

Ascending from the Abstract to the Concrete in School Teaching — the double Move between Theoretical Concepts and Children’s Concepts

Mariane Hedegaard

Copenhagen University, Copenhagen, Denmark
e-mail: mariane.hedegaard@psy.ku.dk

Vasily V. Davydov’s solved the problem between situated and abstract knowledge and integrated these conceptions into a connected theory of knowledge and thinking. His use of germ-cell models as a methodological tool is the key to understand this integration of abstract knowledge with the concrete complex and situated knowledge of a domain. I will show how I built on these ideas in my research of children’s learning and development by presenting a design experiment I conducted. The aim in this article is to illustrate the importance but also the complexity of using germ-cell models in developmental teaching as a tool focusing on the students’ activity that orient children to formulate core models as their own tool to, reflect and analyse within the complexity of concrete life scenarios. The design experiment demonstrates that a primary-substantial abstraction may be a first step in formulating germ-cell models that can evolve so different subject areas can be connected when ascending to the concrete in developmental teaching. To accomplish this, it was important to take the children’s perspective in the teaching process as a ‘double move’ between children’s motive orientation and the subject matter area. The design experiment included the subject areas of biology, history and geography focusing on the evolution of animals, the origin of man and the historical change of societies.

Keywords: primary substantial abstraction, germ-cell, theoretical knowledge, developmental teaching, double-move in teaching, radical-local teaching and learning.

For citation: Hedegaard M. Ascending from the Abstract to the Concrete in School Teaching — the double Move between Theoretical Concepts and Children’s Concepts. *Psikhologicheskaya nauka i obrazovanie = Psychological Science and Education*, 2020. Vol. 25, no. 5, pp. 44—57. DOI: <https://doi.org/10.17759/pse.2020250504> (In Russ.)

Восхождение от абстрактного к конкретному в школьном обучении: двойной ход между теоретическими и детскими понятиями

Марианна Хедегард

Копенгагенский университет, Копенгаген, Дания

e-mail: mariane.hedegaard@psy.ku.dk

В.В. Давыдов сумел решить проблему ситуативного и абстрактного знания и воплотил свои идеи в связную теорию знания и мышления. Модели «клеточек» (germ-cell models), использованные Давыдовым в качестве методологического инструмента, являются ключом к пониманию интеграции абстрактного знания и конкретного, ситуативного предметного знания. В своих исследованиях детского развития и обучения я постаралась продвинуть эти идеи и описала свой опыт реализации проектного эксперимента. Цель настоящей статьи — показать одновременно и важность, и сложность использования моделей «клеточек» в развивающем обучении как средства, сфокусированного на деятельности детей и стимулирующего их конструировать модели как свои собственные средства, рефлексировать и анализировать многогранность конкретных жизненных сценариев. Проведенный эксперимент показывает, что первичная содержательная абстракция может служить первым шагом в построении «клеточки», которая затем эволюционирует таким образом, что разные предметные области оказываются связанными в процессе восхождения к конкретному в рамках развивающего обучения. Чтобы этого достичь, было необходимо рассматривать точку зрения детей как «двойной ход» между ориентацией детских мотивов и содержательной областью. В эксперименте использовались предметные области биологии, истории и географии с акцентом на эволюцию животных, происхождение человека и исторические изменения в обществах.

Ключевые слова: первичная содержательная абстракция, клеточка, теоретическое знание, развивающее обучение, двойной ход в обучении, радиально-локализованное обучение.

Для цитаты: Хедегард М. Восхождение от абстрактного к конкретному в школьном обучении: двойной ход между теоретическими и детскими понятиями // Психологическая наука и образование. 2020. Том 25. № 5. С. 44—57. DOI: <https://doi.org/10.17759/pse.2020250504>

Introduction

Vasily V. Davydov's work [4; 5; 6; 7] has been and still is important both for the theory of epistemology and for research of learning and teaching. Davydov succeeded in solving the problem between situated and abstract knowledge and integrated these conceptions into a connected theory of knowledge and thinking. His use of

germ-cell models as a methodological tool is the key to understand this integration of abstract knowledge with the concrete complex and situated knowledge of a domain. This is the foundation for 'developmental teaching' that builds on the idea of primary substantial abstractions that contain basic conceptual relation within a subject domain as a germ-cell.

I will illustrate how I have built on these ideas in my research of children's learning and development by presenting a design experiment I conducted. The aim in this article is to illustrate the importance but also the complexity of using germ-cell models in developmental teaching as a tool focusing on the students' activity that orient children to formulate core models as their own tool to, reflect and analyse within the complexity of concrete life scenarios. This experiment demonstrates that a primary-substantial abstraction may be a first step in formulating germ-cell models that can evolve so different subject areas can be connected when ascending to the concrete in developmental teaching. To accomplish this, it was important to take the children's perspective in the teaching process as a 'double move' between children's motive orientation and the subject matter area. The design experiment included the subject areas of biology, history and geography focusing on the evolution of animals, the origin of man and the historical change of societies. In biology the subject domain of evolution of animals is a thematic area that is usually first presented to children in high school. The evolution of animals was chosen because it is seen as the core in biology and for understanding the origin of man. The conceptualisation of the origin of man can be seen as the beginning of how societies evolved, and thereby is the link for understanding the historical change of societies. With the design experiment I wanted to demonstrate that it is possible for young school children to participate in learning activities within these subjects, starting with simple primary substantial abstractions of a subject domain and from here move to complex matters in teaching and learning within the domain using the dialectic tensions that primary abstractions contains. To accomplish this the teaching was oriented to tensions in the students understanding of their environment that catch their interest. If the teaching takes departure in such tensions and the questions that comes from these guided by the germ-cell, the teaching may take form as a double move starting with the experienced tension moving to analyses guided by the germ-cell and turning back qualifying students understanding, that may lead to new questions.

