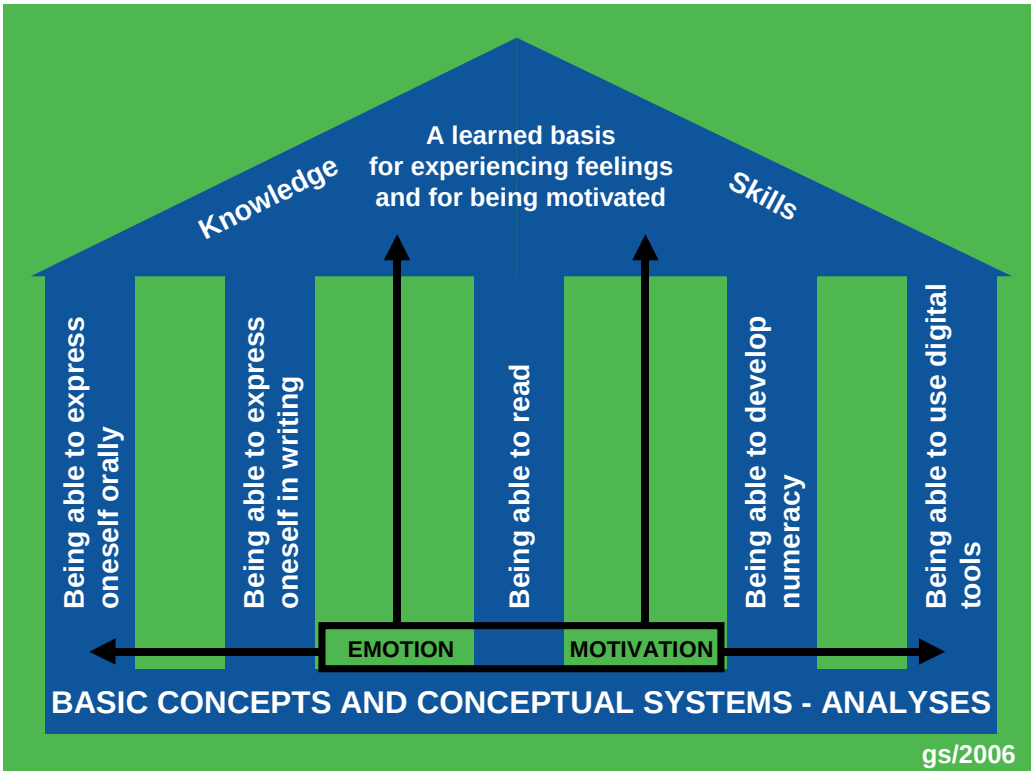
The Concept Teaching Model

A Curriculum for the teaching of Basic Conceptual Systems (BCS) and related Basic Concepts in kindergarten and primary school

Exemplified by a project implemented in the municipality of Balsfjord, Norway, obligatory from 1.1.2008



An expanded version presented at the IACESA Conference

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A preliminary version in English per February 2009

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The illustration on the front page is made by Gunvor Sønnesyn, Pedverket, Voss, 2006.

The English version of the curriculum can be downloaded from the pages of National Support System for Special Education in North-Norway:
http://statped.no/nyupload/moduler/statped/enheter/statped%20nord/dokumenter/fagomr%C3%A5der/sprakogkom/ct_and_bcs_curriculum.pdf

A Norwegian version of the original curriculum can be downloaded from:
http://www.balsfjord.kommune.no/kommunal-plan-for-begrepsundervisning.4454608-58563.html

On the front page, this paper or booklet is denoted “A Curriculum”. However, it may also be said to partially represent a research report. In addition it contains some theory on the Concept Teaching Model, and a brief account of the learning theory behind the approach of Concept Teaching.

The many appendices to be found in this booklet will hopefully be of good help for those who may want to try out and work in kindergartens and schools according to Concept Teaching as an educational approach.

Some frequently appearing abbreviations in the existing curriculum:
CT (systematic Concept Teaching)
The CTM = the CT-model (the Model for Concept Teaching)
BCS (Basic Conceptual Systems)
AC = Analytic Coding

Contents

Preface with specification of changes from the Norwegian to the English version of the curriculum

This proposal for a curriculum for concept teaching builds on the curriculum for Concept Teaching (CT) in kindergartens and primary schools, obligatory from 1.1 2008 in the municipality of Balsfjord, Norway,

Most of the users of the "Concept Curriculum of Balsfjord" have received a 6-days supplementary training in Concept Teaching spanning over ¾ of a year, which consists of lectures on the following:

1) An introduction of Nyborg's comprehensive theory of learning, which strongly emphasizes the role of language in learning. Nyborg also emphasizes the importance of developing or having positive motivational and emotional dispositions towards learning and learning situations cf. **appendix 1**: Central aspects of Nyborg's theory of learning etc.

2) It is possible to teach children and adolescents Basic Conceptual Systems (BCS) and related basic concepts made conscious by means of oral language skills, and learned to a generalized and transferable level by means of a Concept Teaching Model (the CTM).

   Cf. the description of the Concept Teaching Model (The CTM) on pp.12–26 and **appendix 2** containing shortened examples intended to supervise the teaching of BCS and related concepts about Colour, Shape, Position, Place, Sizes, Direction, Number, (surface) Pattern etc. Consult **appendix 3 f**or two inventories of words denoting BCS and related concepts.

3) The supplementary training program also aims to make the teacher aware of how to train children and adolescents in performing Analytic Coding or making varied descriptions of concrete objects, drawings, and events, to such an extent that the process can be performed without adult supervision. Analytic Coding refers both to description of single objects and events as well as to the description of similarities and differences between two and more objects and events. Consult **appendix 4** which contains exercises that aim at contributing to the development of a precise and decontextualised language.

4) How teachers should apply words denoting Basic Conceptual Systems as tools, and analytic coding as a strategy in their teaching of school subjects and skills are also in focus. The 6-days supplementary training on Concept Teaching especially emphasises how the attendees will be able to teach reading, writing, mathematics, nature and environmental themes etc. from a conceptual oriented perspective, cf. **appendix 5** containing a survey of words denoting BCS suitable for the description of letters, numerals and other symbols etc. See also **appendix 6** containing a table with a summary of Basic Conceptual Systems intended as prerequisites for Teaching/learning different school subjects.

5) The teachers learn to utilize a model for the **teaching of skills**, cf. **appendix 7** with the description of this teaching model.

6) The lectures are also on how it's possible for the teachers to assess their concept teaching and the corresponding results, cf. on pp. 29–31 and partly in **appendix 8**.

This English version of the "Balsfjord Curriculum for Concept Teaching" has been expanded and made more understandable for readers who are not familiar with Nyborg's comprehensive theory of learning, and the corresponding didactical models, with the addition of appendices **1, 2, 3, 5, 6, 7 and 13 and 14.**

The English version of the curriculum contains a more detailed version of the Concept Teaching Model (CTM) than can be found in the Norwegian equivalent. It should also be mentioned that two appendices appearing in the Norwegian version have been omitted in the English version.

The English version of the Curriculum is presented for the first time at the IACESA Conference in Cape Town, South-Africa 11–13 February 2009.

Many persons' contribution lay behind first the Norwegian version and now this English version. My thanks go to Pål Færøvig, today Director of the People High School in Balsfjord municipality, for long collaboration and organisation of the supplementary training in Concept Teaching in kindergartens and primary schools in Balsfjord and Karlsøy municipalities. I would also like to thank the headmasters, the leaders of kindergartens and the many teachers who have participated in the supplementary training. Many of them are now practicing CT at different levels. My thanks go also to Kelly Morgan, Seattle, WA USA (for translating appendix 3.2 into English by means of Norwegian speaking friends and for comments to parts of the text), and to Denis Kabush, Courtenay, Vancouver Island B.C. Canada (for some proof reading and comments to parts of the text). The translation of greater parts of the text from Norwegian into English has been done by Lena B. Mjølsnes and Øystein Westerman Hansen.

Finally I am indebted to the National Support System for Special Education in North-Norway (Statped Nord) for giving me the opportunity to write this booklet as part of my work.

Andreas Hansen, Dr. Polit. (Doctor of Education), January 2009
National Support System for Special Education in North-Norway (Statped Nord) and Educational-Psychological Services of South-Troms, Harstad, Norway (andreas.hansen@harstad.kommune.no)

Introduction, background information and the objectives in the original Curriculum

One central theme addressed in The Norwegian National Curriculum for the Development of Knowledge (2006) is a focus on developing basic skills. These skills are: Being able to read, being able to express oneself orally, being able to express oneself in writing, being able to develop numeracy and being able to use digital tools. The focus on basic skills is founded on the following realization, that learning and the ability to gain knowledge, independent of subject matter**,** is closely related to the mastery of the basic skills.

As a response to the introduction of The Norwegian National Curriculum for the Development of Knowledge (2006) and the new Framework Plan for Kindergarten **(**2006), the Municipality of Balsfjord introduced a joint supplementary teacher training program for all kindergartens and schools, focusing on how to utilize Systematic Concept Teaching (CT) on a regular basis. This program primarily targeted school administrators, leaders, teachers in primary school (up to grade 6), and teachers/employees in kindergarten. A series of courses were started in the autumn of 2005 and continued until spring 2007. The supplementary training program has been organized and administrated by the National Support System in North Norway (Statped Nord), Dr. Andreas Hansen, and the Municipality of Balsfjord.

An important objective is to ensure that schools and kindergartens continue to utilize Concept Teaching after the educational program/project is finished. Therefore a curriculum promoting cooperation between schools and kindergartens in the Municipality of Balsfjord was developed. This curriculum is founded upon research showing that Concept Teaching (CT) as an educational approach can improve the development of language skills significantly. By systematic utilization of Concept Teaching (CT) over time, it is possible to compensate for poorly developed language skills. Utilization of CT as an educational approach over time will probably help prevent future learning disabilities.

The curriculum is constructed as a concrete guideline for teaching Basic Conceptual Systems and related Concepts, and is divided into sections according to age group. This curriculum shall not limit, nor replace other methods or educational approaches related to language development. The curriculum shall however be utilized as a foundation, and the primary

educational approach for Concept Teaching applied by kindergartens and schools in the Municipality of Balsfjord.

The curriculum is obligatory for all kindergartens and schools in the municipality of Balsfjord from 1.1.2008

The curriculum is the result of a joint effort courtesy of a network of schools and kindergartens in the municipality of Balsfjord, including the municipality director[1] Pål Færøvig in collaboration with dr. Andreas Hansen, National Support System for Special Education of North-Norway, and Educational-Psychological Services for South-Troms, Harstad.

Main Objectives for the curriculum

- The curriculum shall be a tool utilized for the application of Concept Teaching with the objective of helping children develop prerequisites for learning in terms of oral language skills
- The curriculum shall help prevent learning disabilities due to inadequately developed language skills
- The curriculum shall increase children's mastery of basic skills
- The curriculum shall promote cooperation between schools and kindergartens, and promote continuation with regard to language development from kindergarten to primary school
- The curriculum shall prevent and reduce differences among children related to language development, learning, and promote the development of social skills

[1] At that time Pal Færøvig was the municipality director for all kindergartens and schools, for the library and for culture.

Concept Teaching (CT) – what, how and why, and for whom?

What, how and why

CT refers to systematic Concept Teaching of Basic Conceptual Systems (Colour, Shape, Size, Position, Place, Direction, (Surface) Pattern, Direction, Number, Time etc.) and related basic concepts, which are made verbally conscious by means of oral language skills.

The number of Basic Conceptual Systems can vary from an amount of 19 to 26 BCS depending on how they are grouped.

These Basic Conceptual Systems and related concept are taught by means of a Model for Concept Teaching which was developed by Dr. Magne Nyborg, professor at the University of Oslo for many years.

The approach also aims at helping actual children with negative experiences concerning their learning possibilities to develop (more) positive expectations regarding their own learning. It also aims at teaching them to direct and take control of their attention, train them in prolonging and expanding their Short Term Memory/their Working Memory by consciously applying language in these processes (outer as well as internalized private speech). Moreover it makes children aware of and trains them in the use of language as tools for thinking and problem solving,

The approach also includes training the children in applying a precise and decontextualized[2] (or situational independent) language, cf. the exercises in appendix 4.

[2] This refers to communication about objects and events that possible communication partners cannot look at or inspect together while communicating. The general assumption is that as much as 40%–60% of the conceptual meanings attached to words and sentences applied in ordinary conversation can be derived or understood in light of the immediate context, when communication partners have the opportunity to look at or inspect together what they are talking about. Via CT one aims at teaching a more common conceptual basis for a precise communication represented by “a language” consisting of words and sentences that function and convey meanings across situations or contexts, i.e. a language that to a much lesser extent is dependent upon what the “partners” can view together while talking. Thus, a language that functions in this way may be termed “a precise and decontextualized language”.

In the next stage the learned Basic Conceptual Systems and related basic concepts are deliberately applied as tools for the teaching of school subjects including skills of different kinds at rising levels**.**

The research basis for Concept teaching

Concept teaching rests on a comprehensive theory of learning and a thoroughly empirical research over more than 30 years.

Within the "tradition" of Concept Teaching two Doctoral Thesis have emerged. The first was put forward by M. Nyborg in 1971[3], and the second by A. Hansen in 2006[4]. In addition many books and booklets have been published on Concept Teaching, as well as approximately 12 master theses that also have been delivered. Beyond this an amount of 40–50 reports have been "produced" in Norway, describing projects with Concept Teaching and possible effects vis a vis children and adolescents at various ages and with various learning problems. Concept teaching has also been implemented in some European countries, as well as in some cases in America.

Briefly and general on effect studies on Concept teaching as well as on the many reports

Almost without exception the studies and reports evaluate Concept Teaching as an approach that children and adolescents learn from in such a way that they experience a positive development of their oral language skills and their motivational dispositions towards learning. Most often this corresponds with reports of improved learning of school subjects including actual skills, when such matters also are evaluated.

[3] The effect of possessing verbal "analyzers" upon concept learning in mentally retarded children. Institute for Educational Research, University of Oslo

[4] In Norwegian: Begreper til å begripe med. Effekter av begrepsundervisning for barn med lærevansker på målområder som angår læreforutsetninger, fagfunksjonering og testresultater. Pedagogisk institutt, Universitetet i Tromsø. Available online in pdf-format on http://hdl.handle.net/10037/582 (The title translated into English: Concepts to understand with. A study of the effects of concept teaching for children with learning difficulties in target areas that concern prerequisites for learning, subjects performances and test results).

What kind of children will benefit from Concept Teaching?

Generally one might say that Concept Teaching is well suited for children from the age of four and five, but of course for children who are able to interpret oral language information to a certain degree, and who are able to imitate short sequences of words (or signs) with the teacher and other children in a group, as a model.

As mentioned above, through a period of more than 30 years many teaching experiments has been carried out by Magne Nyborg, Ragnhild Hope Nyborg, Andreas Hansen, Turid Lyngstad as well as by many students and colleagues. Summing up, it is possible to say that the following categories have proved to benefit from this teaching:

- Early teaching of typically developing children; that is within pre-school settings and at the early grades of primary school (Nyborg, 1985, Hansen, 2006).
- Children and young people with specific disabilities, including different kinds of language-learning disorder (Hansen, 2006).
- Children and young people with general disorders of learning, combined with lower IQ. (Nyborg, 1977, 1981).
- Children and young people with “behavioral disorders’, including schizophrenia (Karoliussen, 1993, 1994).

A description of a Concept Teaching Model (the CTM) and its three teaching phases

In the following you will find an introduction to Nyborg's model for concept teaching (the CT-model= the CTM). Then the tasks and processes involved in the model's three phases will be outlined. The procedure is illustrated by means of a summary of an abridged teaching program for **round shape**. Further four important questions that teachers ought to take notice of during the preparation of their concept teaching are mentioned, as well as how a teacher should observe, evaluate and reason around his/her concept teaching. Also, suggestions are made that a key word log is written (daily), and a form for registering performance is kept.

Introduction of Nyborg's model for concept teaching[5]:

Nyborg has developed a particularly accurate model for concept teaching (the CTM) (Nyborg, 1993; Hansen, 2002, 2006) which is supposed to make sure that **conceptual meanings and the words representing these** are learned and "connected" in the appropriate manner. This model has been thoroughly tested and has yielded good results[6].

As mentioned above, within the Nyborg-tradition a distinction is made between words and concepts. The word is a symbol of and a denomination for the concept. Through observation and the manipulation of objects and events in the surroundings, the child acquires basic concepts and conceptual systems regarding colour, shape, size, position, place, direction and number etc. – which are named in a precise manner. The basic concepts and conceptual systems cannot, in other words, be imparted or mediated via explanations of words alone.

In order to facilitate the child's acquisition of the mentioned basic conceptual knowledge, the CT-model helps direct the child's attention towards, discovering and naming

[5] Children will of course learn concepts, although at various levels, by participating in different activities, different social settings, with more or less precise naming, in unrestricted as well as more structured settings. In other words outside of as well as in teaching situations. This is a fact. Teachers should still, in my opinion, also choose to implement a precise and well-organized concept teaching for children by also using Nyborg's model for concept teaching. Such an application might be to the benefit of the most, not to speak of the children who show signs of learning disabilities.

[6] Nyborg,1993, Hansen, 2006, dr. thesis.

partial similarities[7] (and partial differences) in the surroundings, i.e. how different objects and other phenomena are similar, in spite of the many differences they may represent.

It is thus the discovery of partial similarities that form the foundation for children acquiring relevant concepts/conceptual systems in a **verbally conscious, generalized and transferable way**. The terms "generalized" and "transferable" in this context reflect the fact that concepts/conceptual systems in the future really function as teaching- and learning tools in different theme areas.

The model is further characterized by the active way in which the language is used in the teaching to contribute to the children "developing" or "constructing" the Basic Conceptual Systems and related concepts. Repeated verbalizations of the term **round shape** and not merely verbalizations of **round** or **circle** contributed to the integration of the separate concept within **shape** the proper Basic Conceptual System.

When several concepts (referred to as for instance rectilinear, curved/bowed, angular, triangular, square, spherical, cylindrical) are learned in this manner and stored in the long-term memory as part of the conceptual system **shape,** the teacher might next, by employing the word **shape,** direct children's attention towards an analysis of the different features connected to shape in the surroundings, in addition to communicating with them about these features in a particularly precise manner: What **shape** is this piece? It is (has a) **round shape**. What **shape** is this letter (**V**)? **Angular shape**. What **shape** does a football have? It has a **spherical shape** (it is **ball-shaped)** etc.

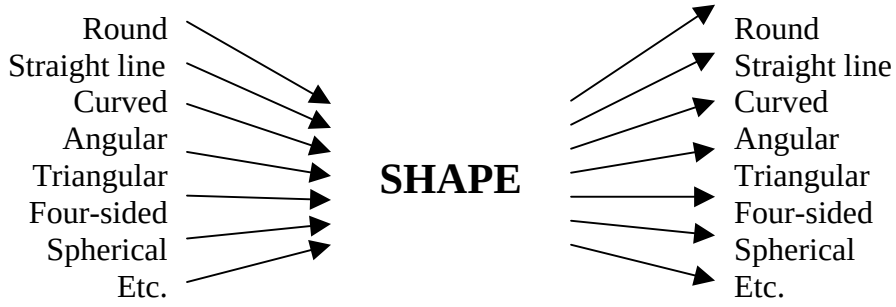
Cf. figure 1 next page, which sums up the above: Teaching according to the principles of the CT-model contributes to the development of **SHAPE** as a verbally/linguistically conscious and available conceptual system stored in the long term memory (cf. the row of words

[7] The term "concept" refers to LTM-stored experiences, organized in categories: i.e. concepts refer to stored and remembered knowledge of similarities between different members of one category of phenomena, In addition comes knowledge of differences within one category and differences between one given category and members of other categories that it might be confused with (Nyborg, 1993). Compare the knowledge about "ball" as a superior (category) or class concept with for instance football, handball, volleyball as different members of the category. Examples of what at first sight might seem like phenomena that are easily mixed up are for instance a croquet ball and an (iron) ball used in track and field events.

denoting concepts to the left where the word **SHAPE** is centered since it is the term denoting the conceptual system).

At the same time, the aforementioned central placement of **SHAPE,** seen with words denoting concepts at the right, illustrates that hearing, reading or thinking about the word **SHAPE** might activate the adhering concepts as possible alternatives when children are answering questions or otherwise communicating about the features of shape, possibly thinking about these features.

Fig. 1: Words denoting a simplified conceptual system of SHAPE



The CT-model implies that the teacher is supposed to act as a role model when it comes to the child's verbal formulations. This means that when a new concept/conceptual system is introduced, to begin with, the teacher usually mediates or imparts what the child is expected to put into words - instead of simply trying out whether the child has already acquired the answer.

If the child is struggling with its formulations, the teacher repeats his verbalizations and continues to support the child's formulations by means of saying together with the child the correct phrase or verbal formulations.

When the teacher applies the principles of the CT-model, it is also considered highly important that he is conscious about and precise in his feedback to the children. Instead of the more general feedback like "great, you're doing good, fine", the teacher should make an effort to give feedback that is as precise and instructing as possible: "You said **round shape** in a precise way. The figure with the **round shape** is beautifully drawn" etc.

When working with children that are insecure regarding **their own learning possibilities** after each lesson as well as and from week to week the teacher should point/make them aware of **what they have actually learned** - depending on how the teacher assesses the needs of each child: Today you have learned about striped pattern – yesterday you did not know anything about striped pattern. Now you know about colours, shapes, sizes and you can tell me the exact colours, shapes and sizes of things – something that you were struggling with at the beginning of the school year three months ago. Now you can tell me about what parts, positions and shapes the letter **h** has when I ask you, and you are able to write the letter in a good way – which you struggled with a little while ago.

After a while the teacher might help the children express on their own what they learn during a lesson (What did we do today, and what have you learned today?) or in the course of a week etc. and in this way help them develop their ”ability” to evaluate their own learning. The idea is that the children are to develop an understanding of themselves as **learning persons in a positive development,** with the positive consequences this might have for children’s self esteem and for their emotional and motivational development in different areas of learning

The Concept Teaching Model – teaching phases, processes and tasks

The CT-model is divided into **3 different phases** that are named according to **the processes** that in particular are represented in each phase.

- **Phase 1: Selective Association** otherwise referred to as learning associations
- **Phase 2: Selective Discrimination** or learning differences
- **Phase 3: Selective Generalization** or discovering similarities

However a fourth and basic process named **analytic coding** underlies the learning in all of the three phases. In this context analytic coding involves the child performing **analyses of and comparing** the different objects that are presented in the light of its knowledge about basic conceptual systems and concepts. Thus the child facilitates its **discovery of the actual partial similarities and partial differences** (What colour, shape, size, position, number etc. do the different objects in question have, and how are the presented and perceived objects **similar** or **different** based on the exemplified questions?).

Analyses and comparisons corresponding to this are presumed to take place initially in **an intuitive way**. As children learn conceptual systems and belonging concepts in a verbally conscious way, analyses and comparisons might be performed on a more **conscious level.**

Re phase 1 of the teaching: Selective Association or learning associations.

When starting to teach children for instance about **round shape** as a term for respectively concept and conceptual systems, the child must be allowed to see, touch and talk about different round shapes.

In order to facilitate children's discovery of "roundness" as the relevant feature or the partial similarity that they are going to learn about, the teacher keeps this feature constant while systematically varying other features or attributes such as the colour, size, pattern, placement, types of fabric/cloth etc. In this way one presumes that the "roundness" – or the partial similarity – is more easily discovered than usually.

The experiences with roundness that children acquire in these different situations are then repeatedly named as **round shape** in the dialogue by both the teacher as a (role) model and by the children.

In connection with this work the children are also invited to for instance draw, paint, use scissors or apply other methods for making round shapes, also by using their fingers or by several children together collectively forming round shapes with their bodies ("self-production-tasks") – while at the same time verbalizing round shape as a term.

The possibilities are numerous, both inside and outside. The aforementioned activities might take place in lessons that are meant for concept teaching, but situations within widely different subjects like mathematics, reading/writing, science, arts and crafts, music and physical education might also serve the same purpose.

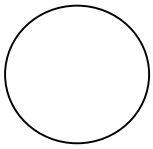
The Selective Association phase with its typed of tasks are illustrated in the following via a partly abbreviated teaching program for **round shape.** The overview of the program is divided into three columns (cf. next page). The column at the left tells **which phase/process** in the concept teaching/learning that is processed. In the same column the phase is divided

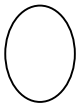
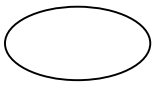
into subcategories represented by named types of tasks. As can be seen, **the selective association phase** is divided into three parts consisting of respectively (1) Simplified opening tasks, (2) more complex tasks, and finally, (3) self-production-tasks.

The column in the middle tells which **material** that forms the basis for the concept learning. The content of the column to the right is referred to as **EXAMPLES OF CONVERSATION PATTERN** and includes an explanation of what is found in the column.

In between the formulations that are emphasized in the column **EXAMPLES OF CONVERSATION PATTERN,** several "minor dialogues" will occur and these will vary according to the teaching context and the children in question etc. This has to do with comments and questions from the children, stemming from spontaneous associations and ideas occurring in the course of the teaching. The teacher should make an effort to "answer" as many of these questions as possible, but at the same time keep as best his/her CT progressing.

Note that the following are simply examples of types of tasks in each phase. Each teacher must therefore **add and vary** tasks according to the needs and interests of the children in question he/she is dealing with. Further it should be noted that quotation marks are **not** used to mark direct speech in the following examples.

PROCESS	**MATERIAL**	**EXAMPLES OF CONVERSATION PATTERNS** which includes explanations, questions, points made by the teacher, nonverbal and verbal actions performed by the children and also the teacher's instructive feedback or consequence related to what the children are saying or doing.
Selective association – *Simplified opening tasks (1)*	 Several pieces of brown cardboard	***In advance the teacher must make sure that the children know what a corner is, e.g. the corners of a tabletop.*** **The teacher** (holds up a piece of cardboard with round shape, gives each of the children one piece and says): Move your finger **along the edge** of this piece of cardboard **all the way around it** like I am doing right now. **The children** do as they are told. **T:** Since the edge is curved **all the way around** and since there are no **corners** along the edge of this cardboard we can say that it has a **round shape**. **T**: Please look at the piece of cardboard and say together with me: **It has a round shape.** **C** and **T: It has a round shape** **T's** positive and guiding feedback: You all did that nicely. Well done. **T** asks again (while holding up a piece of cardboard): What **shape does this piece** of cardboard have? **C** look at the cardboard and reply: (The cardboard has) **a round shape.** **T's** positive and guiding feedback, for instance: That is correct.

Selective association – *Simplified opening tasks (1)*	 A white piece of cardboard	**T:** This is another piece of cardboard. Watch what I am doing. **T** (moves a finger along the edge of a piece of cardboard while saying): The edge of this piece of cardboard is also **curved all the way around,** and has **no corners.** Therefore this piece also has a **round shape**. **T:** What **shape** does this piece of cardboard have? **C:** (That piece of cardboard has) a **round shape**. **The teacher:** You said that nicely. The piece of cardboard has a **round shape**.
Selective association – *Simplified opening tasks (1)*	 A blue piece of plastic	**T**: What shape does this piece of plastic have? **C:** It has a **round shape**. **T's** positive and guiding feedback.
Selective association – *Simplified opening tasks (1)*	 Transparent fish platter	**T**: This is a fish platter. Does it have any corners? **C** (looks at it and reply): No, it does not have any corners. **T's** positive and guiding feedback. **T:** What **shape** does this platter have? **C:** It has a **round shape.** T's positive and guiding feedback.
Selective association – *Simplified opening tasks (1)*	 A coin	**T**: What shape does this coin have? **C**: It has a **round shape.** **T's** positive and guiding feedback. **Possibly more tasks of the same type.**

The same process continues, but now the shape is to be **analyzed or coded** as part of familiar phenomena, i.e. both as part of concrete or "depicted" ones – in or outside the classroom.

PROCESS	**MATERIAL**	**EXAMPLES OF CONVERSATION PATTERNS**
Selective association – *More complex tasks (2)*	A toy car	**T** (pointing at one of the wheels): What **shape** does this wheel have? **C:** It has a **round shape**. **T's** positive and guiding feedback.
Selective association – *More complex tasks (2)*	An open paint box where the colours have a round shape.	**T (**pointing at one of the colours): What **shape** does this colour have? **C:** It has a **round shape.** **T's** positive and guiding feedback.
Selective association – *More complex tasks (2)*	Air valve in the ceiling or on the walls	**T** (pointing at a valve): What **shape** does this air valve have? **C:** It has a **round shape.** **T's** positive and guiding feedback. **Possibly more tasks of the same type**

The work continues with **self-production-tasks.** In these kind of tasks the children are encouraged to "produce" something that has a round shape, that is, they draw or paint a round shape, build it with blocks, use plasticine to form a round shape, make this kind of shape with their fingers, play different games which includes the perceptions of round shapes, etc. When working with these kinds of tasks, they are expected to verbalize what is produced and sensed by means of relevant conceptual terms, possibly through the communication with other children or the teacher.

PROCESS	**MATERIAL**	**EXAMPLES OF CONVERSATIONAL PATTERNS**
Selective association – *Self-production-tasks (3)*	Pipe-cleaner	**T:** Here are some pipe-cleaners. Could you please bend them and attach the end of each of them so that they form a **round shape**? **C** perform the task **T:** What **shape** have you made with the pipe-cleaner? **C:** (We have made) a **round shape** **T's** positive and guiding feedback.
Selective association – *Self-production-tasks (3)*	Plasticine	**T:** Now I want you to make a bracelet out of plasticine. It must have a **round shape.** **C** performs the task. **T:** (while walking around, talking to each individual): Could you tell me what **shape** your bracelet has? **C:** The bracelet has a **round shape** **T's** positive and guiding feedback.
Selective association – *Self-production-tasks (3)*	The children's own fingers	**T:** Could you try to make a **round shape** by placing your index finger or your middle finger against your thumb? **C** perform the task (with assistance if needed) **T** (while walking around, pointing and asking each individual): What **shape** has the opening between the thumb and the finger that you are pressing against it? **C:** The opening has a **round shape**. **T's** positive and guiding feedback. Another possibility is that the teacher could ask two or three children to lie down on the floor and together make a **round shape** with their bodies. **Possibly more tasks of the same type.**

Towards the end of the description of phase 1 it should be underlined that when applying the principles of the CT-model through all the three phases, the teacher is making use of concrete and semi-concrete materials etc. 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 class to be learned about.

As shown in this introduction of the CTM, examples of round shapes are exposed to the children via different objects and drawings etc. 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).

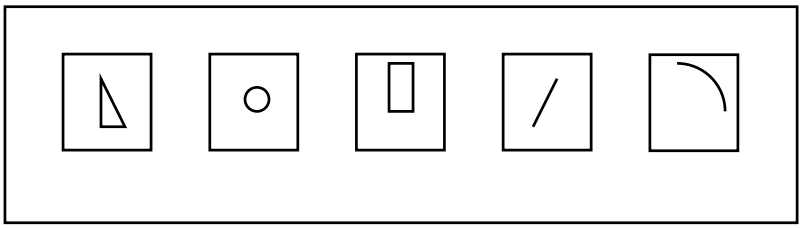
Re phase 2 of the teaching program: Selective Discrimination or learning differences.

In this phase the children are told to point out round shapes among other shapes, to make sure that children really are capable of distinguishing round shapes from other shapes. To begin with this is done through the comparison of two, three, possibly more shapes (only one with a round shape) placed close together by the teacher (**simultaneous concrete discrimination).**

Towards the end of this phase more open tasks are given, within the frames of what can be viewed spatially by the children (**successive discrimination**). The teacher: Could one of you find something/tell me about something in this room that has a round shape? The children are further encouraged to tell about round shapes that they know of at home or that they able to recall out of experiences in other places – if the teacher considers this possible for them.

In connection with the first tasks in this second phase (and in the third phase) the teacher might make use of a teaching panel.

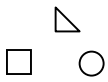
Fig. 2**:** A Learning panel



The learning panel might be made from plywood. Each of the five openings has moldings underneath and along the vertical sides that make it possible to place cards in A5 format in front of the openings. A detailed description of a learning panel is to be found in **appendix 9.**

Cf. how the conversation progresses in connection with the application of the teaching panel both in faze 2: the SD-phase and in phase 3: the SG-phase.

