaching in school could be improved, so that the students' general ability to learn could be facilitated. And - a major notion in Nyborg's educational thinking is that ability to learn is dependent upon prerequisites for learning. 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 symbolized 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 multiple abstractions or *analytic coding* in all further learning, both in further concept and in skill learning. Later in this paper you will be given the opportunity of performing *analytic coding* of a letter by directing your attention by means of some of the mentioned Basic Conceptual Systems.

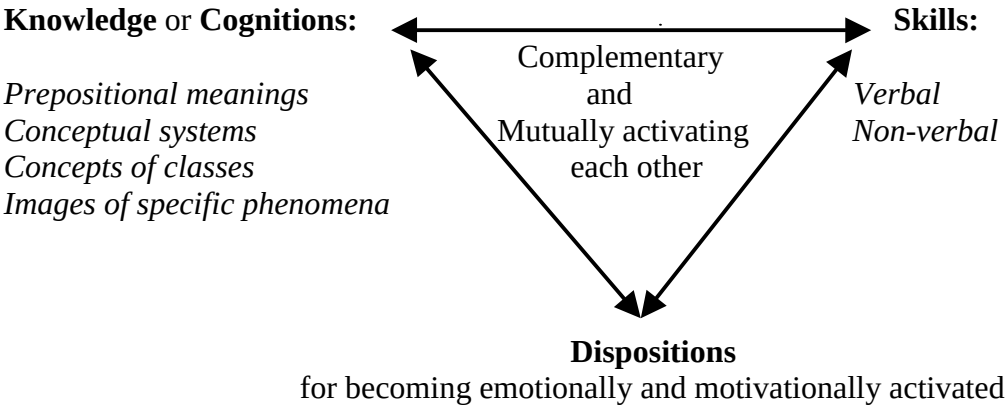
Another main question, asked by Nyborg and closely related to the preceding one, *was:*

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* (which is a depiction of central parts of Nyborg's theory of learning).

By means of this theoretical and depicted model, Nyborg argues that the *process of analytic coding* (c.f. pp 6-7) and *thinking processes*, are dependent upon what has previously been learned/stored in a person's Long-Term-Memory (LTM).

Let's have look at a part of the PSI-model[1] and the three main structures of long-term-memory.



[1] Many psychologists and pedagogues recognise the importance of knowledge, skills and motivation even though they may define these three phenomena differently to a certain extent. To understand how Nyborg's PSI-model as a whole differs from comparable models, one has to have a look at the complete model, with its psychological processes and structures and the way the components of this system interact. In the PSI-model inner phenomena in terms of psychological processes and structures of the person are seem in close interaction with "outer" situations in the PSI-model , which includes persons, things, events etc. Thus the PSI-Model may serve as a tool for performing analysis of what is inadequately functioning, and consequently, for inferring didactical implications. Nyborg started the development of the PSI-model in 1973, in order to help teacher understand his theory of learning by depicting central parts of it. The development of the PSI-model were based on theoretical elements from different researchers and on his theoretical constructions and empirical research.

To the left you'll see the *knowledge or cognition structure* with four kinds of cognition at rising levels. To the right you'll find the *structure of skills*[2], which includes both verbal and non-verbal skills of all kinds.

And it is worth while to remark that according to Nyborg verbal skills seems to play an important role as symbolizing and organizing 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 (negative transfer) or facilitate (positive transfer) the process.

These three LTM-structures are of course mutually 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 CTM, of which I now will give a brief account, aims at modifying and changing all the three structures.

What are the main characteristics of the Concept[3] Teaching Model (the CTM)?

The *CTM* is divided into 3 different phases that are named according to the processes which in particular are represented in each phase. But there is a fourth and basic process which is underlying all of the three phases; namely *Analytic Coding* - the process by which a learning person analyses and selects the proper "features" to be learned about during the work in the three phases.

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[2] In Nyborg's terminology skills are defined as (Long-Term-Memory stored) sequentially organized experiences which underlie acts and other manifestations of what is learned. Verbal skills may be represented in terms of words, digits and other symbols – and are supposed to represent the semantic basis of persons having had the opportunity to learn both the semantics and the symbols. There are of course other "codes" than oral language expressions that may represent the semantic basis, e. g. deafs' sign system etc. Within the tradition of Nyborg very much emphasis is put on applying oral language skills in order to help the pupils integrate and organize their experiences into basic conceptual systems.

