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Breaking out of a professional abstraction:

The pupil as materialized object for teacher trainees

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Abstract: The paper discusses the materialization of the pupil as a professional object for elementary school teacher trainees involved in a project of developmental intervention. Davydov's theory of learning as ascending from the abstract to the concrete and Leont'ev's notion of object are used as theoretical lenses to conceptualize this process. The analysis reveals that experimentation as the first phase in the process of ascending from the abstract to the concrete is fed by conflictual encounters both within the individuals who carry with them a previously acquired empirical abstraction and in the interaction with authorities who reproduce the empirical abstraction. Four steps are distinguished within the action of experimentation The four steps are: 1) contrasting different views, 2) experiencing conflicting views, 3) experimenting with mediating artifacts, and 4) establishing dialectical connections. The four steps may be used as tools for facilitating and empowering the process of overcoming empirical abstraction among learners.

Introduction

The transition from abstract notions of pupils to specific understandings of concrete individual pupils and differences among them is often seen as a natural consequence of novice teachers' exposure to interactions with pupils. Teacher training programs take this transition for granted. Trainees are expected to move from abstract contents taught at the university to real teaching experiences in schools which concretize the abstract contents. In this paper I argue that this transition instead represents a critical phase and a learning challenge in the professional development of teachers.

The paper discusses the materialization of the pupil as a professional object for elementary school teacher trainees who are involved in a project of developmental intervention (Engeström, 2007). Davydov's (1990) theory of learning as ascending from the abstract to the concrete and Leont'ev's (1978) notion of object are used as theoretical lenses to conceptualize this process. The project aimed at introducing in the school a computer-mediated learning practice internationally known as the 'Fifth Dimension' or the 5D (Cole, 1996; Nilsson & Nocon, 2005). The 5D was used as an interventionist methodology of teacher education for university students who would become teachers.

The paper analyzes the intervention as a process of progressive discovery of pupils as the concrete object of the trainees' activity of teaching. More specifically, the paper aims at answering the following research questions: What are the dynamics which characterize the materialization of pupils as professional object for teacher trainees? And, what is the relevance of these dynamics in terms of improvement of learning in teacher education and the 5D type of research interventions?

The 5D intervention project and two conceptions of pupils

The 5D is a model of learning and teaching activity, stemming from cultural-historical psychological theories of learning and development (Cole et al., 2006). In partnerships between universities and local communities, the 5D promotes collaborative research efforts which emphasize childrens' potential and initiatives through individualized learning. The 5D activities are characterized by the participation of undergraduate students in dyads or in small groups with children and by the use of a rich variety of ICT- based and other artifacts (Cole, 1996, chapter 10). One of these artifacts is a maze through which children move according to rules but also independently choosing learning tasks of their interest. Learning tasks are illustrated to children in task-cards in which one can select among progressive levels of difficulty.

The 5D was promoted as a research intervention within a project of collaboration between an Italian university and a local elementary school. The project was designed to be a response to two pressing demands coming from Italian authorities and the local university. For the first, the Italian Ministry of Education wanted to introduce informatics instruction starting from the first grade. Secondly, future elementary school teachers who studied at the university went regularly to the school for internships; they preferred to spend their time during internship more actively than sitting in the classrooms mostly observing what the teacher did and interacting only occasionally with children. The attempt of the researchers was to offer the 5D as an opportunity to meet the new requirement from the Ministry and to offer an alternative to complement the traditional internship in the school.

13 third-year university students were involved in the project as trainees. The 5D took place in the computer room of the school during the regular teaching hours. The 5D physical arrangement was characterized by 13 computers and a three-dimensional board game which reproduced a labyrinth. Each room contained two to three computer-mediated learning tasks.

Each task could be accomplished on three different levels of competence and was explained in a brief guide called ‘task card’. One or two first- and fourth-grade pupils were assigned to each trainee during weekly sessions of three hours for a period of three months. The trainees assisted the pupils in accomplishing the computer-mediated learning tasks. The pupils themselves chose the tasks while navigating through the labyrinth. Four researchers and three teachers of the school were present to supervise and support the trainees. The trainees were asked to write ethnographic fieldnotes after each session.