Examples of tasks in phase 2: Selective Discrimination

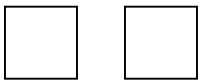
PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERNS
Selective discrimination – *Simultaneous concrete discrimination (1).* .	Three Pieces 	**T:** Point at the piece which has a **round shape!** **C** point at the right piece. **T:** Yes, that is correct. What **shape** (while pointing) does this piece have? **C:** That piece (while pointing) has a **round shape**. **T's** positive and guiding feedback. **As an alternative to the teacher's positive feedback or as a continuation**: **T** while pointing: Why did you point at that particular **shape**? **C:** (I pointed…) because it has a **round shape**. **T's** positive and guiding feedback.
Selective discrimination – *Simultaneous concrete discrimination (1).*	**The teaching panel,** using 5 openings, cf. above). Drawings of different shapes or for instance the use of the following letters **m u f g v**	**T:** Point at the letter which has **a part** with a **round shape**! **C** pointing at the right letter. **T's** positive and guiding feedback. **As an alternative to the teacher's positive feedback or as a continuation**: **T** while pointing: Why did you point at that letter? C**:** (I pointed…) because it has **a part** with a **round shape**. **T's** positive and guiding feedback. **Possibly more similar tasks with concrete objects or "depictions".**
Selective discrimination – *Successive discrimination tasks (2).*	**Things in the close surroundings**	The work continues with the children (only now) being told to point at or approach and touch round shapes in the close surroundings – accompanied by a verbal coding, in this case "a **round shape".** **T:** Can you show me something that has a **round shape?** **C** point correctly, possibly accompanied by the correct verbalization. **T:** What **shape** has this X (the actual thing that is pointed at). **C:** It has a **round shape**. **T's** positive and guiding feedback. In cases where the teacher finds it useful, he might also ask the children whether they are familiar with or know of something that has a round shape outside the school, e.g. at home or in other places. This is definitely a harder task than the previous one. An **alternative** is to give the children as homework to find examples of things that have a round shape in their homes and in the surroundings/environment outside, once the whole teaching program for round shape is covered. A different type of task that Nyborg tends to place towards the end of the SD-phase is evaluations of **true/false utterances** (evaluations of validity): "Is it **true** or **false** that this letter (h) has a **part** with a r**ound shape**?

Re phase 3 of the teaching program: Selective generalization or discovery of similarity.

A prerequisite for the full benefit of the third phase of the teaching is that the children have learned the basis for directing or letting their attention be directed towards **partial similarities** (between presented things, drawings etc) in a verbally conscious way. The reason for this is that concepts and conceptual systems, as mentioned earlier in, are acquired through **the discovery of partial similarities** (in spite of all of the differences) between the examples presented.

Within the framework of the CT-model, Nyborg has found it useful to use the verbal expression **"similar in"** for this purpose. However, the children are usually already in the pre-school years capable of looking for **complete similarity,** i.e. similarity with regard to all features, often referred to as "complete similar" or "similar".

With **complete similarity** as a starting point, the work in the third phase is prepared through selected tasks that make it possible for the children to acquire an ("growing") understanding of the difference between **partial similarity and complete similarity.** One way of doing this is as follows: Two pieces of cardboard or plastic with the same shape, size, type of substance/material and colour are displayed. They are in other words **completely similar,** also when it comes to the colour, cf. situation1.

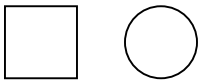
Situation 1: 

Teacher: "Please look at these two pieces of cardboard. Do you think it is possible to say that they are **completely similar?** "

The children will usually, after a short conversation on colour, possibly while focusing on similarity of size by holding one piece close to the other etc, accept the question. Then the teacher asks them to answer the question by using the phrase: "They are completely similar".

Next, one of the pieces from situation 1 is presented along with a new piece that clearly differs from the former in terms of shape, but also a little in terms of size.

Situation 2:



Teacher: “Do you think it is possible to say that these two pieces are **completely similar**?

Usually the immediate answer would be: “They are **not** completely similar.”

Next the teacher follows up his question with a new one, such as: “But can you see ways in which they are **similar**?”

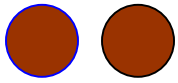
When such a question is posed, it often results in answers such as: “They have the same colour/they are similar in colour”, or “they have the same colour of blue”. If this does not happen spontaneously, the teacher helps the students discover and verbalize via a conversation revolving around the two pieces.

In the case presented here, the two pieces have the identical blue colour so in this respect the children’s answer would be correct. In the generalization tasks (in the SG-phase) that the students would have been presented with after the preliminary tasks mentioned above, the examples would have had different shades of blue, and the phrase/formulation would then be incorrect. The corresponding formulation would then be: “They are similar in having a blue colour (Implied: They do not have **the exact same** shade of blue, but they are similar in having a shade of blue colour).

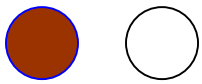
If the teacher wishes to contribute further to this discovery, before starting with the tasks in phase three, Selective generalization, he/she can remove the round piece from situation two and instead display a piece of triangular shape made from the same cloth, different in size and with a different shade of blue. Questions equivalent of the questions posed in situation two are posed. After having concluded that the pieces are **not completely similar** when it comes to the shade of blue, but at the same time **similar in** having a blue colour, the teacher asks the students to say this phrase out loud, possibly repeating it: “They are similar in having blue colour.

Above I have chosen to exemplify how one could start “cultivating” children’s understanding of the difference between partial similarity and complete similarity via the colour and conceptual system “blue colour”. The reason for this is that the CT of basic concepts and basic conceptual systems often starts out with colour concepts (something that most children usually are familiar with) with the intention of making them familiar with the progression of the work in the CT-model, usually before moving on to shape-BCS etc.

This booklet illustrates the progression or work-process of the CT-model via the concept and conceptual system “round shape”. One suggestion as to how the teacher in this connection might facilitate children’s understanding of the difference between **partial similarity** and **complete similarity”** is as follows: The teacher presents two big, one-coloured pieces of cardboard and asks if it is possible to agree that they are completely similar; everyone agrees that this is the case.

Red colour  Red colour

Next the teacher presents one of the red pieces of cardboard again in addition to a white piece of cardboard of the same size and asks the children whether these two also are **completely similar**?



The most obvious answer will be that they are **not** completely similar. Through a conversation it is revealed that they are **not** completely similar because they are not the same colour. When consensus is established on this, the teacher sums up this discovery and asks questions concerning the **shape** of both pieces of cardboard. At this stage of the CT-process the answer will most likely be a **round shape.** When this is confirmed, the teacher asks the students to repeat the following phrase two or three times: “The pieces of cardboard are **similar** in having a round shape.”

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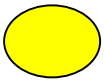
After a common rehearsal of the phrase mentioned above, the teacher presents a big yellow piece of cardboard and a small white piece of cardboard while asking whether the two new pieces of cardboard are **completely similar or not**?

White colour ○ Yellow colour 

Once the children have expressed that the pieces are not completely similar, the teacher continues: "That is correct. They are **not** completely similar, but they are similar in something. So how are these two pieces of cardboard similar? The most obvious answer will be that they are similar in being round or in round shape. When the answer is given, the teacher asks the children to repeat the following phrase: "They are **similar in having a round shape."**

Once this is done, the children are prepared for the tasks in the SG-phase. During this phase detected partial similarities (in this case "roundness" or round shape) which have repeatedly occurred and hopefully been detected during the work in the preceding phases, are describe and made even more verbally conscious than before through an inductive conclusion (by the application of oral language skills): "They are similar in having a round shape."

Note that it's of course possible to ask for **partial similarity** in more then one way, some examples could be: In which respect are these figures similar? In what way are these figures similar? What are all these figures similar in? How are all these figures similar?

Examples of tasks in phase 3: Selective Generalization.

PROCESS	MATERIAL	EXAMPLE OF CONVERSATION PATTERN
Selective generalization – *discovering similarities (1).*	4-5 objects such as: a fish platter a coin a roll of scotch tape and a pot lid	**T:** Here you see four things. Are these things **completely similar**? **C:** No, they are not **completely similar** (possibly, "because… "if the child itself takes the initiative to express differences). **T:** You said that brilliant, very well done. But can you tell me in what ways these things are **similar?** **C:** They are **similar in** having a **round shape.** **T:** That is correct said, well done.

Selective generalization – *discovering similarities (1).*	Drawings of round shapes with different degrees of roundness, size, colour etc.	**T:** In what way are these drawn figures **similar**? **C:** They are similar in having a round shape. **T's** positive and guiding feedback.
Selective generalization – *discovering similarities (1).*	The letters **g d p b**	**T:** In what way are these letters **similar**? **C:** They are similar in having a part with a **round shape**. **T:** It's great that you noticed that they are **similar in having** a part with a **round shape**. **Possibly more tasks of the same kind with concrete objects or "depictions".**
Selective generalization – *discovering similarities accompanied by discrimination* (2).	Drawings of 5 shapes or 5 objects – 3 of them with a round shape and two with other shapes	**T:** Point to the shapes that are **similar in** having a **round shape.** **C** points to the correct shapes. **T:** That is correctly pointed out. **As an alternative to the teacher's positive feedback or as a continuation**: **T** while pointing: Why did you point at these shapes? **C:** (I pointed…) because they are similar in having a round shape. **T's** positive and guiding feedback.
Selective generalization – *discovering similarities accompanied by discrimination* (2).	Teaching panel with the following letters on a sheet of paper in front of the 5 openings: Ø v e p K	**T:** Point to the letters that are similar in each having a part with a round shape. **C** points to nr 1 and nr 4 from the left. **T's** positive and guiding feedback. **As an alternative to the teacher's positive feedback or as a continuation**: **T** while pointing: Why did you point at these letters? **C:** (I pointed…) because they are similar in each having a part with a round shape. **T's** positive and guiding feedback. **Possibly more tasks of the same type with concrete objects, "depictions", letters, symbols for numbers and other symbols etc.**

The concept and conceptual system that is named as a round shape should be processed further by playing games or board games, through descriptions of letters and numbers etc., and via analytic coding in general (cf. appendix 4).

Four important questions to keep in mind in connection with the preparation and the teaching of Basic Conceptual Systems and related basic concepts

When a teacher is preparing for his teaching with the CT-model, as a starting point he/she should ask himself/herself these four questions for each phase:

1) **Which materials should I use?**
2) **How can I explain well, as well as function as a good role model verbally/ linguistically plus pose relevant questions?**
3) **Which answers (verbal and motor) do I expect from each of the children?**
4) **How can I give a precise and guiding feedback on the children's verbal- and motor performance?**

Re question 1: Concrete objects are most commonly used in the beginning of each phase, before turning to drawings, pictures, numbers, letters etc. It's important to find various types of material that make it possible to keep the feature in question – or the partial similarity that the children must detect (and abstract) – constant, while at the same time vary other prominent features.

Re questions 2, 3 and 4: When it comes to these questions, the teacher is referred to the examples of conversation patterns in each of the phases of the CT-model.

The emphasis of the phases of the CT-model compared to the emphasis in more unstructured concept teaching.

Phase 1, the SA-phase, should include the highest number of situations compared to the other two phases of the CT-model. This is the phase that creates the basis for the concept learning through the children's discovery of the **relevant partial similarity** found between the examples that are presented. At the same time, the examples form the foundation for having the necessary experiences in terms of multimodal sensations through the various modalities.

In this phase the teacher has to model, possibly say together with the children the actual phrases. In addition he has to support the children's performance of non-verbal answers, while at the same time helping the children to detect the relevant partial similarity. Keywords

for this phase are a focus on **genuine teaching and corresponding learning,** instead of focusing on **testing** of what children already know. **Tasks corresponding to those found in phase 1, the SA-phase, are usually not emphasized enough in more unstructured concept teaching.**

Phase 2, Selective discrimination or learning difference is to a greater extent than phase 1 characterized by testing, but also in the SD-phase the teacher helps children making correct formulations – while at the same time making sure that the children also later in this process are given the opportunity to make experiences based on perception that are supposed to contribute to the development of those conceptual meanings that the verbal formulations symbolize. In phase 2 there is **no need** for as many situations as in phase 1. **Tasks corresponding to those found in phase 2 are of the type that is considerably emphasized in more unstructured concept teaching.**

In phase 3, referred to as Selective Generalization or discovering similarities, the idea is to make sure that children really have their attention directed towards, have discovered and have become linguistically conscious of the partial similarities between the examples in each of the previous situations and of course also the situations in this phase – in the way that is expressed in the answers from the SG-phase. There is no need for as many situations in this phase as in phase 1. **Phase 3 is completely absent in normal unstructured concept teaching.**

Be careful not to continue only with tasks in the SD-phase if the children have trouble mastering these. Instead one should realize that it is the teaching/learning in the SA-phase that has not been satisfactory and immediately return to more tasks in the SA-phase. The same rule of thumb applies to the tasks in the SG-phase. If the child does not master these – first with support and then mainly on its own – it is necessary to return to tasks from the first two phases. And usually in these cases there is a greater need to work further with the tasks of the SA-phase.

How to reason in the evaluation of your CT and the child's benefit from it, as well as the use of a result form and a keyword log

When teaching according to the principles of the CT-model, it is very important to continuously evaluate the result of the teaching for each basic concept and conceptual system in relation to the tasks to be solved in each phase, based on observations of the children's verbal- and non-verbal answer.

If the children do not learn in a satisfactory way, it might be useful for the teacher to ask himself the following four questions:

1. Can the result be interpreted in terms of given external factors?
What about the room-situations, materials, external disturbances, the number of children in question etc?

2. Could it be that my teaching is not satisfactorily performed?
In this connection the following should be evaluated: The teacher's preparation – sufficient or insufficient? Then the teacher should try to evaluate his/her involvement/enthusiasm in the various situations, the selection of materials and activities, the correspondence between what the teacher shows or points out and the teacher's application and matching use of language (the correspondence between his/her saying and doing). In addition the teacher can evaluate to what extent he/she succeeds with performing an adjusted positive and guiding feedback.

3. Can the result be interpreted in terms of the child's general conditions or its immediate attitude towards learning?
Does the child seem tired and uninterested due to what is presumed to be lack of sleep, lack of food etc., or is the child restless and mentally absent due to observed or presumed negative incidents during the breaks, in the previous lessons, at home etc.

4. Can the result be interpreted in light of a combination of the three former points?

The answer that is considered the most reliable, decides whether the teacher should continue with the teaching as it was and possibly add more situations. Alternatively the answer could

reveal the need for a more radical change and improvement of the teaching and the factors surrounding it.

It is important to update the keyword log as soon as possible after a CT lesson, to write notes describing the actual progression of the lesson, in addition to writing notes of evaluation and ideas of improvements that might appear – and remember always to date these notes. Notes made as part of the preparation for the actual lessons are of course already made. In this way it becomes possible to later document the content and result of a CT-program at different points in time, stretching over weeks and months. The log will thus play a central role in the reconstruction of a child's teaching- and learning possibilities, for instance on occasions where effect evaluations related to CT over time are made. In accordance with what has been described, it might be useful for the teacher to record the results of his/her teaching and evaluations in a form lesson for lesson:

Table 1: Example of a result form for concept teaching already completed

Week/year	**Words denoting basic conceptual systems and related basic concepts plus possible tasks for relevant concept applications**	**Dates, possibly number of times and use of time**	**Evaluations of the learning result**
37	Round Shape	7. 09 & 8.09. 40 minutes	Not quite satisfactory in the SG-phase
38	Round Shape	11.9. 25 min.	OK.
39	Task in analytic coding including colour and shape	19.9 20 min.	OK.

Cf. **appendix 8** with a result form for concept teaching already completed.

The code for the evaluation of learning results should be relatively simple, an example is a grading of results from complete to incomplete degree of mastering, such as +. +**?**. –. An alternative is to use terms like **OK**, not quite satisfactory, poor or make descriptive evaluations such as: The child masters the tasks in the SA-phase fairly well, **has some trouble with** the tasks in the SD-phase and **does not master** tasks from the SG-phase.

When teaching a child, it goes without saying that it is necessary to make sure that one can document what has been taught as well as possible effects of CT. This also makes it possible to reconstruct the teaching that has been undertaken making it easier to better understand and communicate about the child's learning history with the child itself (at least in some cases), with the parents and not to mention with new teachers. Keep in mind that in the long run, there will always be new teachers.

On similarity and dissimilarity in the teaching of Basic Conceptual Systems and related concepts

The main structure of tasks that are exemplified through the introduction of the CT-model and the teaching of round shape will be the same for other shape concepts, and for most of the other basic conceptual systems (BCS).

However, some BCS can be referred to as **relative** BCS. These differ from the other BCSs in that they concern **the relationship between one thing and another thing**, for instance **the sizes**-relation, related to width, height, length, depth etc., such as 2. dimensional and 3. dimensional sizes (e.g. large or small in size in relation to something else), **place**-relation (first place in relation to something else), **weight**-relation (heavy or light weight in relation to something else), temperature-relation (high or low temperature in relation to something else) etc.

This means that the teaching of the relative BCSs must start out with a combined SA- and SD-phase which facilitates comparisons between two or more things, already in the first task. The expression **in relation to** (alternatively compare to) has in this connection turned out to be important for directing the children's attention when it comes to making comparisons.

One example of an opening task (combined SA + SD task) for the size concept “large in height” (high) is as follows:

Two lines on a blackboard

The teacher says while pointing from the highest to the lowest line): “This line is large in height when seen together with the other line.” The teacher rephrases this and repeats: “This line is large in height in relation to that line.”

Teacher: “What height has this line in relation to that line?” The teacher points correspondingly first to the highest line, then to the shortest and finally points back to the highest one.

The children: “That line is large in height in relation to that one.” (The children are helped to point correspondently in the same way as the teacher, if not able to do so on their own).

Another combined SA + SD-task, now with a marked emphasis on **the learning of selective discrimination**, is illustrated in the following:

Three candles in candlesticks

Teacher: “Point at the candle that is large in height in relation to the other two candles.”

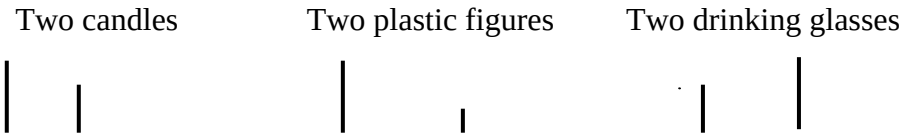
The children point at the right candle.

Teacher’s positive and guiding feedback.

Teacher while pointing: “What height does this candle have in relation to the other two? Or alternatively: “Why did you point at exactly that candle?”

When the children have answered what they are expected to while pointing, the teacher responds with his positive and guiding feedback.

Thorough work in the combined SA + SD phase is followed by tasks in phase 3: The SG-phase. A typical task here could be as follows:



Teacher while he/she is pointing correspondingly: “In what way are this candle, this plastic figure and this glass **similar** in relation to the other ones in the pairs?”

The children with corresponding pointing and expected answer: “That candle, that plastic figure and that drinking glass (possibly “those things”) are similar in being large in height in relation to the things in the pairs.”

Teacher’s positive and guiding feedback.

Note that appendix 2.9 contains more comments on how to teach **size-BCS**.

The structural similarity between teaching according to and learning from the principles of the CTM has proven to be a considerable factor when it comes to facilitate the teaching and the corresponding learning. After the teaching of relatively few concepts for instance within two or three basic conceptual systems, most children obviously learn to know the main features of the CTM. In addition they acquire an understanding of mediating expressions such as “similar in” and “dissimilar in”. They also become accustomed to applying word denoting single concepts in close connection with words denoting basic conceptual systems, e.g. round shape.

A few ways of characterizing the CT-model

CTM – a “frame model”

Nyborg does not consider his model an absolute and permanent working program and expresses this in the following manner:

> I find it necessary to warn readers seeking a complete and permanent working program.

> What are exemplified are instead principles and ways of thinking within learning psychology in a broad sense.
>
> How to translate these principles to a training- or teaching-program, will partially depend on the children that are to be taught, partially it will depend on the will power and fantasy of the pedagogue – his/her creative ability if you will – to make these principles come to life and make them attractive to children.
> (Nyborg, 1978, p 347 – English translation)

It has already been mentioned that that the teaching based on the principles of the CT-model obviously will vary according to the children's age, personality, and type and degree of learning disability etc.

The main principles of the model must of course be followed. However, the progression and approach will differ according to whether CT is applied for instance as a preventive measure in kindergarten, if the teaching is related to a child with Downs syndrome in grade two in school or whether CT revolves around a boy or girl of thirteen being diagnosed as having dyslexia.

CTM – a conversation model and the model's language use

In order to benefit maximally from this kind of concept teaching, the children have to be verbally active in the process. This is of importance to the size of the groups in case of CT. There should be no more than 5-7 children in each group, and in the case of "at risk" children, the number of the group should be even smaller. If the suggestions of "group size" are followed, it will be easier for each child to participate with relevant verbalizations throughout the three phases. Such numbers would also give each child better opportunities to express their associations and "discoveries" as they progress, both through dialogues with the teacher and their "classmates".

There is another important aspect that also is worthwhile to think about. If the children have not repeatedly had the opportunity to express their conceptual knowledge by means of their spoken language, it is certainly no surprise if they in the future not are able to perform precise and corresponding thinking in terms of "private or inner speech."

The final thing worth mentioning in this section is the emphasis that the principles of the CT-model put on verbalizations of words denoting basic concepts and basic conceptual systems in

relation to what is sensed, with the intention of promoting the organization of concepts into (hierarchically organized) conceptual systems. In this connection the emphasis put on the coding of similarities and differences of what can be sensed should also be mentioned.

CTM – a model of interaction and a model of diagnostic teaching

Judging from the empirical data that is available there are good reasons to believe that the principles of the CT-model have an effect on both the structure and security of the teaching- and learning situations for both teacher and the children or the child in focus. Both parties experience what is expected of them and what they can expect if the principles are followed. A main principle is that the teacher organizes the teaching so that the child is successful in his/her work; something which is central to the child's involvement and learning.

"The zone of proximal development" is constantly kept in mind when this is the central goal of conceptual teaching. In this context a famous quote from Vygotsky (1978, p. 87) might be a useful guideline: "…, what a child can do with assistance today she will be able to do by herself tomorrow."

The CT-model has a considerable diagnostic character in the sense that the verbal and non-verbal answers or reactions from the child illustrate to what extent concept learning has taken place.

This also implies that failure in previous concept learning might be detected. The time it takes and the number of examples and student-verbalizations necessary before the concepts and conceptual systems can be reasonably evaluated as learned to a verbally/linguistically conscious, generalized and transferable level, will thus also reflect to what extent something was learned in a better or worse way beforehand.

As shown, the CT-model, because of its structure, has "built-in" possibilities for evaluations of the concept learning in a way that so to say corresponds to a "repeated measurement" research design.

A Proposal for a teaching order of Basic Conceptual Systems (BCS) and related basic concepts in kindergarten and primary school

Introductory comments

The formal teaching of Basic Conceptual Systems and related basic concepts will be divided between kindergarten (age 4–5) and the following two years of primary school (grade 1–2). If necessary, the teaching of BCS can be extended and followed up through grades 3 and 4.

As shown in the curriculum, the focus is on teaching BCS in the final year of kindergarten and the two following years of primary school (grade 1–2).

The possible follow-up of teaching BCS alluded to above, can be carried out by a variant of the proposition for CT presented **in Appendix 11**: "Proposal for Concept Teaching for pupils without learning difficulties, when started with CT from the 3^{rd} – 5^{th} years". This particular proposition for CT could also function as a form of repetition and possible assessment of the level of mastery in previously taught/learned BCS'.

Methods for teaching BCS

Basic Conceptual Systems **1–9,** cf. the table below**,** are taught by means of Nyborg's model for concept teaching (the CTM) – Colour, Shape, Position, Place, Size, Direction, Number, Sound/Phoneme, (surface) Pattern.

The next Basic Conceptual Systems **10-14**, Use of function, Substances/materials, (Surface) properties of substances/materials, (physical properties of) substances/materials, weight can be taught in two ways. **(1)** These can be taught by way of the CTM, or alternatively **(2)** taught in locations and situations where children will be able to experience the BCS in question by way of their own senses. In such a situation it is very important to utilize language in a way which will help children develop Basic Conceptual Systems and related concepts. For instance, use the words slippery surface, plain surface, and painted surface instead of only slippery, plain and painted.

Basic Conceptual Systems **15-21** are to be taught in "natural" locations and situations without utilizing CTM. One must frequently use the aforementioned language, which is expected to

help children construct verbally conscious Basic Conceptual Systems and related basic concepts – Temperature, Smell, Taste, Time, Change[8] in ... , Speed/movement, Value/worth.

Consult **Appendix 9** which contains possible ideas for a collection of teaching material intended for concept teaching. The teacher should be able to gather and make his/her collection of necessary materials for his concept teaching. **Appendix 12** may function as a supplement in this case, since it provides examples of areas of utilization for various Basic Conceptual Systems and related concepts. However, it should be mentioned that a suitcase, with specific objects, which illustrate selected "concepts and BCS has been developed by Sønnesyn and Hem, 1999. Anna-games are another material developed for training children in performing analytic coding (Sønnesyn, 1999).

Please note that one needs not necessarily teach all colour-concepts in the set teaching order , cf. the table on the next page, before moving on to another set of concepts, i.e. shape-concepts, place-concepts etc. If a jump in the teaching order of concepts occurs, it is then important later on to return back and make sure all the concepts found in each BCS in the table are taught. This ensures the quality of the Concept Teaching which shall be performed in kindergarten and primary school.

Note that **appendix 2** consists of shortened version of practical examples or "programs" for the teaching of many of the BCS in question.

[8] Even though **BCS - Change in**… (colour, shape, position, place, size, direction, number etc) is to be found as # 19, usually teachers start with helping children experience "change in…" from the teaching of the first BCS.

Words denoting Basic Conceptual systems (BCSs)	**Institution/ grade**	**Words denoting basic concepts**	**Comments** Most general – cf. appendix 2 with proposal for teaching programs for various Basic Conceptual Systems.
1. Colour Please notice: The concepts "completely similar/-alike" and "similar in" should be taught before starting with tasks in phase 3: Selective generalization of the Concept Teaching Model, cf. pp. 22–26.	Kindergarten	Red, blue, green, yellow, brown, black, white.	Drawing-pad. Crayons etc. Colours – inside and outside, including changes in colour that occur in nature during the various seasons. **Note: Even if BCS-Change in... is listed as BCS # 19, the application of it already starts from BCS-Colour.**
	1.–2. grade Primary school	Teaching of more colours, e.g. pink, violet/purple and orange. Also repetition of learned colours in varying contexts.	Mixing colours – observe and talk about how they change.
2. Shape	Kindergarten	Straight line, round, curved/bowed, triangular, four-sided, cubic, spherical	Various materials. Shapes found or made inside and outside.
	1.–2. grade Primary school	Teaching of circular, oval, conical, cylindrical shape etc. Also repetition of previously taught concepts by application in various contexts, or possibly by means of the Concept Teaching Model, if regarded as necessary.	Shape concepts suitable for describing letters and numbers are repeated, especially in connection with teaching reading, writing and mathematics.
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Shape as a Basic Conceptual System via various applications cf. the survey of Basic Conceptual Systems in appendix 3.	

3. Position	Kindergarten	Horizontal, vertical diagonal/slanting/sloping, standing, lying, sitting, kneeling etc. The first three concepts must be taught via the Concept Teaching Model.	Plumb with a string attached for demonstrating vertical position and a bottle with coloured water for demonstrating horizontal position.
	1.–2. grade Primary school	Horizontal, vertical, diagonal/slanting, Repetition of the other concepts by application in varying contexts.	Repeated in connection with teaching reading, writing and mathematics.
	3. –(4.) grade Primary school	Possible repetition by application of learned concepts as tools for teaching in varying contexts.	
4. Place (in relation to something else) with reference to spatial orientation **and** **Place (in relation to something else) with reference to temporal orientation**	Kindergarten	Place on, under, over, between, in front of, after, behind, first, last.	
	1.–2. grade Primary school	Place on, under, over, first and after/next in a row or sequence (with reference to both spatial and temporal orientation) beside/by the side of, to the left of, to the right of. Also repetition of other concepts and further elaboration of Place as a Basic Conceptual System via various applications.	Repeated in connection with teaching reading, writing and mathematics etc.
	3. –(4.) grade Primary school	Possible repetition by application of learned concepts as tools for teaching in varying contexts.	

5. Sizes	Kindergarten	Large and small in size. (larger, smaller, largest, smallest). Height and Length. Tall (large in height, Short (small in height). (Taller, Shorter, Tallest, Shortest).	Objects etc. which differ in sizes; height and length, cf. the teaching program in appendix 2 for **"Large (in height) compared to..".**
	1.–2. grade Primary school	Repetition of sizes such as height and length, plus introduction/ presentation of other subsystems within Sizes; width/breadth and depth.	Height and length are relevant for descriptions of letters and numbers, etc.
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Sizes as a Basic Conceptual System via various applications of concepts.	
6. Direction	Kindergarten	**Up/upwards, down/ downwards,** from the right to the left, from the left to the right.	Cf. the teaching program in appendix 2 for **"in direction from the left to the right".**
	1.–2. grade Primary school	Repetition of concepts plus introduction of more concepts such as forwards, backwards, alongside/ beside, inwards, outwards, in/into, out of, toward, away from. Compass directions: to the North, South, East and West.	Up/upwards, down/ downwards, from the left to the right, from the right to the left are repeated in connection with teaching reading, writing and mathematics, among other things because they are important as tools when teaching how to write/form letters and numbers.
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Direction as a Basic Conceptual System via various applications in varying contexts.	

7. Number	Kindergarten	(Group) Large/small number in relation to… Groups of one, two, three, four, five (possibly larger numbers). The total number in a group (*cardinal number*) is found by counting and then being named by numbers as well as symbolized by *numerals* (written numeric symbols, e.g. 1, 2, 3 etc.). Changing the number in a group: Increasing the number of a group by adding one more, two more etc. Decreasing the number in a group by subtracting (taking away) one, two etc.	Cf. the teaching program in appendix 2 for **"Group"**. Cf. the teaching program in appendix 2 for **"Finding the number by counting: The number three".** In this program five proposed counting strategies for finding numbers are listed (regarding the *cardinal* aspect): **(1) counting while moving, (2) counting while touching, (3) counting while pointing., (4) counting while nodding, and (5) counting while only looking at…** It is also important to help children learn to count by heart, e.g. from one to ten, from ten to twenty, etc. There are a lot of fairytales which imply counting that is suitable for this purpose.
	1.–2. grade Primary school	Repetition of concepts related to number and further elaboration of number as a Basic Conceptual System via various applications, also the concept of ones and tens, more of addition and subtraction, and the positional system etc.	Numerals (numeric symbols) for cardinal numbers and for ordinal numbers symbolizing "place in a row or sequence" – e.g. (1) 1^{st}, (2) 2^{nd}, (3) 3^{rd} etc. Symbols for mathematical operations (+, -) and relational symbols, such as (> = <).
	3. –(4.) grade Primary school	Possible repetition and further elaboration of concepts related to Number – BCS.	

8. Sound – speech sound/ phoneme	Kindergarten	”Sounds” in general: Strong, weak, low in pitch/deep, high in pitch/high etc. Sounds in nature: sounds made by animals, the sound of birds singing, the sound of the wind blowing etc. The concept ”speech sound” (phoneme) in spoken words. Learning to decide which speech sounds that words start with (occur first in a spoken word).	Sounds in the near surroundings, sounds from instruments, clapping, knocking sounds etc. Cf. the teaching program in appendix 2 for **“Speech sound”.** Cf. the teaching program in appendix 2 for “**Place - first** (in a row, sequence…)”.
	1.–2. grade Primary school	Possible repetition and further elaboration of relevant concepts in varying contexts. Developing awareness about the fact that speech sounds can be symbolized by letters. Learning to decide which speech sounds that words start with (occur first in a spoken word) and which speech sounds come next in the sequence of sounds in words. (Developing awareness about the fact that the articulation of each speech sound can be “felt” in the mouth while simultaneously heard in the ear, and learning to apply this insight as a strategy to break a word into its separate sounds). Learning that reading in the first stage might be explained as ”**saying the speech sounds** (symbolized by the letters) **without stopping between them, in order to hear which word it makes”**	Usually the formal teaching of the associations between a (1a) speech sound and its (1b) articulation, on the one hand, and the (2) letter, on the other hand, takes place in grades 1 through 2, (often inadequately referred to as letter-sound correspondence). Cf. the teaching program in appendix 2 for “**Place - next** (in a row, sequence…)”.

9. Surface Pattern / design	Kindergarten	Dotted, striped, checkered, flowered (surface) pattern	Fabrics with different patterns
	1.–2. grade Primary school	Possible repetition and further development of (Surface) Pattern / Design as a BCS in varying contexts.	
10. Use or function	Kindergarten	The teachers/the staff talk about the use or function of things as part of the ordinary/every day conversation. What objects are usually used for – used to draw with, drink from, play with, sit on, eat with etc.	Cup, glass, pencil, toys, etc.
	1.–2. grade Primary school	Possible repetition and further elaboration of Use as a Basic Conceptual System via various applications.	
11. (Kinds of) Substances / Materials	Kindergarten	Wood, paper, plastic, glass, fabric, leather, metal substance	Things/objects made of glass, metal, plastic, wood etc.
	1.–2. grade Primary school	Repetition in varying contexts and teaching of more concepts belonging to Substances / Materials – Kinds of – as a Basic Conceptual System, e.g. different kinds of metal.	
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Substances / Materials – Kinds of – BCS.	