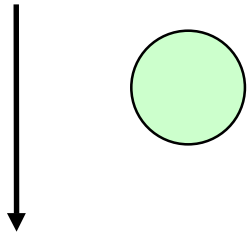
[3] [3] In Nyborg's theoretical framework there is a distinction between <u>*numbers, words and other symbols*</u>, on the one hand, and <u>*concepts of classes*</u>, on the other hand. The former category mentioned may be looked upon as a naming of or as labels for concepts of classes and other kinds of meanings. Concepts of classes are defined as learned/stored knowledge about *partial similarities* between different members *of* classes (i.e. *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.

Phase 1 is named Selective Association (the SA-phase):

Let me give you a brief idea of what is going on during this phase:

First the teacher presents:

A round shape



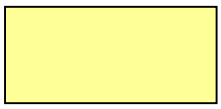
while verbalizing as a model for the pupils:

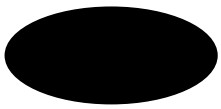
This figure has *round shape (because...)*

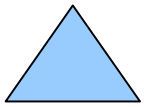
Then the pupils are asked and helped to do the same verbalization while inspecting and touching the round shape.
Afterwards the teacher presents and the pupils make varied examples of representative objects, drawings etc. which are *similar in having round shape with various degrees of roundness*. At the same time the teacher has to systematically vary other features of the examples such as colour, size, pattern, place *etc.***,** to help the learning person to *detect and abstract roundness* as the adequate feature.
Verbalization continues like before: This/that X has *round shape* is repeated by the teacher and the pupils to help the pupils integrate and organize their experiences into *Basic Conceptual Systems* - by using the *sub-ordinate label round* in close connection with the *super-ordinate label SHAPE***.** In other words - by means of (oral) language skills basic concepts are organized into Basic Conceptual systems..

Phase 2 is named Selective Discrimination (the SD-phase).

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





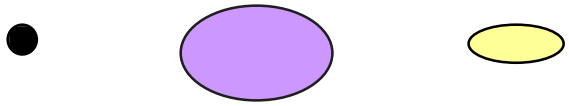


The task of the learning person is to point out or otherwise identify the figure which has a *round shape* and - of course to answer *round shape* - and preferably as part of a sentence - if questioned about the shape of the figure.
During this phase the learning person learns to distinguish between members and non-members of the class which he is to learn a concept about, and learns to act differently - when members and non-members are presented for the learner. In this way the selective discrimination learning process serves the purpose of stopping a too wide selective generalization.
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 *round shape*.

Phase 3 is named Selective Generalization (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 conscious* by means of symbols/language skills.

A brief example of a situation in this phase will be that the teacher presents situations with examples of objects or drawings etc. that vary in many ways



while asking: *In which respect are these figures similar* ?

An appropriate answer and inductive conclusion would be: *They are similar in having round shape.* Thus the detected *partial similarities* are *mediated* and made *"verbally conscious"* through the inductive conclusion just mentioned.
But of course this way of answering must sometimes be learned through several examples and by imitating the teacher's and other pupils' repeated verbalizations - but in spite of this we must sometimes still be satisfied with a shortened phrase reflecting what has been detected and abstracted, like: *similar in - round shape* - for the pupils with severe verbalization problems.

Several educational principles underlie the C TM, but these will not be discussed here.

When teaching a person via the CTM, one has to take into account the person's level of functioning in a broad sense, his age, his interests, his initiatives in the different situations etc. Thus the teaching will vary according to the age, the personality and learning disorders of the person in question. In other words, a quite different program is appropriate for a person of age 6 with general disorders of learning than for a dyslexic person at the age of 16. Our experience is that during Concept Teaching one learns much about, and gets a good understanding of, the learning potential[4] of the pupils.

How can learned Basic Conceptual Systems including Basic Concepts be utilized as tools and prerequisites for subsequent learning?

Below you will have the opportunity to experience how it's possible for you to have your attention directed very precisely towards different features of the letter L by means of names for Basic Conceptual Systems. This is an example of analytic coding[5] applied in the teaching/learning of letters. Possible answers to the questions are to be found in a footnote down at the next page.

[4] A. Hansen 2000A.
[5] According to Nyborg *analytic coding* is synonymous with *multiple abstractions* or *multiple classifications.*

The letter[6] **L**

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

B) What *shape* do the parts have?

C) What *positions* do the parts have?

D) How are the parts *placed* in relation to each other?

E) What is this letter a *symbol for* in reading and writing?

It is our experience that pupils with learning difficulties - when having performed such precise analysis with the help of the teacher, as just demonstrated - learn the letters and what they symbolize 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 learning.

