

# *Finding a Concept That Integrates Specialists' Know-How: The Case of Special School for Handicapped and Neurologically Ill Children*

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**Abstract.** *The integration of specialised knowledge and know-how from many areas is needed to meet demanding challenges and a new path for development. In practice, this is, however, difficult. In the literature on collaboration between specialists representing different areas of expertise, much has been discussed about how coordination and exchange over disciplinary boundaries is possible. The development and function of integrative concepts in collaboration has been studied less. The concept of the object of an activity developed in the tradition of cultural historical activity theory can clarify the difference between the coordination of specialists' contributions and the genuine integration of know-how. One of the activities that call for the integration of knowledge and skills from several areas of expertise is the upbringing of handicapped, neurologically ill children. In this article, we will describe a developmental intervention in which a new collaborative way of working between teachers, therapists and nurses was created. Instead of coordinating their different activities, the representatives of these professions started to collaboratively design and structure individual pupils' daily activities so that they became rehabilitative.*

**Keywords:** *Integration of knowledge, substantive generalisation, boundary crossing, Change Laboratory, rehabilitation, school for handicapped children*

## **Introduction: The Problem of Integrating Know-How from Separate Domains**

In science and professional activity, we see repeatedly situations in which responding to demanding challenges and opening new avenues of development call for keen collaboration between representatives of different professions. This kind of collaboration is, however, difficult in practice. For specialists working in their own conceptual worlds it can be difficult even to recognise the need for or potential of collaboration. Even when the need for collaboration is obvious, differences in perspectives, concepts and tools still hamper its realisation. Crossing disciplinary and professional boundaries has therefore become both a practical challenge in many areas of activity and an important research problem (Löwy, 1992; Fujimura, 1992; Dogherty, 1992; Nonaka & Takeuchi, 1995; Mattila, 2006; Kerosuo, 2006).

Needs and options for integrating knowledge from different specialities vary from situation to situation. In some areas of activity there are well-established views of the needed kinds of expertise as well as established tools and routines for coordinating specialists' contributions. Know-how integration becomes a problem when the established coordination routines become for some reason ineffective, when new kinds of challenges are met or when a new idea emerges that opens new visions for the future, but can only be realised by combining knowledge and skills from many areas of expertise.

Supporting the development of handicapped children is an activity in which the integration of knowledge and know-how from diverse areas is important. In Finland state educational establishments for special education provide handicapped and neurologically ill children the care, basic education and various kinds of therapies they need. The development of methods of care and rehabilitation in these educational establishments has enabled handicapped children to become independent members of the society. At the same time, the number of various specialists working with the children has increased and it has become increasingly difficult to coordinate their activities.

Many proposals have been presented in the literature of how to support the integration of specialised knowledge. The concept of the *object of activity* developed in the tradition of cultural historical activity theory can help to clarify the problem (Leont'ev, 1978; Stetsenko, 1995; Foot, 2002). In this article, we will first discuss attempts to explain and solve the problem of knowledge integration. We will then propose how the problem could be analysed using the concept of the object of activity. We will then proceed to describe how this concept was used in a developmental intervention in which the personnel of a special education establishment re-conceptualised the object of their activity and used the new concept to create a new form of their activity that was based on intensive cross-professional collaboration and knowledge integration. Finally, we will present a theoretical interpretation of what took place in the developmental intervention and discuss the implications of the interpretation in the integra-

tion of specialised knowledge in an activity.

### **Attempts to Understand and Solve the Problem of Knowledge Integration**

In administrative studies, the problem of knowledge integration has typically been interpreted as a technical and organisational problem of information processing and knowledge sharing. To solve the problem either the amount of information has to be reduced, for instance by delegating authority, or the capacity to process it has to be increased by for instance appointing liaison persons, forming organs for coordination, creating new information systems or locating persons in a way that enhances knowledge sharing (Galbraith, 1973; Brown & Eisenhardt, 1995; Allen, 1977; Ancona & Cadwell, 1992). In many areas digital information and communication technology has indeed made collaboration remarkably easier. These improvements concern, however, more people working in the same professional area than persons representing different knowledge domains (Finholt, Sproull, & Kiesler, 2002).

When objectives and concepts differ, enhancing information processing does not solve the problems of knowledge integration. Star and Griesemer (1989) have studied how exchange between “social worlds” is possible despite differences in perspective and only partially shared interests. Star and Griesemer suggest that this is made possible by what they call *boundary objects*. These are material or conceptual objects that:

both inhabit several intersecting social worlds ... and satisfy the informational requirements of each of them. Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site use. (Star & Griesemer, 1989, p. 393)

As examples of types of boundary objects, Star and Griesemer (1989) mention repositories, ideal types, coincident boundaries, and standardised forms. These objects build a shared infrastructure for several activities. Peter Galison (1997) has borrowed the anthropological concept of *trading zone* and the linguistic concept of *hybrid language* to describe the way representatives of different activities can exchange and collaborate in a bounded area, although they disagree about the broader meanings of words.

Boundary objects, trading zones, and hybrid languages explain how exchange between and coordination of activities of different social worlds is possible. They function in the same way as words in natural language. Each word in a natural language has a general (literal) meaning, but in concrete situations individuals and groups complement and colour it with their own associa-

tions and situational senses. The dialectical unity of the general meaning and the various situational connotations of everyday word use make the development of ideas and new concepts possible, but also hamper the stabilisation of specific shared meanings and interpretations. The theories described above do not explain qualitative transformation of collaboration. Language does not just comprise a set of words with specific meanings, but develops continuously. New words emerge that crystallise new generalisations and concepts. In the same vein, new tools of exchange and collaboration develop that are based on new generalisations and concepts. The concept of the object of an activity developed in the tradition of the cultural historical theory of activity can help to understand these transformations.

### **The Relationship between Activity and Concepts**

Words have the function of directing interlocutors' attention to a certain object and they highlight some aspects of that object or its relationships to other objects. The referents of words do not arise from a passive contemplation of the world, but in societal practices. Words direct attention to objects, aspects, and relationships that make a difference in human activities. Knowledge and know-how develop in activities and are in many ways tied to their historically evolved forms, instrumentalities, concepts and professional languages. Therefore, the question of combining areas of know-how does not concern only the creation of more adequate and many-sided representations and explanations, but also the conceptualization of the object and purpose of the joint activity and the principle of its organisation. Knowledge is not just representations of facts. It also reflects the hard won ability of devoted persons to reach results that are deemed important. It is always connected to an object of an activity. Combining knowledge and skills from different domains involves therefore redefining the purpose, instruments and structures of activities as well as the identity of the actors. Competent persons do not change their activity and thinking easily. There has to be a good reason for such changes. A change has to meet a real need, serve an important cause and open a new path for development to be worthwhile.