12. Surface properties of Substances / Materials	Kindergarten	Smooth, rough, matt, shiny/glossy surface.	Things/objects made of glass, metal, plastic, wood etc.
	1.–2. grade Primary school	Repetition in varying situations and teaching of more concepts within the BCS in question, such as sanded, polished, painted, varnished, lacquered, etc.	
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Surface Properties of Substances / Materials Attributes of the Surface – BCS.	
13. Physical properties of Substances / Materials	Kindergarten	Hard/firm, soft, breakable, liquid, heavy, light substance.	Cotton, metal, wooden sticks, modelling clay, etc.
	1.–2. grade Primary school	Repetition in varying contexts and teaching of more concepts such as firm, elastic, inelastic, transparent etc.	
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Substances / Materials — Physical properties of ... – BCS.	
14. Weight	Kindergarten	Heavy or light in weight compared to something else, e.g. a pencil or a box of paints etc. Weighing of objects. For instance the application of 1 kilogram (1000 g) as a weight unit (different kinds of things weighing 1 kilo are presented).	The children are invited to compare two sets of objects – a set of objects that are heavy versus a set of objects that are light. Make arrangements to help the children detect and verbalise the fact that there need not be a firm and exact correlation between size and weight, e.g. the weight and size of a little plumb made of lead compared to the size and weight of a larger ball of yarn, etc.

14. Weight continues	1.–2. grade Primary school	Repetition in varying contexts and teaching of more concepts belonging to Weight as a Basic Conceptual System, e.g. Kg, hg, g etc. Weighing and comparing the different weights of objects. The weight of children.	
	3. –(4.) grade Primary school	Repetition in varying contexts and further elaboration of Weight as a Basic Conceptual system.	
15. Temperature	Kindergarten	Cold/low and warm/high Temperature as related to …, cool, freezing cold, boiling hot, lukewarm.	Water and other liquids and things outside and inside with different temperatures.
	1.–2. grade Primary school	Repetition in varying contexts and teaching of more concepts such as degrees of heat and cold etc. Learning to determine the number of centigrade and degrees of Fahrenheit by means of measuring devices.	Measuring devices.
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Temperature as a Basic Conceptual system.	
16. Smell	Kindergarten	Pleasant/nice and unpleasant/nasty smalls, smells from nature, the smell of different kinds of food, the small of different kinds of fruit, e.g. apple-taste, orange-taste.	The immediate surroundings. Food including fruit.

16. Smell continues	1.–2. grade Primary school	Repetition in varying contexts and further elaboration of Smell as a Basic Conceptual System, e.g. the smell of gasoline, the smell of rotten plants etc.	The immediate surroundings.
	3. –(4.) grade Primary school	Possible repetition and further elaboration of Smell as a Basic Conceptual System	
17. Taste	Kindergarten	Sour, sweet, salty Taste, apple-taste, orange-taste.	Food including fruit for tasting.
	1.–2. grade Primary school	Repetition in varying contexts and further elaboration of Taste as a Basic Conceptual System, e.g. bitter, meat-taste, lemon-taste etc.	
	3. –(4.) grade Primary school	Repetition in varying contexts and further elaboration of Taste as a Basic Conceptual System.	
18. Time	Kindergarten	Day, night, morning, afternoon, evening, the seasons: Summer, Autumn/Fall, Winter and Spring.	
	1.–2. grade Primary school	Repetition in varying contexts and teaching of more concepts such as the days of the week, the months of the year (January, February, March, etc.), year, the present (time), present tense, the past (time), past tense, the future (time), future tense. Learning to tell time.	The natural surroundings. Parts of day and night, the seasons. Hour glass, stopwatch, calendar.
	3. –(4.) grade Primary school	Possible repetition in varying contexts and further elaboration of Time as a Basic Conceptual System.	

19. Change in …	Kindergarten	In colour, in shape, in position, in place(ment), in number, in temperature, in time: e.g. the seasons, the parts of day and night, etc.	The natural surroundings – changes in colour. Changing colour by mixing colours together. To boil water. What happens to water when the temperature sinks below the freezing point?
	1.–2. grade Primary school	Possible repetition in varying contexts of Changes in colour, shape number, pattern, direction etc.	Measuring the height of the children.
	3. –(4.) grade Primary school	Possible repetitions and further elaboration of Change in... as a Basic Conceptual System.	
20. Speed/ movement	Kindergarten	Fast (high speed), slow (low speed) (faster, fastest, slower, slowest) in relation to …	Toy cars etc. Observations of real cars driving, aeroplanes in the air, birds flying, people walking, running, cycling. Children and physical activities.
	1.–2. grade Primary school	Repetition in varying contexts and teaching of more concepts such as increasing speed /accelerating speed, decreasing speed/ decelerating.	

20. Speed/ movement continues	3. –(4.) grade Primary school	Possible repetition and further elaboration of Speed as a Basic Conceptual System, e.g. the speed of cars in terms of xx kilometre per hour, the wind blowing/moving with a speed of xx knots per hour/meter per second. Names of wind forces; Light breeze, moderate gale, storm etc.	
21. Value /Worth	Kindergarten	Right – wrong evaluations. The value of money.	
	1.–2. grade Primary school	Right – wrong evaluations. The value of money.	
	3. –(4.) grade Primary school	Possible further elaborations of Value as a Basic Conceptual system.	

A proposal for an assessment plan for children's learning of Basic Conceptual Systems and related basic concepts

The use of the result table for completed CT, which can found on the last page of **appendix 8**, can help the teacher document which BCS and related basic concepts that have been taught in kindergarten and to what extent the children have learned them.

This result table should be informed about or handed over to the relevant teachers in primary school (and probably to parents) in connection with possible meetings taking place in the "hand-over process" from kindergarten to school. This procedure must of course be in strict accordance with existing rules and regulations.

Relevant Concept Testing of which BCS have been taught in **grade 1 should be done in June**. The same applies for **grade 2 in June** when relevant testing should be repeated making

it possible to evaluate the outcomes with regard to all the BCS and related basic concepts that hitherto have been taught, **cf. appendix 8**: “A way of assessing children’s learning and mastery…”. Whether this should be a matter for the whole group or limited to what may be regarded “at risk-children-” is up to the teacher to decide.

In addition assessment of ”concept learning and mastery” should be followed up in **June in grade 3,** depending on whether the children have received Systematic Concept Teaching or not that year.

The children’s skills in performing **Analytic Coding** should also be assessed on the same occasions, i.e. in late kindergarten and grade 1, 2 and 3, cf. **appendix 4 and 8**.

Differentiated Concept Teaching, time applied, Concept Teaching from a preventive perspective, analytic coding

Teachers are referred to pp. 27–31 for a description of how to prepare for, and evaluate concept teaching.

Not every child will have the same need to participate in all the situations of basic concept teaching. It is however important that everyone participates in the preliminary situations in phase 1: Selective Association. All children will then receive the same opportunity to gain experiences based on the sensory system, and experience how words can denote basic conceptual systems and related concepts. From this perspective all children should also participate in preliminary situations in phase 2: Selective Discrimination, and phase 3: Selective Generalization.

It is up to the teacher to assess the pupils in order to determine who possess a high level of proficiency in language. Children with a high level of language proficiency only need reduced participation in CT. At the same time it is very important that children who do have language and learning disabilities and/or other special needs, receive proper and enhanced concept teaching, beyond that of preventive measures.

CT in kindergartens should formally start with groups of **4-5 year olds**. The groups will be small, and will only consist of **3–5 children with 2–3 sessions** of concept teaching a week. A "learning through play"- approach may be wise given the children's young age. The session should be very concrete and should be carried out in various settings and situations. See **Appendix 9**, for possible ideas for a collection of teaching material.

It is important to utilize language in a way which helps promote the learning of Basic Conceptual Systems beyond single concepts (round shape, curved shape, triangular shape, instead of only round, curved or triangular). This can also be done in informal settings, where children are presented with the opportunity for sensory based learning experiences.

At the pre-school level the two first phases of the CT-model are vital (Selective Association and Selective Discrimination). If children shall benefit from situations in the third phase of the CT-model (Selective Generalization), thorough preparations and appropriate teaching is required. Children must understand the difference between the two concepts "similar" and "partly similar" (partial similarity), see page 22–26 for a description of how to teach this difference.

When CT is taught at the school beginners' level (grade 1) as a measure for preventing learning difficulties, we propose that the initiative includes 2-4 sessions lasting 25 minutes per week. In 2nd grade we propose 2–3 sessions per week.

In 1st grade the group should be relatively small; no group should consist of more than 7–8 children, preferably as few as 4–5. This is also true for the 2nd grade. Under given circumstances groups of 10–12 children may be acceptable. In case of larger groups the teacher must be proficient in concept teaching and the groups should also be somewhat homogenous.

If the teacher chooses to continue with basic concept teaching and exercises in analytic coding up to 3rd and 4th grade, the work will consist of repetition and an expansion of basic concepts. Consult **appendix 11** for a variant of CT which may be suitable, as well as **appendix 3** which contains two inventories of words denoting Basic Conceptual Systems and related Concepts.

Regular practice in analytic coding is included in the basic CT-approach. When children have learned about two Basic Conceptual Systems, the teacher introduces exercises in analytic coding. The easiest form of analytic coding incorporates simple questions about colour and shape. After additional BCS' are learned and understood, the number of questions will be expanded, and will include colour, shape, size, place, surface pattern, weight etc.

Analytic coding describing similarities and differences is performed in the following way. The teacher presents two or more objects and asks: Are these objects similar in colour/shape etc? How are these objects similar and how do they differ? Possible answers could be that these objects are similar in colour, but they differ in shape. The number of questions will be expanded as the pupils are taught additional Basic Conceptual Systems.

Exercises in analytic coding can be incorporated towards the end of a CT-session in a small group, or possibly in a larger group. Exercises in analytic coding should start in kindergarten. When children attend 1st and 2nd grade in primary school, exercises in analytic coding should be carried out 2-3 times per week, for 5-10 minutes at a time. **Appendix 4** contains proposals for exercises in analytic coding.

Taught/learned BCS as tools and analytic coding as a strategy should be applied deliberately by the teacher in his/her teaching of school subjects including skills of various kinds, when this is regarded appropriate.

Teachers should keep written accounts of their experiences with the CT-model, including with the utilization of BCS in different subjects areas, with the goal of being able to share experiences and ideas with other teachers.

An evaluation of the outcomes of Concept Teaching as implemented to date in the municipality of Balsfjord (and the municipality of Karlsøy), Norway.

The curriculum for the teaching of BCSs in Balsfjord municipality has been obligatory for all primary schools and kindergartens since 1.1.2008. This is a rather short period of time regarding an evaluation of the outcomes of the curriculum. However, most kindergartens and schools started as early as 1 to 2 years in advance with the teaching of BCSs in accordance with a little less developed, but in principle the same curriculum. So there are some experiences to report on.

As expressed in the introduction part a series of courses on CT were started in the autumn of 2005 and continued until spring 2007. Another series have been undertaken for new teachers in Balsfjord during the spring of 2008, but of course with much fewer participants than earlier.

In addition I have visited most schools at least one day, for some schools more, giving the teachers in grade 1 through 4 guidance or consultative support on CT. In the spring of 2008 each school and kindergarten received a questionnaire on the implementation of CT: Which BCS and related basic concepts had been taught? What had the children actually learned? How did the children like CT? What was the teachers' opinion on the outcomes of the Concept Teaching Model with regard to effect on language development? On reading/writing? Etc.

The answers were positive. Most of the teachers reported that more children than before in kindergartens and grade 1 seemed to have developed a better basis for learning school subjects in terms of better developed language, than children in classes that had not received concept teaching. Some teachers reported explicitly that this makes teaching of reading, writing and mathematics etc. easier.

In 2003 I was asked by the headmaster/the principal of Sand compulsory school (1–10 grades) in the Balsfjord municipality to give a supplementary training course on CT for his whole staff. In the period of 2003–beginning of 2005 the school received CT for 7 days. In addition

the school received 7 days of consultative support on the application of CT. The teachers in this school and the administration thus became the pioneers of CT in Balsfjord. As a result of their evaluation of CT, all the other schools and kindergartens in Balsfjord wanted the same kind of course on Concept Teaching.

In August 2008 the headmaster and two teachers from Sand compulsory school (1–10 grades) and I wrote a short article in the main journal for compulsory school teachers in Norway (published on 5th December 2008).

The ingress of this article says: Systematic Concept Teaching (CT) can positively change children's prerequisites for learning in terms of an improved language. All children will profit from the approach, even though children in the middle group and children who are functioning at lower levels, will probably gain the most.

In this article the two teachers tell that they have applied CT for years in 1. through 3. grade. In this period they have experienced that through CT children develop a more "common" and decontextualized language which can be applied across subjects and thus enriches the outcomes. Children become more conscious in the way they express themselves and much more precise in their descriptions and their way of communicating. This makes learning easier for the children, the two teachers report, while at the same time it makes it easier for them to explain/describe new tasks to be learned about for the children. The outcomes have been greatest for the children who started out with observable language- and learning problems. The two teachers end with expressing that such a common semantic or conceptual basis for communication that is obtained through CT is an obvious advantage for the inclusion in class and school.

The headmaster reports that the supplementary training and the implementation of CT as an educational approach has been a success and that CT has become an integral part of the teachers' repertoires. The approach has its continuation in the higher grades in terms of more precise language tools (BCSs and related concepts) for the teaching. CT has also been important for special education which has been much more targeted for children with learning problems due to reduced language development. CT applied in a combination of ordinary and special educational contexts contribute to an improved inclusion. According to the

headmaster's experiences with CT, although limited, she believes that all children will profit more or less from CT as an educational approach.

In august 2008 a report on the supplementary training on CT in Balsfjord municipality as well as in and Karlsøy municipality (another collaborating municipality) was delivered to **the County Governor in Troms.** Translated to English the title of the report is as follows: **"An End Report. Concepts to understand with - an inter-municipality project for the implementation of systematic concept teaching in Balsfjord and Karlsøy".** The report is written by the chief municipality education officer in Karlsøy of behalf of both municipalities on the grounds that the two municipalities have received a large amount of money from **the County Governor in Troms** in order to carry out this project.

The report starts with a short introduction that ends with saying: We are by far optimistic regarding the effects that Concept Teaching seems to have on the development of the children's reading and writing skills. Whether this in the long term will increase the children's prerequisites for learning and thus reduce the amount of learning problems in the municipalities, is still a little too early to conclude with, even though we are optimistic in this matter.

Then the next section is on the background for the project. Here is also the information that the series of supplementary training commenced in 2005, and went on in 2006/2007, the target groups being school leader, teachers in 1st through 6th grade (with emphasis on 1st through 4th grade), preschool teachers and preschool leaders as well as assistants in preschool and school.

The main objective for the project is cited as "to develop insight and performance competence regarding the theory behind and Concept Teaching as an educational approach among the participants, on the one hand. On the other hand, the implementation of CT aims at contributing to help children learning to learn in a better way, as well as contribute to develop a precise and decontextualized language.

In addition to these more superordinate goals there were goals more specific defined for the updating period, which corresponds very much with the main objectives for the curriculum in Balsfjord municipality, obligatory from 1.1.2008, cf. pp. 8.

Under a heading on what have been achieved, the report concludes that the main objective with the participants to a large extend have been reached. The same applies with regard to the children's outcomes. The comments regarding the more specific defined goals were on the positive side, as well.

Teachers in kindergartens and primary schools are applying CT as part of their daily work, the report also tells. The same questionnaire as in Balsfjord was sent each kindergarten and each school in Karlsøy municipality at the same time in the spring of 2008. The report reveals that on a scale from 1 to 10 (10 being the highest score) each employee scores between 8–10 when evaluating the outcomes of CT as an approach to help children develop their language. The report also tells that teachers in grade 1, grad 2 and grade 3 report of less problems with teaching reading and that more children learn to read in less time than before CT was introduced.

The report concludes that the effects of CT as evaluated by the employees in this project in the short term are very good, per August 2008. However, the effect in the long term in this project still remains to be demonstrated and evaluated.

The report ends with inviting other municipalities to implement Concept Teaching as an educational approach in kindergartens and in schools.

A more thorough evaluation concerning the effect of the project on CT in both municipalities will be carried out in a year or two (2010?) in order to study possible long terms effects.

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Appendix 1.1: Central aspects of Nyborg's theory of learning, comments to the strategy of concept teaching, some comments to the PSI-model etc.

Introduction to Central aspects

Magne Nyborg (1927–1996) pedagogue 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.

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 the back of this appendix.

B) A Concept Teaching Model – **the CTM**, cf. the explanation in this curriculum on pp. 15-32.

C) An inventory of Basic Conceptual Systems – **the BCS-model,** cf. the model below in this appendix. The BCSs model is also presented in a much longer version in appendix 3.2.

D) A model for the teaching/learning of skills, cf. appendix 7.

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?

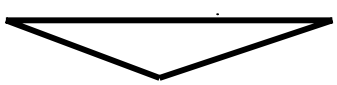
As a result of his research Nyborg argues that **concepts about, and conceptual systems** concerning, classes of phenomena, may be considered major instruments for **positive transfer**; that is, especially when they are involved in **principles, explanations, definitions, rules, laws, equations, etc**. 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[9] or multiple abstractions** in all further learning, both in further concept learning and in skill learning, cf. appendix 5 with an example of analytic coding of a letter etc

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** (**P**erson-**S**ituation-**I**nteractions), cf. the depiction and a short explanation of this model later on in this appendix.

By means of this theoretical and depicted model, Nyborg argues that the process of **analytic coding** 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:

Knowledge or Cognitions  **Skills**

Emotional and motivational dispositions

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

To the left, cf. above, you'll find symbolised the **knowledge or cognition structure** with four kinds of cognition at rising levels (images of specific phenomena: concepts about classes – systems of concepts – propositionally[10] 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 mentioned 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 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, Hansen, 2003).

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

[10] That is, concepts and conceptual systems sequentially organised by means of symbols ordered by grammatical or other syntax to prepositional meanings. Sequentially organised experiences. For example principles, explanations, definitions, rules, laws, equations, etc.

(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 facilitate the learning of the latter and

more ”complex” group of concepts and conceptual systems based upon analytic coding or abstractions.

An inventory of names denoting Basic Conceptual Systems and some related basic concepts – the BSC-model

1. Colour: Red, blue etc.

2. Shape: Linear shapes: straight line, bowed/curved, angular.
Surface shapes: round, triangular, four-sided etc.
Spatial shapes: spherical, cubic, prismic, cylindrical, etc.
Shapes named according to the look of the object; egg shape, heart shape etc.

3. Position: Vertical, horizontal, sloping, sitting, kneeling, lying etc.

4. 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.

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., in length, in height, in width, in depth in relation to… .)

6. Direction: From the left to the right, up/upwards etc.

7. Number: Small/large etc. number in relation to… Number of ones, of tens, to increase/decrease numbers etc. (Also exact numerals symbolising numbers).

8. Sound/speech sounds-phoneme: /a/, /f/, /g/ etc.

9. Surface Pattern: Dotted, striped, checkered, flowered etc.

10. Use or function: To drink from, to sit on, to write with etc.

11. Substance: Wood, glass, metal, plastic, leather etc.

12. Surface attributes: Smooth, rough, glossy, matt, painted 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. Temperature: Cold, warm, boiling hot T, freezing cold T etc. Exact temperatures.

16. Smell: Nice, nasty, smell of food etc.

17. Taste: Sour, sweet, bitter, apple-taste etc.

18. Time.

19. Change in colour, shape, position… etc.

20. Speed/movement

21. Value

It's especially important to teach the first 9 (plus possibly10–13th) listed Basic Conceptual Systems by means of the Concept Teaching Model. Most of the others can merely be taught in a more traditional way by naming the concept and conceptual system (heavy Weight, sour Taste etc.) in relation to children having rich sensorial experiences from the near surroundings, cf. a similar comment on this aspect in connection with the proposal for a teaching order of BCS in Kindergarten and primary school.

Some comments to the strategy of concept teaching applied vis-à-vis children from the age of (4) 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.

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 starts 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 – cf. the explanation of the CTM with its three phases on page 12–26.) 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 **in appendix 5**) in terms of learned Basic Conceptual Systems is emphasized as a means to help inefficient learners learn[11] 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).

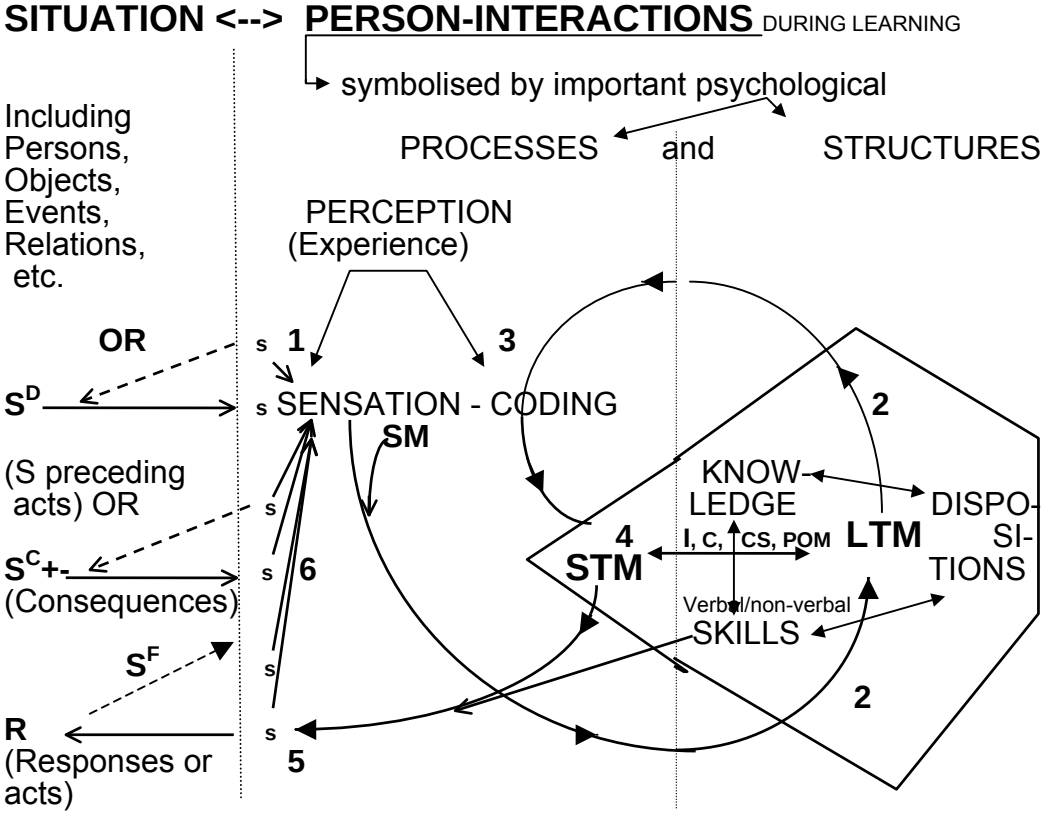
8. Basic Conceptual Systems are deliberately applied in the teaching/learning of more complex conceptual systems as well as in the teaching/learning of school subjects and skills of different kinds.

[11] Cf. the explanation of what are termed basic psychological strategies of learning in this **appendix 1.3.**

Appendix 1.2: A brief introduction of the PSI-model – or a theoretical model of learning and acting persons in interactions with situations, a depiction representing central parts of Nyborg's theory of learning.

This section is intended for those who are at least a little familiar with models of information processing, as the PSI-model might be said to represent an information receiving and information processing system in dynamic interactions with the surroundings.

Fig. appendix 1: The PSI-Model of a learning Person (Nyborg, 1973–1992)



Explanation:
OR- Observing or orientation responses. S^D - discriminative stimuli, preceding acts (R). SM - sensory memory. S^C- stimuli considered consequences of acts. STM- short-term-memory. LTM- long-term memory. S^F- feedback stimuli from the person's own act. R- the person's responses to S^D. s - s sensations corresponding to OR, S^D, S^C, S^F, and R.

Thus the PSI-model, according to Nyborg, draws a very simplified, general and symbolic picture of people in relation to situations. Situations that can be learning situations if they include something that is more or less unfamiliar, new and not yet learned by the person.

It is important to understand that the PSI-model describes a person in a constant and dynamic interaction process with other people and the environment, whereas in the static sketch above, we are only able to observe a "momentary picture".

What is found to the right of the longest vertical line in the model symbolizes the person and what is sketched inside of him, i.e. respectively psychological processes and structures. What is situated to the left in the model represents the external events or phenomena that might also be observed by others than the person him/herself.

In the following, explanations[12] are given for the abbreviations on the left hand side of the model:

OR – observing or orientation responses, made by the person in order to come in contact with stimuli, i.e. turning his/her head, following contours with his/her eyes, oral orientation, etc.
S^{D-} (discriminative stimuli) or sensory stimulation which occurs prior to the action and gives an opportunity to act or releases autonomous reactions.
S^{F-} Feedback stimuli from the person's own actions, i.e. the person can often see/feel what he is doing, hear what he is saying etc.
$S^{K+/-}$ – or the consequence of the actions, i.e. stimuli which is or appears as a consequence of the persons own actions; negative consequences are what the person is trying to escape from, avoid or remove; positive consequences are such which the person is trying to achieve, reach or get in contact with etc.

Next some designations inside of the "**person-part"** of the model:

s – (small versions of the letter s) different types of sensations.
SM – a very short term SENSORY MEMORY, which best can be seen as a continuation of the sensory process once the actual sensory influence has come to an end. SM can be considered to be based on activity in sensory organs as well as in the receiver – and adjacent areas in the brain. The SM-continuation of the sensation might be considered to:

[12] Collected from different sources by Nyborg. However the PSI-model is given an especially thorough review in Nyborg's book "Pedagogy" (1993).

A) serve as a foundation for the activation of already learned experiences stored in the Long Term Memory (LTM), so that what is stored in the LTM (2) might contribute to the coding of what is currently sensed (3) in light of previous experiences in the LTM.
B) serve as a foundation for "building" a memory storage (2), when it comes to something that has not previously been learned.

LTM – A Long Term Memory for experiences that might be activated to **remembering**, **thinking**, **coding** or **acting**. LTM involves three structures, respectively the **knowledge structure** (cognitions) with the following threefold content: (**I**) – Images of specific objects, events, relations, etc.; (**C**) – Concepts of classes of phenomena; (**CS**) – Conceptual systems; (**POM**) – Propositionally organized meanings; the **skills-structures** which include both verbal and nonverbal skills; and the structure of **dispositions** for becoming emotionally and motivationally activated by what at any point in time can be sensed, remembered or thought by a person.

CODING – includes the person's recognition, identification and interpretation of what is sensed in light of LTM-activated experiences and as part of the perception process.

STM – A memory for coded sensations, i.e. sensations coded in light of the LTM – activated experiences. STM – the process can however be prolonged by a rehearsal process – for instance by use of oral language skills (in terms of outer and internalized private speech) to repeat what is coded one or several times and thus holding on to it for a shorter or longer amount of time.

Within the framework of **STM** it is also possible to imagine that processing of what was recently experienced might occur when the actual sensation has ceased; in other words, different events that have taken place recently, are held on to and compared. This might also be referred to as **thinking about** recent experiences.

In addition it is a fact that what is recently sensed and coded might initiate chains of thoughts which gradually lead to thinking which is more distanced from or which is not as much constrained by what happens instantaneously or what was recently sensed.

However – thinking might also occur relatively independent of what is sensed at the moment, in other words experiences stored in the LTM are put together and activated so that one might think of or "put together" what is experienced and remembered and thus, among other things, **learn by means of thinking**.

Judging from the relations that are assumed to exist between STM and LTM, between coding and STM (cf. the arrows in the figure above) Nyborg refers to STM as a necessary memory basis for staying within contexts. A good STM-function is thus decisive in order for the person to remain within a context when it comes to processes of learning and thought.

In the PSI-model, the numbers from 1 to 6 in the "person-part" of the model designate a rather normal order of events (seen in relation to the observable external events or the situation) in the same way as this might occur within a natural teaching- and learning situation. It should still be stressed that this concerns a cycle that will usually transform into ever new circulations:

1. Sensation(s) deriving/stemming from different sources within and outside of the person, i.e. OR, Responses or acts, S^D, S^F, $S^{K+/-}$, etc.
2. activates the LTM-contents. This serves as a basis for
3. coding what is sensed in light of previous experiences
4. in order to possibly store it for a short period of time before the possible
5. response or act is chosen and performed.
6. Coding of the consequences of the action contributes to the evaluation of whether the right choice is made. STM is in this connection an important factor when it comes to interpreting the present in light of the immediate past (Context), i.e. STM might be said to function as a "context-creating" process.

When Nyborg came up with his first version of the model, he used as an important argument that it was possible to bring several functional units close to each other by means of a drawn model, both in terms of time and space. This makes it easier to think about these units simultaneously to as great an extent as possible (keep in mind that STM has limited capacity) Thus it may become easier to see connections and interaction between the relevant areas of function, including between external and internal events. The prerequisite for this is obviously that the words employed, the arrows and numbers which point out the order of events really

are the bearers of meaning and, of course, conceived as the symbols and simplifications that they were meant to be.

To sum up it might be worth mentioning that the theoretical model mentioned above represents and is a result of a summary and also a further development of several researchers work[13]; however, the work done by D. Hebb and D.H. Lawrence are by Nyborg (1978) considered to be of particular importance. Nyborg continued the development of his PSI-model until 1992.

The PSI-model has on several occasions been compared to other models. Such comparisons also include Atkinson & Shriffin's (1968) "Model of memory", Craik & Lockhart's (1972) "Levels-of-processing framework", and Baddeley's (2003) "Model of working memory".

It is important to notice that language plays a prominent role in the model, i.e. in a way that is not seen in the work of Hebb, Lawrence or in any other comparable model of this kind.

In this very brief first introduction of the PSI-model we have gone from the "situation-part" which represents the external part of the model and into the "person-part" in order to see this in connection with (external) actions as an expression for what has been learnt. This corresponds to the guide line that Nyborg claims to have followed in his research:

> In the same way as D. O. Hebb (1949) I have in other words tried to follow the learning of important categories of human learning from the external stimulation of the senses – observed and even prepared for by pedagogues – to coding, STM-rehearsal and storage of experiences; i.e. later manifested in several kinds of expressions of what has been learnt. Between such "inputs and outputs" it may often be possible to assume what takes place – regarding sensations, codings, the short term and long term memory processes, thinking etc., again based on what is expressed by the learners. That is, especially when you know her or him through long-term and every day education: What is expressed is thus understood also on this background.
>
> M. Nyborg (1994, p. 484 – English translation).

[13] Among these are D. Hebb (1949, 1955), D, H. Lawrence (19XX), T. S. Kendler & H. H. Kendler (159, 1962), A. Bandura (1977), J. S. Bruner (1966), G. W. Allport (1961) J. H. Flavell (1963), A. R. Luria (1961), L. S, Vygotsky (1971), referred to in Nyborg 1971, 1978 and 1993.

Appendix 1.3: A six-point summary of Concept teaching as an overall teaching strategy with references to the PSI-model.

In the following Concept Teaching as an overall teaching strategy is summarized in 6 points with references to the PSI-model (Hansen, 2006, dr. thesis.)

1. **The use of the Concept Teaching Model (the CTM) in order to teach Basic Conceptual Systems including related basic concepts integrated with and organized by means of oral language skills.**

   Cf. the combination of skills/knowledge/dispositions in the LTM-part (Long Term Memory) of the PSI-model in fig. above in appendix 1.

In this context my addition to the Concept Teaching Model in terms of a proposal for contributing to the assumed internalization of private speech (in terms of oral language skills) in younger children or children with learning disabilities should also be mentioned, cf. **appendix 13**. In short this is a procedure which starts with external verbalizations of selected expressions during concept teaching (such as ”vertical position”) ending up with assumed “verbalizations” on an internal level (internalized silent private speech).

My second proposal for an addition to the Concept Teaching Model should also be mentioned in this context, cf. **appendix 14**: Reflecting on your own learning.

2. **The use of the CTM in order to help the learner to develop positive expectations concerning his/her own possibilities of learning/for re-learning possible negative emotional and motivational dispositions towards learning[14].**

   Cf. the combination of dispositions/knowledge/skills in the LTM/PSI-model.

3. **A very important goal of CT as an educational approach is to contribute to**

[14] To begin with it will be necessary that the teacher in some cases repeatedly point out what the children have learned after each lesson and from week to week. After a while increasingly more adaptations will be made regarding their development and self-evaluation.

children's learning of how to learn, i.e. the acquisition of learning strategies, which also must be considered important prerequisites for learning.

Cf. the combination of knowledge/skills/dispositions in LTM and Coding (cf. analytic coding by means of BCSs) and STM (Short Term Memory) in the "process part" of the PSI-model.

In this sense**, learning how to learn** involves an acquisition of, among other things, what I choose to refer to as the use of strategies on a more basic and psychological level, such as the performance of analytic coding by means of Basic Conceptual Systems (cf. appendix 4), the conscious use of language in order to prolong the STM-process so that grouping, comparisons and processing in light of what was recently and momentarily coded might take place[15], in addition, the use of oral language skills (in terms of outer and inner private speech) during problem solving, the application of self-instructions when actions are to be learned and performed etc.