These Basic Conceptual Systems are also very applicable and necessary tools for the learning of more *complex Concepts and Conceptual Systems*[7] (of whole objects and events), for the learning of school subjects in general as well as for skills of different kinds. In other words - Basic Conceptual Systems are tools for learning in different areas and at different levels of learning. Let me give you an example of this by turning to the teaching/learning about our Solar system.

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 and peers' use of sentences loaded with *Basic Conceptual Systems concerning Colour, Shape, Position, Place, Size, Direction/Movement, Temperature, Surface, Substance, Weight, Time and so on.*

The example concerning the teaching/learning of the Solar system will probably once more illustrate how dependent a learning person are of mastering and applying *basic concepts and Basic Conceptual System*s as tools for communication and as prerequisites for further learning at increasingly higher levels (deliberately or in a more "automatic " way) .

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[6] A) This letter consists of *(the number of) two parts.*
B) They both have *rectilinear 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 articulation «la».

[7] The principles of the *concept teaching model* can also be used for the teaching/learning of more ***"complex" Concepts and Conceptual Systems*** (of whole objects and events such as rooms, boats, towns and to go, to dance etc.) compared to the *Basic Conceptual Systems*, which are the bases for this learning. At the same time we are training the pupils in being 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.

This also seems valid for persons with learning problems due to conceptual deficit: 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*.

A study of the effect of Concept Teaching in some target areas.

Main research issues

In this study[8] I want to look for possible effects of Concept teaching with regard to

> *a) changes in prerequisites[9] for learning in terms of basic concepts and basic conceptual systems as well as for changes in the children's capability in performing analytic coding.*
>
> *b) changes in the children's level of functioning in reading/writing and mathematics.*
>
> *c) changes in results (pre-test-post-test-results) on tests such as the WISC-R[10], Raven's (Coloured) Progressive matrices, the Bender Gestalt test, ITPA/the subtest verbal expression and Draw-A-Man.*

As part of this study I also wanted to generate experiences with concept teaching as a strategy applied in a combination of both special and in regular educational contexts in order to help towards inclusion. In addition I also wanted to generate experiences with child-parents co-operation at home in conceptual tasks[11]

The choice of tests was due to the fact that I would like to learn what may happen to scores in both verbal and none-verbal intelligence tests (WISC-R and Raven) for children who received a specified kind of basic concept teaching including training in performing analytic coding.

ITPA/verbal expression was chosen because the results of this subtest may say something about possible changes in the children's capability in performing analytic coding (compared with teachers evaluation of this capability in practical situations).

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[8] This study is partly a replication of previous studies within this tradition of concept teaching and partly a study with some new issues in a natural school setting after the school reform in Norway of 1997 that may further validate and extend the research of this approach.

[9] Intelligence, defined as (developed) ability to learn, can of course be positively changed. The logic of this is that ability to learn must be dependant upon **prerequisites for learning**. In Nyborg's theory of learning prerequisites in terms of three LTM-structures are defined (cognitions, skills and emotional- and motivational dispositions). By means of the **concept teaching model** the children are helped to make a positive change in these three structures. Once the three LTM-structures, representing the prerequisites for learning, are positively changed, the same are true for ability to learn and for intelligence.

[10] In a previous study of Concept teaching for 2 children, lasting for 5 year, relatively great changes in IQ gains on the WISC-R were noticed as well as great improvements in mastering school subjects (A. Hansen 1998)

[11] The 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 2-10 minutes to solve the tasks, and both the children and the parents were guaranteed success.
Both two areas for generating experiences are follow-up themes from a previous study which I undertook in 1995/1996

The Bender Gestalt test was chosen because I wanted to learn what may happen to the children's copying[12] of figures, given the educational treatment.

It is also of interest to learn if certain patterns of scores are to be found among the tests, given the educational treatment and on basis of the pre-testing scores, i. e. if there is a tendency towards better scores on one or more tests or a tendency to less good scores on others.

Subjects, grade levels and duration of the intervention part of the study

The training period lasted for two years – from May/June 1998 until May/June 2000. Five children from 3 primary schools in the town of Harstad participated. Two of the children were at grade 2 to 3 (6-8 year olds) and three of the children were at grade 3 to grade 4 (7-9 year olds). One of the children was a boy and four were girls.

All five were children referred to the Educational-Psychological Services with learning difficulties which was a cardinal criterion for being selected to the study**.** Having decided to do rather comprehensive case studies I judged the number of 5 children ± 1 to be manageable. Another important criterion for the selection, was that I had to find children with teachers who accepted to participate in a study lasting for two years, and at the same time, teachers who preferably had been trained in teaching according to the concept teaching model. A fourth criterion was that the children had to differ substantially. A fifth criterion was that I wanted to have participants starting both[13] in grade 2 as well as grade 3. As a consequence of such considerations I ended up with 5 children.