E. Il'enkov (1977) maintains, that in societal practices of human beings the following scheme repeats itself: object – action – word – action – object. In other words, human beings produce representations and concepts on the basis of the observations they make when acting on them and use these representations and concepts to direct their subsequent activity of transforming the objects. In this continuous process, the essential difference is not between the inner mental world and external world but between *representations* and generalisations that reflect the reality, whether inner in the form of mental images or outer in the form of text and diagrams, and the *processes and actions* in which the representations and concepts are created and used. Although a word or a diagram depicting essential relationships may be static in its outer

appearance, its meaning and content can only be properly understood in relation to the actions through which it was produced and in which it is used.

A key insight of the Cultural Historical Activity Theory is that human activity is culturally mediated. Human beings do not perceive the surrounding world as neutral, immediate stimuli, but as objects that have a cultural meaning. A secondary stimulus, a word and the concept it refers to, is attached to the primary stimulus. The secondary stimulus attaches a meaning to the primary that relates it to human practices. Also the object of a joint activity is, according to A. N. Leont'ev (1978, p. 52), always in this way twofold. It appears:

first, in its independent existence as subordinating to themselves and transforming the activity of the subject; second, as an image of the object, as a product of its property of psychological reflection that is realized in the activity of the subject and cannot exist otherwise.

The object is thus, on the one hand, given and observable relatively directly and, on the other hand, constructed and interpreted from different points of view with the help of culturally given concepts. For instance, a patient that consults a physician is first an object of immediate perceptions to the physician, but becomes a specified object of his healing activity as the physician constructs a diagnosis of the patient's illness through an interview, tests and a care plan applying medical knowledge.

The theories of coordination and exchange between separate activities all deal with a case in which the objects of the activities of the concerned actors are separate and parallel. The actors' actions are coordinated with the help of instruments of exchange and coordination like boundary objects, hybrid languages on the one hand, and through established scripts of interaction, on the other (Nelson, 1981). Y. Engeström (2008, pp. 48-63) has depicted the basic structure of this kind of exchange and coordination with the model in Figure 1. Each actor representing a different speciality has his or her own object of interest and action. Coordination is based on the established script of interaction.

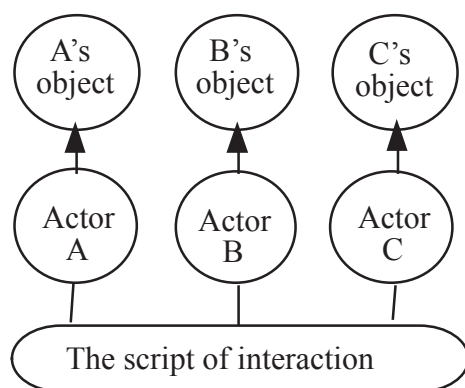


FIGURE 1 The structure of the coordination of specialists' contributions

Coordination of the contributions of actors representing different specialties makes it possible to collect and combine pieces of various specialists' knowledge in an external way, but it does not lead to new concepts and qualitatively new knowledge. Because the object of an activity is partly given, and partly constructed with the help of culturally available concepts and instrumentalities, we can discern two situations of coordination that differ essentially from the point of view of developing collaboration. In some cases the given objects and the conceptualised objects of different specialists are different. In some cases, however, the given object of the specialists is the same, like for instance pupils at school who are taught by a number of specialised teachers, or patients cared by several specialists in the health-care system. Each specialist conceptualises, however, the given object with the help of his or her professional concepts differently as an object of activity and thus the same given object is for each specialist a different object of activity.

Especially in the latter case, disturbances in coordination easily emerge as the differently conceptualised objects partly overlap in a contradictory way. Ruptures between specialists' contributions also can occur as essential aspects of the given object are not conceptualised at all or relationships between different conceptualisations are not recognised and dealt with. These kinds of disco-ordinations may trigger a joint problem-solving process between the specialists representing different areas of expertise. Dealing with repeated disturbances and ruptures becomes a provisional shared object for the actors who work on it disregarding the script (see Figure 2). As a result of the problem solving, an amendment is perhaps made to the tools or the script of collaboration. When the problem has been solved the functions go on as before as separate but coordinated. There is, however, the possibility that in the problem-solving process a new conceptualisation of the given object is reached that integrates the previously separate partial conceptualisations and creates a shared object of activity.

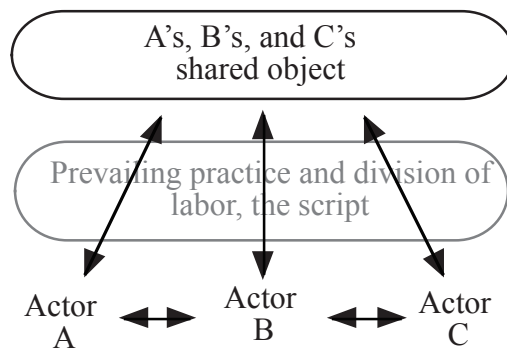


FIGURE 2 The structure of collaboration between specialists

Nonaka and Takeuchi (1995, pp. 95-123) have presented an interesting example of the process of finding a concept that integrates specialised areas of know-how. The example is about home appliances production in the Matsushita Company. The company produced three different types of home appliances in three different departments specialised in different technologies. As the demand for these traditional products decreased the management fused the departments and set a new objective. The new united department should develop new, technologically more advanced products that would succeed in the market by integrating the know-how of the former departments.

Specialists in the various technologies held several meetings, but despite the objective set by the management no idea emerged for a new product that would integrate the technologies. After having discussed the options for a time within the new department, the company decided to send a group of specialists to the USA to study conditions in these supposedly more advanced markets for home appliances. The group learned that housewives were increasingly working outside the home and had therefore no time to prepare nourishing food for their families. An appliance that would help housewives to easily make good food would solve their problem. This observation concerning the housewives' problem was crystallised in the slogan 'easy rich'. In activity-theoretical terms: the group had found a contradiction in the life activity of potential customers, which created a need for a new solution and redefined the need which the home appliances production had to satisfy.