Within CT as an approach, modeling and practice of such strategies[16] should be performed repeatedly when necessary.

4. The use of the CTM and analytic coding by means of BCS as a strategy and as a tool for the teaching of more Complex Concepts and Conceptual Systems integrated with language skills – including the important application of BCS as a tool for the teaching/learning of school subjects at rising levels.

[15] Lerner (1997, p. 205) mentions four examples of strategies that might prolong the STM-process. In addition to rehearsals, or repeating the information in the STM, this involves "chunking, or grouping the information, organizing the information, and making the information meaningful".

[16] The aim is to teach children how to take control of their own attention (via training in performing analytic coding etc.), thinking and learning. In my opinion this relates closely to what is referred to as executive functioning by Borkowski et al. (2004, p. 189), which includes "analyzing, planning, organizing, deliberating and revising – ". In this context this also includes specific strategies connected to problem solving and learning in different theme- and learning areas, such as in reading, mathematics etc, cf. the CRISS-strategies in this connection (Santa & Engen, 1998) and strategies of addition and subtraction (Ostad, 1999). Apart from this it is common to talk about general problem solving strategies such as for instance "the IDEAL Problem Solver" (Bransford et al., 1987) and Sternberg's (1997) six steps problem-solving cycle (Problem recognition, problem definition, formulating a strategy for problem solving, representing information, allocating resources, monitoring and evaluation). What is referred to as meta-cognition and meta-cognitive strategies connected to problem-solving and learning should also be mentioned here.

Cf. the combination of knowledge/skills/dispositions in LTM and Coding (cf. analytic coding by means of BCSs) and STM (Short Term Memory) in the "process part" of the PSI-model.

In this context it is worth noting that in a wide sense, what is aimed at is an improvement of the conceptual basis for precise communication. This will most likely yield positive consequences when it comes to communication[17] concerning phenomena that are not simultaneously observed by the conversation partners. In other words, it is a question of contributing to the development of a precise and decontextualized language.

5. **The application of BCS and a model for the teaching of sequentially ordered skills of different kinds.**

   Cf. the combination of skills/knowledge/dispositions in LTM and Coding (cf. analytic coding by means of BCSs) and STM (Short Term Memory) in the "process part" of the PSI-model.

The aforementioned model for the teaching of skills is divided into **(1)** the cognition phase, **(2)** followed by an imitation and fixation phase, and **(3)** a phase during which training towards automation takes place, **cf. appendix 7: A description of a model for the teaching of skills.**

6. **And finally – the overall teaching strategy also aims at changing or modifying the environments of the learner in a broader sense in order to develop optimal conditions of learning.**

   Cf. the situational aspects of the PSI-model.

[17] "…communication concerning phenomena that are not simultaneously observed…", refers to communication about objects and events that possible communication partners cannot look at or inspect together while talking. The general assumption is that as much as 40%–60% of the conceptual meanings attached to words and sentences applied in ordinary conversation, can be derived or understood in light of the immediate context, when communication partners have the opportunity to look at or inspect what they are talking about together. Via CT one aims at teaching a more common conceptual basis for a precise communication represented by "a language" consisting of words and sentences that function and convey meanings across situations or contexts, i.e. a language that to a much lesser extent is dependent upon what the "partners" can view together while talking. Thus, a language that functions in this way may be termed "a precise and decontextualized language".

Appendix 2: Shortened versions of exemplifying situations or "programs" for the teaching of Basic Conceptual Systems (BCSs) and concepts, cf. the explanation of the Concept Teaching Model (the CTM) on pp. 12–26.

Words denoting Basic Concepts and Basic Conceptual Systems:

Page

The shortened programs may serve as examples for making other programs of in principle the same kind; the blue colour program may serve as model for teaching of other colours in the same manner, similarly the four-sided shape as a model to teach triangular shape and other multisided shapes, "place on" as a model for "place under" etc.

In these programs 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. As you will see this is done by repeated use of, for instance, **the sub-ordinate** label **round** in close connections with

the **super-ordinate** label **Shape = Round shape.** More on this can be read about under the heading: Introducing Nyborgs's model for concept teaching on pp. 12–26**.**
In this way Basic Conceptual Systems 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 (cf. appendix 4), which may be looked upon as a crucial factor in subsequent learning.

However, people with English as their mother tongue might think that the language used in the programs for teaching **Place-BCS** (2.14–2.17 – respectively Place(d) first, Place(d) right after, Place(d) on, Place(d) to the left of something) is kind of awkward and artificial.

The suggested use of language in the program is, for instance, "**Liza has place right after (or is in the place right after) Tom in the row**" (appendix 2.15, the conversation column), while a more common way of saying this in English might be "**Lisa is standing right after/behind Tom in the row**. The ordinary way of expressing this in Norwegian would literally almost be the same word for word compared to the common way in English. As you look at the sentence on Liza in the program, the word **place** is applied, which is not the case in the "common" English example or in a Norwegian corresponding sentence. In the example of English "common" language it's obviously taken for granted that place/placement is **implicitly** expressed, and I agree. There is no need to discuss that.

However, as explained above, in the programs I suggest the **explicit** use of the word **place/placed** in order to help children develop and organize their experiences into **Place-BCS**, even though the language might seem a kind of awkward. In the next stage it is possible to use the two ways of expressing the same matter interchangeably: "**Liza has place right after (or Liza is in the place right after) Tom in the row**"/ **"Lisa is standing right after/behind Tom in the row".**

Do also compare the program suggestion (also in appendix 2.15, the conversation column): "Which **place** has Liza (or where is Liza placed) in relation to Tom in the row!" with the more common verbalizing in English: "**Where** is Liza standing in relation to Tom in the row? In the last sentence the word **where** indicates **which place**. As in the example above it's possible to combine the two sentences in a synonymous way.

It should also be remarked that this special use of the oral language primarily is applied in the teaching sessions of BCSs and when training the children in performing analytic coding. Furthermore, BCSs should be used as thinking tools and analytic coding as a strategy when teaching the children reading/writing, mathematics, etc. It is our experience that most children in every day conversation usually apply the ordinary "oral language code", even though they master the more explicit way of expressing themselves. The observed exception is that children seem to be more explicit (i.e. with regard to applying words denoting BCS and related concepts) when they need to be more precise in their conversation.

Finally it should be mentioned that more elaborated versions of some of the programs presented here as well as some programs for teaching additional Basic Concepts are presented in the teaching material Grunnlaget (The Basis) (Sønnesyn & Hem, 2002)**.** ISBN 83-90960-06-9.

Appendix 2.1: Words denoting basic concept and basic conceptual system: Part of a whole (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	A toy car The letter b More tasks of in principle the same kind with other things or drawings	**Teacher** while pointing: This wheel is a part of the whole car. What is this wheel a part of? **Child**: The wheel **is a part of the whole** car. **T:** You said that nicely (positive and guiding feedback). **T** while pointing: Here you see a letter. The curved shape (or round shape) is a part of the whole letter. What is the curved shape a part of? **C:** The curved shape is a part of the whole letter. **T:** That's quite right. The curved shape is a part of the whole letter.
Selective discrimination – learning differences	Pictures of or concretes (maybe small 3. dimensional models) like a bucket, a doll, an aeroplane and for instance a branch. Possibly by tasks with the learning panel Possibly by successive discrimination learning tasks	**T:** Point at the picture/the thing which is only a part of a whole thing! **C** points to the branch. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at the branch? **C:** (I pointed…) because it's/the branch is a part of a whole thing. **T's** positive and guiding feedback. Drawings of whole things and one thing which obviously is a part of a thing. Cf. the description of the use of the learning panel on p. 20 and a detailed drawing of the panel in appendix 10. **C** is asked to point at parts of wholes in the near surroundings and name them, and as an additional task to tell about other things that are parts of wholes, if expected to be able to do so. Cf. examples of such tasks at page 20.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Some parts of identifiable concrete whole things or drawing of parts of things Part of concrete things or drawings of parts. Also possibly use of the learning panel with drawings of whole things and two with obviously parts of things.	**T:** In what way are all things you see here (or how are all things here they) **similar?** **C:** They are similar in being parts of wholes. (*Be aware of that children must know the difference between complete similarity and partial similarity before they can be expected to come up with a right answer. In the beginning of CT, the teacher also usually has to model this sentence for the children, cf. pp 22–26).* T: You said that brilliantly, very well done. **T:** Point at the things/drawings that are similar in being parts of whole things! **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these two things/drawings? **C:** (I pointed…) because they are similar in being parts of things/drawings. **T's** positive and guiding feedback.

Appendix 2.2: Words denoting basic concept and basic conceptual system: Speech sound (A. Hansen, 2006)

There are a lot of programs aiming at teaching and helping children develop phonological awareness, including teaching the children about what a sentence is, what a word and a syllable are, and of course what a speech sound is. Such programs should of course be applied as before. The following proposal of a small teaching program for helping children acquire a growing awareness of **Sound** as a Basic Conceptual System and the concept of **"speech sound"** in contrast to other sounds is only a small addition.

Therefore this proposal must not be confused with a program aiming at training children in breaking words into speech sounds.

When talking with children about sounds, one should ask them to apply the word sound as an integrating word for the different sounds in close connection with the names for the specific sounds (in order to help the children construct a Basic Conceptual System of Sound): Which sound do you hear now? I hear the sound of a car (a car-sound), instead of only answering: I hear a car. I hear the sound of an aeroplane (an aeroplane-sound), the sound of clapping (a clapping-sound), the sound of tapping (a tapping-sound) etc.

When the concept "speech sound" is taught, the teacher should start with explaining how the words we apply in our speech can be broken into separate sounds which we call **speech sounds.** The word sun, for instance, the teacher tells the children, can be divided or broken into three speech sounds, namely the speech sound /s/, the speech sound /u/, and the speech sound /n/, The word pig can be broken into the speech sound /p/, the speech sound /i/ and the speech sound /g/.

The teacher should also help the children become aware of the fact that they form or produce speech sounds in their mouths and with their lips, and by means of their voice (voiced sounds) or without the use of their voice (unvoiced sounds). Thus we can hear the speech sounds (with the ear) and simultaneously "feel" them by the way we make them in our mouths and with our lips.

The children are then asked to imitate some speech sounds in order to help them experience that the sounds can be "felt" in the mouth, "felt" by the lips and heard (with the ear). Afterwards the teacher presents some speech sounds – first with a prolonged pronunciation of the sound as part of a recognizable word for the children, then the sound is pronounced separately. The task of the children is to repeat the sound individually or as a group. The naming **speech sound** is actively applied in this connection: Will you please say the speech sound /i/ (as in pig) after me! (The children say /i/). Which speech sound did you say? (We said) the speech sound /i/.

It is probably wise to make use of the children's own names when demonstrating different speech sounds, even though other words also could do.

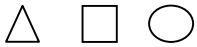
PROCESS	**MATERIAL**	**EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts**
Selective association – learning of associations	The name /Ann/	**Teacher** while pointing**:** Now I am going to say your name. It is Ann. (a little prolonged pronunciation of /a/). Is it true or not true that the speech sound /a/ is a part of the name Anne? **Child:** That is true. **T's** positive and guiding feedback. **T:** Can you say the speech sound /a/! **C** says /a/. After the sound is pronounced, **T**asks: Which kind of sound is /a/? **C:** /a/ is a speech sound- **T's** positive and guiding feedback.
	Similar tasks are given to more children in the group/class.	First more tasks with names and vowels in focus, then tasks with selected consonants are worked with in the same way. The same kind of dialogue continues.

The first phase continues.	Also tasks of "self-production", cf. p. 19.	The children are asked to come up with examples of other speech sounds from their names or from other words, if regarded able to do so.
Selective discrimination – learning differences	T makes a whistling sound plus the speech sound /e/. More task of same kind, also with rows of three sounds.	**T:** Now I am going to make two sounds, a speech sound and another kind of sound. Afterwards I will ask about which sound is the speech sound! **T** makes the whistling sound and the speech sound /e, and asks: Which of the sounds is a speech sound? C: /e/ is a speech sound **T:** That's a correct answer. The same kind of dialogue continues.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Three speech sounds: /r/ – /o/ – /k/. A clapping sound + the speech sound /a/ + a coughing sound + the speech sound /I/ Two, three additional tasks of in principle the same kind.	**T:** Now I am going to make three sounds. Listen carefully. Afterwards I will ask you how the sounds are similar! **T** pronounces the three speech sounds. **T:** In what way are all three sounds that I made (or how are all the three sounds) **similar?** **C:** They are similar in being speech sounds. T: You said that brilliantly, very well done. **T:** Now I am going to make more sounds. Not all of them are speech sounds. Listen carefully and find out which of the sounds are similar in being speech sounds! T pronounces four sounds and asks: Which of the sounds are similar in being speech sounds? **C:** /a/ and /i/ are similar in being speech sounds. T: That quite right: /a/ and /i / are speech sounds. You are so clever. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you repeat the sound /a/ and the sound /i/? **C:** (I repeated /a/ and /i/ pointed…) because they are similar in being speech sounds **T's** positive and guiding feedback. The same kind of dialogue continues.

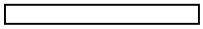
Appendix 2.3: Words denoting basic concept and basic conceptual system: Blue colour (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	An object or drawing with blue colour More tasks of the same kind Also tasks of "self-production", cf. the explanation on p. 19.	**Teacher** while pointing: This X? has blue colour? What colour does it have? **Child**: It (X?) has a blue colour. **T:** That's correct. You knew that (positive and guiding feedback). The teaching continues with in principle the same kind of tasks. It is important simultaneously to vary the colour in focus within the spectrum of red colour from task to task. In the beginning relatively smaller variations in red colour, then greater variations in red colour. It's very important that the children are looking at the examples of blue colours at the same time as they're hearing blue colour said or are saying the phrase themselves. The children should be allowed to draw or paint something with red colour. They should also be allowed to mix colours in order to see how they change, included what happen to other colours when they are mixed with white or black.
Selective discrimination – learning differences	A thing with blue colour + other things with other colours. Possibly tasks with the learning panel and writings/ drawings with blue colour. Possibly successive discrimination learning tasks	**T:** Point at the thing which has a blue colour. **C** points to the right thing. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that thing? **C:** (I pointed…) because it has a blue colour. **T's** positive and guiding feedback. The children are asked to look for something with a blue colour in the near surroundings, and are invited to tell about something elsewhere having a blue colour, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Four of five things with different blue colours More tasks of the same kind Three things with variations of blue colour and two things with other colours. More tasks, possibly with the learning panel	**T:** In what way are all the things you see here (or how are all things here) **similar?** **C:** They are similar in having a blue colour. **T:** You said that brilliantly, very well done. **T:** Point at the things/drawings that are similar in having a blue colour! **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having blue colour. **T's** positive and guiding feedback.

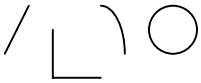
Appendix 2.4: Words denoting basic concept and basic conceptual system: Round shape (A. Hansen, 2006), cf. the more elaborate version on the pages 17–26.

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	 A piece of Cardboard More tasks of the same kinds, with different objects or drawings with a round shape. The teacher systematically varies other attributes such as colour, size, substance, but also degree of roundness etc. Also tasks of "self-production", cf. the explanation on p. 19.	***In advance the teacher must make sure that the children know what a corner is, e.g. the corners of a tabletop.*** **Teacher** is holding up a piece of cardboard while saying and doing: Look at me. Now I'm moving my fingers along the edge of this cardboard all the way around until I reach my starting point. I see no corners along the edge. Since the edge is curved all the way around and has no corners, we can say that this piece of cardboard has **a round shape**. Now I would like to hear you say **it has a round shape** together. **C: It has a round shape.** **T:** You all did that nicely (positive and guiding feedback). The children are then each given similar cardboards and are asked to let their fingers run all along the edge. Afterwards the teacher repeats as a model "it has a round shape and" and once more asks for the shape of the cardboard. **Teacher and children go on with the same kind of dialogue.** The children are invited to "produce" something with round shapes, by drawing, painting, making "arm-rings" of a formable substance, etc.
Selective discrimination – learning differences	Three shapes  Possibly tasks with the learning panel Possibly successive discrimination learning tasks, cf. p. 20.	**T:** Point at the shape which has a round shape. **C** points to the right shape. **T:** That's correct. It has a round shape. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that particular shape? **C:** (I pointed…) because it has a round shape. **T's** positive and guiding feedback. The children are asked to look for something with a round shape in the near surroundings, and are invited to tell about something experienced elsewhere having a round shape, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Three, four different objects with a round shape More tasks, with objects or drawings of round shapes Objects or drawings. Three with a round shape and two other shapes. Possibly use of the learning panel.	**T:** In what way are these objects (or how are all things here) **similar?** **C:** They are similar in having a round shape. **T:** You said that brilliantly, very well done. The same kind of dialogue. **T:** Point at the things/drawings that are similar in having a round shape. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having a round shape. **T's** positive and guiding feedback.

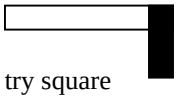
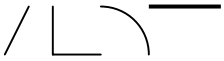
Appendix 2.5: Words denoting basic concept and basic conceptual system: Straight line shape (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	 A ruler A straight line  A curved line More tasks of in principle the same kind. Also tasks of "self-production", cf. pp. 19.	**Teacher:** Here I've got a ruler and a pencil. Now I'm drawing a line by means of these two things. This line is a straight line because it's not curved like this line (draws a curved line and points to it). **T:** Since this line (points to the first drawn line) has the shape of a straight line, we can say it has a straight line shape. I would like to hear you all say straight line shape (while looking at the line). **C:** Straight line shape. **T:** You said that nicely (positive and guiding feedback). **T**: Now I would like all of you to make a straight line by the help of your rulers. **C** draws lines with straight line shapes. **T's** positive and guiding feedback. **T:** What shape do the lines have? **C:** Straight line shape. **T's** positive and guiding feedback. Things with a straight line shape or a straight line edge (edges of boxes, tables, doors, windows etc.) are presented and commented upon through a similar kind of dialogue.
Selective discrimination – learning differences	 More tasks, possibly also tasks with the learning panel Possibly successive discrimination learning tasks	**T:** Point at the figure/shape that has a straight line shape. **C** points to the right figure. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that figure? **C:** (I pointed…) because it has a straight line shape. **T's** positive and guiding feedback. C is invited to point out while naming edges with a straight line shape in the near surroundings and are invited to tell about something experienced elsewhere having a straight line shape, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Rectilinear shapes varying in position, length etc. More tasks, with objects or drawings with a straight line shape, including letters, numbers or other symbols. Two lines with and three without a straight line shape. Possibly use of the learning panel.	**T:** In what way are all the lines you see here **similar?** (or how are all these lines **similar?** **C:** They are similar in having a straight line shape. **T:** You said that brilliantly, very well done. **T:** Point at the things/drawings that are similar in having a straight line shape. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having s straight line shape. **T's** positive and guiding feedback. The same kind of dialogue as with "a round shape" cf. the program for round shape at pp. 17–26.

Appendix 2.6: Words denoting basic concept and basic conceptual system: Curved/bowed shape (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	 More tasks of the same kinds, including curved shapes as part of more complex wholes. Also tasks of "self-production", cf. pp. 19.	**Teacher** while holding up a bow: Does anyone know what this is? **Child:** It's a bow. **T:** That's right. It's a bow. Now look at the shape of it. We can say that the shape is curved. Can you say together: The bow has a curved shape! **C:** The bow has a curved shape. **T:** You said that nicely. **T:** Look. I'm drawing a line with curve shape. What shape has it got? **C:** That line has a curved shape. **T's** positive and guiding feedback. Letters, numbers/figures and other symbols should also be applied in some of the tasks. The same is the case for the next two phases below. The children are asked to draw of form of something with a curved shape as well as say: a curved shape
Selective discrimination – learning differences	 More tasks, possibly with the learning panel **K H D F L** Possibly successive discrimination learning tasks	**T:** Point at the figure that has a curved shape. **C** points at the right figure **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that figure? **C:** (I pointed…) because it has a curved shape. **T's** positive and guiding feedback. **T:** Point at the letter which has a part with a curved shape. **C** points at **D.** **T's** positive and guiding feedback. **C** is invited to find examples of curved shapes in the near surroundings and are invited to tell about something experienced elsewhere having a curved shape, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Curved shapes of different length and thickness etc. More tasks, possibly also with letters and numbers Two shapes with and three without a curved shape. More tasks, possibly also with the learning panel	**T:** In what way are all the shapes you see here (or how are all shapes here) **similar?** **C:** They are similar in having a curved shape. **T:** You said that brilliantly, very well done. **T:** Point at the shapes that are similar in having a curved shape. **C** points at the right shapes. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these two shapes? **C:** (I pointed…) because they are similar in having a curved shape. **T's** positive and guiding feedback.

A**ppendix 2.7: Words denoting basic concept and basic conceptual system: Angular shape (A. Hansen, 2006)**

PROCESS	**MATERIAL**	**EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts**
Selective association – learning of associations	 A try square (or "a carpenter's angle") is shown  More tasks of the same kind with different angular "openings" or degrees and with the arms pointing in different directions. Also angular shapes as part of more complex wholes. Some tasks of "self-production" cf. p. 19.	**Teacher** while pointing: This is a tool that we may call a try square or a carpenter's angle, and these two parts are called arms (touches the arms). Now look at the shape of this carpenter's angle. It is possible to say that it has an angular shape. Can you say together: It has an angular shape! **C:** It has an angular shape. **T:** You said that nicely. **T:** Look at this figure which I'm drawing. This figure has also two "arms" just as the carpenter angle. Therefore we can say that this figure also has an angular shape. What shape does it have? **C:** It has an angular shape. **T's** positive and guiding feedback. Letters, numbers/figures and other symbols should also be applied in some of the tasks. The same might also be done in the next two phases below. The children are asked to draw or form something with angular shape as well as name it an angular shape.
Selective discrimination – learning differences	 Possibly tasks with the learning panel Possibly successive discrimination learning tasks	**T:** Point at the angular shape! **C** points at the right figure. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that figure? **C:** (I pointed…) because it has an angular shape. C is invited to find examples of angular shapes in the near surroundings and is invited to tell about something experienced elsewhere having an angular, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Angles of different degrees, different length of the arms, the common point pointing in different direction, etc. More tasks, possibly also with letters and numbers Three figures with and two without angular shape. More tasks, possibly also with the learning panel	**T:** In what way are all shapes you see here (or how are all shapes here) **similar?** **C:** They are similar in having an angular shape. **T:** You said that brilliantly, very well done. **T:** Point at the figures that are similar in having angular shape. **C** points rightly. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these figures? **C:** (I pointed…) because they are similar in having an angular shape. **T's** positive and guiding feedback.

Appendix 2.8: Words denoting basic concept and basic conceptual system: Four-sided shape (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	 More tasks of in principle the same kind. Remember to vary with different kinds of four-sided shape, including four-sided shapes as part of more complex wholes. Also tasks of "self-production", cf. p. 19.	**Teacher:** Look at me while I'm touching each side of this cardboard. Let's count how many sides there are together. **T + Child** while **T** is pointing to each side: **One-two-three-four.** **T:** How many sides has it got? **C:** It has got four sides. **T:** That's correct. **T:** And because it has got four sides, it's possible to say that it has a four-sided shape. Can you repeat this all together: It has a four-sided shape. **C:** It has a four-sided shape. **T:** Very well said. The teacher points out different objects with a four-sided shape (door, shelf, tabletop, window, book etc.) which are commented upon and named as having a four-sided shape through a dialogue. The children are asked to draw or form something with a four-sided shape, as well as name it a four-sided shape.
Selective discrimination – learning differences	Three wooden or plastic etc. shapes. One with four-sided shape. More tasks, possibly with the learning panel. Possibly successive discrimination learning tasks	**T:** Point at the shape with a four-sided shape **C** points out correctly. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that shape? **C:** (I pointed…) because it has a four-sided shape. **T's** positive and guiding feedback. **C** is asked to find examples of four-sided shapes in the near surroundings and are invited to tell about something experienced elsewhere having a four-sided shape, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Four, five objects or drawings with a four-sided shape More tasks of the same kind. Three figures with and two without a four-sided shape. More tasks, possibly also with the learning panel	**T:** In what way are all things you see here (or how are all things here) **similar?** **C:** They are similar in having a four-sided shape. T: You said that brilliantly, very well done. **T:** Point at the things/drawings that are similar in having a four-sided shape. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having a four-sided shape. **T's** positive and guiding feedback.

Appendix 2.9: Words denoting basic concept and basic conceptual system: Large in height (high) compared to …A. Hansen, 2006)

Some comments:

This suggestion of a program for the teaching of **large in height (high) in relation to something else** may serve as a template for the teaching of **larger in height (higher) and the largest in height (highest)**…as well as **small in height (low)/smaller in height (lower)** and **smallest in height (lowest)** compared to…

The same is true for other basic sub-conceptual systems of **sizes,** such as **length, width/breadth and depth** in relation… all of which represent **1. dimensional sizes.** In addition comes the **2. dimensional sizes** (the size of a circle, of a triangle etc.) and the **3. dimensional sizes** (the size of a ball, of a cube, of a cylinder etc.) in relation to… (also exact measures).

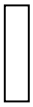
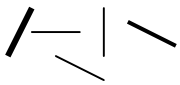
In the teaching program I have suggested the use of the expressions **in relation to or compared to** in order to make the children aware of the relative aspects. For instance, a tennis ball is larger in size compared to a marble, but smaller in size compared to a football. The same effect might be achieved by using "seen beside" or "relative to". It's up to the teacher to choose the expression that best fits the local dialect, but at the same time it's important to remember choosing one that helps the relative aspect to become explicit.

It is my experience that after having taught children for instance **large in height** one needs only a few tasks to make them completely aware of the opposite, namely **small in height**. This is also true for the teaching of **larger** and **largest** in heights. At the same time we often express synonymously **large in height; high, larger in height; higher** and **small in height; low, smaller** in **height; lower** etc. The main idea of applying the word for the **concept (large)** together with the word for the **Basic Conceptual System (height)** should all the same be practiced in the teaching phases in order to help the children construct the **Conceptual System**, cf. the explanation regarding this on pp. 31–33. **Length, width/breadth** and **depth,** etc. should be taught in the same manner, if one chooses to do so, but by adjusting the phrasing as needed.

PROCESS	**MATERIAL**	**EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts**
Selective association – learning of associations + Selective discrimination – learning differences	Teacher and a child side by side	**Teacher:** Look at us. I am large in height in relation to/compared to you (or Ann - name of the child). (T is simultaneously pointing upwards along himself and along the child, and thereafter from the top of his own head to the top of the child's head). T: **Can you say together with me**. T **(the name) is large in height compared to/in relation to Ann (corresponding pointing).** **T + C:** (The name) is large in height in relation to/compared to Ann. **T:** You said that nicely (positive and guiding feedback).
	Drawing of two trees with different height or 3. dimensional small models	**T** while pointing: Here you see two trees with different heights. This tree is large in height in relation to/compared to that three (**T** is simultaneously pointing at and from the larger tree to the smaller tree and then back to the larger one). What height has this tree in relation to/compared to that? **C** with corresponding pointing: This tree is large in height in relation to/compared to that tree. **T's** positive and guiding feedback.
	Two lines side by side 	More tasks of the same kind.

The first two combined phases continue.	Two letters side by side e f More tasks, possibly with the learning panel. Also self-production tasks. Possibly successive discrimination learning tasks	**T:** Point to the letter that is large in height in relation to/compared to the other letter. **C** points to the right letter. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that letter? **C:** (I pointed…) because it is large in height in relation to/compared to that letter. **T's** positive and guiding feedback. C is asked to colour or "produce" something being large in height in relation to/compared to something else, as well as name it a large height compared to… C is asked to identify something being large in height in relation/ compared to something else in the near surroundings and are invited to tell about something experienced elsewhere being large in height compared to something else, if expected to be able to do so.
Selective generalisation – discovering similarities Selective generalisation – discovering similarities + discrimination	Pairs of things with different heights, e.g. pencils, candles, sticks etc. More tasks of in principle the same kind. More candles with different heights, some of them with similar larger heights. l s o h r t n f More tasks, possibly also with the learning panel.	**T** while simultaneously pointing at the ones in the pairs being large in height: In what way is that pencil, that candle and that stick similar compared to the other ones in the pairs (with corresponding pointing to the small ones? **C:** They are similar in being large in height compared to the other ones in the pairs. **T's** positive and guiding feedback. T: **Point to the candles that are similar in being large in height (in relation to/compared to the others).** C **points at the rights candles.** **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T** while pointing: Why did you point at these candles? **C:** (I pointed…) because they are similar in being large in height in relation to/compared to the other candles. **T's** positive and guiding feedback. **T:** Point out the letters that are similar in being large in height in relation to/compared to the others. **C** solves the question correctly. **T:** You did that really well. As a continuation, if regarded as necessary: See above.

Appendix 2.10: Words denoting basic concept and basic conceptual system: Vertical position (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	  A ruler attached to a nail More tasks of the same kind, including vertical position as part of more complex wholes. Also tasks of "self-production", cf. p. 19.	**Teacher:** Here I've got a plumb with a string attached**.** When I hold the string with the plumb like this (the string moves a little before it hangs straight up and down without moving) it gets a special position. When the plumb makes the string hang like this, we say that it has a vertical position. Now look at the string and say after me: Vertical position. **Child:** Vertical position. **T:** You said that nicely (positive and guiding feedback). **T:** What position does the string have? **C:** The string has a vertical position **T:** That is absolutely right. **T:** This ruler is hanging in the same position as the string with the plumb. Therefore it also has a vertical position. T: **What position does the ruler have?** C: The ruler has a vertical position. **T's** positive and guiding feedback. Letter and numbers/figures and other symbols should also be applied in some of the tasks. The same applies for the next two phases. The children are asked to draw, to paint etc. and to position their body or parts of it in a vertical position, as well as name it a vertical position.
Selective discrimination – learning differences	 More tasks and possibly also with the learning panel Successive discrimination learning tasks	**T:** Point at the line that is in a vertical position. **C** points at the right line. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that particular line? **C:** (I pointed…) because it has a vertical position. **T's** positive and guiding feedback. **C** is asked to find examples of vertical positions in the near surroundings and are invited to tell about something experienced elsewhere having a vertical position, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Lines in vertical position with different lengths, thickness etc. More tasks of the same kind. Three things in vertical- and two in other positions also more tasks, possibly with the learning panel: **L O V R E**	**T:** In what way are all the lines you see here (or how are all lines here) **similar?** **C:** They are similar in having a vertical position. **T:** You said that brilliantly, very well done. **T:** Point at the things/drawings that are similar in having a vertical position. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in being in a vertical position. **T's** positive and guiding feedback. Three letters with parts in a vertical position and two without.

Appendix 2.11: Words denoting basic concept and basic conceptual system: Horizontal position (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	A transparent bottle A glass, a bowl etc.+ more bottles A line on a paper, on a flip over etc. in a horizontal position and a bottle with water More tasks of the same kind, including horizontal positions as part of more complex wholes. Also tasks of "self-production", cf. p. 19.	**Teacher:** As you can see, here I've got a bottle with some water inside. You see that the water moves a bit when I turn this bottle around, and becomes still when I stop turning it. The surface of the water then becomes level. When it becomes level it's possible to say that it has a position (*T turns the bottle again two, three times, waits for the water to become level, tells the C to observe the position of the surface and makes them aware that the surface of the water has the same position each time*). **T:** The way the surface lies when still we can call a horizontal position. Please look at the surface of the water and say together with me: It has a horizontal position. **T** and **C:** It has a horizontal position. **T:** You said that nicely (positive and guiding feedback). (***T** might also make **C** aware of that the surface of water in glasses, bowls, lakes, the sea has a horizontal position when being still. **C** should also have the opportunity to move bottles in different positions in order to observe that the water assumes the same horizontal position no matter which way the bottle is turned).* **T:** Look. This line on the blackboard has the same position as the water in the bottle which I'm holding close to the line. Therefore we can say that this line also has a horizontal position. Tell me what position the line has! **C**: It has a horizontal position. **T's** positive and guiding feedback. Letter and numbers/figures and other symbols should also be applied in some of the tasks. The same applies for the next two phases. The children are asked to draw, to paint etc. and to position their body or parts of it in a horizontal position, as well as name it a horizontal position.
Selective discrimination – learning differences	 More tasks and possibly also with the learning panel Successive discrimination learning tasks.	**T:** Point at the line that is in a horizontal position. **C** points at the right line. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that particular line? **C:** (I pointed…) because it has a horizontal position. **T's** positive and guiding feedback. **C** is asked to find examples of horizontal positions in the near surroundings and is invited to tell about something experienced elsewhere having a horizontal, if expected to be able to do so.

Selective generalisation – discovering similarities	Lines in horizontal position with different lengths, thickness etc. More tasks of the same kind.	**T:** In what way are all the lines you see here (or how are all lines here) **similar?** **C:** They are similar in having a horizontal position. **T:** You said that brilliantly, very well done.
– discovering similarities + discrimination	Three things in horizontal positions and two in other positions, also possibly more tasks with the learning panel: **L O A G U V**	**T:** Point at the things/drawings that are similar in having a horizontal position. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having a horizontal position. **T's** positive and guiding feedback. Three letters with parts in a horizontal position and two without. More tasks of the same kind.