Even if the children in a very general way were kind of similar by having been referred with learning difficulties, their difficulties varied substantially. In this sense they represented kinds of sub-groups of children often referred to the Educational-Psychological-services, except perhaps for the child of *case 1*.
This child had half a year in advance been diagnosed as having *non-verbal learning disabilities* (Rourke 1989) by a psychological assessment team. *A second one (case 2)* was functioning very much behind her class mates in reading/writing and mathematics, having extremely great problems with symbolic learning[14], seeming to have a delayed language development. In addition she appeared to be very rigid when it come to shifting her attention in a deliberate way. *A third one (case 3)* exercised general learning difficulties (due to mental retardation) functioning years behind her class mates, being among other things, characterized by a very short concentration and attention time span. *A fourth one (case 4)* who was born prematurely, had shown a delayed motor development and had marked problems with his concentration as well as with learning numbers/mathematics and letters/writing and reading.

[12] That is, what may happen when children are taught/learn prerequisites for solving this kind of tasks in terms of knowledge of parts of a whole, number of parts, shapes, sizes, positions, etc. Knowledge that may serve as tools for directing their attention towards characteristic features of the figures in question as well as serve as tools in self-instructions directing the copying. This is a theme followed up from my master thesis. The results on the Bender test have to be compared with the teachers evaluation of the children's outcome of the educational treatment as well as with results on ITPA/the verbal expression subtest.

[13] The reason for this being that in Norway the more formal training of reading/writing and formal symbolic training first starts in grade 2 and I wanted to work with children who displayed learning difficulties in reading/writing/mathematics etc.

[14]Her great problems with remembering letters and numerals were, according to my analyses, probably due to a specific kind of learning difficulties in terms of problems with the integrative learning of the relationship between letters as symbols for phonemes and articulations as well as the learning of numerals as symbols for numbers in groups and positions in sequences. This kind of difficulties may be mixed up with difficulties of a more general kind due to mental retardation.

The fifth child (case 5) displayed a delayed language development having problems with finding words, and having some problems with establishing social relationships in and outside school. She also had some problems with learning numbers/mathematics and writing/reading.

Frequency of application and the experimental treatment

The amount of the children's time for special education had already been decided before I made the agreement with the school authorities, the teachers and the parents and the children regarding participation in this study.

In May 1998 most of the pre-testing took place. The concept teaching started in the first part of September 1998 (primary school starts immediately after the 20th of August in Harstad) and lasted for almost two years until may 1999. In this period the children received on an average between one to two lesson a week with concept teaching. This differed[15] from child to child. For instance, while the child of case 3 on an average had only one lesson each week with basic concept teaching during the whole study period, the children of case 4 and case 5 received 3 lessons during the first year and approximately 2 lessons each week during the second year.

During this period a selection of *basic concepts* and the following *Basic Conceptual Systems* were taught/learned according to the principles of the Concept Teaching Model.

1. ***Colour***
2. ***Shape***
3. ***Position***
5. ***Size***
6. ***Place*** (both spatial and sequential related concepts)
7. ***Direction***
8. ***Number***
9. ***Sound/phoneme***
10. ***(Surface) Pattern***
11. ***Use or function***

Two of the children were also taught some concepts within ***Weight, Smell, taste. Time and temperature*** as conceptual systems were systematically named for all, ***c.f. Appendix I with a survey of (names for) Basic Conceptual Systems.***

The sequence of teaching the basic conceptual systems and the selection of basic concepts as well as the emphasis put on teaching different concepts differed to a relatively great extent between the teachers[16] according to what they and I considered as being the needs of the children.

Some other concepts important for the outcome of concept teaching were also taught:

- *Partial similarity versus complete similarity* (partial similarity as important tools for the search and verbal mediation of partial similarities between objects or events).

[15] Teacher's and children's illnesses, starts and ends of the terms, participation in special themes in connection with Christmas and Eastern etc. reduced the number of lessons of concept teaching.
[16] In my doctoral thesis there will be a specification of the sequence of concept teaching in connection with each case study.