The specialists of the company then started to search for an idea for a product that would meet this customer need. It turned out that the development of a bread machine had been considered in the company previously, but the idea had been abandoned. Now it was realised that an automatic bread machine would be just the kind of appliance that would meet the 'easy rich' requirement. Such an appliance could be created by integrating the technological know-how of the previous three departments. After some initial problems the company managed to create a bread machine that met the requirements. It was a great success. Subsequently the company developed a number of other home appliances meeting the same need. Later on the management decided to generalise the insight gained in the home appliance department. For this purpose the slogan 'easy rich' was transformed into the more general 'human technology' that would characterise all the company's products.

There are a number of important issues to consider in the example. Although the authors do not bring it forth, it seems that the breakthrough was reached only through studying the activity of the potential clients, not in the discussions between specialists although they had the objective of integrating the technologies. The 'easy rich' generalisation concerning the need of the potential clients redefined the need for home appliance production, but the new object that integrated the technologies only emerged when the idea of a product that would meet that need was found. It is interesting that the later, more general formulation of 'human technology' does not any more carry an



idea of a client need.

The phases in Nonaka and Takeuchi's case story neatly correspond to Leont'ev's (1978, pp. 52-56) theoretical idea that a need prompts the search for an object that would meet the need and the effective motive for an activity is only established when such an object is found. In this case, however, the idea of a new object had to meet at the same time two historically evolved needs at the same time: A general need among potential customers and Matsushita's need to find an idea for a viable product that would boost sales and harness the synergies between its know-how in three areas of home appliances technology.

Ilana Löwy (1992) has described how the research in immunology changed dramatically when the researchers reconceptualised the object of the research. Until the 1950s the research was conceptualised as searching for an explanation for how the body defends itself against pathogens. As the research advanced it was however recognised that the body reacted with a defensive mechanism also to other substances than pathogens. Then, for the first time an idea of preserving biological identity was proposed: the mechanism was not about repelling pathogens, but about preserving the chemical identity of the species. However, the reconceptualisation of the object of research did not at first lead to collaboration between physiologists, biochemists and physicians to reveal the mechanism because the undeveloped research technology prevented precise enough observations. Immunologists instead focused on experimental chemical research. As a result of these studies more evidence was obtained that supported the identity hypothesis. The first kidney transplant operations increased the need for immunological knowledge. As research methods developed, the research activity was increasingly understood as investigating how the body preserves its biochemical identity. This concept created the basis for collaboration between biologists and physicians.

According to Löwy, the ambiguity of the concept of 'preserving the biochemical identity' made it an especially good boundary object. From the point of view of the Cultural Historical Activity theory, on the contrary, it is essential that the concept redefined the object and motive of the research activity. The ambiguities of the concepts that define the object of a joint activity have a specific nature and content: they are ambiguous because they define an object that is unfinished, but opens important future possibilities. The perspectives the concept evokes create the motive for collaboration.

Löwy's study contains also another important observation. The concept of preserving biochemical identity did not lead to a redefinition of the object of the research activity when it was invented. This shows the multilayered nature of the concept of the object of an activity and how it is conditioned through the possibilities of available instruments. A new concept concerning the object of the activity combined with and corresponding new instruments opens a new zone of proximal development for an activity. It reinterprets the relationships between observations concerning various aspects of the object and creates an



association between the idea of the object and the purpose of the activity. Without the tools the new concept does not affect the practical activity. J. H. Fujimura (1992) has also highlighted the importance of this concept-instrument relationship. He speaks about 'standardised packages' that define a conceptual and technical workspace.

Perhaps the most important of Löwy's observations was that new scientific observations and the new concept concerning the object of the activity created to understand them not only creates the basis for sustained research activity, but also the sustained development of the forms of collaboration between researchers representing different disciplines. Elaborating Raethel's and Fichtner's idea, Engeström (2008, pp. 48-63) characterises this kind of sustained joint development as *communication*, because the changes in the object of the activity and in the structure of collaboration (including the participants' roles) condition and mutually support each other: the form of collaboration is changed to meet the progress and changes in the object of the collaboration and the new forms of collaboration enhance the mastery of the emerging new aspects of the object (See Figure 3).

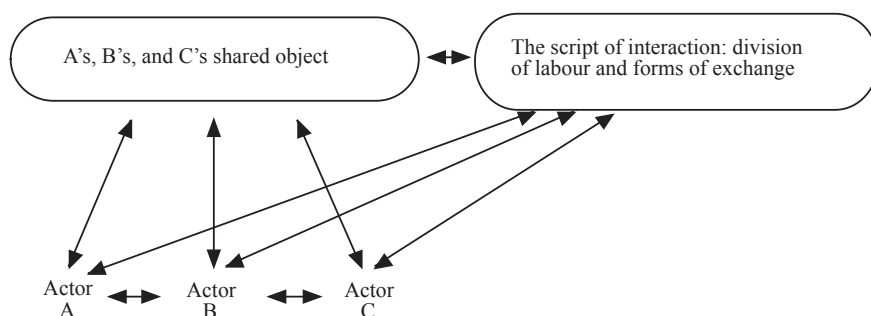


FIGURE3 Communication – sustained developmental collaboration

Keating and Cambrosio (2003, pp. 4, 17-22) criticise sharply social scientists who speak about 'social worlds' disregarding the great importance of material tools and describing collaboration as if it were just a matter of will. They use the concept 'biomedical platform' when studying the collaboration between biologists and medical scientists. With this concept they refer to many-sided systems of instruments, sets of data, systems of representation, practices and social structures, which integrate the biological research of healthy organisms and the medical research of diseases and healing, scientific and practical knowledge as well as established practice and new inventions. This kind of platform entails a concept concerning the purpose of the collaborative activity and enables flexible movement between levels of collaboration from coordination to collaboration and communication.

The examples presented above show that the concept concerning the object

of the activity restructures the givens of the object. In the bread machine example the givens were the potential users of home appliances and in the immunology example the scientific facts produced by the research. Such a concept shows how a new kind of use value can be created by combining know-how from certain areas of expertise in a specific way. Without such a concept abstract objectives do not suffice to integrate know-how as the Matsushita's bread machine example shows. Even a good idea or conceptual generalisation, which later proves to be right, does not change the collaboration if it is not combined with instruments that change the subject-tool-object relationship. The idea of the preservation of biochemical identity became important only when there were instruments for doing empirical research on the basis of it. This new concept solved a contradiction between the old concept and new facts in a way that opened a new line of research and a corresponding new zone of proximal development for it. It is also important to notice that it was not the idea of making a bread machine as such that changed Matsushita's activity but the idea of a bread machine as an object that would meet both the need of potential customers and the company's need to harness the synergies between its areas of technological know-how. This shows how the concept concerning the object of an activity has a layered structure and is tightly connected to the other elements of the activity system.