Some comment to the relation between straight line shape, on the one hand, and vertical- , horizontal- and diagonal/slanting position, on the other hand:

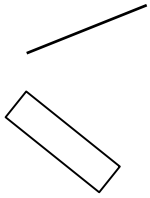
It is fairly common to experience that children in the beginning are confusing straight line shape with the three mentioned positions, but this is a matter that can be solved rather easily.

Children usually have no problems with having their attention directed or directing their attention towards the straight line shape in contrast to the colour of the same line, when only Colour and Shape as BCS are learned about. As soon as they learn about vertical Position, for instance, and the teacher assigns them to the task of performing analytic coding of a line, problems may often occur. A question regarding the shape of a certain line, might be answered with "vertical position" or even worse, with "straight line position". Obviously such an answer tells us that it might be difficult in the beginning to distinguish between an especially straight line shape and a vertical (or horizontal and slanting) position.

In order to help the children overcome this "coding problem", the teacher should start with making sure that the children really know the concept of "straight line shape". When this is clarified, the teacher should move, for instance, a pencil with straight line shape identified along one of its sides, in all the three positions mentioned, along with a dialogue like **(T):** Look closely – this pencil has a straight line shape as seen from and along its side. **(T):** What shape does it have? **(C):** The pencil has a straight line shape. **(T):** Now I am going to move this pencil with straight line shape into three different positions. **(T):** What position does the pencil have now? **(C):** Vertical position. **(T):** What position does it have now? **(C):** Horizontal position. **(T):** And what position does it have now? **(C):** Slanting position. **(T):** Yes, so let us summarize that a pencil with straight line shape may be placed in both a vertical- , a horizontal as well as in a slanting position.

The teacher might also draw lines with a straight line shape in respectively horizontal- , vertical- and slanting positions and challenge the children to tell what shape and positions the lines have, thus training them in making conscious shifts in their attention towards shape and position in each case.

Appendix 2.12: Words denoting basic concept and basic conceptual system: Diagonal/slanting/sloping position (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	 A ruler held in a another diagonal position near the line More tasks of the same kind, including diagonal position as part of more complex wholes, cf. p. 66. Also tasks of "self-production", cf. p. 19.	**Teacher:** Here I've drawn a line on the blackboard. It has neither a vertical position nor a horizontal position. It's a diagonal line, and therefore we can say that it has a diagonal position. Please look at the line and say together with me: It has a diagonal position. **T** and **C:** It has a diagonal position. **T:** You said that nicely (positive and guiding feedback). T: **This ruler has neither a vertical nor horizontal position, but it has a diagonal position just as the line on the blackboard. What position does it have?** **C:** It has a diagonal position. **T's** positive and guiding feedback. The same kind of dialogue continues. Letters and numbers/figures and other symbols should also be applied in some of the tasks. The same applies for the next two phases. The children are asked to draw, to paint etc. and to position their body or parts of it in a diagonal position, as well as name it a diagonal position.
Selective discrimination – learning differences	 More tasks, possibly also with the learning panel Successive discrimination learning tasks	**T:** Point at the line that has a diagonal position. **C** points at the right line. **T:** That's correctly pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that particular line? **C:** (I pointed…) because it has a diagonal position. **T's** positive and guiding feedback. **C** is asked to find examples of diagonal positions in the near surroundings and is invited to tell about something experienced elsewhere having a diagonal position, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Lines in diagonal position with different lengths, thickness etc. More tasks of the same kind. Three things in diagonal positions and two in other positions, also possibly more tasks with the learning panel: **L O A G U V**	**T:** In what way are all lines you see here (or how are all the lines here) **similar?** **C:** They are similar in having a diagonal position **T:** You said that brilliantly, very well done. **T:** Point at the things/drawings that are similar in having a diagonal position. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having a diagonal position. **T's** positive and guiding feedback. Three letters with parts in a diagonal position and two without. More tasks of the same kind.

Appendix 2.13: Words denoting basic concept and basic conceptual system: Striped (surface) pattern (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	A cloth with striped pattern	**Teacher:** Look at the stripes of cloth. Because of the stripes we can say that the cloth has a striped pattern. What pattern does it have? **Child**: It has a striped pattern. **T:** You said that nicely (positive and guiding feedback).
	More tasks of the same kind.	The use of different fabrics, objects, possibly drawings of things with a striped pattern. Strips in different positions, different degrees of thickness, stripes with different colours etc.
	Also tasks of "self-production", cf. p. 19.	The children are asked to draw, to paint etc. something with a striped pattern, as well as name it a striped pattern.
Selective discrimination – learning differences	Four cloths. One with striped pattern and three with respectively a dotted pattern, a flowery pattern and a checkered pattern	**T:** Point at the cloth that has a striped pattern! **C** points at the right cloth. **T:** That's correctly pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that cloth? **C:** (I pointed…) because it has a striped pattern. **T's** positive and guiding feedback.
	More tasks possibly also with the learning panel	The same kind of dialogue.
	Successive discrimination learning tasks	**C** is asked to find examples of striped patterns in the near surroundings and is invited to tell about something experienced elsewhere having a striped pattern, if expected to be able to do so.
Selective generalisation – discovering similarities	Three cloths (or drawings, pictures) with variations of striped pattern.	**T:** In what way are these cloths (or how are the cloths here) **similar?** **C:** They are similar in having a striped pattern. **T:** You said that brilliantly, very well done.
	More tasks of the same kind.	
– discovering similarities + discrimination	Three things with striped pattern - and two with other patterns, also more possibly tasks with the learning panel.	**T:** Point at the things/drawings that are similar in having a striped pattern. **C** points at the right things/drawings. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these things/drawings? **C:** (I pointed…) because they are similar in having a striped pattern. **T's** positive and guiding feedback.

Appendix 2.14: Words denoting basic concept and basic conceptual system: Place(d) first (in a row in relation to…) with reference to spatial and temporal orientation (i.e. in a sequence of links distributed in space as well as in time), cf. the comments below. (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations + Selective discrimination – learning differences	Three children in a row (facing the same direction). **First place is here defined as first from the left to the right. (cf. the reading- and writing directions in most Western cultures).** More tasks where each of the children gets experiences with being on place first in a row More tasks with small models of cars, animals, dolls etc. all oriented to the left with their "front side". Also tasks with established rows of objects or drawings without a defined "front side and rear" Possibly successive discrimination tasks Also some tasks in order to teach C about <u>place first</u> with regard to time (e.g. in terms of sounds distributed in time) e.g. a cough sound, a stamp sound and a pat sound etc.	**Teacher** while pointing: Now I've placed you (alternatively the name of the children) in a row. Liza is standing first in the row, so we may say that she has place first (or is in the first place) in the row in relation to the others. Let's say together: Liza has place first (or is in the first place) in the row. **T + C:** Liza has place first (or is in the first place) in the row. **T:** You said that nicely. **T:** Which place has Liza in this row of children (or where is Liza placed in the row of children)? **C:** She has place first (or is placed first) in the row. **T's** positive and guiding feedback. The same kind of dialogue continues. **T:** John, can you place these four animals in a row, and remember which direction their heads must be in. **C** Performs the task. **T:** That's correct, very good. **T:** Tell me what place this animal has (pointing to the one in the first place) in relation to the others in the row! (or tell me where this animal is placed…)? **C:** That animal has place first (or is in the first place) in the row. **T's** positive and guiding feedback. When asking the children to perform these kinds of tasks, the teacher once more must make explicit for them that place first, also in this connection, is to the far left of the row. **C** is asked to identify something having place first in a perceivable row in relation to something else in the near surroundings, and is invited to tell about something experienced elsewhere having place first in a row, if expected to be able to do so. **T:** Now I'm going to make three sounds. In place first (or in the first place) of the row you will hear a cough sound. Afterwards I'm going to ask you about which sound you heard in place first (or in the first place) of the row. **T** makes the sounds with marked intervals. **T:** Tell me which place the cough sound had (or where the cough sound was placed) in the row of sounds. **C:** The cough sound had place first (or was in the first place) in the row. **T's** positive and guiding feedback.

The combination of the first two phases continues		More tasks of in principle the same kind. Also similar tasks given without the teacher each time telling the C the answer in advance: Instead he merely asks: Which sound has place first (or is in the first place) in the row that I'm going to make?
	Now the teacher applies speech sounds in some tasks, e.g.: **/o/–/l/–/i/** Maybe tasks of "self-production", cf. pp. xx	**T:** Now I'm going to make three speech sounds. Afterwards I'm going to ask you about which speech sound you heard on place first (in the first place) of the row. **T** makes the speech sound with marked intervals. **T:** Which speech sound had place first (was in the first place) in the row of sounds? (Alternatively - which speech sound did you hear in the first place in the row)? **C:** The speech sound /o/ had place first in the row (alternatively – I heard the speech sound /o/ in the first place in the row of sounds). **T's** positive and guiding feedback. More tasks of in principle the same kind with speech sounds in a row and the same kind of dialogue. Perhaps some of the children will be able to make rows of speech sounds as well as rows of other sounds and ask the same kind of question as the teacher to the other children?
Selective generalisation – discovering similarities + discrimination	Also some tasks in order to teach C about place first in spatial oriented tasks by means of written words, e.g. **big** **moon** **house** Place first in time related tasks by means of sounds in rows , e.g. **/a/ – /s/** **/o/ – /n/**	**T** while pointing at the letters on place first in the words: In what way are these letters similar, with regard to the place they have (occupy) in the words? (or how are these letters similar with regard to the place they have/where they are placed in the words?) **C:** They are similar in having place first (or in being in the first place) in the rows (of letters in the words). **T:** You said that brilliantly, very well done. More tasks of the same kind with rows of more words, numbers/figures or something else in rows. **T:** Soon you'll hear two rows of speech sounds. In what way (how) are the speech sounds /a/ and /o/ similar, with regard to the place they have (or with regard to where they are placed) in the two rows of sounds? **T** makes the two rows of speech sounds. **C:** The speech sounds /a/ and /o/ are similar in having place first (or in being in the first place in the rows (of sounds). **T's** positive and guiding feedback. If the children can't manage this kind of exercise, the rows of sounds might be made more "concrete" for some children, if the teacher writes the symbol for the speech sounds in order to help the children solve the exercise. More similar tasks, possibly with rows consisting of more than two speech sounds.

Some comments:

Place first in a row (with reference to spatial orientation) must be related to and understood in light of the context. Perceived direction of a "real" row in motion or a drawing indicating direction of a row will influence which "member", "link" or "unit" of the row that will be perceived on place first in the actual row. Thus place first in a row might be identified as the place respectively to the far right, to the far left, the lowest place in a row

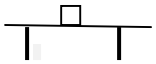
moving downwards or the highest place in a row moving upwards. Therefore Place first in a row (with reference to spatial orientation) sometimes needs to be made explicit by the naming of the referential direction or via identified front- versus rear sides of non-moving rows of persons, objects, letters, numbers etc., cf. the program above. Place first in a row related to time, on the other hand, can be identified as the first occurrence in a sequence of events.

Appendix 2.15: Words denoting basic concept and basic conceptual system: Place(d) right after (in a row in relation to…) with reference to spatial and temporal orientation (i.e. in a sequence of links distributed in space as well as in time) (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations + Selective discrimination – learning differences	Three children in a row (facing the same direction). First place is here defined as first from the left to the right. (cf. the reading- and writing directions in most Western cultures). More tasks where each of the children gets experiences with being "in the place right after" in a row More tasks with small models of cars, animals, dolls etc. all oriented to the left with their "front side". Also tasks with established rows of objects or drawings without a defined "front side and rear". Possibly successive discrimination tasks. Also some tasks in order to teach C about "in <u>place right after something else</u>" with regard to time (e.g. in terms of sounds distributed in time) e.g. a **cough** sound, a **stamp** sound a **pat sound** etc.	**Teacher** while pointing: Now I've placed you (alternatively the name of the children) in a row. Tom has place first (or is in the first place) in the row. Liza is standing here right after (to the right of) Tom, and therefore we can say that Liza has place right after (or is in the place right after) Tom in the row. Let's say together: Liza has placed right after (or is in the place right after) Tom in the row. **T + C:** Liza has place right after (or is in the place right after) Tom in the row. **T:** You said that nicely. **T:** Which place has Liza (or where is Liza placed) in relation to Tom in this row? **C:** She has place right after (or is in the place right after) Tom in this row. **T's** positive and guiding feedback. The same kind of dialogue continues. **T:** John, can you place these four animals in a row, and remember which direction their heads must be in (a zebra, a lion, a crocodile and a hippo). **C** performs the task. **T:** That's correct, very good. **T:** Tell me which place the crocodile has in relation to the lion (T is pointing correspondingly first at the crocodile, then to the lion and lastly back to the crocodile)! **C:** The crocodile has place right after (or is in the place right after) the lion in the row (possibly corresponding pointing). **T's** positive and guiding feedback. When asking the children to perform these kinds of tasks, the teacher once more must make explicit for them that "place right after", also in this connection, must be related to the place immediately to the Right of something else in the row. **C** is asked to identify something having place right after something else in a perceivable row in the near surroundings, and is invited to tell about something experienced elsewhere having place right after something else in a row, if expected to be able to do so. **T:** Now I'm going to make three sounds. The stamp sound is going to be in the place right after the cough sound. Afterwards I'm going to ask you about which sound you heard in the place right after the cough sound in time! **T** makes the sounds with marked intervals. **T:** Tell me which sound you heard in the place right after the cough sound (in the row of sounds). **C:** I heard the stamp sound in the place right after the cough sound in the row. **T's** positive and guiding feedback.

This first combined phase continues		More tasks of the same kind. Also similar tasks given without the teacher each time telling C the answer in advance: Instead he merely asks: Which sound is in the place after the X sound in the row.
	Now the teacher applies speech sounds in some tasks, e.g.: **/o/–/l/–/i/** Maybe tasks of "self-production", cf. p. 19.	**T:** Now I'm going to make three speech sounds. Afterwards I'm going to ask you about which speech sound you heard in the place right after /**o**/ in the row. **T** makes the speech sound with marked intervals. **T:** Which speech sound was in the place right after /**o/** in the row of sounds? (Alternatively - which speech sound did you hear in the place right after **/o/** in the row)? **C:** The speech sound **/l/** was in the place right after the speech sound /o/ in the row (alternatively – I heard the speech sound **/l/** in the place right after the speech sound **/o/** (in the row of sounds). **T's** positive and guiding feedback. More tasks of in principle the same kind with speech sounds in a row and the same kind of dialogue. Perhaps some of the children will be able to make rows of speech sounds as well as rows of other sounds and ask the same kind of question as the teacher to the other children?
Selective generalisation – discovering similarities + discrimination	Also some tasks in order to teach C about place after in spatial oriented tasks by means of written words, e.g. **big** **bad** **bed** Place first in time oriented tasks by means of sounds in rows , e.g. **/a/ – /s/** **/o/ – /n/**	**T** while pointing at the letters on place after **b** in the words: In what way are these three letters **(i, a, e)** similar with regard to the place they have (occupy) (or how they are placed) in the words in relation to those letters **(b, b, b)**? **C:** They are similar in having place right after (or in being placed right after) **the letters b, b, b** in the rows (of letters in the words). **T:** You said that brilliantly, very well done. More tasks of the same kind with rows of more words, numbers/figures or something else in rows. **T:** Soon you'll hear two rows of speech sounds. In what way (how) are the speech sounds **/s**/ and **/n/** similar, with regard to the place they have (or with regard to where they are placed) in relation to **/a/** and **/o/** in the first place in the two rows of sounds? **C:** The speech sounds /s/ and /n/ are similar in having place right after (or in being in the place right after) (in the rows of sounds) in relation to **/a/** and **/o/.** **T's** positive and guiding feedback. If the children can't manage this kind of exercise, the rows of sounds might be made more "concrete", at least for some children, if the teacher writes the symbol for the speech sounds in order to help the children solve the task. More similar tasks, possibly with rows consisting of more than two speech sounds.

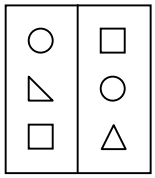
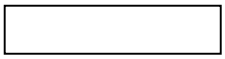
Appendix 2.16: Words denoting basic concept and basic conceptual system: Place(d) on (in relation to...) (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations + Selective discrimination – learning differences	 A line with a letter on Drawings of three things, three letters etc. that have place respectively over, on and under the a line or something else., possibly also tasks with the learning panel Tasks of "self-production," cf. p. 19– outside or inside. Possibly successive discrimination learning tasks	**Teacher** while pointing, after having placed a glass on a table: This glass has place on (or is placed on) (in relation to) this table. Where has this glass place now (or where is the glass placed now) in relation to the table? **C:** The glass has place on (or is placed on) the table. **T:** You said that quite right. **T** while pointing: Where has this letter place (or is this letter placed) (in relation to the line)? C with simultaneous pointing: That letter has place on (or is placed on) the line. **T's** positive and guiding feedback. **T:** Point at the letter that has place on (or is placed on) the line. C points to the right letter. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that letter? **C:** (I pointed…) because it has place on (or is placed on) the line. **T's** positive and guiding feedback. More tasks that give C sensorial experiences with place on something, e.g. C place themselves or tell others to place themselves on something – or C is told to draw something on a line or to place a thing on something else., **C** is asked to find examples of place on in the near surroundings and is invited to tell about something experienced elsewhere having place on something else, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	Things placed on for instance a table, a line, etc Tasks with letters, numbers etc. Possibly also with the learning table. Letters, numbers that are written under, on and over a line, more than one on each place in relation to the lines	**T:** In what way are all things you see here **similar** (with regard to place)? (or how are all things here **similar (with re to place)?** **C:** They are similar in having place on (or being placed on) the table. **T:** You said that brilliantly, very well done. The same kind of dialogue continues. **T:** Point at the letters/ numbers that are similar in having place on (or in being placed on) the line. **C** points at the right letters/numbers. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these letters/numbers? **C:** (I pointed…) because they are similar in having place on (or in being placed on) the line. **T's** positive and guiding feedback.

Appendix 2.17 Words denoting basic concept and basic conceptual system: Place(d) to the left of something, cf. the comments below. (A. Hansen, 2006)

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations + Selective discrimination – learning differences	**a)** **b)** Ruler Ruler Eraser Eraser Child behind desk facing a ruler and eraser that are placed in front along an imaginary line going through the middle of the C's body. The eraser is moved.  Possible tasks with the **learning panel** or without it, e.g. tasks with drawings of garages with cars placed outside, as proposed in this example: Fire cars placed to the right of the garages, and one garage with a car placed to the left.	**Teacher** (cf. situation a) Here you see an eraser and a ruler straight in front of you. Look – I am going to move the eraser to another place (**T** performs the task, cf. situation b). **T** while pointing correspondingly from the eraser to the ruler and then back from the eraser: Now the eraser has been placed to the left of the ruler. Can you say together with me: The eraser has been placed to the left of the ruler! **T+ C** while pointing: The eraser has been placed to the left of the ruler! **T:** You said that perfectly. **T** with corresponding pointing: Where has the eraser been placed in relation to the ruler? **C** while pointing: The eraser has been place to the left of the ruler! **T:** That's quite right. **It is extremely important that the situations are presented so that C experience <u>place to the left in relation to something else</u> in all four direction (to the north, south, west and east) inside and outside the classroom, otherwise C will probably relate place to the left ...to irrelevant "clues" in the near surroundings.** T demonstrates the same with new things in two, three similar situations but in different directions with the same kind of dialogue, including helping C with the right kind of answer, if necessary. Thereafter C is presented with other things in **situation a** and is asked to move the closest thing so that it is placed to the left of the other thing in each situation, **cf. situation b**. The same kind of dialogue continues. **T** while pointing**:** Here you see a round shape and a line in a vertical position. (The round shape has place/is placed to the left of the line with vertical position – if necessary). Where has the round shape place/is the round shape placed n relation to this line? **C** while pointing: The round shape has place/is placed to the left of the line (with vertical position). **T's** positive and guiding feedback. **T:** Here you see five drawing of garages and cars. Each garage has a car placed beside it. Point to the drawing where the car has place/is placed to the left of the garage. **C** points at the right drawing. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that drawing? **C:** (I pointed…) because the car has place/is placed to the left of the garage. **T's** positive and guiding feedback.

The combination of the first two phases continues	Also more possible tasks with "self-production", cf. p.19. **1 2 3 4 5** **d b** More tasks of in principle the same kind with pairs such as **u n, p q, b d.** In addition possible tasks with single letters and place to the left of ….with regard to their parts: **q, d, u, h, n, p.** Possibly some tasks with successive discrimination.	Additional tasks which help **C** experience placed to the left of …. , e.g. with **C** placing itself to the left of another child or to the left of something else. As alternative tasks, the child may draw or colour something that is placed to the left of…. **T** might give the instructions for the last kind of tasks. Some tasks with numbers and letters: **T:** Look at these numbers. Please point at the number with place to/ that is placed to the left of 2 (and of 5, of 3). **C** points at the right number. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that number? **C:** (I pointed…) because it has place to/it is placed to the left of the garage. **T's** positive and guiding feedback. **T** while pointing: These two letters might both be said to consist of a round (or alternatively a curved) shape. Point to the letter where the round shape has place to/is placed to the left of the line with a vertical position. **C** points at the right letter. **T:** Why did you point at that number? **C:** (I pointed…) because it has a round shape with place to/that is placed to the left of the line with vertical position. **T's** positive and guiding feedback **C** is asked to find examples of something having been placed to the left of something else in the near surroundings and is invited to tell about something experienced elsewhere having also been placed to the left of something else, if expected to be able to do so.
Selective generalisation – discovering similarities – discovering similarities + discrimination	a ruler xxx xxx Different small objects Plate with some knives and forks xxx xxx	**T** while pointing: In what way are all objects you see here similar, when you look at the place they have/how they are placed in relation to the ruler (how are all objects here similar with regard to how they are placed in relation to the ruler)? **C:** They are similar in having been placed to the left of the ruler. **T**: You said that brilliantly, very well done. **T** while pointing: Point at the cutlery that are similar in having been placed to the left of the plate. **C** points at the cutlery on the left side. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at those things? **C:** (I pointed…) because they are similar in having been placed to the left of the plate. **T's** positive and guiding feedback.

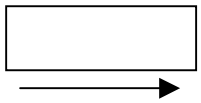
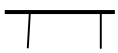
Selective generalisation – discovering similarities + discrimination	A piece of paper with a line dividing it into two halves. Drawings of geometrical shapes on each side  Possible tasks with the learning panel or without  Drawings on 5 sheets A5-format of flag staffs with flags. Three of the flags has place to the left of the flag staffs. Possibly more tasks of similar kinds.	**T** while pointing: Please colour the shapes that are similar in having place to/in being placed to the left of this line. **C** colours the right geometrical shapes. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T** while pointing: Why did you colour these shapes? **C** while pointing: (I pointed…) because they are similar in having place to the left of /similar in being placed to the left of that line. **T's** positive and guiding feedback. **T** while pointing: Here you see drawings of some flag staffs with flags. Point at the flags that are similar in having place to the left of/ similar in being placed to the left of the flag staffs. **C** points out correctly. **T's** positive and guiding feedback. **T** while pointing: Why did you point at these flags? **C** while pointing: (I pointed…) because they are similar in having place to the left of those flag staffs. **T's** positive and guiding feedback.

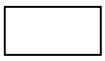
Some comments:

Learning about right and left seem to be rather difficult for quite a lot of children. Therefore most often one should start with teaching children about their **right hand** versus their left hand. The right hand might then be related to a child's preferred writing or drawing hand, which is relatively easy to remember, if right-handed. In this case the left hand in contrast is explained as the "non-writing" hand, but of course named the left hand. The right side of the body should then be identified and named as the right-hand side of the body, and vica versa for the left-hand side of the body. Of course it will be the other way around for the ones who are left-handed, starting with the naming of the left hand etc.

On this background, it is quite easy to proceed with the teaching of basic concepts and basic conceptual systems such as "place to the right of something" and "place to the left of something" as well as "in direction from the right to the left" and "in direction from the left to the right", (cf. appendix 2.18). The reason why **place to the left of something** and **direction from the left to the right** are presented in the shortened versions of the teaching programs of this appendix, is that this kind of knowledge "represents" the reading, writing (and to a certain degree mathematical calculations) directions in most Western cultures. In cultures applying other directions in these matters, other concepts within Place-BCS and Direction-BCS would be more appropriate to start with.

Appendix 2.18: Words denoting basic concept and basic conceptual system: Direction from the left to the right, cf. comments below. (A. Hansen, 2006)

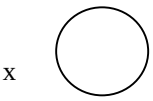
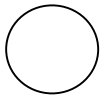
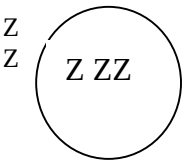
PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations + Selective discrimination – learning differences	Blackboard, flip over or something to draw a line along or in  Arrow indicating the direction Toy car on desk  Some tasks with self-production cf. p.19. Tables with an object placed to the very left of and another object placed in the middle of a desk 	**Teacher** while pointing: Look here. Now I am going to draw a line on this blackboard. I will start here on the very left side and draw the line in direction from the left to the right. **T** while pointing along the line: Please, say together with me: In direction from the left to the right. **T and C:** In direction from the left to the right **T:** You said that nicely. **T:** In what direction did I draw this line? **C:** (You drew the line) in direction from the left to the right. **T** while pointing: That's quite right. I drew that line in direction from the left to the right. **T** while pointing: This car is placed to the left on this desk. Now I am going to "drive it" in direction from the left top the right. T performs the movement once, repeats it while saying: In direction from the left to the right. **T** while pointing: In what direction did I drive the car? **C:** (You drove the car) in direction from the left to the right. **T's** positive and guiding feedback. **T** places the car to the left on the desk, points to **C** and says: Now it is your turn to drive the car from the left to the right. **C** drives the car in the right direction. **T:** In what direction did you drive the car? **C:** (I drove the car) in direction from the left to the right. **T's** positive and guiding feedback. Additional tasks helping C experience movements in direction from the left to the right, e.g. by moving something by drawing or e.g. experiences by pointing in direction from the left to the right etc. **T** leads the activities, poses question about direction, helps with the answers, if necessary, and gives positive and guiding feedback. **It is extremely important that the tasks are presented in such a way that C experience <u>in direction from the left to the right</u> in all four directions (to the north, south, west and east) inside and outside the classroom, otherwise C will probably relate <u>in direction from the left to the right</u> to irrelevant "clues" in the near surroundings.** T **while pointing: Here you see two objects/things on this desk. I am going to move these things in two different directions. Afterwards I will ask you to point at the thing that I moved in direction from the left to the right.** *T **moves the thing that was placed in the middle of the desk to the right side of the table. Then he moves the thing that was placed to the very left of the desk in direction downwards to the floor.*** **T:** Point at the thing that I moved in direction from the left to the right. **C** points to the right thing. **T's** positive and guiding feedback.

The combination of the first two phases continues	Additional tasks, maybe also involving three things that are moved in different directions.	As an alternative to the teacher's positive feedback or as a continuation: **T** while pointing: Why did you point at this thing? **C** while pointing: (I pointed…) because you moved it in direction from the left to the right. **T's** positive and guiding feedback. Possibly tasks of similar kind with "things" that are being moved in direction from the left to the right in contrast to "things" being move in the opposite direction, being moved in direction downwards or upwards. The same kind of dialogue.
Selective generalisation – discovering similarities	Desk with e.g. three things placed from the middle of the desk and to the very left side of it 	**T** while pointing: Here you see some things on this desk (e.g. a toy car, a fork, a little book). I am going to move these things, look closely at what direction I move these things in. **T** moves the things in direction from the left to the right, placing the things to the very right of the desk. **T** while pointing: In what direction did I move these things? **C:** (You moved those things) in direction from the left to the right. **T's** positive and guiding feedback. **T:** So – In what way are all the things similar, when you think of the direction I moved them in? **C:** They are similar in having been moved in direction from the left to the right. **T's** positive and guiding feedback.
Selective generalisation – discovering similarities + discrimination	Blackboard, flip over or something else  Four lines are drawn on the blackboard. Two lines in direction from the left to the right, one line in direction upwards and one line in direction downwards	**T:** Now I am going to draw four lines on the blackboard. Afterwards I will ask you to point to those that are similar in that I drew them in direction from the left to the right. **T** performs the drawing. **T:** Point at the lines which are similar in that I drew them in direction from the left to the right. **C** points out the right lines. **T's** positive and guiding feedback **T** while pointing: In way are the lines you pointed at (how are the lines…) similar? **C** while pointing: (I pointed at…) because they are similar in that you drew them in direction from the left to the right. **T's** positive and guiding feedback.

Some comments:
After the children have learned about direction downwards, direction upwards and direction from the left to the right, they should be trained in tasks with performance of combinations of concepts with regard to motor functioning: For instance, the children are asked to draw lines on a blackboard, on a flip over, on a sheet of paper etc. in direction from the left to the right (in the combination) with a sloping position and in direction downwards (alternatively: in direction upwards (for instance to the right) with a sloping position etc.) When children have learned direction from the right to the left, the number of performance combinations and practice situations are of course increased.

Appendix 2.19: Words denoting basic concept and basic conceptual system: Group (A. Hansen, 2006)

When children start counting or finding the number, the first kind of training often is about finding the number of a group of some kind. Usually one starts with counting objects of the same kind or objects belonging to the same category. In order to facilitate their learning of counting it might be a good idea first to start teaching C a "first version of" the concept of group. In this short version of a CT-program a group is understood as something physically being separated from other things with e.g. a rope ring, as a first approach to the concept denoted as group. But the concept of group is of course something more than that. Therefore, in the next stage one should make or identify groups without such easily identifiable limits, consisting of objects grouped physically close to each other. C should also later on learn about groups as sequences/rows of sounds of events, cf. the program for teaching "the number three". The concept of group could be more fully elaborated and explored, but this is beyond the intent of this small program.

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	 x= small toy animals	**Teacher** while saying and doing: This is a rope ring, and here you see some small toy animals. Now I will teach you how to make a group of these animals. Look – now I am moving these animals into the rope ring. **T:** See – I have put the animals close together inside this ring of rope. So now I have made a group. **T:** Can you tell me what I have done? **C:** You have made a group of animals. **T:** You said that nicely.
	 Y= toy cars	**T** while pointing: Here you see some toy cars. Are they standing close to each other in the rope ring? **C:** No, they are not. **T:** Please, move the cars into the rope ring and make a group of them. **C** does as told. **T's** positive and guiding feedback **T:** Tell me what you just have done with the cars! **C:** I have made a group of cars. **T's** positive and guiding feedback
	Additional task with "self-production".	**C** is asked to move different objects into various kinds of rings. C is possibly also asked to draw some shapes on a sheet of paper etc. which might serve as another way of marking the boundaries of the groups. The same kind of dialogue continues.
Selective discrimination – learning differences	 Rubbers inside and outside the ring	**T:** Please point at the rubbers that are forming a group. **C** points at the right rubbers. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T** while pointing: Why did you point at those rubbers? **C:** (I pointed…) because they are forming a group. **T's** positive and guiding feedback.
	Additional task, possibly also with the learning panel.	The dialog continues.
	Possibly successive discrimination learning tasks	**C** is asked to find examples of groups in the immediate surroundings, if regarded able to do so. T might also in advance have made easily detectable groups.

Selective generalisation – discovering similarities – discovering similarities + discrimination	Four groups each consisting of different objects and with various number. One or two additional tasks Toy cars inside and outside a rope ring, pencils inside and outside a rope ring, small plastic shapes a bit scattered and some rubbers a bit scattered. Possibly one or two additional tasks	**T** while pointing: In what way are all these objects you see here (or how are all objects) similar? **C:** They are similar in being together in a group/in being gathered in groups. **T:** You said that brilliantly, very well done. The same kind of dialogue. **T:** Please point to the objects that are similar in being together in a group. **C** points at the right objects. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these particular objects? **C:** (I pointed…) because they are similar in being together in a group. **T's** positive and guiding feedback.

Appendix 2.20: Words denoting basic concept and basic conceptual system: Finding the number of a group by counting: the number three (A. Hansen, 2006)

Some comments: This short version of a teaching program focuses on the teaching of an exact concept of number. On the other hand one must bear in mind that learning by heart a series of numerals also is important in order to develop counting skills. Thus this must be practised over and over again.

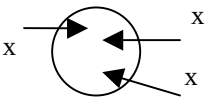
When children are six years old, most of them have acquired knowledge of number concepts up to eight to ten, and some have developed an understanding of much greater numbers. It's of course important to remember that though children use a lot of numerals and can count to relatively great numbers (by heart?); these skills do not necessarily symbolize or correspond to having a well developed concept of numbers. Therefore it is important to work with children's oral language in relation to the concept of numbers, so that the numerals applied really become symbols for well developed number concepts. Not until this is achieved, should one start the formal teaching of the written symbols.