- *In relation to* (a tool for the teaching of relational concepts within place, size and direction as Conceptual systems).
- *Parts(s) of a whole* (a tool for the direction of the attention between parts-whole-relationships.
- *Symbol for* .. (a tool for verbally to distinguish between a symbol and what it refers to (e. g. letters as symbols for speech-sounds and articulations, written numerals *as symbols for numbers in groups etc.).*

Within the lessons of concept teaching the teachers were recommended, as a second kind of activity, to train the children in performing *analytic coding* (c. f . pp. 5-6 and the explanation of the notion of analytic coding) as they went on learning more concepts and conceptual systems. For some of the children the teachers applied Anna games, a material developed for this task, but most of this training was intended to take place by use of concrete everyday objects, drawings etc.

As a third element of concept teaching the teachers (and especially the class teachers) were encouraged to *deliberately apply the learned concepts as tools* in the teaching of reading/writing/mathematics as well as in the teaching of other school subject and skills. A far more extended use of learned concepts as tools for the learning of school subjects would have been easier to achieve had the teacher in charge of concept teaching also been in charge of teaching reading/writing and mathematics etc.

Because the children differed much in their special needs, the teachers developed individualized education programs especially for the concept teaching of 3 of the children in co-operation with me. The two remaining children, on the other hand, were given more or less the same kind of concept teaching.

For the child being diagnosed as having non-verbal learning disabilities *(case 1)*, very much emphasis were put on teaching spatial- and sequential related concepts as well as concepts concerning direction. Learned concepts were then applied in “paper and pencils” tasks inspired from the Instrumental Enrichment Program developed and reported of by Feuerstein and colleagues (1980), ideas which also had been applied by the late Ragnhild Hope Nyborg in her concept teaching practice as well as in my own practice.

The child represented in *case 2*, having problems with her academic learning and displaying a perseverative way of behaviour when it came to direct or to have her attention directed towards characterizing features of objects or letters, received much training in performing analytic coding in general. Her great problem with “symbolic learning” was relatively quickly reduced and overcome as a consequence of repeated analytic coding of the symbols and what they represent, (cf. pp. 5-6) She then experienced a breakthrough in reading bringing her forwards in leaps. Once the numerals, the operational symbols and the positional systems made sense for her, and again as a function of meaningful learning based on a conceptual background, she also improved relatively rapidly in this field.

The teacher of the child of *case 3* also put much emphasis on the use of learned basic concepts as central tools for the learning of letters as well as for the progress in making synthesis of speech sound/reading words. This child also had great difficulties in drawing as well as in copying/reproducing letter and numerals, and therefore the teacher also very consciously “applied” learned concepts in helping her improve in these matters, as well. This was the only child participating in the study who scored as being mentally retarded in the

testing with the WISC-R. This child also had a breakthrough in learning to read in the middle of the first project-year (in her 3rd grade) although her learning curve was less steep than that of the child of case 2. Unfortunately, due to different reasons this child received no more on an average than one lesson a week with basic concept teaching by means of the principles of the Concept teaching Model.

The children represented in *case 4 and case 5* were given more or less the same program of concept teaching although they also differed a bit, cf. the description above. They followed a more "conventional"[17] teaching sequence of conceptual systems than the others. They also received repeated training in performing analytic coding, especially in the course of the second year of the study, both in relation to "natural" objects in the surroundings as well as by means of the produced material *Anna Game*s. Having learned new conceptual systems and concepts, these two children on several occasions were given a sheet with tasks to be solved at home, in co-operation with their parents. In addition they were the only children in the study having the opportunity to receive concept teaching repeatedly in a small group from a special educational point of view as well as in the class as part of regular instruction. More on this below.

The teachers, group guidance and educational settings

Six teachers were involved in the study. Three of them were responsible for the educational treatment that mainly took place in an special educational setting. The other three were the class teachers who had the responsibility for the children the rest of the week in school.

The prerequisites for performing concept teaching among the ones responsible for the educational treatment or the training were from the start very good for the teacher of case 1 and case 2 as well as for the teacher of case 4 and case 5. Both were pre-school teachers[18] that had followed a six-day training course of concept teaching during the school-year of 1997/1998. In addition the teacher of case 1 and case 2 had received training in concept teaching for 5 days during 1995 as participant in a one-year innovative study[19] of how to effectively train concept teachers for 6 year olds which I undertook in the region of Harstad.

The concept teacher for the child of case 3 (a qualified teacher) had participated the last 3 days of the course of concept teaching during 1997/1998 thus missing the introductory training of the concept teaching model and main parts of the underlying theory. However, this teacher had the opportunity to participating in the missing part of the course towards the end of September 1998, immediately after the start of the study.