Galina Zuckerman [37] points to three phases in design experiments that I find relevant and in a modified version will use to structure this presentation. The three phases are: (1) study of age-specific potentialities of younger schoolchildren, with a team of researchers, (2) design of instructional activity, with a team of designers, (3) transformation of primary education, with a team of educators. The phases in the design experiment I conducted were: (1) studying age specific-potentialities and constructing the germ-cell, outlining the main themes of the teaching, with a team of academics within the different subject matter fields of biology, geography and history. (2) Several years of weekly teaching, in cooperation with teachers and academics within different subject areas, formulating concrete tasks for everyday teaching of students in the design experiments. In this weekly planning the team took both the content of the germ-cell and the students' actual activities into consideration. (3) Writing up the results to contribute to the theory of developmental teaching and children's development, and in other ways trying to influence the educational system of teaching in primary school.

Davydov's [4; 5; 6] theory about theoretical knowledge and thinking influenced all three phases in the design of the experimental teaching. To illustrate this I will start by presenting Davydov's theory of the theoretical knowledge with focus on the concept of germ-cell as the tool for creating conditions for subject-matter teaching. The germ-cell models were used by the teachers to guide the students' task solutions whereby the student acquire their own core conceptual relations to explore concrete situated knowledge.

To accomplish this teaching has to encompass three phases that has to be viewed both from the teacher's perspective and the students' perspective: a goal formation/motive orientation phase, a phase of building germ-cell/core models and an evaluation phase. In the following section this is illustrated with the design experiment in comprehensive school. Traditionally in comprehensive school in Denmark the focus is only on teaching content and children's learning competences. Students understanding of the aim and goal of the teaching and evaluation of their learning is not seen as phases in teaching and learning.

Constructing germ-cell models

A germ cell depicts the relation between the moments/concepts that the subject area covers, so these are moments at the same unit. Concepts in a germ-cell of a knowledge domain define each other. These concepts are dialectically related so that they are each other's conditions. These conceptual relations when pointed out would be obvious in all concrete cases as moments within the knowledge domain of the subject area. To establish a germ-cell in science takes many generations. An example of a germ-cell is Lada Aidarova's [1] substantial primary abstraction in the subject area of communication where the primary generalisation was word in the sense of meaningful communication and the germ cell depicted the relation between sender and receiver with a message that may vary in both form and content. This model was used in a developmental teaching experiment in mother-tongue. When one of the moments changes the germ-cell depicts how the other involved moments also change (e.g., as in the communication germ-cell when a student gives a message in contrast to a teacher the meaning of the message may be the same but both the word form and context will change).

To understand how a germ-cell may be formulated within a subject domain the historical original forms of the tension in moments in the subject domain have to be found. It is necessary that the tensions and contradictions that have driven the development clearly appear through the conceptual relations in a germ-cell model. To find the tension between the moments these units should be both dependent on and complementary to each other. To formulate a subject's germ-cell, one must look for contradictions in the well-established subject area and then work backwards towards the origin of the subject area.

In my research on teaching biology, geography, and history the idea of subject area analyses was based on the idea of organizing key concepts into germ-cell models that were formulated in cooperation with academics within the subject domains. To establish a germ-cell for the study combining biology, geography, and history several university researchers were consulted in biology, geography, and history [14; 22].

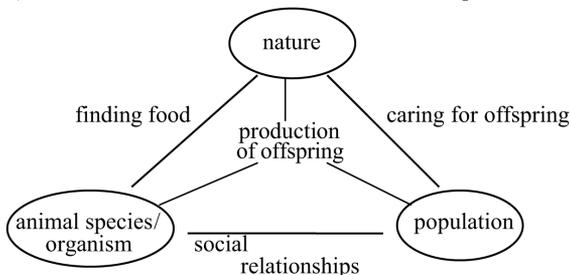
The three themes in my design experiment, the evolution of animals, the origin of man and the historical change of societies were also chosen because in the Danish comprehensive school in the 1980ties taught biology, geography and history as integrated from 3rd to 5th grade. This was done mostly by taking different themes that did not have connection with each other but came out of daily life such as a period with studying healthy food followed by a period of grandparents' life. My aim was to integrate the thematic areas into a wholeness that contain the central concepts within the three different subjects. The subject matter analyses took place within the science domain of evolution of animals, the origin of humans and the historical change of society, and was used within experimental teaching in 3-5th grade in the Danish comprehensive school [11; 14; 15; 16; 17; 18; 19; 22]. The project lasted eight years starting in 1982 with observations studies, germ-cell construction and followed by two pre-projects. The final teaching experiment took place starting with 3rd grade and continuing through 5th grade for the same children from 1987—1990. The germ-cells of these three domains and how they evolved into each other can be seen in fig 1a, -b, -c, -d.