Meetings between researchers and trainees were held in the school after each 5D session. During these meetings participants discussed salient moments or difficulties as experienced by the trainees and as reported in their fieldnotes. Researchers who participated in the meetings were also the instructors at the university who organized a course based on Vygotsky’s works. All the trainees took part in the course before the beginning of the project.

The 5D was designed to be a response to the critique by the trainees of the traditional university internship program in the school which did not allow them to interact directly with the pupils. During the phase of preliminary ethnographic fieldwork, interviews were conducted in which these trainees repeatedly pointed out their need to directly interact with pupils in order to prepare themselves for the teaching profession.

The project made visible two conceptions of pupils. Teaching in this school and the trainees’ teacher education program were primarily based on the practice of going through age-appropriate curriculum units according to the teacher’s plan. This practice was captive of a tradition which does not allow the pupils to act independently, and restricts manifestations of their individual potential.The 5D intervention aimed at experimenting with a more active role of pupils in the school.

The extraordinary act as ascending from the abstract to the concrete

From a theoretical point of view the analysis draws on Leont'ev's (1978) notions of need and object, and on Davydov's (1990) notions of empirical and theoretical generalization. According to Leont'ev (1978),

> need appears only as a condition of the need of the organism and is in itself not capable of evoking any kind of positively directed activity ... Only as a result of its 'meeting' with an object that answers it does it first become capable of directing and regulating activity. The meeting of need with object is an extraordinary act. (p. 54)

Paraphrasing Leont'ev, the need to teach appears only as a condition of the need of the teacher trainee and is in itself not capable of evoking positively directed activity of teaching. Only as a result of its 'meeting' with the pupils as an object that answer this need does it first become capable of directing and regulating teaching activity. The meeting of the need to teach with the pupil as an object is an extraordinary act.

Leont'ev notion of object is not reducible to the everyday meaning of the term object, which would imply unidirectional teaching processes dominated by teachers who objectify pupils. Neither does the everyday notion of object apply to the idea of trainees' need to discover the pupils as the object of their activity of teaching. For Leont'ev (1978), the object of activity has a dynamic life of its own; it resists attempts at control.

In the extraordinary act, there is an aspect of breaking out which Leont'ev does not take up. The extraordinary act does not consist merely in the meeting of one's need with an object, like in the case of a hungry person who finds food and fills her need with it. For teacher trainees, the need to teach was fed with a pseudo-object, a professional abstraction. The empirical thinking

into which the trainees were socialized was overwhelminly present in the fieldnotes written by the trainees after the first encounter with the pupils. One of the students wrote the following.

> ***Trainee 5:*** The first grader with whom I worked today can be defined hyperactive, he was not interested in the task, he wanted to play by doing tricks to his buddies, was disturbing with impertinent comments, inspite my attempts to encourage and stimulate him. He did not manage to accomplish the task, became nervous and refused to continue. Has difficulties in grasping situations in their globality, in reading and writing, and to find logical connections. He is still in the sensorimotor phase.

The extraordinary act requires breaking out from the pseudo-object. This process is conflictual by nature (Vasilyuk, 1988). As my analysis will demonstrate, the puzzlement of the trainees while encountering problematic situations was an indication that they were facing conflicting conceptions of the pupils.

The pseudo-object may be conceptualized using Davydov's notion of abstraction. In dialectial terms an abstraction is an aspect separated from its functional relations in the overall systemic totality to which it originally belongs (Falmagne, 1995). Davydov argues that there are two types of abstractions: empirical and theoretical. Empirical abstraction, also called formal abstraction, is a classification of superficial features of phenomena. Theoretical abstraction refers to the identification of the genetic origins of phenomena that may externally be not alike at all. A theoretical abstraction is based on a functional relationship, also called germ cell. While observation and categorization are actions at the root of empirical abstraction, concrete transformation, change and experimentation are actions at the root of theoretical abstraction. One not familiar with Davydov's theory would spontaneously associate empirical with concrete, and theoretical with abstract, based on the ordinary use of these terms. Instead, in dialectical terms the

process of ascending from the abstract to the concrete is a movement from empirical to theoretical abstraction.