### **Re-conceptualisation of the Object of the Activity of the Professionals in a Special School for Handicapped and Neurologically Ill Children**

The second author of this article, a consultant in a commercial consulting firm, carried out a developmental intervention in a state special school in Finland in 2005 and 2006. The intervention covered all the activities of the institution. As the result of the intervention the special school re-conceptualised the object of its activity in a way that led to a new form of collaborative support of the development of the handicapped children and young people. In the following we will describe the intervention. We will call the special school for handicapped simply 'the school'.

The task of the school is to provide basic education and support services for classes of children with a motor handicap or a neurological injury. The services provided by the school comprise also rehabilitation-need assessment and many forms of rehabilitation and guidance. Annually about 200 children visit the school for a period of examination and support. In addition there are about fifty permanent pupils in basic education, many of whom live during the school week in the Students' Home of the school. The school employs on average 115 persons although the number varies according to the changing need for temporary school assistants. The school has been divided into three departments.

Students' Home provides accommodation and basic care for the pupils. An important part of the work in the Students' Home is collaboration with the

parents because for many of the pupils the Students' Home is a substitute for their real home for several years. The Students' Home is divided into departments on the basis of the age of the pupils. There are also special departments for training in independent action, for those who are finishing their compulsory education, and for morning and afternoon care for children not living in the Students' Home. A nursing science based philosophy has traditionally been applied in the activity of the Students' Home and a 'personal nurse' has been appointed for each pupil.

The rehabilitation department of the school carries out rehabilitation-need assessments and provides the therapies the pupils need. The assessment and therapy services include also the assessment and design of the learning environments and children's learning aids as well as production of written reports about them. The activity of the rehabilitation unit is based on a medical mindset.

The teaching department provides primary and basic education in classes. Its activity is based on the pupils' individual study plans and the official curriculum of the Finnish comprehensive school. When the developmental intervention started, the department applied the traditional system of subject-based division of labour and 45-minute lessons.

Several reasons led to the launching of a developmental intervention in the school. The initial interviews with the management and members of the staff revealed that both the management and the personnel felt that the activity was 'in troubles'. The number of pupils had increased and the pupils were more severely handicapped than earlier. In addition the National Board of Education had decided that special schools have to be developed into regional service centres that would respond to the special pupils' and their networks' needs with services based on the centres' special expertise. The National Board had also decided that the service centres have to cover the costs of their activity themselves. Rehabilitation-need assessments and summer classes arranged by the school were at that time chargeable, but the income from them was not enough to cover the costs of the school. The management of the school was also worried about the personnel's well-being and stamina. The personnel experienced problems at work and felt that no progress had been made in the development in school operations.

The view of the developmental needs was vague; therefore the consultant suggested that a collaborative developmental-needs assessment be carried out in the school. The management agreed. A core group was formed to carry out the developmental-needs assessment in collaboration with the consultant. The group comprised the management of the school and the department heads as well as representatives of personnel from each department. The consultant collected from the personnel of each department assessments of developmental needs in group interviews based on a set of questions given beforehand. Data was also collected about changes in clientele, services and personnel from statistics concerning the activity and from the annual reports of the school

The central result of the developmental needs assessment was that numerous problems and disturbances occurred especially in matters that called for the coordination of the activities of the departments. The departments had traditionally operated independently according to their respective frames of reference and their objectives and operating practices had diversified; therefore, it was difficult to coordinate their activities. The given object, the pupils, was the same for all departments but it was not shared because each department conceptualised the object in a different way. Another central finding was that, during last decade, remarkable change had occurred in the type of pupils coming to the school: the pupils needed more therapy and care than before. It seemed that haste and interruptions in the pupil's and personnel's days was caused by difficulties in the co-ordination of the therapy, care and educational activities. The third result was that there were elements for building a new form of operation, but the current service activity as such did not meet the demands set by the National Board of Education for service centres. On the basis of this developmental needs assessment, the management decided to launch a developmental project covering the whole institution.

According to the proposal of the consultant it was decided to apply the Change Laboratory method (Engeström, 2007) that is based on Developmental Work Research Methodology (Engeström, 1987). One of the features of the method is to bring the given object of the activity as concretely as possible under the participants' examination and prompt their critical assessment and questioning of the prevailing conceptions and practices. The core group was extended by inviting more representatives of personnel to the group. This extended group carried out, guided by the consultant, ten weekly, two-hour Change Laboratory sessions in the spring 2006. The consultant collected specimens of assessments from her interviews with members of the staff, her ethnographic observations concerning the operating processes in the care, rehabilitation and education departments as well as disturbances and ruptures occurring in and between them.

While the core group's Change Laboratory process was still going on, similar Change Laboratory processes were launched in the Students' Home, the Therapy Department, and the Teaching Department. The whole process was divided into four main phases: 1) recognition of the current practices and problems inherent in them as well as 2) the analysis of the historical roots of the problems, 3) the specification of the central inner contradictions and developmental challenges of the activity system, and 4) developing a new model of the activity, experimenting with it, and carrying out the first changes to implement the new model. The phases of the project are depicted in Figure 4.

The developmental process comprised four interlinked Change Laboratories, one in the Core Group and one in each department. The Core Group supported the development in the departments by giving materials and developmental tasks as well as by assessing and commenting on the plans and ideas of experimentation created in the departments. It also helped depart-

ments in planning experiments and supported them in carrying them out. Special task force groups were formed when needed to prepare specific plans. Task forces were set to: plan a new system for introduction of newcomers, planning summer courses, planning and realising the new form of teaching, and planning the service for new clients. The task force groups were multiprofessional and cross-departmental.