The evolution of animals

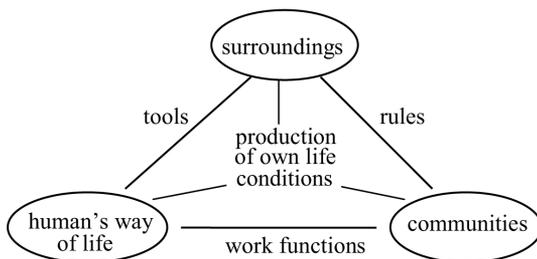
Creating the model for evolution of animals (Fig. 1a) we worked with the opposition between animals' adaption to nature and the evolution of their offspring that changed an animal species. The germ-cell included the moments of nature/biotope, organism/species and group/population [12; 24; 33].

The first content introduced in the teaching was nature, encompassing landscape, climate, plant-life, and animal life, exemplified with animal life in Greenland and Africa. Animal life was then separated, and the first primary abstraction became the relation nature-animal life. The tension used was animal life being part of nature and separate from nature so one could follow an animal species adapting to nature (e.g., polar bear in Greenland's nature). The model become complicated through explaining the survival of a species though specific ways of survival, spe-

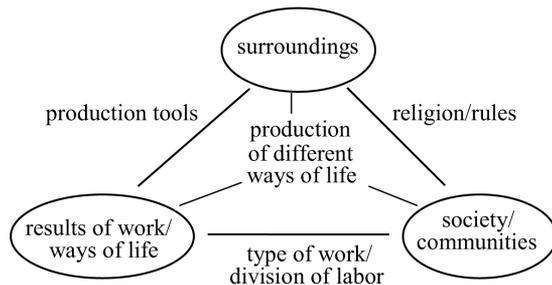
a) Problem area model: the evolution of animal species



b: Problem area model: the origins of man



c: Problem area model: Changes in society through time



d: Final model for the changes in society through time

Rules, work functions/the division of labor and production tools become the deciding factors.

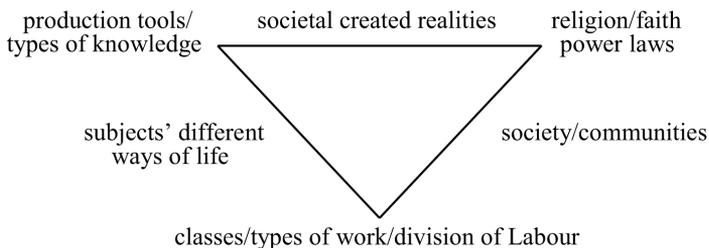


Fig. 1. Models for the subject-related content

cific ways of cohabitation and specific relations to other species and parental care. The central point came when the children had to figure out what happened if challenging demands for adaption appeared such as when animals from Greenland were moved to Africa. Or when the adaption through generation lead to evolution (as when mountain hares were moved to the Faroe Islands) [15].

The origin of humans

The leap from animal to humans is connected to the problem of the origins of humans. Analysing this problem led to extension and changes of the concepts in the germ-cell for the evolution of animals into the model of the origin of man. The changes took place from: (1) type of organism to humans' way of life; (2) nature changed to surroundings and (3) population changed to communities. (see Fig 1b). Here the tension was between human' adaption to nature in contrast to human change of nature (production). Production is what creates change with division of labor, tools and rules [9; 26; 27].

The historical change of society

The historical change of society led again to an extension of the model and unfolding of the concepts. The demand here was to explain a change from one type of society to another. The model of the historical change of society (Fig. 1c) builds on the primary abstraction that human production creates a society and it is the relation and opposition between the productive forces and the production relations that create development and change [25; 31].

The concepts that form the substantial abstraction now extend from being nature to encompass the environment as recognized and created through society with the resources that nature and society contain (the socially created reality). The humans' way of living changes to humans as defined through their work and working relationships.

In the last model (1d) the humans are included in the institution (e.g. the governmental magistrate, or a work institution or an educational institution). in which individual humans participate. The community is no longer just a group determined by rules and work functions/division of

labor but become society in its diversity. Rules of production are extended to rules of society. The necessary production functions/division of work include classes in society and work tools include production tools.

Perspectives

A version of the models constructed through subject analyses of the evolution of animals, the origin of humans and the historical change of society also became the foundation for Engeström's model of activity theory as formulated in his PhD: *Learning by Expanding* [10].