The class-teachers of the children in the study, did not receive any training of concept teaching before the study, but all 3 followed a course of 6 days (for circa 25 teachers in the region) during the first year of the project. These teachers did not have any responsibility for the basic concept teaching of the study. On the other hand as class teachers they co-operated

[17] They followed a teaching sequence more or less equivalent to a general program developed in order to prevent learning disorders due to problems with language learning for 5- and 6 year olds. (Nyborg/Brittmark 1993), modified by the present author.

[18] In Norway pre-school teachers are formally certified for teaching up to a level that includes the first grade of primary school. But for the lack of qualified primary school teachers pre-school teachers are often engaged in grade 1-4.

[19] An up-grading course comprising four elements: A) 5- days of basic lectures on CT, B) Group guidance 2 to 3 hours each month, C) Guidance by modelling CT in the classroom by a CT- expert and D) The study of relevant literature. The effect of this model for an up-grading course seems very promising.

with the teachers of special education and, to a certain degree, made some use of learned BCSs as tools in their teaching of the children in question. This was especially true for the class teacher of case 1 and case 2 and the class teacher of case 4 and case 5.
In the period of the study the teachers and I had regularly meetings, all together 10 in which the teachers were given group guidance regarding concept teaching. In addition the teachers received consultative support concerning questions they had on teaching problems for each of the children in the study.

The teaching of basic concepts and basic conceptual systems took place mainly in small groups or was done individually as well as to a certain degree within the regular instruction in the classroom.

In the beginning of the study the children of case 1 and case 2 received concept teaching as a group, but after approximately 11/2 month the teacher had to change to teaching them individually, due to their different needs. Training in performing analytic coding were on some occasions practiced in the class as a whole including the two children with special needs. On these occasions both of the two children performed better than the average child of the class demonstrating developed skills in this kinds of tasks.

The child of case 3 (the only child scoring as being mentally retarded[20] on the WISC-R) received all of her basic concept teaching[21] individually. The concept teacher also made use of learned basic concepts and conceptual systems as tool in the teaching of reading, writing and mathematics in some lessons beyond the lessons of basic concept teaching. The class teacher also made some use of the same tools in directing the child's attentions during the follow-up of teaching school subject in class.

The concept teaching of the children of case 4 and case 5 took place in a small group combined with a certain degree of regular instruction in the classroom according to a plan for helping towards a better inclusion. First 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 the same levels as themselves. As a second step 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 done by the children's teacher of special education. On the other hand the class teacher of case 4 and 5 gradually become more and more conscious in using learned basic concepts as tools in her teaching of different school subject and in different settings.

The program of concept teaching for the children of case 4 and case 5 also had a link into their homes through 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,

[20] Optimally this child should have had at least 4 lessons each week with concept teaching according to her intellectual level of functioning as well as a teaching where learned concepts extensively should have been taken into use as tools in the learning of school subjects.
[21] Due to different reasons only one lesson of concept teaching on an average each week.

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.

Research design

The design of this study is a combined one, comprising case studies[22], a pre-test-post-test-design and a time-series-design (repeated measurement).

Some findings at the end of the training period regarding:

A) Prerequisites for learning in terms of basic concepts and basic conceptual systems as well as the children's capability in performing analytic coding.

Especially four of the children had made very good progress according to the teachers' observations and evaluations. This was also partially true for the child of case 3, with regard to learning basic concepts and basic conceptual systems in relation to the amount of lessons with concept teaching. However, this child had received very little training in analytic coding, and consequently she didn't display much progress in this kind of task when compared with the other children.

B) Level of functioning in school subjects:

Especially four of the children had made very good progress. The child of case 3 also displayed good progress in relation to her "base line" at the start of the study.

Three of the children were achieving "normal" learning results according to their teachers.

[22] Tables with specifications of the sequences of concept teaching with dates for the teaching and the use of time along with the teachers' evaluations will be presented in my doctoral thesis for each of the cases. The changes in levels of functioning in reading/writing and mathematics will of course also be specified. The description of each case will also focus on to what extent and how Basic Conceptual Systems were applied as tools for the learning of school subjects etc.