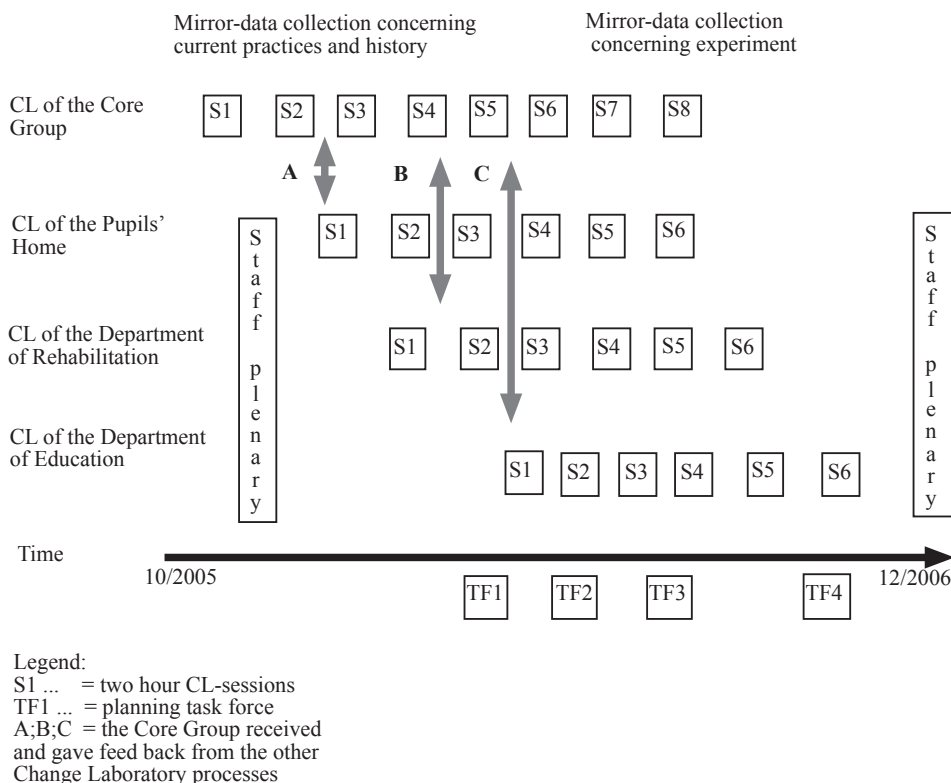


FIGURE 4 The structure of the developmental intervention process

In the Change Laboratory of the core group the participants examined the historical changes that had taken place in the nature of handicaps and injuries of incoming pupils (the given object of the activity). For several years, the principle of inclusion has been applied in the Finnish school system. According to this principle the needs of children and young people who need special care are primarily met in a normal school in the home municipality of the pupil. As a result of this development, which is positive from the point of view of the pupils and their families, the special school received pupils with increasingly severe handicaps and injuries in need of extensive care and assis-

tance. One of the staff members described the change aptly:

*"While earlier a few pupils were in wheel chairs and others walked and a few had an individual curriculum, now a few walk and almost all have an individual curriculum."*

Because of the changes in the kind of pupils and also because the school had hired new experts to give therapy, care and individualised guidance the activity of the pupils and the departments had become hectic. According to statutes, therapy had to be given during the pupil's school day. The pupils had to be moved from the classroom to therapy rooms. Because the transfer involved putting on clothes and changing utilities, and pupils' movement was cumbersome the transitions took increasing share from the pupils' school day during which therapy, teaching and care had to be delivered. Because of the transitions the effective time for rehabilitation and teaching diminished. Therapies took time from teaching. When the participants examined how many pupils need therapy in a day or week, the result was a surprise for many of the staff members. The students had 2-6 therapy appointments per week. As haste thus increased, the personnel carried increasingly out tasks the pupils could have carried out, which diminished pupils' possibilities to learn and practise independent action. The picture shown in the mirror data represented the script-based coordination of the specialists' contributions as in Figure 1 in which the separate objects of the various specialists collide and create disturbances.

From the point of view of the progress in the developmental intervention, a crucial piece of mirror data was the reconstruction of the school history of an individual pupil. Guided by the consultant the participants collected information about all plans and evaluations that had been made concerning this pupil in the different departments for teaching, care and rehabilitation, and of all teaching, care and rehabilitation given to the pupil, as well as collaboration with his family. As an example a pupil was selected who had been a client of all the departments of the school and also gone to the normal school in his home municipality before coming to the special school. The analysis of this data revealed clearly the distinctness of the plans and actions of the various departments and the resulting inconsistency and ruptures in the teaching, care and rehabilitation of the pupil. The data also revealed the weaknesses of the applied methods of assessment. When interviewed, the family of the pupil expressed the wish that the school would consider more the possibilities inherent in the pupil's daily life when assessing the pupil's action capability and in the development and planning of actions to support his development.

This mirror image of the working practices of the school made it clear to the staff how poorly the traditional way of coordinating specialists' activities functioned in the changed situation. After discussing the case it was clear to the participants of the Change Laboratory that they had to find a way to reme-

dy the situation in which each department and even individual specialists within departments defined separate parts of the therapy, teaching and care of the same pupil as their separate objects of activity. A concept had to be found that would help to see the teaching, care, and rehabilitation of the pupil as a shared object of the specialists' activity. The consultant searched together with the staff for a new principle to structure the activity by reading literature in the field and investigating the work practices of similar institutions at home and in other European countries. As a result of this investigation the participants found the conductive method of teaching and rehabilitating handicapped children created by the Hungarian physician Andreas Pető (1893-1967). The method is in use in many European countries including Finland, and it turned out that one of the physiotherapists and one of the teachers of the school had studied the method and even experimented a little with it in some phase, but the use of the method had not become common and those who had experimented with it had abandoned it.

Pető's conductive method unites the teaching, rehabilitation and basic care of a CPinjured pupil (Hári & Ákos, 1988). Movement, balance, the maintenance of posture, coordination and control of muscles, muscle power, and communication are developed stepwise. There are five basic principles in the method:

1. Acting in a group and the encouragement power of the group
2. Education and guidance by a multi-professional team
3. Environment that supports learning and agency
4. Objective-oriented, versatile program
5. Rhythmic intention, using language and rhythm to coordinate and to become aware of learning and action.