The teaching- learning themes connected with the germ-cells for the evolution of animals, the origin of man and the historical change of society in the experimental teaching are similar to Jerome Bruner's didactic material "Man a course of study" [2]. This study material was constructed together with several researchers in biology and anthropology and had 'the origin of man' as a central theme. When I started the project of working with germ-cell for the subject domain of evolution of animals, the origin of man, and the societal change of societies as themes in the teaching experiment, I did not know about Bruner's material. The difference between this and the one I conducted was formulating primary general abstractions as germ-cell models. Like in Davydov's developmental teaching theory [6], I conducted teaching experiments where the teacher used germ-cell models to guide the teaching that through tasks led students to formulate their own core models to guide their activities whereby it surpass Bruner et all's study, in the way knowledge was conceptualised. The similarity with Bruner et all's material was also found in the conception that students should learn the methods of science through analogy to scientific methods. In the design experiment I conducted children should act as researchers as formulated in Davydov's theoretical conceptions of developmental teaching.

"Although the thinking of schoolchildren has certain traits in common with thinking of scientist, artist, moral philosophers, and juridical theoreticians, the two are not identical. Schoolchildren do not create concepts, images, values and norms of social morality, but appropriate them in the process of learning activity. But in performing that activity, schoolchildren execute mental actions com-

mensurate with actions whereby these products of spiritual culture have been historical elicited.

In their learning activity, school children reproduce the actual process whereby children have created concepts, images, values, and norms” ([6 (9): 21] & Davydov, 1988 (9), p. 21).

Because the central conceptual relations of a germ-cell is generalised and thereby simplified it is possible to use them for guiding teaching even in the early grades in comprehensive school and for children to acquire and use these relations as their own tool, such as is demonstrated in Davydov’s research in mathematics [4] and art [6], in Markova [30] and Aidarova’s [1] research in mother tongue language, in Lompscher [29] research in biology, in Hedegaard’s [14; 15; 16; 17; 18; 19] research in biology, human geography and history and Hedegaard and Chaiklin’s research with cultural minority children in social science [20] see also, Hedegaard et al [21].

A teaching strategy using research methods: The didactic theory of Developmental teaching

This dialectic between the abstract and concrete is transformed into a theory of education where one always have to ascend from the abstract to the concrete in teaching and learning, — from the central concepts in the germ-cell model to situated activity. Davydov pointed out that the didactic structure of the teaching activity is connected with student’s learning activity, they are two sides of the same coin. Developmental teaching is therefore based on the assumption that each teaching period is dialectically linked to phases in children’s learning process. Here Davydov [5] argues that learning activity has three parts: (1) the motive formulation, (2) learning activity and (3) reflection. These three parts are the foundation for the phases in teaching activity: (1) goal formulation (2) learning tasks and (3) evaluation, where these three phases are guided by the special content of the germ-cell model and the transformation of the germ-cell model through the learning/teaching activity into students core-models.

The first main phase in teaching is to help children develop a motive orientation to explore the subject area and support them to formulate goals for researching the thematic relationship that com-

prises the substantial abstraction and the main problem for the subject domain of the course (see an example of children’s core models Fig. 2 that illustrate a primary relations for the relation between an animals species and its nature).



Fig. 2. The drawing picture the relation between nature and animal species

It depicts a herring shark that lives in the sea near Greenland, where there are icebergs, the shark swallow herrings. The food depicts how the relation between the animal and the nature is constituted.

The second main phase is characterised by the formation and expansion of the thematic relationship in the form of core models for the problem area being investigated, where the teacher through various assignments using the germ-cell as a tool, guides the student toward finding the substantial abstractions. The tasks and the guidance should result in the students’ formulations of their own core model that are created through shared group activities and classroom discussions. These models should guide and motivate the students to further exploration within the subject area (see examples of children’s germ-cell models for respectively the evolution of animals and the origin of humans).



Fig. 3. The drawing depicts the development of animals exemplified by the life of horses

In Fig. 3 the left relation is between animal and nature mediated by food. The upper circles show nature. The bottom relation depict the relation between horses where the right circle show other types of the same kind (population) mediated by their way of interacting, and the right side show the relation of the population to nature mediated by caring for offspring and relation and to other species. Fig. 4 shows how tools enter into the relations between man and nature and between society and nature.

The third main phase in developmental teaching is created by the teacher formulating tasks that guide children to take a critical standpoint with respect to their own skills, and to the conceptual relationship being investigated (see an example Fig. 5) of children's germ-cell model for the historical change of society.

Teaching within the zone of proximal development: The Double Move

The double move approach is inspired by Vygotsky's theory about the zone of proximal development [36] with the teaching reaching into the zone of proximal development. This move starts with the teacher relating the objective of the subject area to the students' wondering. The central core in the students' learning activity is the students' motivation. Through the learning process several