C) Some test results:

Table 1: *Pre-test-post-test results (May 1998 - May 2000)*

	WISC-R*	**Raven**[23]	**Bender****	**ITPA***** /the sub-test verbal expression
Case 1 Age Pre - Post 8 - 10	IQ-gain **+11**points. *(Pre 87 – Post 98)*	Pre: **5** percentile Post: **25(50)** percentile.	Pre- score[24] 11= < 5 percentile Post-score 1 = 50-60 pc.	Pre-score = 25points = psycholinguistic age = 7:3 Post-score: 34 p. 30p.= PLA 9:6 More than 2 yr. gain.
Case 2 Age Pre - Post 7:10-9:10	IQ-gain **+6** p. *(Pre 76 – Post 82)*	Pre: **5** p. Post: **10** p.	Pre-score 9 p. = 10 percentile Post-score 1p.= 60-75 pc.	Pre-score = 16 p. = psycholinguistic age = 4:10 Post-score: 39 p. 30 p.= PLA 9:6 More than 5 yrs gain.
Case 3 Age Pre - Post 7:11-9:11	IQ-gain **+11** p. *(Pre 52 – Post 63)*	Pre: **10** p. Post: **5** p.	Pre-score 24 p. = age-equivalent[25] < 4 (21) Post-score 13 p = age-equivalent = 5:0 - 5:1.	Pre-score = 19 p. = psycholinguistic age = 5:7 Post-score: 15 p. = PLA 4:8 Almost a year decrease
Case 4 Age Pre –post 7:1- 9:1	IQ-gain **+11** p. *(Pre 65 – Post 76)*	Pre: **5** p. Post: **10** p.	Pre-score 16 p. = < 5 percentile Post-score 6 p. = 10 pc.	Pre-score = 13 p. = psycholinguistic age = 4:3 Post-score: 32 p. 30 p.= PLA 9:6 More than 5 yrs gain.
Case 5 Age Pre-post 6:7 - 8:7	IQ-gain **+7** p. *(Pre 94 – Post 101)*	Pre: **80** p. Post: **95** p.	Pre-score 8 p. = 40 percentile Post-score 0 p. = 90-95 pc.	Pre-score = 10 p. = psycholinguistic age = <4:3 Post-score: 27 p. = PLA 8:0. More than 4 yrs gain.

***Wechsler Intelligence scale for children – Revised**.

****Raven's (Coloured) Progressive Matrices** (the book form). A supplementary measure of nonverbal reasoning ability. May be less culturally loaded than other intelligence tests. Primarily designed as a measure of Spearmans's g factor or general intelligence (Anastasia & Urbina 1997).

*****Bender Gestalt Test**. Described as a non-verbal, standardized, perceptual-motor test. Other descriptive terms for this type of measure are visuospatial, visuoconstructive, and visual motor. Success on this test appears to require good executive skills.

******Illinois Test of Psycholinguistic Abilities**. The subtest verbal expression is said to measure ability to express concepts verbally.

[23] Table IX, p. 38, (J.C. Raven 1965) applied in the scoring,

[24] The higher scores, the more negative results and the reverse.

[25] Koppitz 1975.

The Draw-A-Man test was also used, but is not yet scored. The results show on an average much better drawings from "pre- to post-drawings".

Some experiences concerning concept teaching applied as a strategy in a combination of special and in regular educational contexts in order to help towards inclusion.

According to the teachers of case 4 and case 5 the combination of concept teaching in a group outside the class with concept teaching in the class as a whole (18 pupils), was very profitably for the two children in question. At the start of the study the two children, and particularly the child of case 5, almost didn't speak in class, the teachers report. During the group lessons with concept teaching the children learned basic concepts and conceptual systems to a verbally very conscious level. At the same time the activities and the interactions between them and the others in the group (including the teacher), led to much dialogic training with the starting point in the principles of the concept teaching model, and they improved very much in this sense. 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, for instance, how to verbalize detected partial similarities (..*they are similar in having vertical position*). They were also just as active verbally as the rest of the class during such lessons. In the beginning this level of active verbal participating were limited to the group- and the class lessons with concept teaching. During the first year of the study this changed ending up with the two children communicating with and speaking more or less just as much as the rest of the class regardless of subjects or activities. The concept teacher and the class teacher attribute to a large degree this positive development to the strategy of concept teaching and to what the children had experienced of mastery in the two mentioned settings.

Some experiences with child-parents co-operation at home in conceptual tasks.

The parents tell that they appreciated very much having the opportunity to observe how clever and how accurate the children were in their verbal communication when solving the conceptual tasks in co-operation with them. They also say that they have become even more conscious of the importance of a precise naming of the basic concepts and conceptual system[26].

Closing comments including some additional data a year after the end of the intervention period of the study

Half a year in advance of this study the child of case 1 had been evaluated by a psychological assessment team and diagnosed as being a child with *nonverbal learning disabilities.* The changes occurring during the training period (1998-2000) of this study concerning the child's academic functioning, and as revealed by the rise in test-scores, open for a re-evaluation of this diagnosis.