Before the teaching of exact concepts of number start, the children should have had the opportunity to learn about other conceptual systems and selected concepts, e.g. concepts regarding colour, shape, sizes etc., so that they have become familiar with the phases of the concept teaching model and the verbalising of "partial similarities and possibly "partial differences" (similar in and different in).

The concept of group should also have been taught, at least to such a degree that the children temporarily understand it as a naming for gatherings of things etc. of the same kind or category separated/divided from the surroundings with a rope ring etc. Later one should group objects by putting them close together without the use of such identifiable limits as a rope ring etc. And finally learn to group objects, drawings etc. according to some common characteristic. In addition the children should learn about numbers with regard to audible groups or a series or row of events.

A prerequisite for being able to find the number of a group by counting, is that the children have developed an understanding of the **"one-to-one correspondence" in terms of saying only one numeral for each perceived element of a group.** The five proposed counting strategies (regarding the cardinal aspect) are similar in having thinking as an underlying process and the naming of each perceived element in common.

A very concrete way as **a first step** for making the children aware of this is to demonstrate and perform what I prefer to call **(1) counting while moving objects**, cf. below. **A second step** can be what I call **(2) counting while touching with a finger** (i.e. the children touch each element of an "established" or existing group one by one while uttering only one numeral for each touched element). **A third step** can be what might be called **(3) counting while pointing** to each element of a group. **A fourth step** can be called **(4) counting while nodding** as a marking for each counted element. **A fifth step** can be what I prefer to denote **(5) counting while only looking at,** referring to the fact that it is not possible to observe the children performing any kind of outer one-to-one correspondence activity when counting, except by watching their eye movements.

PROCESS	MATERIAL	EXAMPLES OF CONVERSATION PATTERN, including nonverbal acts
Selective association – learning of associations	A rope ring  x= small toy animals	**Teacher** while pointing: Here you see a rope ring and three small model animals. Now I am going to move these animals into the rope ring and at the same time find the number by counting. It is very important to say only one number for each animal that you move into the rope ring. Look closely at what I do: **T** then moves the animals one by one into the rope ring while saying the numbers one by one exactly at the same time that each animal touches the "ground" within the rope ring with a knock (marking of the one- to- one correspondence in time). **T:** I moved the animals into the ring and counted to the number three. Therefore we can say that the number of this group is three. What is the number of animals in the group? **C:** The number of animals in the group is three. **T:** That's correct and you said that nicely.

The first phase continues	x  x x Other toy animals	**T** with indicating pointing: Please move these animals into the rope ring while counting the number. **C** moves the animals one by one while saying the numbers (one-two-three) exactly at the same time as each animal touches the ground within the ring. **T** with corresponding pointing: What is the number of animals here? **C:** The number of animals is three. **T's** positive and guiding feedback.
	Additional tasks with different categories of things/objects that are counted one by one while moved into a ring.	**T** leads the activities, including modelling the doing and saying if necessary, assesses the learning result and gives **C** positive and guiding feedback.
	Some tasks with counting the number three in established or existing groups	**T** leads these kind of tasks which aim at giving C experiences with the counting strategy (2) **counting while touching with a finger** and with strategy (3) **counting while pointing** to each element of a group (possibly also some experiences with strategy (4) **counting while nodding)**.
	Possibly some tasks with number in groups in terms of a series or rows of sounds or events.	**C** should be given the opportunity to experience and count the number (of three) in rows of sounds made by clapping, tapping, coughing, snapping fingers, whistling etc., all rows of sounds produced by **T** while the children are counting.
	Also tasks of "self-production", cf. p. 19.	The children are asked to make groups with the number three, e.g. by moving cubes into a rope ring or by drawing or forming something representing the number of three. Also possible tasks in which C has to make rows consisting of (the number of) three sounds or three movements. The sound tasks are more demanding and may be a problem for some of the children. T gives the necessary support and assesses which C should be given this kind of tasks.
Selective discrimination – learning differences	Three groups with model animals: Three small animals in one group. Two big animals in the second and three animals of middle size in the third group.	**T:** Here you see three groups of animals. Please point at the group where the number is three. **C** points at the right group. **T:** That's correct pointed out. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at that group? **C:** (I pointed…) because the number is three. **T's** positive and guiding feedback.
	Additional tasks of the same kind.	If C has problems with solving this kind of tasks, T may give support by saying: Remember that you must count the number in the groups in order to find out where the number is three.

The second phase continues	Possibly tasks with the learning panel	Drawings or pictures of groups with different numbers. One with the number three.
	Possible tasks with two and two or three groups/rows with sounds.	**T:** Now I'll make two groups/rows of sounds, a group/row with some clapping-sounds and another with some whistling-sounds. In one of the groups/rows the number will be three. Listen carefully, count the sounds and find out which group/row of sounds has the number three. **T** makes the sounds and asks: Which group/row of sounds had the number three? **C:** The group/row of clapping-sounds had the number three. **T's** positive and guiding feedback.
	Additional tasks of the same kind.	
	Possibly successive discrimination learning tasks	**C** is asked to find examples of groups with the number three in the immediate surroundings, if regarded able to do so. T could also in advance have made easily detectable groups with the number three.
Selective generalisation – discovering similarities	Four groups with different elements. Small sticks in one group, cubes in the next etc. All groups with the number three.	**T:** In what way are all groups you see here (or how are all groups) **similar?** **C:** They are similar in having the number three. **T:** You said that brilliantly, very well done.
	One or two additional tasks.	
– discovering similarities + discrimination	Five groups. Two with the number of three and three groups with various numbers, preferably differing a lot from the number three.	**T:** Point at the groups that are similar in having the number three. **C** points at the right groups. **T's** positive and guiding feedback. As an alternative to the teacher's positive feedback or as a continuation: **T:** Why did you point at these groups? **C:** (I pointed…) because they are similar in having the number three. **T's** positive and guiding feedback.
	One or two additional tasks, possibly drawings or pictures presented at the learning panel.	

Appendix 3: Two (a short and a long version) inventories of words denoting Basic Conceptual Systems and related basic concepts.

Appendix 3.1: A short inventory of Basic Conceptual Systems and related basic concepts

1. Colour: Red, blue etc.

2. Shape: Linear shapes: straight line, bowed/curved, angular.
Surface shapes: round, triangular, four-sided etc.
Spatial shapes: spherical, cubic, prismic, cylindrical, etc.
Shapes named according to the look of the object; egg shape, heart shape etc.

3. Position: Vertical, horizontal, sloping, sitting, kneeling, lying etc.

4. 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.

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., in length, in height, in width, in depth in relation to… .)

6. Direction: From the left to the right, up/upwards etc.

7. Number: Small/large etc. number in relation to… Number of ones, of tens, to increase/decrease numbers etc. (Also exact numerals symbolising numbers).

8. Sound/speech sounds-phoneme: /a/, /f/, /g/ etc.

9. Surface Pattern: Dotted, striped, checkered, flowered etc.

10. Use or function: To drink from, to sit on, to write with etc.

11. Substance: Wood, glass, metal, plastic, leather etc.

12. Surface attributes: Smooth, rough, glossy, matt, painted 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. Temperature: Cold, warm, boiling hot T, freezing cold T etc. Exact temperatures.

16. Smell: Nice, nasty, smell of food etc.

17. Taste: Sour, sweet, bitter, apple-taste etc.

18. Time.

19. Change in colour, shape, position… etc.

20. Speed/movement

21. Value

(A. Hansen, 2002)

It's especially important to teach the first 9 (plus possibly10–13th) listed Basic Conceptual Systems by means of the Concept Teaching Model. The most of the others can merely be taught in a more traditional way by naming the concept and conceptual system (heavy Weight, sour Taste etc.) in relation to children having rich sensorial experiences from the near surroundings, cf. a closer comment on this aspect in connection with the proposal for a teaching order of BCS in Kindergarten and primary school.

Appendix 3.2: A long inventory of Basic Conceptual Systems and related basic concepts

An Inventory of Basic Conceptual Systems (BCS) and Basic Conceptual Vocabulary

Introduction

Following is an inventory of the *Basic Conceptual Systems (BCS)* and *Basic Concepts* identified by Dr. Magne Nyborg as essential prerequisites to effective learning. The knowledge of these systems and concepts is crucial to the higher level cognitive skills involved in a student's ability to describe, compare, explain, define and determine principles and rules.

Basic Conceptual Systems (BCS) – refers to any of several fundamental and distinct systems or classes of concepts that are organized together in terms of partial similarities and differences. These systems are labeled through the use of specific linguistic symbols known as superordinate terms (Color, Shape, Position, Place, Size, Direction, etc.) These systems help students to mentally organize and form relationships between the different kinds of information they are exposed to in both educational and social contexts.

Basic Concepts / Conceptual Vocabulary – refers to the specific members of these systems / classes which are organized around specific linguistic symbols. Each basic concept belongs to a specific system/class and represents a specific set with partial similarities and differences. For example, the Conceptual System labeled "*Shape*" (the superordinate term), contains within it the Basic Concept labeled "round shape" (subordinate term). This conceptual term refers to all the shapes that share certain common physical properties (closed shape having a continuous round border), but which also have partial differences (oval, egg shape, circular, larger/smaller, different color, etc.). All concepts belong to a specific Basic Conceptual System.

The following pages contain an inventory of the key *Basic Conceptual Systems* and the *Basic Concepts* that are organized within them as identified by Dr. Nyborg. The numbering system used in this inventory is based on the numbering of the Basic Conceptual Systems in a preliminary version of Dr. Andreas Hansen's booklet/paper January, 2009, entitled: A Curriculum for the teaching of Basic Conceptual Systems and related basic concepts in kindergarten and primary school – exemplified by the curriculum implemented in the Municipality of Balsfjord, Norway. The exception is the numbering of 22. Systems of Measurement. Please Note: The BCSs and Basic Concepts whose translation from the original Norwegian is uncertain are marked in blue and, additions related to American educational needs are marked in red.

Kelly Morgan
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Version updated January 2009

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[18] It should be added that in Nyborg's original paper on BCS, by the end of almost each BCS he added abbreviations (o.fl./osv.) which indicate that there are more to be included in most of the BCS than he had exemplified.

1. Conceptual System – Color

Basic Color Concepts*:*

Primary colors:

red

blue

yellow

Secondary colors:

green

*orange **

*purple/violet **

Non-spectral colors:

brown

black

white

Light / dark shades of color

*pink (light red)**

2. Basic Conceptual System – Shape

Basic Shape Concepts*:*

Linear shapes:

Straight line shape

Arc, bowed/curved, arch shape

Angle shape

2 Dimensional shapes:

Round shape (circle, oval)

Triangular shape (triangle)

Diamond shape

Square shape

3 Dimensional shapes:

Cubical shape (cube)

Spherical shape (ball, sphere)

Conical shape (cone)

Cylindrical shape (cylinder)

Shapes named for the items that they resemble:*

Heart shape

Egg shape

Star shape

Moon (crescent) shape

3. Basic Conceptual System – Position

Basic Position Concepts

Linear positions:

Horizontal position —

Vertical, perpendicular position |

Diagonal, at an angle, slanting position ⁄

Body positions:

Sitting position

Standing position

Lying position

Bent, Kneeling position

4. Basic Conceptual System – Place / Orientation in Space / and temporal orientation

Basic Place / Orientation in Space Concepts:

Placed on something

Over / Above something

Under something

Next to / Beside something

Between things

Inside, Outside of something

On the right side / to the right of something

On the left side / to the left of something

First in a series, sequence

Next in a series, sequence

In which place is it in relation to…?

5. Basic Conceptual System – Size

Basic Size Concepts:

Size:

Length, width, height, depth
Surface area (area, form), volume

Larger in size in relation to other things
Smaller in size in relation to other things

Height - Measurement along a straight line in a vertical position

Taller (larger) in height in relation to …
Shorter (smaller) in height in relation to …

Length - Measurement along a straight line in a horizontal position

Longer (larger) in length in relation to …

Size – general areas of size measurements

- *1 dimensional linear measurements in relation to …*

Length	→	*dm*
Width		*m*
Height	↑	*cm*
Depth	↓	*km/ml*
Circumference		*mm*
Diameter		
Distance	↔	

- *2 dimensional Surface Area in relation to squared measurements:*

m^2
km^2

- *3 dimensional Volume in relation to cubic measurements:*

mL,
L,
1 L = 1 cm³
1000 L = 1 m³

6. Basic Conceptual System – Direction

Basic Direction Concepts:

***General Direction Concepts**: Things similar in that they are moving from left to right, or vice versa.*

- *moving forward or backwards*
- *moving towards the right, towards the left*
- *moving up / upwards, down / downwards*
- *moving inwards, outwards*
- *moving into, out of something*
- *moving towards, away from something*
- *moving alongside / beside something*

Compass directions:

- *moving to the South (Southward) – North (Northward)*
- *moving to the East (Eastward) – West (Westward)*

7. Basic Conceptual System – Number

Basic Number Concepts:

*Groups that are **equal** in number:*

- Groups of ones

- Groups of tens, etc.

Making groups that are larger or smaller in number.

Larger / smaller number in comparison with …

Cardinal Numbers: 1 2 3 4 5 6 7 8

Ordinal Numbers: 1st, 2nd, 3rd, etc.

8. Basic Conceptual System – Sound

Basic Sound Concepts:

General Sounds – *tones, Klangen Noise -* ***Language-Sounds***

- *The tones in songs or the tones made by musical instruments*
- *Several tones together.*
- *Music symbols for notes.*
- *The sounds of things being knocked on.*
- *Noise, dissonance, commotion – unpleasant sounds.*
- *Motor sounds.*
- *Sounds that are strong, weak, high in pitch, low in pitch.*
- *Sounds in nature: animal sounds, birdsong, the sound of wind blowing, etc.*

- ***The sound of Language*** *– the sound of spoken language, sounds are organized into words.*

- *The concept that letters are* ***Symbols*** *for the sounds of language. They represent the Phonemes that are combined to form words.*

9. Basic Conceptual System – Surface Pattern / Design

Basic *Surface Pattern / Design* Concepts:

Striped pattern,

Checkered pattern,

Spotted or dotted pattern,

Flowered pattern

10. Basic Conceptual System – Function / Use

Basic Function / Use Concepts:

Function / Use *-Things identified by how they are used or by their function*

Used to drink with, from

Used to draw, write with

Used to sit on

Used to eat with

Used to cut with

Used to color with

11. Basic Conceptual System – Substances / Materials

Basic Substances / Materials Concepts:

Kinds of Substances / Materials - *Things / parts of things similar in what they are made of.*

- *Kinds of Wood: Spruce, Pine, Oak, Beech, etc.*
- *Glass*
- *Plastic*
- *Leather*
- *Fleece, hide*
- *Rubber*
- *Wool*
- *Cotton*
- *Nylon*
- *Granite, marble, slate, etc.*
- *Ceramic / Clay*
- *Stone ● Cement*
- *Paper, newsprint ● Cartons, cardboard*
- *Metal – Iron / steel, tin, brass, etc.*

12. Basic Conceptual System – Surface properties of Substances, Materials

Basic Surface properties of Substances / Materials Concepts:

- Things similar in that they have a / an…

- *Even - Uneven surface*
- *Smooth surface - Rough surface*
- *Glossy surface*
- *Matt surface*
- *Slick surface*
- *Furry surface*
- *Hairy surface*
- *Polished surfaced*
- *Painted surface*
- *Varnished surface*

13. Basic Conceptual System – Physical properties of Substances / Materials

Basic Physical properties of Substances / Materials Concepts:

- *Things similar in the physical properties of the materials that they are made of ….*

  - *Heavy material*
  - *Light material*

  - *Hard material*
  - *Soft material*

  - *Elastic/stretchy material*
  - *Non-elastic/non-stretchy material*

  - *Solid material*
  - *Liquid material*

  - *Sticky material*

  - *Transparent material*
  - *Non-Transparent, opague material*
  - *Translucent material*

  - *Breakable material*
  - *Unbreakable material*

14. Basic Conceptual System – Weight

Basic Weight Concepts:

Weight - *The word* ***Weight*** *is the name for the physical property of things that is measured by instruments called* ***Scales****. These instruments are used to weigh things or people: bathroom scale, kitchen scale, store scale, letter scale, etc.*

- *We are able to find the weight of people and materials by weighing them with a scale. (property weight)*

- ***Weight*** *– Determining an item's weight by weighing*

- *Finding the weight:*

  - *Using a scale to determine the weight of things like bags of sugar, flour,*
  - *coffee, tea, etc. Determine the weight in number of grams, kilograms.*

  - Using bathroom scales to find your own weight in kilograms.

- Finding or thinking of things that are either large in weight (heavy) or low in weight (light) in comparison with each other: (Piano / flute, table / stool, etc.)

Later:

● *Comparing the weight of equal amounts of different substances: specific gravity.*

15. Basic Conceptual System – Temperature

Basic Temperature Concepts:

Temperature

● *Cold / Low temperature in relation to something*
● *Hot / High temperature in relation to something*

● *Ice cold / Boiling hot*
● *Chilly / Lukewarm temperature*
● *The temperature can change by heating or cooling*

● *Cold / Hot in relation to the body temperature*

● *Temperature above 0°*
● *Temperature at 0° - Ice begins to melt, water begins to freeze*
● *Temperature under 0° - Water freezes into ice*

● *Temperature is measured by means of a thermometer*

Thermometer *is the name of all the instruments / tools that are similar in that they are used to measure temperature*.

100° Water boils and forms steam.

37° to 43° The temperatures at which a fever occurs

37° All human beings are similar in that they have a normal body temperature around 37°C

15° to 30° Summer temperatures in Norway

0° Temperature at zero: Water begins to freeze and ice begins to melt

-5 to -15° Temperatures similar in that they are <u>below</u> zero. Winter temperatures

Thermometer – *measures the degrees of heat*

The degree lines on the thermometer from 0° to 40° and above measure degrees of warm temperatures.

The degree lines on the thermometer from 0° to -40° and below measure degrees of cold temperatures.

16. Basic Conceptual System – Smell

Basic Smell Concepts:

Smell *– We are able to perceive smells/odors by means of olefactory-cells within the upper nasal cavity: as these cells are activated, signals from them are sent up to the brain.*
It is the gases or (Dunster) that substances give off that we sense as smells /odors:

Pleasant, nice smells and unpleasant, nasty smells

The smell of foods

The smell of gasoline

The lack of any smell / odor

The smell of paint

The smell of flowers

The smell of hay, grass

The smell of apples

The smell of manure

The smell of wooden things

The smell of rotten plants

Create a new scent!

Smell *– Materials that have similar smells / odors; they both smell like wood, leather, etc. Materials that have different smells / odors.*

Identify the smell of leather, new cut wood or fresh cut flowers, and compare it with the smell of plastic soles, plastic flowers and other things made of plastic.

17. Basic Conceptual System – Taste

Basic Taste Concepts:

Taste *- We are able to perceive tastes by means of taste-buds located at different places in the mouth; as they are activated, signals from them are sent up to the brain. Taste is closely tied to the sense of smell:*

General Taste Categories*:*

sweet taste

sour taste

salty taste

bitter taste

*Things that are **similar** in taste.*

*Things that are **different** in taste.*

Specific tastes:
apple taste, meat taste, lemon taste, orange taste

18. Basic Conceptual System – Time

Basic Time Concepts:

Time *- Time goes by but we can't see, hear or in any other way feel it pass. But we can observe what happens around us and the changes that occur as time passes. That is the way we can know that time is passing.*

Changes that show the passage of time:

- *Day changes into night and then into a new day.*
- *Winter changes into spring, summer, Fall/Autumn into a new winter, etc*
- *Children grow up, becoming adults, etc.*

Measuring Time

- *Measuring time – exact time, to the point*
- *Measuring time – in terms of distance, mileage to/from a location*

In the number of seconds
In the number of minutes
In the number of hours

In the number of days
In the number of weeks, months, years

- *Measuring the movement of the sun and moon: Calendar*
- *Time measured with a watch or clock: hours, minutes and seconds.*

- *Measuring the time before and after a moment*
- *Long and short intervals of time*

- *Time before now –the past*
- *Time right now – the present*
- *Time that will come after now –the future*

19. Basic Conceptual System – Change in …

Basic Change Concepts:

Changes *that occur over the course of time …*
(Changes that occur by themselves / changes brought about by someone)

*- In **shape**, form by cutting, hammering, sawing etc*
*- In **color** by ripening, by mixing/blending colors, etc.*
*- In **sound** - in volume, in the strength of the sound, in pitch, i lyd-art, etc.*

*- In **place** - by moving to a different location*

*- In **size** - by assembling/putting together, by taking apart, by growing.*

*- In **number** - by adding or subtracting*

*- In **orientation** - by rotating, reversing, etc.*

*- In **direction** - by turning about, turning around, etc.*

*- In **weight***

*- In **temperature***

*- In **taste** or **smell***

*- In **function**, **use***

***Other Changes** – over the course of time:*

- in order - in place, in number
As a result of learning
From something to something else
In sequence from before to after
Has always a cause or more.

***Fall Changes** - There are a lot of changes that occur during the season of fall.*

*- In the **color of plants**: from green to …*

*- In the **temperature of the air and water**: from high to low*

*- In the **length of the days**: from long to short*

*- In the **growth cycle of plants**: from ongoing to little or none*

*- In the **movement of animals (migration)**: from north to south*

*- In the **coat color** and **feather color** of animals: from dark to light.*

*- In **light**: from strong/intense to weak.*

***Cyclical Changes** – changes that occur in the course of …*

***a year cycle**: Summer, spring, winter, fall*

***a day cycle**: Day, Evening, Night, Morning*

20. Basic Conceptual System – Speed / Movement

Basic Speed / Movement Concepts:

***Speed / Movement -** Things that are similar in that they move, change places, with …*

Fast speed in relation to others.

Slow speed in relation to others

Greater speed (faster) in comparison to others

Lesser speed (slower) in comparison to others

Increasing speed (acceleration)

Decreasing speed (deceleration)

Moving along at the speed of:

10 m. per second (the speed of a brisk breeze)

334 m. per second (the speed of sound)

50 km. per hour

90 km. per hour

300,000 km. per second (the speed of light)

21. Basic Conceptual System – Value / Worth

Basic Value / Worth Concepts:

***Value / Worth**: Goods and services that is similar in that they have value for us:*

***Monetary Value**: The amount of money (dollars, cents) that we can get by selling or that it costs to purchase specific goods and services.*

***Services**: Some travel by bus or train, watch movies, go on the merry-go-round, ride the ski-lift, send letters, etc.*

Goods and services that are similar in monetary worth/value:

- *similar in that they have large monetary worth/value*
- *similar in that they have a little monetary worth/value*
-

Goods and services that are <u>different</u> (vary) in their monetary worth/value

*Goods and services that are similar in that they have $10, $20, $100, $1000. in monetary worth/value.**

*One thousand $1000 = One million dollars**

*One thousand $1,000,000 = One billion dollars**

*(Dollar values)**

***Worth / Value**: for each as us, many things have value that is not only measured in monetary value.*

Some things and services may have little monetary value, but still have great value/worth to us.

Some things may have value/worth for us:

- *Because we've had them a long time and have become fond of them*

  - Because they have sentimental value

- Because we have a great deal of use for them, and benefit from them

- Because it required a lot to achieve them (medals, knowledge, etc).

Reverse: Something that has great monetary value, may have little worth / value for us.

***Persons** – A Father, Mother, siblings, teacher or other individuals - can have great value to us because they love us or like us and we them.*

22. Basic Conceptual System – *Systems of Measurement*

Basic Systems of Measurement Concepts:

***Units of Measurement for Size** –*

Linear measurements – km - kilometer, dm - decimeter, m - meter, cm - centimeter, mm - millimeter

Surface area measurements – km^2, m^2, cm^2

Spatial or volume measurements – 1000 cm^3 = 1 L, 1000 L = 1 m^3

***Units of Money** – the monetary value /price (In dollar values)*

*Bills - 1$, 5 $, 10 $, 20$. 50$. 100$**

*Coins – penny 1¢, nickel 5¢, dime 10¢, quarter 25¢, half-dollar 50¢, 1$ coin**

***Units of Measurement for Weight** –*

mg – milligram, g – gram, kg – kilogram, t - metric ton

***Units of Measurement for Time** –*
(Age, duration) (speed – distance per time interval)

Seconds, minutes, hours

Days, weeks, months, years.

*kph (kilometers per hour), mph (miles per hour)**

***Units of Temperature** –*

Number of degrees Celsius (°C)

Appendix 4: Proposal for exercises in analytic coding or multi-faceted descriptions of objects and events. Ultimately these might contribute to the development of a precise and decontextualised language.

The proposal for the exercises in the following is developed by A. Hansen (2002).

Before these exercises are further elaborated upon, examples will be given of how the teacher might make a thorough analysis of objects and events in the immediate surroundings. This is achieved by directing the focus of attention by means of words which denote Basic Conceptual Systems.

However, the effect of this will depend on whether the aforementioned words actually represent current conceptual meanings for the children in question. It should also be noted that analytic coding might be performed in a different order and on a different scale, depending on what is taught and learned about Basic Conceptual Systems, and what is to be analyzed.

- What[19] is this? What is this X called?
- What is this used for? What is the purpose of this? (Can it be used in different ways, for different purposes?)
- What is the number of parts? (In case of several parts)?
- What do we call this part? And that part? Etc.
- Which color is this/are these? (Why this/these colors – if relevant.)
- What shape is this/are these? (Why do you think it has this shape?)
- What size does this/do these have compared to….?
- Where is this/are these placed compared to the rest… (If relevant)?
- What position does this part/these parts have (if relevant)?
- Which pattern can be seen on the surface of this/these parts?
- Which substance is this /is these parts made of? (Why exactly this substance – if relevant)
- How would you describe the surface of this/these parts/objects?
- How heavy is it compared to…? What does the object weigh compared to…?

Additional questions? Cf. the list of BCS in **appendix 3.**

[19] If the questions are used in a guessing game, then the first and the second question should of course be asked at the end, not in the beginning, as illustrated in the example. Also, the additional questions in the parentheses are not necessary in this context.

Experience shows that most children need to rehearse this repeatedly in the same explicit manner shown above, in order to gain competence as far as analytic coding is concerned. Adults might also experience difficulties with this kind of varied and directed coding, especially when there is no preparation involved. It is therefore important for the teacher him-/herself to repeatedly practice and conduct this kind of training.

The question list shown in the example of analytic coding, which includes names of Basic Conceptual Systems, should gradually be learned by heart so that the teacher and children to a greater extent might guide their own focus of attention and perform analyses with the least possible support from such a list.

- To start off, the pupils might, together, be assigned the task of describing an object chosen by the teacher, helped by a conversation guided by the teacher. In this context both the teacher and the pupils can use a written overview of relevant questions, depending on what the pupils have learned of Basic Conceptual Systems (BCS) as support. The teacher writes down whatever comes up on a blackboard or a flip-over etc. Exercises like this in analytic coding should make use of both familiar and less familiar objects. A pencil, ruler, chair, stool, pot lid, rubber- or plastic ball, spatula, mug, egg, cup, hammers, saw etc. are some examples of familiar objects
- The teacher describes an object or a symbol (things, clothes, letters and numbers or other symbols etc.) in the classroom or outside, and the pupils try to find out what the teacher is describing. The function of the object, what it might be used for and the name of the object is revealed only at the end, this way the students have to make an effort to find out what the teacher is describing.
- The pupils might be encouraged to bring objects from home, which will be displayed in the classroom. The pupil in question will then be encouraged to say as much as possible about the object on display, and next his/her fellow students might add to this description.
- An object is passed around among the pupils. Each pupil is allowed to say something descriptive about the object, and the teacher then writes this down. This procedure should generate a very thorough description or a comprehensive analytic coding of the objects, which will be summarized by the teacher at the end of the session.
- When letters, numbers, and other symbols are taught they should be described by means of relevant Basic Concepts and Basic Conceptual Systems. Later on it is possible to make a quiz by assigning the task of describing selected letters or numbers. This kind of quiz should first be directed by the teacher. An example could be the following: I’m thinking about a symbol/number consisting of two parts, both parts are curved, one part is placed on top of the other, the opening of both parts points towards the left. Which symbol/number do I have in

mind? When the pupils grow accustomed to this kind of task, they should be encouraged to direct the quiz themselves.

- True/false evaluations: Is it true or false that frogs have 5 feet, that Lise is wearing a red sweater, that a cow might have horns etc. Another alternative: is it true/false that… 2+3=5 …etc. Such evaluations are of course based on the assumption that the pupils are familiar with the concepts of 'true' and 'false'.
- Analyses of differences and similarities. The teacher shows two, three, four or more objects, drawings, pictures and asks the pupils to point out the differences and similarities between them. The teacher might make this task easier by, before starting, asking in the following questions in order to direct the pupils' attention: Do they have the same number of parts, do they have similar colors; shapes; size etc? Then the attention might be directed towards asking about differences based on the same Basic Conceptual Systems.
- Making an analysis by means of BCS as part of further categorization. For instance, we can analyze an apple with regard to the number of parts, color, shape, size, taste etc. How is it similar and different compared to other apples? Which superior category or group does apples belong to? An apple is a fruit. What other kinds of fruit are we familiar with (and have eaten)? Further conversation might revolve around the origins of the different fruits, where they are cultivated, what they are used for etc. The data might be registered in a concept map for future reference.
- Rehearsing words denoting orientation in space/place such as on, above, underneath, in front of, between, second last, after etc. The pupils should physically experience these spatial orientations, for instance by placing something in front of, or behind etc. a selected object/person. It is important to make sure that the pupils are given plenty of time to verbalize what the object they are handling is seen in relation to, such as: The pencil is placed **on** the table.
- Two pupils are sitting back to back. One of them has been given a drawing which is to be "copied" by the other, based on the first pupil's description. The drawing must be developed in a way that allows for the use of Basic Concepts and Basic Conceptual Systems when describing it. The pupil drawing might ask questions, or questions/answers might be allowed from both parties (these two conditions represent varying levels of difficulty). Other pupils are welcome to observe. After this task is completed, a conversation revolving around the similarities and differences between the original and the copy might be productive.
- Two pupils are sitting on both sides of a vertical surface Both pupils have a set of similar objects (pictures, lego, sticks etc.) in front of them. One pupil is in the lead and constructs something while instructing the other, who is supposed to make the same construction. An example of such an instruction might be the following: First you put a blue block

on your desk, then a red one on top of the blue one, etc. The pupil who is being instructed is allowed to ask questions. An alternative is to allow questions and answers from both parties. Other pupils are welcome to observe. When the task is completed, a conversation revolving around the similarities and differences between the original and the copy might be productive.

- Two pupils are sitting back to back. Each one of them has a drawing that resembles a labyrinth. One of them gives directions for a trail that each of them is supposed to draw. Questions and answers might be allowed from both sides. Other pupils are welcome to observe. Afterwards, the drawings will be compared to one another. Differences or similarities between the original and the copy will be discussed.
- "Anna Games" ("Anna" concepts lotto; Sønnesyn, 1999). This material consists of a box with ten games. By means of these games the pupils have the opportunity to practice the use of (words denoting) Basic Concepts and Basic Conceptual Systems which they have learned through Concept teaching. These games are best suited for pupils having received Concept Teaching, but can also be used by pupils without learning difficulties due to reduced verbal development in order to help them become aware of Basic Conceptual Systems and belonging Basic Concepts. In such a perspective the games might be suitable for pupils aged six to ten.

Appendix 5: Words denoting Basic Conceptual Systems and related concepts also suitable for the description of letters, numerals and other symbols, examples of letter descriptions etc.

Table appendix 5.1 contains words denoting Basic Conceptual Systems and related concepts which are considered important tools for making analysis and precise description of letters etc.

Table appendix 5.1 (Translated into English from "Hansen, Koppen and Svendsen, 2006")

Words denoting Basic Conceptual Systems (BCSs)	**Words denoting basic concepts**
SHAPE	Round, straight line, curved/bowed, angular.
POSITION	Vertical, horizontal, diagonal/slanting.
SIZE; HEIGHT	Large and small in Height (in relation to…)
PLACE (with reference to vertically spatial orientation)	To the right of, to the left of (in relation to …).
PLACE (in relation to lines)	On, under, over/above (in relation to a line).
DIRECTION	Up/upwards, down/downwards, from the right to the left, from the left to the right.
NUMBER (of parts)	One, two, three etc.

When teaching children the letters it's also useful for children to have learned the meanings behind the following words **Part of a whole** (cf. appendix 2.1: Part of a whole), **in relation to** (cf. appendix 2.9: Large in Height…, and pp…on relative BCSs.) and **symbol for.**

It is highly recommended that children are taught the actual BCSs and the relevant selected related basic concepts via the Concept Teaching Model. Only in this way can the teacher be reasonably sure that the mentioned BCSs and related basic concepts will function as effective tools for the analysis and learning of the letters.