Fig. 4. Human's way of life

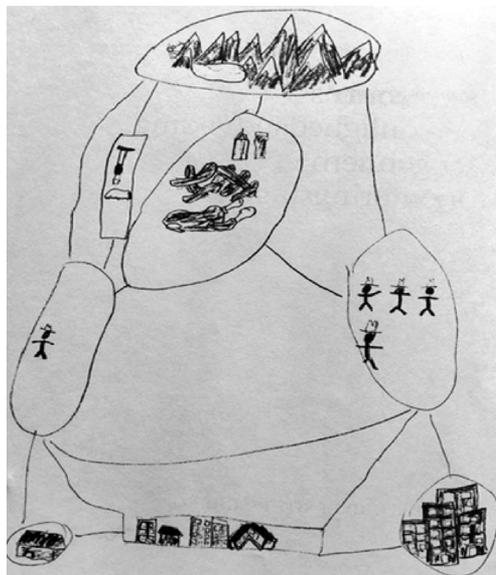


Fig. 5. Historical changes of society, indicated with the three types of building, at the bottom of the drawing

changes take place in students motivation. For the motivation to start a need must be established. Elkonin [8], Leontiev [27] and Davydov [7], all three point out that older pre-schoolers gradually begin to feel the need for sources of knowledge that are more extensive than those available in everyday life and play. The learning motive can also be a process initiated by the teaching activity when they enter school. This may be created through making oppositions or conflicts between phenomena and between phenomena and students' experiences. For the student to keep an interest in the new topic the activities must also give students competence with tools to go forward reflecting and analysing the introduced themes.

In the double move approach, the process of instruction runs as a double move between the teacher's germ-cell model of the domain and the students' everyday knowledge and motive orientation, supporting the students to build core-models of the subject area. The teacher guides the learning activity both from the perspective of the general concepts and from the perspective of engaging students in "situated" problems that are meaningful in relation to their developmental stage and life situations. This type of teaching and learning in school favours cooperation between teacher and students and between students in problem formulation and problem solving within a subject domain, to form core-models to help their explorations.

The 'double move approach' [14; 15; 19], is in principle not different from developmental teaching, but it stresses the departure in the student motive orientation and knowledge for teaching and learning activity in comprehensive school as a spiral process of solving problems where the teacher guides the students in the beginning until the student become acquainted with a subject domain. Gradually then through the process of learning students takes over and guides their own learning process and thereby finds their own problems. In the beginning, the first phase the students work with situated problems chosen by the teacher that are both meaningful for them and that incorporates central concepts of a subject domain. In this first phase the students

through class discussions and problem solving acquire methods to act, guided by the primary relation within the subject domain. In the second phase through solving tasks that the teacher has prepared the students extend the primary relations into a conceptual system of central conceptual relations — a *core model*. In this phase the students also guided by the teacher develop their own methods of exploring the subject domain. In the third phase, having acquired general concepts and methods the students become able to evaluate their own learning in relation to how well they feel they can use these concepts and methods in different concrete problem solving activities and to formulate new central problems. In this phase the students have acquired an identity as learners who can take initiatives and guide their own learning.

The teaching I designed [14; 15; 17; 19] focused on the move between the subject matter concepts and the students motive orientation. I will illustrate this from the first subject domain in the teaching: the evolution of animals, with the task the teacher brought into the classroom. The teaching started with one of the general questions that children may wonder about "Have there always been the same animals on the earth?" The teacher created a contrast by reading three different stories of how life is created on earth followed by a class discussion of what the children think. The next step was to introduce a procedure for exploration. This was done by asking the question: "What can a scientist find out about?" The students should imagine they were scientists and they were asked to make drawings of their ideas about what a scientist can research (See an example Fig. 7)¹. The following lists of questions were used as a research procedure for keeping clear in each session what they were supposed to study:

The research procedure:

What are we researching?

What do we know?

What do we not know about our research problem?

How can we model the relation between the important concepts of our research problem

¹ The evolution of animals took 31 teaching session each of 3 hours. These sessions are outlined in Hedegaard (14: 250—61) by depicting the material brought to the classroom, the teaching activities and tasks and the demands for students learning activities.

Which methods can we use to find out about
what we do not know?
Does the model need to be revised?

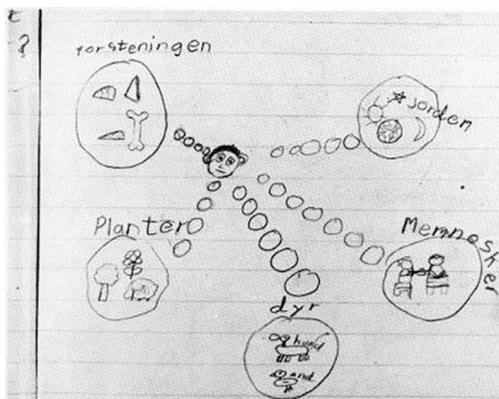


Fig. 6. The drawing depicts the child as a researcher in the middle and what a researcher can explore, the child has written: fossils, the earth, animals, plants, human beings

The teacher introduced the steps of the research procedure in the class discussion through making a goal result board, that could keep track of the students' research. In the first sessions the teacher did not go through all the steps, they were gradually included in the following sessions. Each session always started with some or all the steps in this procedure, depending on the tasks.

As mentioned above, to be able to use the primary substantial abstractions the children also has to acquire the methods to explore the subject domain (research area). Only through using research methods is it possible to ascend from a substantial abstraction to concrete events. In the concrete project focusing on the evolution of animals, the origin of man and the historical change of society children had to explore concrete examples of animals' life, of humans' productivity and of societies' change through history. Therefore, we used a research procedure (together with other specific methods).