An example of theoretical abstraction comes form Engels and concerns the steam engine (Vygotsky, 1997, p. 321). The germ cell of a steam engine as it was designed by its inventor in his drawings looks very different from any particular steam engine. Later, starting from this germ cell, steam engines were built in many different ways and shapes, and for many different purposes - for ships, for locomotives, etc. The system of using steam power is thus based on the discovery of a very simple relation which was then modeled for making different variations of it. Theoretical thinking experiments with problematic situations in order to find the germ cell behind them. Then, starting from this original abstract principle, one can observe its different material manifestations and even conceive further new variations as the abstraction is applied to the understanding and construction of the concrete – in this case concrete pupils in the school.

The teacher education program of these trainees conveyed a formal abstraction of pupils. The pseudo-object trainees met when they went through their internship was this formal abstraction based on superficial features. The conception of the pupil as a pseudo-object corresponds to the ideas that age determines pupils' capabilities to learn and that the teacher needs to control pupils in order to avoid distraction in learning. The 5D was an attempt to make the trainees overcome this empirical abstraction and move toward a theoretical abstraction. The theoretical abstraction from which the trainee could ascend to the concrete pupil corresponds to Vygotsky' ideas that pupils' capability to learn is expanded by means of social and artifactual mediation, and that pupils' agentive initiatives are crucial for learning.

The trainees were already familiar with these ideas of Vygotsky, having partecipated in a class and a seminar in which they read his works. This was, however, not sufficient for them to overcome the empirical abstraction. According to Davydov (1988), the starting point for the

formation of theoretical abstraction is transformation. Transformation is the first of six learning actions which characterize the process of ascending from the abstract to the concrete. This action, also referred to as “the main action”, consists in experimenting with a task “in order to reveal the universal relationship of the object under study” (Davydov, 1988, p.30).

Davydov’s description of this first action does not include the individuals’ experiential and conflictual encounters with their previously acquired empirical conceptions which are likely to play a role when they start experimenting. A similar critique was previously formulated by Engeström (1999):

Davydov’s theory is ... oriented to learning processes within the confines of a classroom where the currucular contents are determined ahead of time by more knowledgeable adultes... This probably explains why it does not contain the first action of critical questioning and rejection... (p. 384)

In this paper I will demonstrate that the extraordinary act in which the need meets an object is a process of ascending from the abstract to the concrete, which requires the subject to break out of previously acquired conceptions in conflict with new emerging ones. In this perspective the experimentation appears as a composite learning action which can be realized in four different steps, presented in the next section.

Breaking out from a pseudo-object

The main data collected during the project consist of 113 ethnographic fieldnotes written by the trainees and videorecordings of 10 meetings between researchers and trainees. These data serve here an exploratory analysis based on careful reading of the entire corpus. I have tentatively

identified a pattern of successive steps that may be further explored as a potential expansion of the first learning action suggested by Davydov (1988). Salient excerpts from these data are used here as examples which elucidate a four-step pattern[1]. The four steps are thus a hypothesis to be tested in further research. Not every thrainee went through all these four steps, but in the corpus as a whole they appear distinctively enough to suggest a pattern.

The fieldnotes through the period of the 5D intervention show that the trainees were initially captive of abstract features of the stereotypical pupils. The 5D intervention and the efforts of researchers in the meetings to solicit detailed and self-critical fieldnotes provided an opportunity for the trainees to open up and to start transcending this abstraction. In particular the fieldnotes written toward the end of the project document this turn toward a different type of abstraction.

Step 1: Contrasting different views. While experimenting with teaching in the 5D the trainees began to describe teaching experiences with pupils which were in contrast with the practices of teacher's control and age-appropriate tasks.. The trainees came across with characteristics of the pupil which were unknown to them and discovered individual potentials of each pupil. In this step, which coincided with the beginning of the 5D, they mainly emphasized that children can do things on their own.

> *Trainee 4:* Giulia had never worked with a computer before. I had my hand on her hand on the mouse and half way through I realized that my hand was not guiding her anymore. She was moving autonomously on the desktop.