The central idea of Pető's method to make the daily activities of the pupils rehabilitative provided a starting point for reconceptualising the object of the professionals' activity and integrating the contributions of the various specialists. The core group decided to start experimenting with the method in practice. A number of young teachers became inspired to experiment with the method in their own classes. An opportunity to study the method was quickly arranged for all those who were working with the pupils in these classes. After learning the basics these teachers started to develop their teaching according to the method. In one of the classes therapy and care were integrated with teaching mathematics and history, in another with mother tongue and environmental studies. Thus experience was gained about the applicability of the method in teaching different subjects. The experiment was carried out by a multi-professional team consisting of the class teacher, the pupils' assistants, nurses and therapists. The team assessed jointly each pupil's situation and set the objectives of teaching and rehabilitation. The team assessed also how the method could be used in other parts of the pupils' daily activities besides teaching. The child's agency and attempts were mainly guided verbally although correct movements were also demonstrated and the pupil's posture



was corrected.

Experimenting with the new method took about two months. After that the multiprofessional team that planned the experimental teaching assessed the results and the feasibility of the method as well as ways to develop further its application. The results concerning pupils' progress in subjects, their independent action and control of the body were very good. Although the Petö classes were demanding for the children, they were enthusiastic about learning in a new way. The school staff assessed the experiment additionally from the point of view of the pupils and the staff. The results of the experiment strengthened the Core Group's view that activity has to be developed along that line; therefore, the Core Group planned to organise training in the method for the whole staff. The idea was that the elements of the conductive method would be realised also in other situations than in Petö classes and that "holistic activity for supporting the pupil" would be articulated to be the shared integrative frame of reference of the activity. As a result of the discussions a new shared concept of the object of the activity was created; 'making the pupil's daily activities rehabilitative', on the basis of which concrete changes in pupils' and staff's daily activities could be made.

After a few first sessions of the Core Group's Change Laboratory, Change Laboratory processes were started in the departments. In these processes the personnel of the department focused on the specific developmental needs of the department on the basis of the new common idea. Partly the same mirror data was used in these sessions as in the Change Laboratory of the Core Group such as the documentation of the school history of the pupil. In addition, specific mirror data was collected about the activity of the department.

### **The Change Laboratory Process in the Students' Home**

A five two-hour session Change Laboratory process was carried out in the spring of 2006. The whole staff of the home took part. The mirror data reflecting the home's activity consisted of individual care plans and data about practices of documenting pupils' physical well-being and development. The examination of the documentation revealed that ninety percent of them concerned basic care and malady treatment measures, although the staff felt that the pupils needed increasingly support for psycho-social and cognitive development. The documentation depicted more the actions of the staff than the pupils' experiences and development while staying in the Students' Home. Little had been documented about the methods used by the members of the staff in assisting the pupils or the feasibility and results of their interventions. It was also observed that the plans were not concrete. This was reflected also in the comments of pupils' parents who were interviewed for the laboratory. The parents said that they need concrete advice and instructions on ways to help the child. Objectives had been set for the care of the children but they were too general to direct the activity. According to the 'personal-nurse' care

system, each nurse set the objectives and planned the care of his or her own pupils independently although the whole staff of the Students' Home was responsible for all the pupils in the home.

The mirror data provoked a discussion about how to better assess pupils' action capability and its development. The assessment practices were dominated by the assessment made annually in all state special schools. That assessment was, however, not sufficient for these special pupils and provided only very general descriptions. The mirror data showed that the staff lacked the tools for assessing changes in the psychosocial action capability of the children.

The consultant collected all the care, rehabilitation and teaching plans made during the last two years for each pupil to be used as mirror data in a Change Laboratory session. The examination of these revealed that the Students' Home did not get or acquire information about the objectives set and plans made for each pupil in the other departments. Also the knowledge concerning pupils gained in the Students' Home was not utilised enough in the work of the other departments. Individual teaching plans and the meetings in which they were discussed were the shared tools of the work community that could be used to overcome these problems, but also other shared tools would be needed for continuous assessment and planning. On the basis of these observations a task force was set to design suitable assessment methods for the school. It was also realised in the Change Laboratory sessions that the division of labour that was based on professions was no longer functional in the changed situation. The idea of a class team and a shared set of tools for the team were developed and a decision was made to experiment with this in practice. Through these experiments the staff of the Students' Home was involved in the class work that was based on the idea of '*making daily activities rehabilitative*'. The personnel of the Students' Home took the change as a new possibility and started to plan the new arrangements in the Students' Home and in the classes.

### **The Change Laboratory Process in the Rehabilitation Department**

The rehabilitation department comprised two teams, one of which was responsible for the therapy of the pupils of the school and the other the rehabilitation assessments of other children and young people. The Change Laboratory process in the rehabilitation department comprised six two-hour sessions. The focus was on the rehabilitation-needs assessment and the content and methods of therapy given to the pupils.

An important part of developing the therapy activity of the school was to organise the pupil's day so that therapy, care and teaching would form an integrated whole. The question was, how to apply in practice the idea of making pupils' daily activities rehabilitative together with teachers, pupils' assistants working in classes, therapists, and nurses. Traditionally rehabilitation, assess-

ments and tests were carried out in the therapist's own office or in a special therapy room. According to the new view, rehabilitation took place during all of the pupils' activities and assessment should be made in pupils' natural environment.

The decision to experiment with multi-professional class teams helped in the creation of the new model, but before the experiment it was necessary to discuss the nature and expectations of the rehabilitation activity. Traditionally rehabilitation had been defined as a support function for teaching. The staff of the teaching department and the rehabilitation department discussed in their common meetings first how the departments themselves define the relationship between rehabilitation and teaching, how the individual and class rehabilitation is carried out in practice and what is accomplished through therapy in the current system.

In the Change Laboratory session's ideas were created about how to integrate care and teaching according to the idea of rehabilitative daily life. As the multiprofessional class team started its work in the autumn 2006, therapists were also involved in its work. New practices were created such as preparing plans concerning the support of the pupil jointly, jointly carried out control and calibration of the pupils' learning environments and utilities, instruction of other members of the team amidst practical work. The presence of the nurse or assistant in pupils' individual therapy sessions was also a new practice. Through it was safeguarded that the nurse or the assistant immediately received the information, instructions, exercises and a model to guide the pupil also in the class and the Students' Home in the way the therapist had planned. The new practices made it possible to share the knowledge and know-how of the individual members of the staff and to make it into the common expertise of the class team. It was decided to jointly schedule the pupils' days from the beginning of the next term on so that the therapy sessions would leave enough time for pupils' rest and transition from one place to another and that teaching and therapy would be interlocked optimally.