The inspiration for the research procedure came from Aidarova's [1] experimental teaching. The procedure was used as a supporting model to keep track of the students' exploration of how each of the moments in the germ-cell varied and changed with each other and how to move

forward to transform these moments into the following version of the germ-cell from the evolution of animals to the origin of man and later to the historical change of societies.

To illustrate how the teacher worked with steps in the research strategy, a condensed extract is presented below from the observation of the classroom discussion in 4th grade, the 5th session where the teacher (T) used the germ-cell of the origin of man to guide the teaching.

This is in the beginning of fourth grade. The children have through the previous four session already worked with the first three steps in the research procedure. They have explored about fossils and what they can tell about animals and humans and have seen a film about chimpanzees living on a deserted island at Estonia. The teacher (T) attempts in the class discussions with his questions to get the children to employ the steps in the research procedure formulating the core concepts in model of the origin of man.

T: What is our theme for investigation today?

Peter: How humans came into the world and some believe they were apes.

Lars: Then, all we have to do is to get hold of a time machine

T: Right, now you have to write in your notebooks what we find out about this problem, just like I do on the blackboard.

T: What did we use last time to investigate the problem?

Bibi: We saw a film, where the apes lived almost like some people.

T: That is to say that we used analogy to the apes.

Henrik: It is almost 90% certain that we descended from the apes, but it is not 100% sure. We do not know. We must just as well be descended from the giraffes.

T: explains that 200 years ago people believed that the Bible describes how humans came into the world, he describes the creation myth.

T: Then it was discovered that this explanation could not be right.

Bibi agree: No, because how could we have children then?

T agree: Now, fossils were found and remains of skeletons.

Bibi: From an ape.

T: We saw that the bones from earlier archaeological findings looked more and more like ape bones, but not completely

Henrik: No, it is not 100 % definite.

Bibi: But were there dinosaurs and why aren't they alive today?

Tommy: People went and shot them.

Henrik: I saw a dinosaur at the museum that was caught in a trap and people threw spears at it.

T: It probably was not a dinosaur because no humans lived at the time they lived.

Bjarne tells about a Super Nova. That is probably why the dinosaurs don't live any more.

The children are very eager to be allowed to tell.

T: We have touched a little on why we use apes to find out about the origin of humans: because their way of life is a little bit like the first humans' way of life.

T tells that the children now have to work in their groups for 10 minutes (four in each group) and together write down what they know about apes' way of life from seeing the film.

T then continues the class dialogue while at the blackboard, he writes the children's suggestions under the category: *What do we know*. Then he guides the class dialogue about what they *do not know*, and this he again written at the blackboard and the children write in their notebooks.

The extract illustrate the way the teachers worked with the children in the class dialogue using the double move approach by: (1) bringing material like fossils, showing films, making a library in the classroom that the children freely could use in their groupwork (also visiting museums where they themselves had to construct tasks in groups, that the other groups should solve), (2) leading the class dialogue from the steps in the research procedure, (3) organising group work where there were division of tasks, (4) keeping track by showing how children could produce goal-results board and later made this a task for the group activities.

In line with Petrovski's [33] conception of how group work should orient the group members to shared goals, both the group work and the class dialogue the teacher oriented the children toward the general problem and to use the substantial abstraction of how humans relate in another way than apes or other species to nature.

In group work the children in the classroom were divided into four groups where each group came to have a special task to explore that relate to the general problem and each group work again were organised into division of work with each child taking responsibility for a special task (a) leading the group discussion keeping the goal of the task in mind (b), using their core models to searching for material (c) writing down the solutions, (d) presenting in the class dialogue. The teacher took care that these tasks were rotated between the children in each group, thereby learning the research procedure.

When evaluating the projects based on these ideas I have specially focused on the students' development, where motive development is seen as dialectically related to their knowledge acquisition [14; 15; 16; 17; 19].

Barriers and challenges for transformation of primary education

It is one thing to make research within teaching and learning another is to influence and transform education. This I came to experience is a political process.

The students the teachers and the school where the design experiment was conducted appreciated the teaching, so much that the headmaster and the other teachers made the theoretical knowledge and the double move with the phases from developmental teaching their model for future teaching and the involved teacher made courses for the other teachers about how to proceed.

The results of the experimental teaching were published in several publication. What we, who had engaged in the project wishes was to inspire teaching in comprehensive school in Denmark [15; 19; 22]. The books got positive evaluation in the teacher unions journal, and I was invited to present the ideas in several courses. Gorm Sigersted who was the teacher in the three-year experimental teaching also made courses first for teachers at the school of the experimental teaching and then at the national teacher education, for a couple of years. Unfortunately, he got sick and could not continue to work. The ideas though never spread to reform comprehensive teaching, so the influence became sporadic. Other researchers doing research within the compre-

hensive school in Denmark grounded in other theoretical approaches — the Negt and Piaget tradition [23] were favoured by the government [35]. In this approach the focus was to engage children in teaching by drawing on their experiences, and by doing group work. An approach that fits with the 'double move' but it lacks the systematic guidance implied by using germ-cell models. Another obstacle for the 'double move' was connected to the problems for teachers to have enough time to prepare their lessons.