[1] These data are excerpts from fieldnotes and conversations which were produced to carry on the practical work of the 5D rather then to explicate the trainees cognitive learning processes. Similarly to previous studies of dialectical thinking in everyday contexts (Basseches, 1984), the excerpts are suggestive and incomplete by their very nature.

Trainee 8: We were working on a task on the food chain. Lorenzo and I established a relation of collaboration. He asked for help when he needed help, otherwise he continued on his own. The teacher came to point out that the task we were working on was based on the program of the third grade and that there were therefore notions involved that the pupils did not have yet. Lorenzo, hovewer, understood immediatly these notions. After the first reading he summarized: "Sheep eat grass and the wolf eats the sheep. The grass is a producer, the sheep a primary consumer, and the wolf a secondary consumer."

Trainee 6: This has been an exciting day with the 5D. It has helped me to understand that it is wrong to underestimate the pupil's capabilities.

The process of breaking out of a pseudo-object or an empirical abstraction is a conflictual process. The conflict here is between two contrasting conceptions of the pupil, which materialized in the eyes of the trainees through comments like the one of the teacher mentioned by trainee 8 and the responses by the pupils which encouraged the trainees to explore the 5D type of teaching. This conflict led the trainees to a second step.

Step 2: Experiencing conflicting views. As the 5D sessions continued the trainees started to point out that they were encountering difficulties. These difficulties were reported by referring to superficial features of the pupil or of the task, which, they thought, made the pupil not anymore work well on the tasks. For instance in the following fieldnote excerpts the pupils are described as distracted or bored, and the task too difficult as such. These problems encountered by the trainees were also taken up during the meetings with the researchers who suggested that the trainees should experiment with mediating artifacts.

Trainee 6: Today he [the pupil] was particularly distracted. ... He did not show interest in what we were doing. The task card required the reading of the clock taking into account the position of the

sun or the moon through a window. “But I do not know how to do it”, he said. I reassured him, telling that we would accomplish the task together. I started by explaining the procedure several times, and he followed counting the hours and the minutes. During the accomplishment of the task he continuously asked for help from me. He tried to complete the task during the time we had available, but he did not suceed. I hope that next time he will be less distracted because I am sure that he can make it.

While the trainees were allowed to perform teaching in the 5D their need to teach did not take an immediate effect as they were puzzled by two types of problematic situations for the pupil and for themselves.

The first type of problematic situation concerned interferences and attemps of control by the school teachers, exemplified in the next two excerpts.

Trainee 4: I had difficulties with a pupil who wanted to write to Giò, and was thinking about a sentence. Then the teacher came and told her what to write. The teacher often interferes that way.
Researcher: She replaced the pupil’s voice with her own.
Trainee 4: And she replaces also our own voice.

Trainee 5: The pupil was associating alphabetical letters with pictures. For instance she associated the letter “A” with the picture of an apple. And the pupil was very capable to accomplish this task. The teacher came to sit by and said “Let’s see what you are doing”, and took over accomplishing the task herself. When the task was completed she said to the pupil “Very good, you have finished”. I was tempted to tell the teacher “That is not so. You have completed the task, not the pupil”. ... The pupil thought she had actually finished, but I told her “Look, the task should be done by yourself, not by the teacher”, and she started over again.

The second type of problematic situation concerned difficulties encountered by the pupils in the course of the accomplishment of demanding tasks. In the meetings they reported on these situations as problems difficult or impossible to solve. These considerations led to suggestions to withdraw the pupil from the demanding task and to give him or her an easier one instead, as in the next two excerpts.

Trainee 6: He refused to work. I tried to explain the task in every possible way, using the simplest possible words. Nothing, he refused.

Researcher 1: Did you notice differences between this task and the others which he accomplished participatively?

Trainee 6: It's just the clock that he does not manage to understand.

Researcher 1: He does not manage to understand the system of the clock.

Researcher 2: Also my pupil refused to accomplish a task, because it was difficult, it was really difficult, and he could not make it. During the week I built an instrument which could help him. You could think about something practical...

Trainee 7: My pupil did the task of the clock last time. The difficulty consisted in distinguishing between day and night. ... I had to convey to her the difference between day and night, when there is the sun and when there is the moon. With the help of drawings in the notebook I explained that 1 o'clock can be written 13:00 when there is the sun, and 1 when it is night.