### **The Change Laboratory Process in the Education Department**

The Change Laboratory of the education department comprised seven sessions in the autumn of 2006. The immediate developmental challenge was to diminish the amount of stress experienced both by the personnel and the pupils and to improve the support given to the pupils by improving the organisation. The integration of rehabilitation and teaching became a central question and the planning of the multi-professional work in the classroom. It was to find a way to schedule the pupils' day according to the idea of making pupils' daily activities rehabilitative.

The mirror data collected showed that the breaks between the 45-minute lessons that were held according to the traditional school practice were often used to carry out a care measure, to transfer the pupil from one classroom to

another or to give therapy for the pupils. Pupils could only go out during the lunch break in the time of the year when they had to put on outdoor wear. Although the teachers tried to keep on schedule, it was not realised in practice because pupils had individual plans and each pupil had to receive a certain amount of instruction in a certain subject in a week.

The teachers characterised the lesson plan as “theoretical.” When a pupil moved from the class to a therapy session, the schedule had to be changed. The structure of the timetable turned out to be one of the reasons why pupils’ days were so disorganised and rushed and hasty: quick transitions from one subject to another interrupted the learning process and all pupils did not have time enough to accomplish their tasks.

The teachers planned in the Change Laboratory how the traditional timetable could be changed. In spring 2006 the teachers started to experiment with double lessons and changes in the timing of breaks and lunch time. The experiments showed that to avoid haste, more radical changes were needed. The planning task was demanding because the teachers wanted to give the pupils time to accomplish their tasks independently according to the conductive method. Searching for a solution and reaching a common decision was not easy, but finally two class teams wanted to experiment with dissolving the traditional weekly timetable.

Led by the teacher the team of the small pupils’ class based the teaching on thematic units and integrative instructional solutions. The timetable on the wall of the class was now empty besides for the weekly swimming groups and computer lesson. The team could, however, give the prescribed amount of weekly teaching on each subject; only the teaching methods had changed. In March 2007 the personnel of the class found the experiment a success. Because of the change in the structure of the timetable neither the staff nor the pupils were not any more in constant hurry; there was time enough for pupils’ independent action and therapy did not disturb teaching as before.

The structure of the timetable was also changed in the elder pupils’ class. In the new structure two subjects were paired and they were studied every other week. Thus longer periods could be obtained for the study of one theme, for instance a whole morning. In this time the teacher had sufficient time to teach the subject and the pupils to go deep into the subject and accomplish their tasks. The necessary breaks could be held and care measures taken in peace. In addition there were on Wednesdays a ‘daily paper day’ during which the pupils would read papers with the teacher and examine articles, enabling the study of several subjects. The class team assessed that the new practice had improved pupils’ possibilities to learn and finalise their learning processes. Also for the staff the new model has meant less pressure at work.

An essential change that was planned in the Change Laboratory was the multiprofessional class team and the teams shared tools. These were among others the weekly team meetings, a shared action plan, and a shared documentation system. The job description of the nurses was expanded so that a

nurse is appointed to work with certain classis and will be present in the class during teaching. Therefore, a common view of the pupils' needs emerges and the nurses learn suitable ways to assist the pupils in the evening when they are doing their homework. The nurses now know more about the pupils' school day to report when the parents contact them.

### **Conclusions: The Need for a Substantive Generalisation Concerning the Object of Joint Activity**

Although the different professional groups in the school worked to support the development of the same children, they had delineated and defined the object of their activity in terms of their respective professional concepts and traditions. As more severely handicapped and neurologically ill pupils became selected to the school, it became increasingly difficult to master the activity through the external coordination of specialists' contributions. The prospect of economic crisis increased the pressure for change.

Petö's conductive method was not a historically new invention at the time of the intervention nor was it unknown in the professional spheres of special education. Some of the members of the staff had even experimented with it. The concept did not, however, gain momentum enough to lead to collaborative transformation of the activity of the school before it was seen as a way to solve the crisis. That momentum was only created in the intervention as the personnel analysed jointly the systemic causes of their daily problems and realised the contradiction between the task of helping severely handicapped children and their profession-based division of labour. The decisive piece of mirror data that led to this realisation was the reconstruction of the history of the plans and measures of care, teaching and rehabilitation of a pupil. It showed how problematic the way of working – which is generally seen as normal – was. This data forced the professionals to see how badly the measures they took were co-ordinated.

Petö's invention and the integrative concept of '*making daily activities rehabilitative*' defined the object of the professionals' activity in a new, promising way that motivated them and gave a reason and direction for transforming their activity – it started a new kind of communication between the professionals (see Figure 3). The case shows, however, how much further planning and experimentation was needed to ascend from this abstract germ cell to concrete new practices in the school. New tools and a new form of professional collaboration, the multi-professional class team, had to be developed. Teachers, assistants, nurses and therapists had to redefine their work and professional roles. This process highlights the multilayered and many-faceted nature of the concepts that define the object of an activity (Engeström, Pasanen, Toiviainen, & Haavisto, 2006, p. 61).

In the Cultural Historical Activity theory, knowledge is seen as a tool to plan the way to effect the object of the activity. According to M. Wartofsky (1979) it

is useful to differentiate between primary tools with which the work is actually carried out and secondary tools that describe the ways of creating and using the primary tools. Y. Engeström (1990) has extended Wartofsky's idea and differentiated between 'what,' 'how,' 'why,' and 'where-to' tools. When the integration of knowledge from different domains is discussed, it is often implicitly assumed that the integration concerns the why-tools, that is, varying explanatory concepts and theories. In reality, one cannot easily separate these from the complex layered structure of the instrumentality of an activity. In this case we can see, that the different professionals had not only carried with them to the school the explanatory concepts and methods of their professions, but also the forms of organizing the work typical of each profession's mainstream practice; the subject and lecture structure of a school, the session model of therapy, and the 'dedicated-nurse' model of care. Integrating know-how in this case meant the restructuring of the whole instrumentality on the basis of the new explanatory concept defining the object of the activity.