The idea of germ cell and developmental teaching was exported to New York City through cooperation with Seth Chaiklin and Pedro Pedraza at the Centre for Puerto Rican studies, Hunter College, City University of New York. The focus was to develop a teaching approach for a group of culture minority children in New York City that had difficulties in the educational system. It became a year project in an afterschool activity in East Harlem, where the idea of the double move was extended into a 'radical-local' approach. Radical in this connection means root, so again we used substantial primary abstractions as germ-cell models to guide the teaching and to orient children to central concepts in social science. Local in this connection means to include their local cultural background in the teaching topics, drawing on children's local culture. Combining radical-local with the double move guided the teacher to take departure in children's motive orientation and children local culture and orient children to central concepts in the subject area and to engage in learning activity [20].

The radical-local approach was later transported back to Denmark for young refugee boys that could not adapt to the school system by an initiative from the municipality in Aarhus, the second largest city in Denmark. Here a special school was created — the 'Project school'. I was engaged as a consultant and the radical-local approach was used in the school for two years with success [21]. Then, the political change also changed the school government, a new rector came in the 'Project School and changed the teaching approach. In the same municipality I engaged in a project with Somali children who all had difficulties in school and therefore were collected in one class at one of the Aarhus schools.

Because of their war experiences the school municipality characterised them as unteachable. Here I worked together with Inge Melby an anthropologist for two years from 2000-2002 to make a teaching program with the ideas based on the double move and radical local approach. After two years, the students became so competent, they could be moved into normal classes.

The cultural-historical approach was appreciated by Bernd Fichtner and Maria Benitas who invited Chaiklin and me to Porto Alegre in Brazil where a socialist government was in power. The idea was to introduce the double move and radical local teaching and learning to children in the city. We worked political on these ideas from 1998 to 2001 for three years, where we visited Porto Alegre several times promoting the ideas. Then the government changed. In Brazil the ideas are still growing in the state of Goias [28].

Concluding remarks

Davydov's theory of theoretical knowledge and thinking has been a valuable tool in my research in teaching for many years. With the 'double move' I have stressed children perspective as a move from their motive orientation and interest to theoretical concepts and back to qualify their interests and develop their learning motive. For cultural minority and refugee children it has been important to stress the move between local values and knowledge and theoretical concepts since the local aspect may vary in relation to the dominating culture, so ascending to the concrete have to be ascending to the local concrete.

Other researchers in Denmark have also been influenced by Davydov's theoretical approach. Vagn Rabøl Hansen [13] made experimental teaching in mathematics in first grade, and Sven Thyssen [34] in mother tongue in second and third grade in comprehensive school. Seth Chaiklin [3] did a project about physic teaching in high school. But to influence school practice is another task than doing experimental research, and this has not been accomplished in Denmark. Perhaps it has been extra difficult in Denmark, because the instructional approach was changed in the 1970ies toward experience-based group work. The critique was that developmental teaching and the double move was too teacher guided. Today

the critique is directed at the experience-based teaching since it does not solve the problem of children learning theoretical knowledge and thinking. The problem with influencing the practice is

that it cannot be changed overnight it demands teacher training, if this can be solved there is a way forward for teaching children theoretical knowledge and thinking in school.