Table appendix 5.2: An example of analysis and description of a letter (Translated into English from "Hansen, Koppen and Svendsen, 2006")

b

Questions containing words denoting BCSs in order to facilitate children's analysis	**Descriptions in terms of possible answers**
How **many parts** is it possible to say that this letter consist of? What is the **number** of parts?	The **number** of parts is **two**.
What **shape** do part 1 and part 2 have?	Part 1 has a straight line shape and part 2 a **round** (or alternatively curved) **shape**.
What **position** does part 1 have?	Part 1 has a **vertical position**/is in a vertical position.
What **place** does part 1 have **in relation to** part 2?	Part 1 is **placed to the left of** part 2.
What **place** does part 2 have **in relation to** part 1?	Part 2 is **placed to the right of** part 1.
What **height** does part 1 have **in relation to** part 2?	Part 1 is **large in height** in relation to part 2.
What **height** does part 2 have **in relation to** part 1?	Part 2 is **small in height** in relation to part 1.
How are part 1 and part 2 **placed in relation to** an imaginary or real line?	Both parts are **placed on** the line.
What **speech sound** is this letter **a symbol for**? (Or alternatively – which speech sound does this letter represent?)	This letter is a **symbol for** the **speech sound /b/.**

The next version of this Curriculum for Concept Teaching will probably contain descriptions of all letters in the alphabet.

In the book "Basisbok for begynneropplæring i lesing….– English translation of the title: A basic book for concept teaching and beginning to read (Hansen, Koppen, Svendsen, 2006) the teacher is provided with summaries of questions and answers regarding analyses and descriptions of articulation of speech sounds and letters, **cf. the page below**. The book also describes how to give parents a lesson (lasting for approx. an hour) on beginning to read including informing them about a sheet that will be sent home with their children once they master tasks presented on the sheet to a certain degree, so that the children alone or with only a minor support from their parents will have success in learning letters, combining speech sounds to words, breaking words into speech sounds etc., **cf. two pages below.**

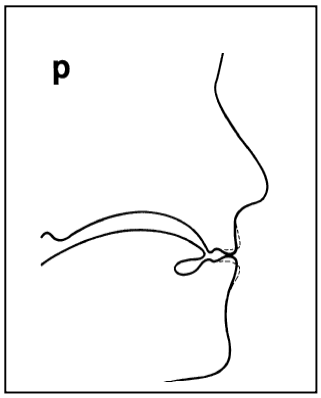
The letter p and the speech sound /p/

The speech sound /p/ on place first in words: pear, pancake, potato, police, Peter, Paula, Pam

Syllables: pa, pe, pi, po, pu, py

Analysis of the articulation of the speech sound/phoneme: say, see, feel in the mouth, hear

What do we do with the lips when making the speech sound /p/?
We press the lips lightly and firmly together.
Where is the tip of the tongue placed?
The tip of the tongue is placed behind the bottom teeth.
Do we make the sound by means of our voice or Without our voice?
We make the sound by blowing the air.
Does the air go through the mouth or through the nose?
The air goes through the mouth.
Is the sound short or long in time?
The sound is short in time.



Analysis of the letter (grapheme): We see, trace, describe and write.

How many parts does the letter p consist of?
The letter **p** consists of 2 parts.

What shape do part 1 and part 2 have?
Part 1 has a straight line shape and part 2 a round shape.

What position does part 1 have?
Part 1 has a vertical position.

What place do part 1 and part 2 have?
Part 1 has place on and under the line. Furthermore it has place to the left of part 2.
Part 2 has place on the line and to the right of part 1.

What heights do part 1 and part 2 have?
Both part 1 and part 2 are small in height on the line.

What speech sound is this letter a symbol for?
Or which speech sound does this letter represent?
Read/say the speech sound /p/.

The letter as a symbol for the speech sound.

p

Letter description summary:

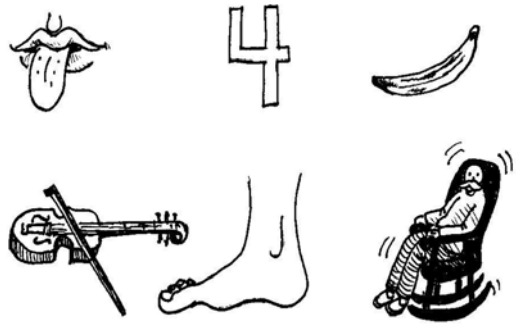
The letter **p** consists of 2 parts.
Part 1 has a straight line shape in a vertical position. Part 1 is placed to the left of part 2, and on and under the line. It is small in height on the line. Part 2 has a round shape. It is placed to the right of part 1, and on the line. It is small in height on the line.

Home task - Speech sound and letter training. (Andreas Hansen, Kirsti. Koppen and Anne Svendsen, 2006)

1. Tell me what you see here?

- **Put a mark on the drawings with a name that starts with the speech sound /f/.**

1.



2. Draw two things that starts with the speech sound /f/. (If necessary, use the backside of the sheet).

2.

3. Describe the different parts of the letter.

- **Trace with your finger at the letter 5 times, while saying the speech sound /f / each time.**
- **Write at the letter with different crayons while saying the speech sound each time**

3.

4. Put a mark under the letter f and say the speech sound while looking at the letter

f

4. (Note: This is not a reading task).

Father has a funny fork.

Mother gets a fine fiddle.

Tom finds five fishes.

Lisa feels fine.

5. Say/read the row of syllables together with an adult three times.

- **Point at the letters when you read the syllables.**
- **Point at and read the syllables loud to yourself, if you can.**
- **Do any of these syllables have a meaning?**

5.

fa	**fo**
fe	**fu**
fi	**fy**

Lesson for (date)……

Name ……..……..…

Appendix 6: A table with summary of Basic Conceptual Systems as prerequisites for learning different school subjects (Nyborg, 1993, pp. 386–387).

This table represents a summary of chapter XII, pp. 302–387 (Nyborg, 2003) with contains a discussion on how **Instrumental Language Functions in terms of Basic Conceptual Systems** are considered basic in learning most subjects, and how Conceptual Systems in general are important in learning coherent knowledge-skill components of cultures.

Subjects	**Symbolized BCSs, related to each subjects**
I Instrumental Language Functions:	
I.1 Native Languages: Meaning Aspects:	**All BCSs** necessary to analytically code when learning concepts and conceptual systems related to wholes and parts of wholes, and when describing them in terms of attributes, relations, numbers in sets, etc.
Skills: Oral language **Speech perception** **Literate Lang.:** **Reading** **Writing**	**Sounds BS**; **places** in **sequences**; articulatory **movements** and **places**; **volume/accentuations/rhythms**; distribution **in time (sequences**), etc. In addition; **BCSs** concerning **part/wholes, shape, colour, Positions, sizes, places (also in spatial rows), number of parts** (of letters, of words, etc.) Analytic coding also in terms of speech sounds (phonemes) and sequences, etc.
I. 2 Foreign languages: (meaning, skills, oral, Literate):	BCSs valid for learning **native languages** are usually valid also for learning **foreign languages**.
I.3 Mathematical language: (oral and "literate")	For the **skill aspects** (oral and literate lang.), very much the same is valid for math. Language as for native language, except for the fact that math. "literate" language is a sign language, while native languages usually are alphabetic lang. **BCSs**: **Number in sets of classified** phenomena **(all BCSs**). **Changes** in numbers and relations between numbers. BCSs related to units of measurement: E.g. **sizes (length, height, depth, areal, volume), value, temperature, weight, shapes/sizes, etc**. Number in **Parts of whole sets. Place of symbols (for ones, tens, hundreds, decimals, etc.).**
II Subjects instrumental in other senses:	
II.1 Geography:	**Places** (on earth, within continents, countries, etc.), reached by **moving (change place**), in diff. **directions** and **distances** (along **rectilinear/straight line shapes**); **number (of persons, units); sizes, part/wholes**, **etc**. For descriptions of more details of geographical realities; **All BCSs.**

II. 2 History:	**Time** - at diff. **times in the past**, following each other in **sequences; at the same time**, or within the **same period of time – in the past: Sequence – places in a row – in time: Number of units of time (Calendars** and other instr. for measuring time: **Age /duration**, measured in units of time. **Historical time** within different areas of knowledge. **Regularities in the past** may be used to predict corresponding regularities **in the future**.
III Natural sciences: **III.1 Biology:** - **Conc. Plants,** - **Animals,** - **and Men**	**Alive – not-alive/dead**: Being alive: Changes in terms of **growth and learning**: **Changes in size, weight, shape, colour, etc.; functions; parts of wholes**; made of **substance** with **surface attributes; patterns; tastes; smells; number of parts** (and part of parts) i.e. most **BCSs.**
III.2 Chemistry:	**Substances, basic and composites**: **attributes of substances (hard, soft, liquid, solids, gases, etc.**); density (**weight pr unit of volume; number of units**); **changes by mixing or by reactions; colour; part/wholes within and between atoms and molecules); functions (used in making --), etc.**
III.3 Physics:	**Forces** may cause **staying at rest or start/maintaining movements (changes in place**), in diff. **directions and distances (e.g., lengths); Number of weight units of forces, etc.**
IV Religion and the study of societies, as subjects:	
IV.1 Religion, bases for beliefs and moral	**Alive – not alive/dead** (belief in **life after death**): To the extent knowledge about the "**natural" phenomena or reality** is necessary in order to describe **right and wrong acts**, daily realities of life, in order to understand the "meta-natural", **all BCSs** may be necessary.
IV.2 Study of societies:	In which **groups of persons (number in sets**), are someone motivated to live **close (place/distance**) and **cooperate.** Motivated by internal forces (interests) or by external **forces** (attraction or fear of punishment/ power; government). Societies in different **places**; when many aspects of reality are involved: **All BCSs** may be necessary.

<u>V Subjects concerning arts and athletics:</u>	
V.1 Music - knowledge: **- performance:**	Sounds in terms of tones and phonemes; place in time rows or sequences (of tones); or differ. Tones (numbers in sets) occurring at the same time (harmonies, in addition to melodies); changed tones, harmonies, rhythms/accentuations, dynamics (volume change). When symbols are used, many BCSs apply.
V.2 Painting/sculpturing	**Shapes, colours, substances, positions, sizes, place-relations, parts of wholes, part-whole- relations, functions, content/meaning, etc.**
V.3 Athletics and dance: (concern. acts/events)	**All BCSs** which are necessary in order to describe acts (or events and links of events) and **positions** are relevant; **changes by moving (change place), change positions, move** in diff. **directions** and **distances**, at diff. s**peeds** (e.g. units of length / **number in set) pr time unit**; **forces involved, functions** of links or whole acts, etc. Dances to known music (see above).

Appendix 7: A description of a model for the teaching of skills, according to M. Nyborg (1993)

This model will be of considerable assistance during the process of reflecting on and organizing the teaching of different types of skills[20].

The model is divided into three phases:

1. The cognition phase

In this phase the children are supposed to learn via observations, i.e. by observing acts and other events – as a basis for subsequent self-instruction, imitation and self-evaluations.

The teacher (or other capable persons) acts as the model. In order to demonstrate the act so that it is easily perceived, the teacher should in his demonstration try to "mark" or emphasize the different parts of the act (the links of a sequence), if possible. For instance, the writing of the symbol "2" is emphasized by a small pause between each part. At the same time the teacher is verbalizing what he is doing while performing the act: First I write/draw the curved line of 2 like this (T performs). Then I go on next with writing this line (T performs) in a sloping-(slanting) position in direction downwards to the left. Finally I write the last line in a horizontal position in direction to the right (T performs). The teacher must adjust his explanations, pauses and the speed of his movements in accordance with the actual children's prerequisites for learning.

The same principle should also be applied in connection with the teaching of new words that are difficult to pronounce, when teaching dancing, or other gross motor acts that might be difficult to "grasp", when teaching how to play different instruments, when teaching the basics of drawing and painting, when teaching mathematical algorithms/strategies etc.

[20] Whereas concepts of classes are defined as LTM (long term memory)-stored knowledge about partial similarities and partial differences, cf. the definition in appendix 1, p. 4, skills are defined as sequentially organized, LTM-stored experiences.

Before the demonstration the teacher should ask himself the following two questions in order to generate an understanding of how he might model the act so that it is easily understood by the child.

(A) What parts/links can this act/event be divided into?

(B) How can I best explain what I am demonstrating for the children while performing the act?

2. The imitation and fixation phase.

Imitation in terms of trials, subsequent evaluation, choices and fixations.

The naming of this phase is a reflection of its contents. The child tries to imitate what it has just observed while evaluating whether the imitation is correct or not. The teacher should observe and be supportive while the child makes his/her attempts to perform the act correctly. When the child for the first time is able to perform the act in a correct manner, usually deeply focused, we might say that the child has reached the fixation level.

3. Exercises directed towards automation

Towards a level of functioning at which the act or perception seems to take place automatically; without attention paid to it, with the level of energy spent on it at a minimum level, not easily disordered by stress, etc.

Usually the act must be performed repeatedly in order for it to become more or less “automatic”. The amount of exercise necessary and the investment of time will of course depend on the complexity of the act. The teacher should also support the child in order to facilitate the learning of the skill in question.

Some comments on the model for the teaching of skills (A. Hansen, 2006)

As has been pointed out, the use of language should go hand in hand with the demonstration of skills, and thus facilitate skill learning. This is especially likely to happen when the understanding of the language applied is shared by the "partners" in skill teaching/learning. If the child has learned basic conceptual systems and related basic concepts to a verbally conscious, generalized and transferable level, the teacher should take great care in applying those in the cognition phase etc., cf. the demonstration and the corresponding verbalizing concerning the writing of the symbol "2" in the cognition phase above. According to a theoretical analysis (Nyborg, 1993; Hansen, 2006) and experiences it seems safe to assert that the use of language often has a great impact on the learning of skills. However, there is a two-way relationship in this regard: The knowledge of BCSs may very often facilitate skill learning, as the application of oral language skills contributes to the learning of concepts and facilitates the organization of single concepts into hierarchically organized BCSs and more complex conceptual systems.

Although the model for the teaching of skills distinguishes three phases in a sequential course, in many cases it will be necessary that the pedagogue and the child alternate between the phases and the tasks that need to be solved by the child in each phase. This is probably particularly important when it comes to the tasks that are to be solved in the cognition phase and the imitation- and fixation phase.

The time frame of each phase will often vary depending on what type of skill the teaching revolves around. It usually takes quite some time and practice before something is automated, and for this reason such a task requires a lot of hard work. Since the exercise in the automation phase is based on what is imitated and fixated in phase two, it is most important that what is rehearsed is correct to begin with. This leads us back to the cognition phase and the importance of learning by observing in relation to imitation and fixation of an event/act in this phase.

The child's involvement when it comes to learning relevant skills is also a matter of motivation. The motivation behind the involvement in relevant skill learning is in other words an important precondition that among other things might be "built up" if information is given on the significance of mastering the skill, if the child does not have sufficient knowledge on

the skill and wants to learn it. The adaptations made in the first two phases and the aforementioned conditions for benefiting from a process of learning by observing will be particularly important to keep in mind, considering the importance of the child, without too great difficulties, should experience mastering in terms of a correct fixation. Thus, the motivation to keep on practicing with a goal of the automation of a skill is established.

The significance language use can have for skills learning, for instance in terms of analytic coding in connection with BCS, has already been clearly pointed out. Taking advantage of language is in other words an important and facilitating factor when it comes to skills learning. There is still an aspect of language use that ought to be stressed in connection with skills learning and the performance of skills, the fact that language will influence the act differently depending on where the person is positioned regarding the process of imitation, fixation and practice towards automation of the skill.

Whereas language might be a facilitating factor in regard to the tasks that are to be solved in the first two phases, an active use of language will increasingly be left in the background since the child has a goal of automation, which means that the act will eventually be performed automatically, without very little of attention paid to it. An active use of language will on this level possibly delay or disturb the automation process or the actual acting based on an automated skill.

In line with this, a demonstration accompanied by instructions (cf. the cognition phase) might facilitate the child's first attempt at writing a letter correctly (cf. the imitation- and fixation phase), for instance by the child verbalizing to itself when it comes to the performance and possibly regarding the appearance of the letter. When further practice towards automation then takes place, the verbal activity is increasingly left in the background before disappearing altogether, in order not to disturb the automation of the skill.

This is comparable to learning the skills involved in driving a car (in regard to the learning of motor skills). At first any inexperienced person will depend on the "pedagogue's demonstration and instructions. Next the person, based on his/her observations, will be able to imitate and instruct him-/herself, and this will in turn become the foundation from which his/her actions will be performed and coordinated. When the skill is learned and has reached an automated performance level, the need for verbal/linguistic "control" will disappear and

the individual is able to drive with a very small degree of attention directed towards the technical aspect of driving and might instead focus on paying attention to what is going on in traffic in order to adjust his/her driving to the environments (perceptual motor skills).

Appendix 8: A way of assessing children's learning and mastery of Basic Conceptual Systems and related basic concepts as a result of Concept Teaching, some points for a report on CT, and a form for summing up results

Introduction

The following assessment of children's learning should be compared to the table or form registering performance mentioned earlier in the curriculum. The main purpose of this form is to evaluate children's mastery of Basic Conceptual Systems and related basic concepts over a defined teaching period. A form for registering performance is provided on the last page of this appendix. An example of how to fill out the form can be found on page 30.

The teacher observes how children master the tasks included in the 3 phases of the CT-model and makes the registration of the performance in the form as soon as possible after the teaching.

The results should also be compared to children's functional level or possible change in functional level in reading and writing, mathematics etc. over a set period of time. The teacher should also consider to what extent he has made use of taught and learned Basic Conceptual Systems as tools and analytic coding in his teaching of school subjects.

Assessment of (basic) conceptual functional level according to Turid Lyngstad

Direct assessment of children's learning of Basic Conceptual Systems and related basic concepts after completed CT should be carried out by means of a pre-determined procedure. One should be especially careful when assessing "at-risk" children with regard to language and learning difficulties which may be due to incomplete development of oral language skills. Children without language- and learning difficulties can also be assessed by the same procedure in order to discover possible changes in conceptual functional level.

The following form is an example of assessment of "round shape" as a concept and conceptual system. The form is a brief version of a diagnostic concept test developed by Turid Lyngstad. The test contains 4 exercises.

Item #	Materials	Question to the child	Notes of what the child says	Score
1. Item – learning of associations, cf. phase one of the CT-model: **Selective association** **(CT model = The Concept Teaching Model)**	A piece of cardboard with round shape	Look at this piece of cardboard. What shape does it have?		
2. Item – learning of differences without verbalising, cf. phase two of the CT-model: **Selective discrimination**	Three or more objects/drawings, one with round shape	Point at the thing/drawing that has a round shape.		
3. Item – verbalising of detected partial similarities, cf. part one, phase three of the CT-model: **Selective generalisation**	Three to five objects/drawings that have a round shape	In what way are all these objects/drawings (or how are all x) similar?		
4. Item – detection of partial similarities + learning of differences without verbalising, cf. part two, phase three of the CT-model: **Selective generalisation + discrimination**	Objects or drawings. Three with around shape and two with other shapes.	Point at the objects/drawings that are similar in having a round shape		

This particular variant compares a child's test score in relation to maximum conceptual functional level according to criteria developed by Magne Nyborg, and not in relation to other children's test results in the same age group. The scoring criteria for the concept and the conceptual system called round shape follows.

The scoring should follow this template:

For item 1:	Round (name denoting concept)	= 1 point.
	Round Shape (name denoting concept + conceptual system)	= 2 points.
For item 2:	Right pointing out.	= 2 points.

For item 3: Verbalising of partial similarity (they are similar in) + naming

of concept and conceptual system	= 3 points.
Verbalising of concept and conceptual system	= 2 points.
Verbalising of similarity and conceptual system	= 2 points.
Verbalising of similarity and concept	= 2 points.
Verbalising of conceptual system or concept	= 1 point.

For item 4:	Pointing out the right alternatives	= 2 points.
	Pointing out more than one, but not all	= 1 point.
	Pointing out one, or both right and wrong ones	= 0 point.

Maximum score for each concept and conceptual system is 9 points – consisting of 5 points for right verbalisations and 4 points for right pointing outs.

The diagnostic test will provide a good indication of the mastery of Basic Conceptual Systems and related concepts. It will show if the BCS and related basic concepts have been learned to an extent where they are transferable to the test situation after a defined teaching period.

The next page contains Turid Lyngstad's template developed for the purpose of assessing the level of mastery in the chosen Basic Conceptual Systems and related concepts.

Diagnostic Concept Testing

According to T. Lyngstad, Norway, brief variant

Name:…….. Date:……

This test variant compares a person's test score in relation to maximum conceptual functional level according to criteria developed by Magne Nyborg and not in relation to other persons' achievement at the same age.

Name denoting basic concept and basic conceptual system:…….NB:

Item #	**Materials**	**Question to the child**	**Notes of what the child says**	**Score**
Item 1. – learning of associations, cf. phase one of the CT-model: **Selective association** **(CT model = The Concept Teaching Model)**				
Item 2. – learning of differences without verbalising, cf. phase two of the CT-model: **Selective discrimination**				
Item 3. – verbalising of detected partial similarities, cf. part one, phase three of the CT-model: **Selective generalisation**				
Item 4. – detection of partial similarities + learning of differences without verbalising, cf. part two, phase three of the CT-model: **Selective generalisation + discrimination**				

Assessment of children's ability to perform analytic coding.

Children should be given the task of performing analytic coding of chosen objects in regard to the BCS which have been taught in a defined teaching period. This is most interesting if such an assessment takes place both **before** and **after** the set period of concept teaching, so that it becomes possible to compare results directly. It is of course necessary to utilize the same testing criteria in both tests.

For instance, the subtest "verbal expression" borrowed from the ITPA-test (Illinois Test of Psycholinguistic Abilities) can be used, but there may be other tests or subtests that are suitable for this purpose.

This subtest may be useful in a formal way (for those who have access to the ITPA-test), if one requires a standard for children's ability to make many-faceted descriptions of objects and events (which in this case is comparable to children's mastery of analytic coding).

The test could also be used informally, giving the child an opportunity to perform analytic coding in relation to this subtest. The description of a nail is the introductory exercise. The child is assigned the task of telling everything it knows about a nail. If the child encounters problems when describing the nail, he/she may receive help. One can help the child describe two, three or maybe four of the nail's attributes. This exercise will be employed in order to ensure that the child understands the task at hand.

Subsequently the child is presented with a ball, a block, an envelope, and a button, and will be asked to describe the object at hand. It is possible to help the child by asking the following questions if he/she does not continue with the exercise: Do you know more about this object? The teacher makes a written account of the child's descriptions and compares performance to the assessments made **before** and **after** the teaching period where the CT-model is utilized. The same test criteria and the same prerequisites for the test must of course be employed on both occasions.

Teacher supported assessment of the mastery of Analytic Coding

An easier form of assessment for those who do not master the mentioned exercises well could be a form of teacher supported assessment of analytic coding. This is performed in the following way. The teacher asks the child questions regarding the number of parts, colour, size, shape, and position etc, in object, letters and numbers, consult **appendix 1**. Under such circumstances the goal is to discover whether the children in question have made progress in their performance.

Controlled Drawing Observation

Another form of assessment is called Controlled Drawing Observation. This form of assessment cannot be called a test, but could be described as an attempt to create a structured situation where the goal is to make observations. These observations can be used as a basis for communication between the specialists and the unskilled in pre-school and primary school. This particular form of assessment can for instance be employed in September for pupils in the 1st grade, and again in May or June at the end of the school year. The results present the possibility to assess how children master varying basic concepts, as well as the ability to process and execute fairly complicated oral instructions.

Controlled Drawing Observation, oral instructions:

Material applied: A sheet of paper (A4), and writing tool. The instructions are oral and will be given only once.

Part 1

1. Draw a ball in the middle of the sheet of paper.
2. Draw a line from the ball towards one of the corners of the sheet of paper.
3. Draw lines from the ball towards the other corners of the paper.

How many “rooms” do you have on the sheet of paper?

Part 2

1. Draw a line from the ball towards the edge of the paper.
2. Draw lines from the ball towards the middle of the other edges of the paper

How many “rooms” do you have now?

Part 3

You will now draw in the rooms. You may choose the starting point yourselves. Do not start drawing until you receive a full description from the teacher.

1. In one of the rooms you will draw 3 lines. They do not need to be of similar length.
2. In another room you will draw 3 triangles. The triangle in the middle shall be the smallest one.
3. In a third room you will draw 4 balls. Two of the balls shall be of equal size.
4. Now you will draw 4 squares in a row. The last square will be the largest.

Short break.

Part 4

You will now receive a longer instruction, listen very carefully before you start drawing.

5. Draw a tree in one of the empty rooms. It is an apple-tree. 3 apples are hanging in the tree. 5 apples are lying on the ground.
6. Draw a house. The house has 3 windows and a door. The house has a slanting/diagonal roof. The house has a chimney, and smoke is rising. The house has a flagpole beside it, with a hoisted flag. The sun is shining.
7. Draw a man/human being.
8. Draw a cat.

Do not assign this exercise to groups exceeding 8-12 pupils

One teacher will lead the exercise, and another (pre-school) teacher will observe the children during the exercise and take notes in relation to the following points:

1. The child asks the teacher to repeat the instruction.
2. The child tries to watch the child seated alongside in order to determine what to draw.
3. The child shows general signs of uncertainty.
4. The child shows an underdeveloped grip on the writing tool. Impaired motor function.
5. Other relevant observations, for instance spontaneous expressions, signs of relief when the task is completed etc...

How to write a report summing up completed Concept Teaching in relation to a defined period of time

A report should contain a short description of the teaching and evaluation (2–4 pages) of the results achieved in a set teaching period. The report can be used to evaluate individual children or groups. The report should contain a description of the following points:

1. On which level did the child (children) function before the period of Concept Teaching?

2. What did the period of Concept Teaching contain in terms of exercises/tasks?

    - Concept Teaching of Basic Conceptual Systems by means of the CT-model: which BCS' and related basic concepts have been taught?
    - Exercises in Analytic Coding?
    - Have taught/learned BCS' been utilized as tools when teaching school subject? What has been done? How has it been done?
    - Has CT been applied in special an educational setting, in a regular educational setting or in combined settings?
    - Other?

Developmental trend and results

Development and results measures of children's functional level after a defined period of concept teaching are summed up. Subsequently it is important to evaluate whether a positive

development is at least partially the result of concept teaching, and not a result of some other "competing" factors.

When evaluating such a development, it is very useful to be familiar with the child's history of performance, preferably 1–2 years before the period of concept teaching. If the child shows a positive development after concept teaching was utilized for a defined period (without any other changes in the teaching offered), it may be reasonable to assume that CT at least partially have helped the child improve performance and reach a higher functional level in the areas tested.

One may also include the children's opinions on concept teaching. Have they liked or disliked CT? Do the children show a higher level of concentration and motivation after CT? Do the children show increased involvement when doing actual exercises? If comments made by parents can help evaluate CT, one may include these.

Table appendix 8.1 Result form for concept teaching already completed

Week/ year	**Words denoting Basic Conceptual Systems and related basic concepts plus possible tasks for relevant concept application**	**Dates, possibly number of times and use of time**	**Evaluation of the learning results**

The code for the evaluation of learning results should be relatively simple, an example is a grading of results from complete to incomplete degree of mastering, such as +. +**?**. –. An alternative is to use terms like **OK**, not quite satisfactory, poor or make descriptive evaluations such as: The child masters the tasks in the SA-phase fairly well, **has some trouble with** the tasks in the SD-phase and **does not master** tasks from the SG-phase.

SA =Selective Association
SD=Selective Discrimination
SG=Selective Generalization

Appendix 9. Ideas for a collection of materials for the teaching of Basic Conceptual Systems (BCS) and related basic concepts in accordance with the principles of the Concept Teaching Model.

From the book "BU-modellen" (Nyborg, 1994) ("The CT-model" – This book is not translated into English)**.** The appendix is somewhat modified.

Using object and events found in the close surroundings

As mentioned earlier, an important principle of the CT-model is that the most important sources of experience are to be found in the pupil's close, everyday surroundings. This might not apply in every case, since some schools and kindergartens are situated in places that lack a lot of what ought to be part of children's sources of experience as they develop.

It will, however, be important to have the close, concrete objects that can be sensed in many ways as a starting point. Nature as it appears in a variety of forms should often be the arena used when teaching BCS. It might be possible to say that BCS "are" or exist in all objects and events and might be abstracted from most existing things.

Ideas for a collection of teaching materials

It has often been useful to start with "the little things", including small scale models of actual objects. The following suggestions for teaching materials are based on years of experience.

Part-whole:

Objects made up of parts that might be easily detached and put together again. This is a precursor to an intellectual understanding of dividing whole objects into smaller parts.

Colour-Basic Conceptual System (BCS)

Objects, surfaces or lines, pieces of fabric, wrapping paper. Candles, yarn, etc. which might result in representative collections of colours within the range of different shades of red, blue and green etc.

Shape - BCS

Linear shapes: curved shapes, straight line shape shapes, angular shapes:

Ruler, a carpenter's angle from woodshop, angles made from thin/narrow moldings, templates for making curved shapes. Pictures/models of Roman arches in churches and other buildings/constructions. Bow belonging to stringed instruments, etc. Curved shapes in stringed instruments, faces and the rest of the human body.

Surface shapes: Round shapes, triangular shapes, four-sided shapes etc.

Small wheels and other objects or parts of objects that have round shape (the top of mugs and drinking glasses, bowls, pans, frisbees etc.). Objects that have elliptic shapes (for instance cupboard decorations, gems framed in rings etc.). Round, triangular and four-sided shapes found in traffic signs. Houses usually consist of many four-sided surfaces. The square shape is particularly important. It is suggested that square decimeters (dm^2) and square meters (m^2) are made available for the pupils. Helpful templates for making shapes should also be at hand.

Spatial-shapes: spherical, cubic, prismic and cylindrical shapes.

The shape of a cube is particularly important since it constitutes the foundation of spatial measuring. As it has square shaped sides it is recommended to start with cubic-centimeters (cm^3) and cubic-decimeters (dm^3). The latter compares to cartons that contain one liter. A "cubic-meter-cabin" should be built and used in order let the children experience the size of a cubic meter. Balls, marbles, eggs, cylinder-shaped mugs and cups are other examples of teaching material applied for experiencing spatial shapes.

Position-BCS:

Vertical positions: Use a plumb with an attached string (weight used by bricklayers or a homemade weight). The pendulum found in clocks. The hour hand in watches, corners and edges in rooms, letters and numbers on blackboards or screens.

Horizontal positions: A plastic bottle filled with coloured water is held in horizontal position in front of a horizontal surface. Then the bottle is rotated to show that the water surface always stays in a horizontal position. An arrow or a pointer on some kind of a surface placed on the wall which can be used to show various positions in relation to vertical and horizontal lines. Letters, numbers, the sides of floors etc are other examples suitable for highlighting horizontal position.

Diagonal/slanted positions: All of the positions that diverge from the horizontal and vertical positions are diagonal positions. These might be found in diagonal ceilings, in letters, numbers and other locations both indoors and outdoors.

Place-BCS:

In addition to the pupil himself/herself there are a number of things that might be used to demonstrate“place in relation to something else”. Small models of chairs, cars, animals, trees, houses etc. and also toys of different kinds can and should be used.

Size-BCS

When describing size specifying only big or small sizes (height, length, width/breadth, depth) in relation to something else, the best thing is to use objects that differ in many respects. It is therefore important to have several objects available from the beginning, small models of houses, trees, pictures, animals etc. and then compare them two at the time. They will then be placed in a way that makes it natural to **talk about** one of them as being bigger than the other, or smaller than the other.

When measuring length, defined as measurements along straight lines in different positions, measures of length such as cm, dm, m etc. must be applied. Furthermore, surface shapes must

be measured according to cm^2, dm^2, m^2 etc. When measuring spatial shapes, the unit is often defined in terms of the cubic shape and measured in terms of cm^3, dm^3, m^3 etc.

We have found it appropriate to start out with decimeters and meters, square decimeters and square meters, deciliters and liters as measuring units. It is therefore suggested that sticks measuring 10 cm, and rulers/folding rule are kept available, along with several square decimeters made of carton and at least one square meter of folding thick paper used as measuring units. In addition, empty milk cartons should be included as part of the teaching material. Later on, in the subjects of physics and mathematics other measuring units ought to be used and demonstrated on a regular basis.

Number-BCS:

It is worth mentioning that several things belonging to the same category must be kept together, so that the pupils can make groups by counting them and then dividing them. “We find number by means of counting, and we can count one by one (ones); but we can also make groups of ten, which makes it easier to count ten by ten (tens), hundred by hundred (hundreds) etc.

BCS for different types of Substances:

In order to teach concepts of substances and materials that later can be related to chemistry in the future, it is necessary to collect pieces of things that are made from the different substances such as glass, plastic, wood, metal, stone, porcelain etc. Water is an easily available substance to start with, if the differences between solid, liquid and volatile substances are taught, (vapor-water-ice).

We have focused on the substances found in everyday life, including fabric and rubber. Our attention has been particularly directed towards the qualities of the different types of substances – the mass; their weight, temperature, the surface structure, function, the sound it makes when you tap it, the smell (the smell of leather for instance).