It is interesting to compare the concept of '*rehabilitative daily activities*' to the school's earlier characterization of its activity as '*holistic support of pupils' development.*' The earlier formulation characterises a preferred kind of support, which, as we have seen, was more a desire than reality. It is not a substantive generalization concerning the principle of the activity, but a classificatory notion delineating a specific quality of support, the holistic one, from other possible kinds. The difference between these notions is in one sense similar to the difference discussed above between the '*easy-rich generalisation*' and the '*human technology*' notion. The former is a substantive generalisation concerning client need; the latter is a descriptive, classificatory notion that makes the distinction between human and less human technologies. The difference between a substantive generalisation and a descriptive, classificatory generalisation is not apparent from the verbal formulation as such. It is revealed only by analysing the creation and use of the generalisation. A substantive generalisation is only reached through analysis and experimentation. There is, however a difference between a substantive generalisation concerning the client need and the productive activity. A substantive generalization of a productive activity expresses the principle of producing a phenomenon, of meeting a need. The difference between a descriptive generalization and a generalization explaining why a given thing has its qualities is nicely exemplified in Spinoza's famous definition of a circle. According to him a circle should be defined as the figure produced by a line, one end of which is fixed and the other end of which moves. This definition gives the principle of producing a specific kind of outcome. "Making daily activity rehabilitative" is a definition of the method to increase handicapped children's' capability for independent action. The widely applied system of Managing by Objectives (Drucker, 1964), however, easily leads to abstract characterizations of objectives that express external qualities of the result to be reached without providing a substantive generalisation that shows the principle to reach the objective.



The idea of making daily activities rehabilitative expresses the object of collaborative work of the different professionals in a form that calls for co-configuration (Victor & Boynton, 1998, p. 195; Engeström, 2004, P. 12). The contribution of the different professionals, the pupil, and his/her family members are needed in configuring the pupil's daily activities so that the objective of rehabilitation can be integrated in them. This, however, can only take place, if all the available resources and know-how is used flexibly and creatively instead of according to a standardised script.

## References

- Allen, T. (1971). Communications, technology transfer, and the role of technical gatekeeper. *R & D Management*, 1, 14-21.
- Allen, T. (1977). *Managing the flow of technology*. Cambridge, MA: The MIT Press.
- Ancona, D. & Cadwell, D. (1992). Democracy and design: Predictors of new product development team performance. *Organization Science*, 3, 321-341.
- Brown, S. & Eisenhardt, K. (1995). Product development: Past research, present findings, and future direction. *Academy of Management Review*, 20(2), 343-378.
- Dogherty, D. (1992). Interpretative barriers to successful product innovation in large firms. *Organization Science*, 3(2), 179-202.
- Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit Oy.
- Engeström, Y. (1990). When is a tool? Multiple meanings of artefacts in human activity. In Y. Engeström, *Learning, Working and Imagining* (pp. 171-195). Helsinki: Orienta-Konsultit.
- Engeström, Y. (2004). New forms of learning in co-configuration work. *Journal of Workplace Learning*, 16(1/2), 11-21.
- Engeström, Y. (2007). Putting Vygotsky to work: The Change Laboratory as an application of double stimulation. In H. Daniels, M. Cole, & J. V. Wertsh (Eds.), *The Cambridge companion to Vygotsky* (pp. 363-382). Cambridge: Cambridge University Press.
- Engeström, Y. (2008). *From teams to knots: Activity-theoretical studies of collaboration and learning at work*. Cambridge: Cambridge University Press.
- Engeström, Y., Pasanen, A., Toiviainen, H., & Haavisto, V. (2006). Expansive learning as collective concept formation at work. In K. Yamazumi, Y. Engeström, & H. Daniels (Eds.), *New learning challenges: Going beyond the industrial age system of school and work* (pp. 47-77). Osaka: Kansai University Press.
- Finholt, T. A., Sproull, L., & Kiesler, S. (2002). Outsiders on the inside: Sharing knowhow across space and time. In P. J. Hinds & S. Kiesler (Eds.), *Distributed work* (pp. 357-379). Cambridge, MA: The MIT Press.
- Foot, K. A. (2002). Pursuing an evolving object: A case study in object formation and identification. *Mind, Culture, and Activity*, 9(2), 132-149.
- Fujimura, J. H. (1992). Crafting science: Standardized packages, boundary objects, and "translation". In A. Pickering (Ed.), *Science as practice and culture* (pp. 168-214). Chicago: The University of Chicago Press.
- Galbraith, J. (1973). *Designing complex organizations*. Reading, MA: Addison Wesley.
- Galison, P. (1997). The trading zone: Coordinating action and belief. In P. Galison (Ed.), *Image and logic: A material culture of microphysics* (pp. 781-844). Chicago: Univ. Chicago Press.



- Hári, M. & Ákos, K. (1988). *Conductive education*. London: Routledge.
- Il'enkov, E. V. (1977). The concept of the ideal. *Philosophy in the USSR: Problems of dialectical materialism*. Moscow: Progress.
- Keating, P. & Cambrosio, A. (2003). *Biomedical platforms: Reading the normal and the pathological in late-twentieth-century medicine*. London: The MIT Press.
- Kerosuo, H. (2006). *Boundaries in action: An activity-theoretical study of development, learning, and change in health care organization for patients with multiple and chronic illnesses*. Helsinki: University of Helsinki Press.
- Leont'ev, A. N. (1978). *Activity, consciousness, personality*. Englewood Cliffs: Prentice-Hall.
- Löwy, I. (1992). The strength of loose concepts: Boundary concepts, federative experimental strategies and disciplinary growth: The case of immunology. *History of Science*, 30, 371-396.
- Mattila, E. (2006). Questions to artificial nature: A philosophical study of interdisciplinary models and their functions in scientific practice. *Philosophical Studies from the University of Helsinki*, 14. Helsinki: University of Helsinki, Department of Philosophy.
- Nelson, K. (1981). Social cognition in a script framework. In J. Flavell, L. Ross (Eds.). *Social cognitive development: Frontiers and possible futures* (pp. 97-118). New York: Cambridge University Press.
- Nonaka, I. & Takeuchi, H. (1995). *The knowledge-creating company*. London: Oxford University Press.
- Star, L. & Griesemer, J. (1988). Institutional ecology, 'translations', and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology. *Social Studies of Science*, 19, 387-420.
- Stetsenko, A. P. (1995). The role of the principle of object-relatedness in the theory of activity. *Journal of Russian and East European Psychology*, 33(6), 54-69.
- Victor, B. & Boynton, A. C. (1998). *Invented here: Maximizing your organization's internal growth and profitability*. Boston, MA: Harvard Business School Press.
- Wartofsky, M. W. (1979). Perception, representation, and the forms of action: Towards an historical epistemology. In M. W. Wartofsky, *Models: Representation and scientific understanding*, Boston Studies in the Philosophy of Science, 48 (pp. 188-210). Dordrecht: Reidel.