Towards the end of the training period three of the children were assessed by their teachers as having no more learning difficulties, and consequently, as having no need for further special education.

[26] This corresponds much with experiences from a previous study of mine (1995/1996) where parents, answering a questionnaire about a similar kind of co-operation, also added that they actually, through the co-operation themselves had learned the importance of and to be more accurate in their verbal communication with their children.

By the end of the training period according to my assessment in particular the child of case 3, but also the children of case 2 and case 4 still needed Concept Teaching in order to further improve their pre-requisites for learning, and their levels of academic functioning. The results in the tests, together with other information clearly pointed out what further Concept Teaching should focus on[27].

The children's learning curves were clearly steeper than when the study started. In this perspective they were children who had "entered" much more positive learning careers[28], that probably would bring them beyond what their previous levels of functioning could have done.

During the winter and spring of 2000-2001 I have been writing about the 5 cases in order to present them in an acceptable and adequate way in accordance with the research issues. In this matter I have on several occasion been in contact with the teachers that participated in the study in question, for a further discussion on, as well as an explicit validation of, the written "presentation" of the cases.

These meetings have also made it possible for me to gather information about how the children are doing in school up to one year after the end of the defined training period. The teachers have also agreed to give me a report on the children's functioning in school by the end this school year (June 2001). This so to say adds another year to this study with regard to parts of the study.

[27] This footnote is partly based on data gathered during the spring of 2001: The teacher of special education for the child of case 3 has continued with the application of learned basic concepts and Basic Conceptual Systems as tools for teaching/learning, but has not taught this child more of these concepts and conceptual systems during the school year of 2000-2001 nor trained the child in performing analytic codings on her own. However, according to the teacher's reports as well as the test results (c.f. table 1) the child needs much more of this kind of training in order to make a significant positive change in the conceptual pre-requisites for learning. The teacher now (Spring 2001) realises this and wants to do more of this basic training during next year (2001-2002), having asked for my guidance in this matter.
The child of case 2 (and case 1) moved to a new school as a consequence of their moving up from 4. to 5. grade getting new teachers who have been informed about the study, but who don't know the theory behind and the educational approach itself in detail. The child of case 2 therefore hasn't received any more concept teaching after the termination of the training period. The new teachers look upon the child of case 1 without the "diagnostic glasses" of non-verbal learning disabilities, even though they have heard about the diagnosis. According to them this child is functioning in every aspect on the average or above compared with her class mates.
On the basis of the test scores at the end of the training period, I also assessed the child of case 4 to have some more need for further basic concept training as well as training in the use of analytic codings and self-instructions, especially in performing different tasks involving visual–motor performance. According to his teachers, he had no more learning difficulties towards the end of training period, and consequently had no need for further special education. During the year (2000-2001) following the defined training period, he has received no special education. On the other hand the class teacher often has followed up with the application of learned concepts as tools in her teaching in class. According to her assessment at the beginning of June 2001, this child is functioning a little above the average level of the class in reading and may be a little under the average level in mathematics.

[28] Much can probably be done and should be done for lots of children who experience being not too smart during the first years of school. Sternberg, for instance, tells his story and about his theory in the book Successful Intelligence from 1996, c.f. also Sternberg (1999) and later sources on the theory of Successful Intelligence. Meichenbaum & Biemiller (1998) ask how the gap between those who thrive and those who falter gets so large, and are putting forward pedagogical guidelines for diminishing the gap. And there are many others trying to contribute in this matter, for instance the developers behind, and the trainers applying, different approaches within the "field" of Cognitive Education.

Summing up the status one year after the end of the training period it is possible to conclude that the children, generally speaking, have continued their positive learning of school subjects which were very much improved during the defined training period[29].

Only the children of case 2 and 3 still have need for further special education. The child of case 3 has a substantial need for further special education including more basic concept teaching, whereas the child of case 2 now has special needs only in mathematics and English as a foreign language as well as for minor support in reading and writing in class.

It should also be added that four of the children function well socially and are well included in their classes. The child of case 3 is also well included in class, but often seeks company during breaks outside class with children two or three years younger than herself.

It seems possible to conclude that the positive learning careers that the children entered during the training period have continued. Hopefully, this trend will help them to a better realization of their abilities and possibilities in life.

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[29] There is, however, one negative exception: The child of case 3 have not improved very much in mathematics.

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Appendix I: Names for Basic Conceptual Systems (BCSs) including some basic concepts.

1. Colour: Red, blue etc.

2. Shape: *Linear shapes*: Rectilinear, bowed/curved, angular.
Areal 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, also 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.

9. Sound/phoneme

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