Researcher 1: You might want to try with some mediational means which could bring him to gradually accomplish this task which is clearly too hard for him.

Trainee 8: Today he was working on a task of geography. It was very complicated because he had to find on the atlas a lot of towns which were indicated. The teacher told me "You see, in this situation, for instance, the difficulty does not encourage him to go on". Yes, but the fact is that this task is very complicated.

Researcher 1: And then what happened, did the pupil make progress, has he finished the task, is he about to finish it?

Trainee 8: He should finish it, but I suggested him to ask for permission from Giò to change the degree of difficulty [in the computer program]...

Researcher 1: The lower degree of difficulty is merely a puzzle to put together. Also there is the fact that the pupil has chosen himself this level of difficulty, clearly expecting that this would be more complicated then the easier level. You do not want him to think that he is not good enough to accomplish more complicated tasks. This should not happen. ...

Trainee 8: The point is that I see him almost bored because he has to look for so many towns. ... I saw that he was a little bored, that's why.

Researcher 1: We might want to wait a little

Researcher 2: Perhaps the atlas is in itself too complicated. What if you would look for some other support?

*Researcher 1***:** Like which kind of instrument?

*Researcher 2***:** Perhaps something you could make by yourself. Study the task card – when you know it, you know its characteristics.

Trainee 8: Perhaps I could make an atlas with capitals only.

Researcher 2: Good.

Researcher 1: That is useful. If you want you can bring the task card home and create your own mediating artifact to use in this context and with this child.

Discussions in meetings with the researchers on the difficulties the trainees were encountering led to a third step.

Step 3: Experimenting with mediating artifacts. The trainees started building and experimenting with mediating artifacts, by following the suggestions of the researchers and by looking at what other trainees were doing. For learning how to read the clock they created a cardboard clock. For learning how to list words in alphabetical order they created a surface with movable letters of the alphabet. Also simplified maps of Italy were built.

The data provide evidence that these artifacts had indeed impact on the pupils' learning, as indicated in the following examples.

> *Trainee 8:* Today while we were working Lorenzo told me "I asked my sister the question: 'Where is Milan?' and she answered 'In Sicily'. And I said 'What are you talking about? It is in Lombardy' to her who is a third-grader!"

> *Trainee 8:* At the beginning of the 5D Lorenzo could not find even three districts, and did not know to which regions they belonged. Now he associates the districts he already knows to the regions without looking for them on the map.

> *Trainee 8:* Today we had a blackout and we could not use the computer. Lorenzo decided therfore to write a letter to Giò to show him what he had learned so far. I could observe that he was able to locate without any help districts that he did not know at the beginning.

Inspite of the evidence of the impact of the artifacts on the pupils' learning, in the fieldnotes this third step is still reported with reference to the pupil in terms of the empirical abstraction. In this sense, as Davydov (1990, p. 301) also has pointed out, the trainee's method of constructing and using the artifactual mediation went ahead of her own words. As the following fieldnote excerpt shows, inspite the evidence that the artifact had an impact on the learning of the pupil, the trainee referred only to the visual aspects of the artifact as the solution to the pupil's difficulty with the clock (see Davydov, 1990, p. 32, for a critique of superficial visualization).

> ***Trainee 6:*** The instrument I prepared has made the task easier and this time Luca has accomplished it without caprices. The clock full of colours and with cartoons which represented animals made the task fun.

At the same time, hovewer, a new step became visible.

Step 4: Establishing dialectical connections. In the 5D trainees started to establish dialectical connections between the pupil, the task and the mediating artifact which went in the direction of a theoretical abstraction and which were expressed in the fieldnotes through concrete episodes. They discovered connecting features of the learning child that initially remained unnoticed because the trainees focused only on external features of the pupil and the task. By explaining to themselves the systemic constellation of the pupil's difficulties in accomplishing the task and the mediating artifact as an instrumental support, the trainees began to see the pupil in a new light, as in the following fieldnote excerpts.