References

1. Aidarova L. Child development and education. Moscow: Progress, 1982.
2. Bruner J.S. Man, a course of study. Educational Development Center, Cambridge, Mass., 1970.
3. Chaiklin S. Developmental teaching in upper-secondary school. In Hedegaard M., Lompscher J. (eds.), *Learning Activity and Development*. Aarhus: Aarhus University Press, 1999, pp. 187—210.
4. Davydov V.V. Arten der Verallgemeinerung im Unterricht. Berlin: Volk und Wissen, 1977.
5. Davydov V.V. Ausbildung der Lerntätigkeit. In Davydov V.V., Lompscher J., Markova A.K. (eds.), *Ausbildung der Lerntätigkeit bei Schülern*. Berlin: Volk und Wissen, 1982, pp. 14—27.
6. Davydov V.V. Problems of development teaching. *Soviet Education*. Vol. 30, no. 8—9—10, 1988—1989. (In Russ.).
7. Davydov V.V. What is real learning activity. In Hedegaard M., Lompscher J. (eds.), *Learning activity and development*. Aarhus: Aarhus University Press, 1999, pp. 123—138.
8. Elkonin D.B. Toward the stages in mental development of children. *Journal of Russian and East European Psychology*, 1999. Vol. 37, no. 6, pp. 11—30.
9. Engelsted N. Springet fra dyr til menneske. Copenhagen: Dansk Psykologisk Forlag, 1984.
10. Engeström Y. Learning by expanding: An activity — theoretical approach to developmental research. Helsinki: Orienta-Konsultit, 1987.
11. Engeström Y., Hedegaard M. Teaching Theoretical Thinking in Elementary School: The Use of Models in History/Biology. In Bol E., Haenen J.P.P., Wolters M. (eds.), *Proceedings of the Third International Symposium on Activity Theory*. Den Haag: SVO/Soo, 1985, pp. 159—169.
12. Gould S. Ever since Darwin. London: Penguin, 1977.
13. Hansen V.R. Tilegnelse af teoretisk viden. In Schmidt S., Thyssen S., Hansen V.R. (eds.), *Virksomhed, udvikling og undervisning*. Copenhagen: Tiden, 1983.
14. Hedegaard M. Skolebørns personlighedsudvikling. Aarhus: Aarhus University Press, 1988.
15. Hedegaard M. The zone of proximal development as basis for instruction. In Moll L. (ed.), *Vygotsky and Education*. New York: Cambridge University Press, 1990, pp. 349—371.
16. Hedegaard M. The qualitative analyses of the development of a child's theoretical knowledge and thinking. In Martin L.; Nelson K., Toback E. (eds), *Sociocultural psychology. Theory and practice of doing and knowing*. New York: Cambridge University Press, 1995, pp. 293—325.
17. Hedegaard M. How instruction influences children's concepts of evolution. *Mind, Culture, and Activity: An International Journal*, 1996, no. 3, pp. 11—24.
18. Hedegaard M. The influence of societal knowledge traditions on children's thinking and conceptual development. In Hedegaard M., J. Lompscher (eds.), *Learning activity and development*. Aarhus: Aarhus University Press, 1999, pp. 22—50.
19. Hedegaard M. Learning and child development. Aarhus: Aarhus University Press, 2003.
20. Hedegaard M., Chaiklin S. Radical local teaching and learning. Aarhus: Aarhus University Press, 2005.
21. Hedegaard M., Frost S., Larsen I. Krigsbørn i eksil. Aarhus: Klim, 2004.
22. Hedegaard M., Sigersted G. Undervisning i samfundshistorie. Aarhus: Aarhus University Press, 1992.
23. Illeris K. Tendenser i 70'ernes pedagogik. U90 Samlet uddannelsesplanlægning frem til 90-erne. Copenhagen: Ministry of Education, 1978.
24. Jensen U.J., Harre R. The philosophy of evolution. London: St. Martin's Press, 1981.
25. Kjelstadli K. Fortida er ikke hva den en gang var. Oslo: Universitetsforlaget, 1992.
26. Leakey R., Lewin L., Møller G. Folket ved søen: Om menneskets oprindelse, natur og fremtid. Copenhagen: Gyldendal, 1982.
27. Leontiev A.N. Activity, consciousness, and personality. Englewood Cliffs, NJ: Prentice Hall, 1978.
28. Libaneo J.C., Freitas da Madeira R.A.M. Mariane Hedegaard's contribution to developmental didactics and to pedagogical research in Brazilian context. In Edwards A., M. Fleer, L. Böttcher (eds.), *Cultural-historical approaches to studying learning and development. Societal, institutional and personal perspectives*. Singapore: Springer, 2019, pp. 323—335.
29. Lompscher J. Problems and results of experimental research on the formation of theoretical thinking through instruction. In Hedegaard M., Hakkarainen P., Y. Engeström (eds.), *Learning and teaching on a scientific basis*. Aarhus: Aarhus University, Institute of Psychology, 1984.
30. Markova A.K. The teaching and mastery of language. *Sovjet Education*, XXI, no. 2—3—4, 1978—1979.
31. Marx K. Capital, vol 1. London: Penguin, 1976.

32. Mayr E. Evolution and the diversity of life. Cambridge, MA.: Harvard University Press, 1976.
33. Petrovski A. Studier I psykologi. Kollektiv og personlighed. Moskva: Sputnik, 1990.
34. Thyssen S. Motivation and activity in early school age. In Bol E., Haenen J.P.P., Wolters M. (eds.), *Proceedings of the Third International Symposium on Activity Theory*. Den Haag: SVO/Soo, 1995, pp. 127—135.
35. U90 Samlet uddannelsesplanlægning frem til 90-erne. Copenhagen: Ministry of Education, 1978.
36. Vygotsky L.S. The collected works of L.S. Vygotsky. Vol. 1. New York: Plenum Presse, 1989.
37. Zuckerman G.A. Developmental education. A Genetic modelling experiment. *Journal of Russian and European Psychology*, 2011. Vol. 49, no. 6, pp. 45—63. DOI: 10.2753/RPO1061-0405490603

Information about the authors

Mariane Hedegaard, PhD, Dr. Phil (Psychology), Professor Emerita, Department of Psychology, Copenhagen University. Senior Research Fellow at Department of Education, Oxford University, e-mail: mariane.hedegaard@psy.ku.dk

Информация об авторах

Марианна Хедегаард, PhD, Dr. Phil, эмерит-профессор, факультет психологии, Копенгагенский университет; старший научный сотрудник, факультет образования, Оксфордский университет, e-mail: mariane.hedegaard@psy.ku.dk

Получена 17.07.2020

Received 17.07.2020

Принята в печать 05.08.2020

Accepted 05.08.2020