BCS concerning the properties of the substances:

Blocks made from hard/firm? substances, softer substances, sticky substances, brittle or fragile substances, elastic and non-elastic substances, durable substances versus non-durable substances must be included in the collection of teaching materials. Other attributes, flammable versus non-flammable, might also be useful to take into consideration.

Weight-BCS:

It is our experience that after having taught children large weight, one needs only a few tasks to make the completely aware of the opposite, namely small weight. This is also true for the teaching or larger and largest weight. At the same time we often express synonymously large weight: heavy, larger weight: heavier and small weight: light, smaller weight: lighter etc. The main idea of applying the word for concept (large) together with the word for the basic conceptual system (weight) should all the same be practiced in teaching phases in order to help the pupils construct the conceptual system. Scales are usually the best instruments for weighing.

Surface properties-BCS:

Any objects are constructed of some type of substance. The substance used to construct the object might have a smooth or a rough surface, even or uneven, a shiny as well as a smooth surface etc. By shining or polishing the surface it can be altered to appear smoother and shinier, and varnish might make it even more smooth and shiny. If the varnish is polished, it might become dull again. Once again it is necessary to collect samples of the different types of surface.

Surface Pattern-BCS:

Teaching material for the teaching of surface pattern-BCS should include objects, pieces of fabric, plates (in all shapes and sizes) with different surface patterns such as dotted, striped, checkered, and flowered, etc.

Temperature-BCS:

Temperature can be felt “on the body”. Temperature can be inferred from frost on branches or in the grass, and from the fact that water is covered with ice. The air may “quiver” with heat part of the year, and also from the steam rising from boiling water. In order to measure temperature, different kinds of thermometers are required There should also be a thermometer outside to measure the variations in temperature outdoors, in addition to one showing the temperature inside.

There are a number of ways to express temperature: from cold to low temperature via cool temperature, from lukewarm to warm and high temperature.

The work on temperature should therefore start with attempts at estimating the temperature compared to that of the hand or the cheek. In our experience children respond well to taking part in the measuring of temperature both inside and outside, i.e. every day for a period of time and at the same time of the day.

Sound-BCS:

It is worth noting that sound arises in several different ways. Both the teacher and the pupils are capable of producing several different sounds, sounds originating from using language, tones, melodies and noise. Tones might also be produced by means of different musical instruments.

A wide range of sounds can be heard in nature, at home and in traffic. Particularly in the spring, the sounds of all the wild birds are easily recognized because of their characteristic singing. Animals produce their own sounds and noises. Above all, children need to learn different sounds by listening to songs and also to sing themselves, and by hearing and using the spoken language.

Smell- and Taste-BCS:

Smell and taste often come together in a sort of combined experience. This is reflected in the fact that they are often named in the same way. The words used to describe smells, such as

‘good’ and ‘bad’, are also used to describe taste. Subcategories are named by the source of the smell, and the same principle applies to taste: The smell of apples, oranges, all of the different smells of flowers, etc.

In order to taste something, you need to put it in your mouth. There are several bad smells that can be identified, despite not having tasted the source of the smell, for instance rotten eggs. Among all of the different kinds of tastes it should be possible to let children experience the taste of something sweet, sour, salty and bitter.

Time-BCS

The passing of time cannot be sensed without external or internal points of reference. Such points of reference must take place on a regular basis. In order to experience the passing of time, children must experience points of reference such as our heart beats, that night becomes day, winter becomes spring, spring becomes summer and summer turns into fall, like an everlasting cycle. We measure time by registering seconds, minutes, hours, days, weeks, months and years by means of clocks and calendars.

Besides what is already mentioned, a metronome has proven useful for “cutting” time into “present times” with intervals of a few seconds. For the measuring of short spans of time, stopwatches are useful instruments.

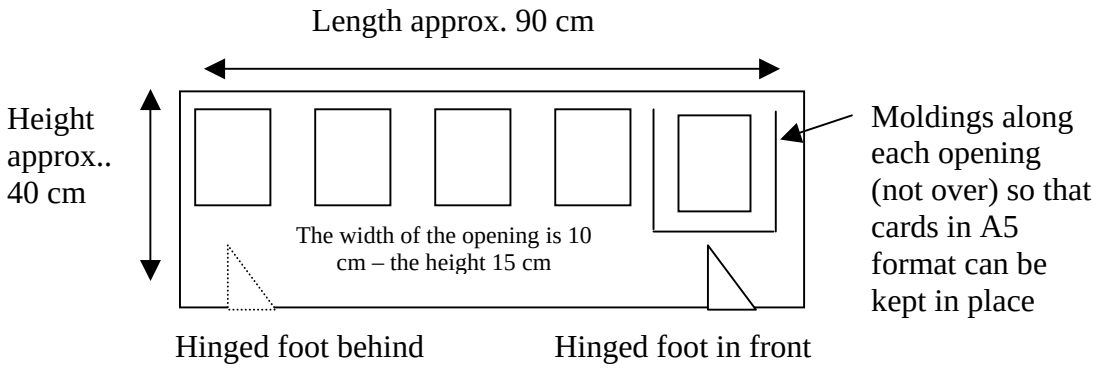
BCS concerning changes:

Changes can be experienced in regard to colour, shape, position, place, number, size, direction, etc. It is possible to give children experiences with change, for instance by mixing colors or studying change of color in the fall and the springtime, by cutting, folding or giving shape in different ways, by changing positions of things that are supposed to change positions etc. There are numberless opportunities.

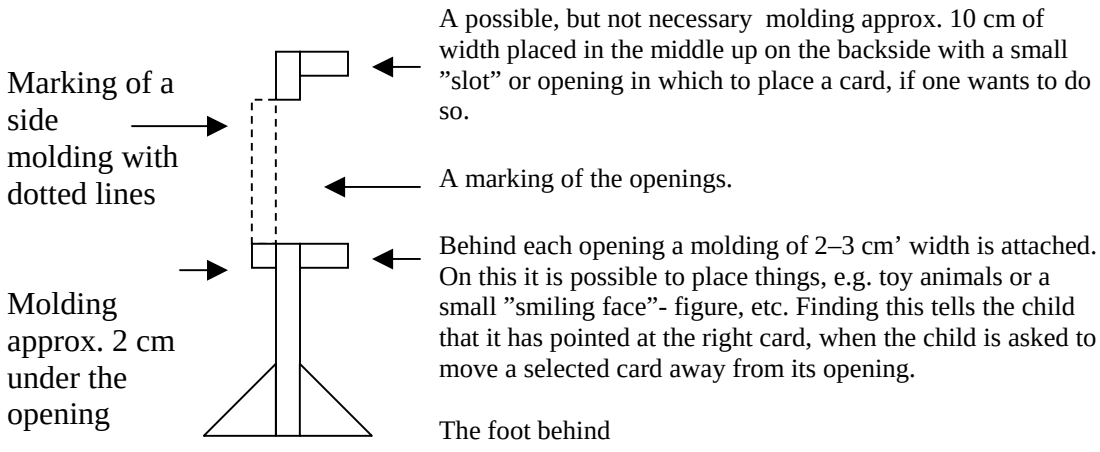
Appendix 10: A detailed description of a learning panel

The learning panel may be applied in the Selective Discrimination phase and the Selective Generalization phase of the Concept Teaching Model. Examples of tasks can be found in the proposals for teaching programs in Appendix 2 and in the description of the Concept Teaching model. The panel can for instance be made from plywood or other materials that are easy to handle.

The learning panel with its five openings seen from the front side.

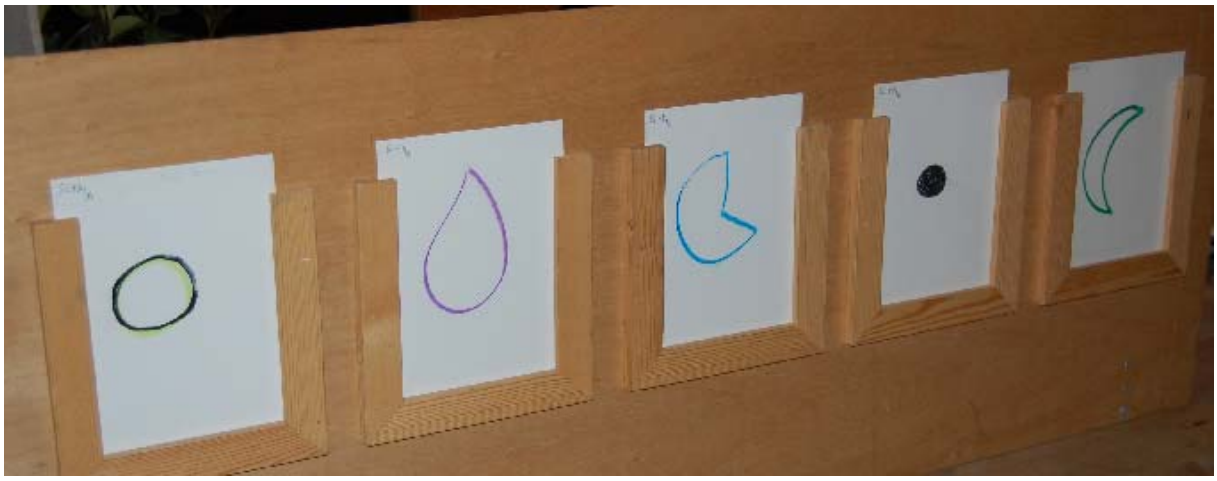


The learning panel seen from its left side.



The learning panel.

A situation in the second phase, the SD-phase: Point at the line that has a straight line shape.



A situation in the third phase, the SG-phase: Point at the figures that are similar in having a round shape.

The learning panel seen from behind.

Appendix 11: Proposal for Concept Teaching (CT) for pupils without learning difficulties, when starting with CT from the 3rd-5th year. Depending on what grade the pupil is in, adjustments might have to be made.

By Andreas Hansen, National Support System for Special Education (Statped Nord), Norway, 2007.

1. The teacher distributes a survey of words denoting Basic Conceptual Systems and belonging concepts (one sheet of paper for each student), cf. **appendix 3.** An enlarged inventory of "the Basic Conceptual Systems (BCS)" is placed on display in the classroom.

2. The teacher starts the training in Analytic Coding (AC), cf. **page 2 in appendix 4** and beyond for suggestions for different types of tasks. It is of great importance to be specific with the language used in these tasks, i.e. to use subordinated and super ordinate terms consistently together where this is appropriate (for instance what shape does this thing have? A curved shape. Point to the figure with a striped pattern and four-sided shape).

3. The teacher applies the principles of the CT-model, for the teaching of 1–3 concepts per BCS, more if necessary. This applies to the first 10-14 BCS that are listed.

4a. The teacher presents hierarchically arranged presentations of selected BCS.

4b. Alternatively: The teacher assigns the pupils in groups the task of writing words denoting concepts within selected BCS in a hierarchically arranged survey that is presented in class later on.

5. Very important: In connection with the work described in point 4a (possibly point 4b) the pupils will be asked to find as many examples as possible in the near surroundings representing the concrete things necessary to learn the denoted Basic Conceptual System and Basic Concept in question. That is, the pupils should find examples of straight lines for rectilinear shape, examples of squares, rectangles etc. for four-sided shape, an empty roll of toilet paper and other examples of cylindrical shapes, balls and other objects for spherical shape, etc. These various and concrete examples of shapes must be handled and experienced.

If necessary, the teacher and pupils might bring relevant examples to school. Making a collection of teaching materials for each named BCS is a good idea.

6. <u>For somewhat older pupils</u>: The pupils are asked to form groups and discuss how various named BCS might be useful with regard to (A) learning in different fields, (B) working in various trades or professions, and (C) leisure activities.

7. The teacher is encouraged to make use of words denoting Basic Conceptual Systems and Basic Concepts as tools and perform Analytic Coding (both coding of similarities and differences) as a strategy in subsequent teaching when this seems sensible.

Appendix 12: A memo with examples of transfer- or application"areas" for various Basic Conceptual Systems and belonging concepts

NAVF, B.70 - 10-67

Nr. 3, 1974

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with some modifications

CONCEPTUAL SYSTEMS USED IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS (Referred to as "O-fag" in the memo from 1974).

As a foundation to ensure reliable knowledge about the close and later more distant objects and events found in the child's surroundings.

I.e. at home

near the home

in and nearby the school

in the town or city

in the municipality, in the country

in the past and present, etc.

CONCEPTUAL SYSTEM		**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	
Super ordinate name of conceptual system/Basic Conceptual System	Subordinate name of conceptual system/Basic Concept	The establishment of reliable knowledge about the close and later more distant "things" and events found in the child's surroundings, i.e. at home, near the home, at school etc.	Special equipment
Colour	Red Green Blue Yellow Orange Purple Brown White Grey Black Dark Strong Weak	The concepts of colours used to -analyze and identify particular objects and object categories/classes, particular events and event categories. Particular objects: "My ball is red, yours is green, etc. Object categories/classes: Dark skinned, yellow-haired, blue-eyed; etc.; most plants are green in the summer, several animal categories are characterized by common colours (and patterns), etc. -analyze variations in nature and the change of colour for each season. - assess how people by using colours create variation and similarity, comfort and beauty – in clothes, furniture, houses and interiors, in pictures and patterns etc. -learn the colours which symbolize danger and safety (in traffic), hot/cold, on/off (devices), height and delimitation. Etc. -estimate temperature (red – yellow - blue – white). -assess emotional conditions (become pale, blush etc.) -assess age: Grey- and white-haired, grey woodwork etc. -assess how colors are used to reflect or absorb light, as protective coloring etc. Why are certain things given a specific color? The color concepts are thus "transferred" to many of the so-called "o-fag" school subjects (subject incorporating nature study, sociology, history and geography), and at the same time they are important components in our mother tongue which might be used to describe what we experience.	

Words denoting Basic Conceptual systems and Basic Concepts		**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
SHAPE	straight line curved/arched angular triangular four-sided elliptical(oval) circular spherical cylindrical cubic prismatic	Concepts of Shapes used to analyze -<u>particular objects</u> Similarities and differences between -<u>object-categories/classes</u> -<u>object-surfaces</u> -<u>parts of objects</u> -analyze shapes used as symbols -in traffic -on maps – (geography) -on charts, etc. -analyze combinations of shape and function: <u>Why</u> do objects and parts of objects have the particular shape that they have? Why are most balls spherical? (Cylinders are also able to roll). Why are wheels circular or round? Why are pots often cylindrical? Why are bases of houses, tabletops, walls, floors, etc. often rectangular?	

Words denoting Basic Conceptual Systems and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
PATTERN striped checked dotted flowery etc.	Pattern-concepts used to analyze -patterns on objects and part-of-object surfaces, i.e. in clothes, in furniture-textiles, in wallpapers, carpets, in the unpainted surface of wood etc. - (colour- and) patterns as symbols for different relations – in maps, charts etc. -the function of patterns: Why do we make patterns on surfaces? Why are people almost always wearing clothes with patterns, why do we put patterns on walls etc.? (History)	
DIRECTION upwards downwards forwards backwards along to the side right, left side from the left to the right from the right towards to the left inwards outwards North South East West etc.	Direction-concepts are used to analyze: -The movement of objects -The movement of parts of objects -The pupils' own movements, including the movements of the hand when writing, the movement of the eye when reading, the direction in which we read and write. -Deciding the direction of cars, trains, airplanes and other objects. -Cardinal points determined by means of a compass (earth-magnetism – geography, physics) -Time of day decided by means of the position of the sun (for instance in the southern direction) -In what direction do we find situated. ---- compared to the school, our home etc. -The reading and writing direction in other languages and cultures.	Compass, preferably one for each of the pupils in the group. A compass rose permanently drawn on a slab of stone in the schoolyard or on a plate attached somewhere in the classroom.

Words denoting Basic Conceptual Systems and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
SURFACE PROPERTIES (as opposed to inside of the substance) even uneven smooth rough shiny slippery hairy feathered dressed with skin	Surface concepts used to analyze -the surface of objects -the surface of parts of objects Why do we polish and varnish/paint surfaces? How is it possible for us to slide with skates and skies on respectively ice and snow? Why is it that balls (ball bearings) are polished so that they turn out as even/smooth/shiny as possible? Why do we lubricate most parts that are supposed to rub against each other? Why do plates, cups and other containers usually have hard and shiny/smooth surfaces? Why do animals have a <u>hairy</u> surface, or a <u>feathered</u> surface, and why is it that <u>we</u> have to use clothes – on the surface? How come we can see reflections of ourselves, also in windowpanes and the water surface? Which sensory organs do we use to find the nature of the surface? Etc. Apparently this is another conceptual system that might be applied in several subject areas.	

Words denoting Basic Conceptual Systems and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
SIZE(S) big small bigger smaller etc. **Length** -number of length units **HEIGHT** **WIDTH** **SURFACE AREA** -number of surface areas etc. **SPACE** -number of rooms etc. **Shape and size combined**	Size-concepts used to analyze -the relationship between the size of objects and object categories/classes, i.e. things that are or usually are large compared to others that are small or smaller -at school, at home etc. -The relationship between the size of <u>parts</u> of objects and object-<u>surfaces</u> -<u>changes in size</u> from before until after an incident, for instance in connection with <u>growth</u>. -the fact that the size of objects and parts of objects are proportional to the use (function) of the object and therefore requires adjustments accordingly: the height of the seat of a chair in relation to the length of children's (a children's chair) and grown-ups' legs; the shaping of the back of a chair, adjustment of the shape and size of the back of a chair etc. -objects with different shapes (containers such as milk cartons, boxes, cans) which are similar in being used for measuring 1 liter, ½ liter and 1 deciliter respectively, etc.	Decimeter sticks Folding rule Dm^2 plates Liter and deciliter measure

Words denoting Basic Conceptual Systems and Basic Concepts		**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
PLACE in relation to "something"	-Above something underneath something between (two things) to the left of… to the right of something, etc.	Place-concepts used to analyze -the spatial placement of objects in relation to each other. -the place (and position) of parts of objects in relation to each other. -where events take place etc. -why the flowers need to be placed near the window, why the fireplace/oven is placed near the chimney, why many lamps are placed right underneath the ceiling, why windows and pictures usually are hung centered on the wall, why the nose is placed right above the mouth, etc.	
TASTE (Individual)	good bad salty sweet sour bitter apple-taste pear- taste meat- taste etc.	Taste-concepts used to analyze and identify -single edible objects via taste-identifying coding-systems -edible object categories/classes -drinkable fluids -Fluids and partly dangerous objects that are not suitable for consumption. Which sensory organs do we use for tasting? Why do we code (partly individually) certain taste qualities as good, others as less good or "bad"?	

Words denoting Basic Conceptual Systems and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
SMELL (individually) good bad rotten burnt scorched the smell of spices the smell of leather the smell of tree the smell of flowers the smell of apples the smell of meat	Concepts for qualities of smell, often combined with taste-concepts, are used to analyze -single events and single objects via important reactions to the coding of smell -object categories and event categories -objects and events in respectively dangerous, harmless and positively important groups of objects Animals What is the reason that they use their sense of smell to a greater extent than humans? Where do we find the sensory organ for smell? Why do experiences with smells and tastes have a tendency to merge? Why are certain animals capable of releasing pungent smells? Etc.	
FUNCTION/ USED: for eating for drinking to write on to write with etc.	Used to analyze object functions, e.g. Birds The wings are used for flying, the legs are used to jump, sit, climb and grab things, the feathers protect it from the cold and the humidity, the tail is used for steering and support etc. e.g. Rubber This type of substance is used in several object parts (or objects) that are supposed to rapidly return to their original shape after being “deformed”. Thus it might be used in things that are supposed to bounce, but also things that are supposed to soften certain movements.	

Words denoting Basic Conceptual Systems and Basic Concepts		**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
WEIGHT	big- (heavy) small-(light) bigger smaller biggest smallest number weight-units kg, hg, g	Weight-concepts used to analyze -the weight of <u>specific</u> objects, compared to other objects and weights, etc. -the weight of object <u>categories</u>, object categories which are similar in that they are usually <u>heavy</u>: stove, oven, sofa, piano, refrigerator etc; or objects that have in common that they are usually light or do not weigh much: pillows, duvets, mattresses made of foam rubber etc.	Weights (which might be found in junk shops or in regular shops) boxes, in addition to weights of 1kg, Hg, etc.
Weight and size Combined		This relationship is often proportional to the "capacity" of the one that is supposed to carry the objects: "I can easily carry that thing", "It'll be hard to carry that thing", "I can't carry this thing at all", "I'll need more people to carry this", etc. -Objects which are light because they are small, objects which are light because they are made out of a light substance. If the pupils are given the opportunity to weigh a kg of flour, sugar, rice, coffee etc, they might get familiar with the relationship between size and weight, i.e. find out which materials are heavy and which ones that are light.	Hg weights can be made out of small cans filled with lead shots. Should stay in the classroom permanently.
Specific weight/gravity		-The weight of the different materials, i.e. types of materials made <u>similar in size</u>, usually turn out to <u>differ in terms of weight</u>. The weighing (the indicator on the weight showing smaller and larger discrepancies) of prisms of similar sizes made from different materials (types of trees, types of metal, plastic, glass etc) -Why is it that we usually use heavier materials to make pans, the keel of a boat, the foundation of houses, partitions between apartments and houses, etc.? (Heavier materials are not only heavier, but also tending to "stick together" in a better way).	Equally sized prisms made from different but familiar materials.

Words denoting Basic Conceptual Systems and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
KINDS OF SUBSTANCES, **THE SUBSTANCE** tree glass metal plastic rubber leather bones concrete ceramics etc.	(It is preferred that the different types of substances are analyzed according to colour, pattern, smell, weight etc, if it is possible, as this will make the coding process easier.) The concept of substance is used to analyze what -objects -object categories and -parts of objects and fluids in the environment are made of Guided tours in locations (work shops, factories) where the different objects are made from different substances (shoemaker workshop, machine shop, pottery, factories that make plastic boats, depending on the possibilities present. Tours in locations where the objects are sold (department stores selling glass ware, furniture shops, hardware stores, draper's shop etc.) -What are objects and object categories usually made from these days? -Why different types of substances are used for different purposes (since they differ in terms of how easily they can be shaped, in terms of hardness, weight, fragility, stickiness, transparency etc. - What are objects and object categories made of today compared to what they were made of back in time?(History) -Why object categories are made of different materials and in different ways than before etc. (History) (Because we have more knowledge and make better instruments, partly to make "artificial" substances, partly to adapt both these and natural substances in a more efficient manner. -What are objects made from in our country compared to foreign countries? (Geography). -Why different sorts of substances are used in different cultures and under varying climatic conditions. (Geography).	A collection of types of SUBSTANCES is created.

Words denoting Basic Conceptual Systems and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
PROPERTIES OF THE SUBSTANCES hard S soft S sticky S brittle S heavy S light S breakable S unbreakable S elastic S non-elastic S flammable S malleable S changeable S possible to smell S transparent S	Used as a basis for analyzing which qualities that might be attributed to different substances, and why different substances are used the way they are used. -in objects -object categories where certain substances are common. Examples of questions that are posed – also for the pupils: -Why is glass, and also plastic to a greater extent, used to make windowpanes, wineglasses, folding screens etc.? -Why is it that different types of wood have always been used to make objects? -Why was it so important to find iron a long time ago? (History – present time) -Why is it so important to find oil in our time?	
SOUND/RING loud weak high/light low/deep sharp muffled long short, i.e. lasts a long/short amount of time	Used to analyze the ring or sound of -objects -parts of objects and -types of substances When they fall, when they are tapped on or set in motion. -Several different kinds of sounds heard in relation to speech sounds/phonemes -Noise compared to harmony and melody. -Sounds from nature, from birds, animals, trees and other plants in motion. Subcategories of sound-names (rustling sounds, the sound of something dripping, the sound of clucking etc. – nature study) -Tuners and the sound of other musical instruments. -The change of sound when it comes to strength (accentuation), and length (rhythm), pitch (melody), unison (harmony) (in other words; this is transferred to the field of music).	

Words denoting Basic Conceptual System and Basic Concepts	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
Lasts, have/has lasted, have/has lived, have/has existed etc. **TIME** short amount of time long shorter amount of time longer shortest longest Number of seconds, minutes, hours, days, weeks, months, years. a long time ago, in a short while **TIME-line** Early, in the middle of, late on/in, at daytime, in the week/during the week, in a month, time of the year in life/of life etc. The time (point in time) before, during and after an event. First, second, in the middle and last on a timeline. **DURABILITY** **AGE** **FREQUENCY** **SPEED/MOVEMENT** **NUMBER**-conceptual system MOTHER-TONGUE EDUCATION	The duration of events measured objectively by means of a watch, measured less objectively by counting at a steady pace, by counting steps, by reading the pulse etc. Time as a subjective experience, i.e. the time span is experienced as short when several and important events have taken place; the same amount of time is experienced as long lasting when few or insignificant events have taken place. The time concepts used to analyze -the duration and order of events -the duration and order of the elements of events -when events took place or will take place (dating), -the frequency of the events, i.e. the number of times they occur, per time-unit -the speed of the events (in the course of a short/long period of time, number of meters per second, etc.) -(History) Events which took place (for instance objects that were made) a long time ago a hundred years ago a thousand years ago The age of objects and people, i.e. has been, existed, lived for a long period of time, a short period of time, in the course of two years, in the course of one hundred years etc. -the time when events will take place in the future (planning): in a little while, in a long time, in two hours, in three days etc. (This is a task that will probably take a while to complete, and the best thing might be to start with the short intervals of time and the points in time that are close to the present time, both in the past and the future.) It appears that the number of units, times etc. are included in several conceptual systems that might be part of the O-fag (A subject which incorporates nature study, sociology, history and geography), it concerns and might hence be adapted in connection with O-fagene/subjects. O-fagene/subjects constitute a situation where also the mother tongue is used, learned and hence expanded.	Stopwatch Regular clocks in the classroom, possibly a pendulum clock.

Words denoting Basic Conceptual Systems and Basic Concept	**APPLICATION IN NATURE STUDY AND ENVIRONMENTAL SUBJECTS**	Special equipment
TEMPERATURE High (warm) Low (cold) (compared to an object of reference or temperature) Higher/ Lower Highest T lowest T boiling T melting T freezing T (Number of) degrees **PLACE:** above/below zero Even Uneven	Used to analyze the temperature of different -Objects -Object categories -Fluids and fumes/gases: -Variation and similarity when it comes to temperature at different times of the year, both inside and outside etc. -"Things" that are similar in the way that they keep an even temperature, humans and several animals on average keep a higher temperature, ice, snow, food in the freezer keep an even low temperature, whereas water in a hot water container, the sun, the centre of the earth etc. keep an even high temperature. -Things that are similar in the way that they change temperature according to the temperature of the environment (most objects, including cold-blooded animals). "Things" that are similar in the way that they are often warmed up (given a higher temperature.): Stoves, hot plates, engines, different types of fluids etc. -Why water and other fluids are warmed up to boiling temperature; why materials/substances melt. -Why other things are deprived of heat (refrigerators, freezers) -Heat as a condition for growth, but also for decay and decomposition. -PHYSICS: High/low temperature as the speed difference related to the motion of molecules.	

Appendix 13: From external verbalizations of conceptual terms to "internal" verbalizations or internalized/silent inner speech – a proposal for an addition to the CT-model (A. Hansen, 2006)

This heading reflects my proposal for an exercise in four steps connected to the use of the CT-model, which may facilitate some children's internalization of spoken units in terms of oral language skills, in other words contribute to the development of inner or internalized private speech (Vygotsky, 1934/1986/2001). It is assumed that this might occur if the child is made aware of and is given learning experiences which promote the conscious recognition of the fact that he/she thinks using words inside his/her head.

It is expected that the suggestion might have effects that go beyond "natural" internalizations of speech when it is used with younger children from 4–8 years of age in addition to children with reduced prerequisites for learning and thinking in terms of poorly developed oral language skills.

The proposal is as follows: When teaching children basic conceptual systems and related concepts, thereby bringing these to a verbally conscious level via the principles of the CTM, the students are also asked to participate in an exercise that is demonstrated by the teacher, step by step: **(1)** The children recite for instance "vertical position" at a normal volume, **(2)** the children whisper "vertical position" loud enough for others to hear, **(3)** the children repeat "vertical position" so quietly that they can only hear the words themselves, and finally **(4)** the children think the words "vertical position" inside their heads without pronouncing them. (Moreover, these "verbalization-steps" are demonstrated on a video about CT that I made for 6-year olds in 1997 – unfortunately this material is only available in Norwegian).

According to Vygotsky (1934/1986/2001), point 4, in other words contains the idea that the children perform what might probably be referred to as a preliminary/early variety of internalized private speech. This in turn rests on the assumption that the phenomenon of internalized speech among other things changes syntax and is shortened as internal speech is increasingly "practiced".

The previously mentioned four-step exercise should probably, to begin with, be carried out further along in the selective association phase (the SA-phase) or early in the selective discrimination phase (the SD-phase). In addition it should be repeated after the teaching of a

concept and conceptual system has been carried out in all of the three phases of the CT-model. The reason for this is that only then is it reasonably safe to assume that the children have learned the relevant concept as part of a conceptual system to a verbally/linguistically conscious, generalized and transferable level. In this last case it is at least reasonable to expect that the activity revolves around not only a step-by-step exercise in external verbalizations and silent inner speech of words that are more or less void of meaning, but also an activity based on oral language skills and corresponding concepts and conceptual systems integrated with and thus "accompanied by" (positive) emotional and motivational experiences.

The aforementioned proposal with the goal of contributing to the promotion of the internalization of private speech should also be seen in connection with my comments and emphasis on the teaching of strategies, which reflect that teaching **children how to learn** is crucial to CT as an educational approach.

Basically this boils down to teaching of what I refer to as strategies for learning on a **basic and psychological level** (cf. the PSI[21]-model in appendix 1, figure 1), such as performing analytic coding by means of BCSs, and the further conscious use of speech (outer or internalized) in order to prolong STM (Short Term Memory) via a rehearsal strategy. In this way what is recently and momentarily coded and rehearsed, could be elaborated together with what at the same time is directly activated from LTM (Long Term Memory) to STM. Such basic strategies also involve the use of internal language or thinking in terms of internalized private speech during problem solving etc.

Moreover, the last point of **appendix 1** includes an account of "learning how to learn" seen in relation to the PSI-model.

It should also be mentioned that Ostad and Askeland (2008) have done some interesting research on "Sound based number facts training in a private speech internalization perspective",

[21] The PSI-model represents a depiction of central parts of Nyborg's theory of learning making it possible to take into account and think about perception processes such as sensation and coding, and how they relate to LTM (Long Term Memory) as well as to STM (Short Term Memory). The "person part" of the model is seen in close connection with the "situational part" or the context in which the person is a part of at each moment.

Appendix 14: Reflecting on your own learning - a proposal for an addition to the CT-model

This proposal on reflecting on your own learning, like the proposal mentioned in appendix 13, has not been systematically tested in connection with the CT-model, even though its use has been recommended for years now.

The proposal entails the following: Towards the end of each CT-lesson the teaching should be completed by a conversation on what has recently been learned. This activity is supposed to raise the children's awareness of what they have learnt during the actual lesson (possibly also what they have done in order to learn this): It is also expected to raise the awareness of how the **recently** learned "material" relates to possible **previous learning,** and in addition promote a certain understanding of impact the actual learning might have on **future** functioning and learning.

When it comes to children who are insecure with regard to the outcome of their learning, to begin with it might be necessary that the teacher repeatedly points out what the children have learned after each lesson and from week to week – depending on how the teacher evaluates the children.

After a while it should be the children's own responsibility – if and when they are considered to be capable of this – to reflect on their own learning in a conversation led by the teacher based on questions like:

1. What did you learn this time?

(1B. What did you do in order to learn this?)[22]

(1C. What was easy and what was hard?)

[22] Questions 1B and 1C inside the brackets are not primarily included, but may be added.

2. **Does this remind you of something that you have already learned? If so – how is what you have learned today similar to and different from what it reminds you of?**

3. **How might what you have learned become useful on later occasions/what might it be used for later (- at school, while playing, on a trip, when you are doing homework, running errands etc.)?**

The additions to this question will of course have to be adjusted depending on the age of the children and their level of function. It is safe to assume that question 2 might contribute to the integration of what was recently learned with what has already been learned and thus further support the development of the knowledge structure in the children's LTM (Long Term Memory), cf. appendix 1, fig. 1, the PSI-model, which is a depiction of a learning person in dynamic interaction with situations in his/her surroundings. At the same time the question aims at hindering or reducing the possibilities for confusion (interference) of knowledge units. The goal of question 3 on the other hand is the promotion of a transfer of what is learned in relation to different relevant situations and areas that are aimed at.

Neither M. Nyborg nor R. H. Nyborg were concerned with this kind of immediate and reflected conversation on what children actually learn. I have, from about 1999 and onwards, in my training and guidance of teachers that use the CT-model, argued that such short and consciousness-raising conversations with what was recently learned as a starting point, should be made part of the use of the CT-model.