> *Trainee 6:* The teacher passed by and asked Luca what he was doing. Luca explained to her that the cardboard clock allowed him to accomplish the task and to learn how a clock functions. ... He said "Teacher, now I explain to you how the clock works. The smaller hand is the hand of the hours, the bigger one is the hand of the minutes." And he continued that way, answering correctly all the questions that the teachers asked. The teacher looked surprised. I think she did not expect to get such detailed answers.

> *Trainee 8:* This morning I was working with Lorenzo and another pupil came by. ... This pupil noticed that Lorenzo was using the geographical map I made for accomplishing the task and asked "How come he got that and I didn't?". I told him that perhaps he did not need it.

The two trainees, by writing these fieldnotes, showed that they had developed a keen eye and appreciation for the social and artifactual mediation as wells as for pupils' agentive initiatives of learning. The end of the 5D project coinciding with the end of the school year did not allow further observations of the development of this fourth step. The two examples from trainee 6 and trainee 8, however, illustrate that the trainees were developing a sensitivity for the potentials and

needs of each child, met through individualized interactions and with the use of mediating artifacts. This new feature in their perception of teaching and learning is especially noticeable if we compare the two examples provided for step 4 and the first excerpt by trainee 5 given at the beginning of this paper. The description of the pupil, classified as hyperactive in the excerpt by trainee 5, was based on an empirical abstraction. Descriptions such as those in the excerpts by trainees 6 and 8 imply a clear movement from initial empirical abstraction toward theoretical abstraction.

Conclusion

Teacher training often keeps a consistent distance between trainees and pupils; at least for these trainees it was still the case. Teacher trainees' need to interact with pupils on learning tasks is not likely to meet the object of teaching – the pupil in his or her full life and learning potential - if the practice in their educational program is based exclusively on traditional classroom situations. Future teachers need extraordinary situations such as the 5D where children can break out of the predetermined pupil role and express their potential. Teacher trainees who are exposed to these extraordinary situations have a chance to start filling their need with the true object of teaching.

This process of discovery of the object is, however, not just a consequence of the creation of a stimulating context such as the 5D. In addition to that the trainees take steps of ascending from the abstract to the concrete. The four steps identified above are only part of the process of ascending from the abstract to the concrete. The analysis points out that experimentation and transformation as the first phase in the process of ascending from the abstract to the concrete is fed by conflictual encounters both within the individuals who carry with them a previously

acquired empirical abstraction and in the interaction with authorities who represent and reproduce the empirical abstraction.

The analysis presented in this paper leads to the conclusion that active exposure and increased interaction with pupils individually, in a developmental context such as the 5D research intervention, can provide a chance for the trainees to dwell in the materiality of the object of their future profession. In my analysis I expand on Davydov's (1988) first learning action of transformation. I suggest that we may distinguish four steps within this action: 1) contrasting different views, 2) experiencing conflicting views, 3) experimenting with mediating artifacts, and 4) establishing dialectical connections. The first two steps are not included in Davydov's definition of the first learning action. These four steps may be used as tools for facilitating and empowering the process of overcoming empirical abstraction among teacher trainees involved in 5D type interventions.

My motive as a researcher to initiate this project was the conviction that in order to change the school we need to nourish the mentality of future teachers. One might object that in this experiment we were training 5D teachers, and that the school, differently from the 5D, is a place where the teacher must face twenty or thirty pupils at a time. Although it is legitimate to point out the number of pupils in a classroom, a more crucial issue is the type of interaction with the pupil in traditional classroom settings. The main formative aspect of the 5D experiment for these teacher trainees consisted in the realization that pupils are different from one another and that as teachers they need to learn to interact differently with each pupil. In the long run this can have an impact also on a classroom as a whole. Schools receive teacher trainees who are taught to reproduce the normal school. Possibilities of change in this sense lay in proposing and implementing new experiences for teacher trainees and pupils. This is where, in my view, the 5D has its place. The 5D is a space which opens up the true object of teaching, even though it cannot

be directly transplanted in traditional teaching. The 5D should find a place in school, without wanting to replace school. The 5D can function as a developmental laboratory and as a transitional space in which trainees can experience the object in its full potential. This would be a way to meaninflully train future teachers, and to make use of the knowledge they bring to school from the university.

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