

# Teaching transposition: toward significance and legitimizing of knowledge

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**Riassunto:** *Il presente contributo descrive la trasposizione didattica (Chevallard, 1985) in quanto compito fondamentale del docente. Realizzare una trasposizione didattica implica inizialmente una riflessione dell'insegnante sulla struttura epistemologica del sapere disciplinare, adottando sia un principio di vigilanza epistemologica (Chevallard, 1985; Bachelard, 1939; Develay, 1995; Astolfi, 2008), sia di rilevanza sociale (Damiano, 1999, 2007; Rossi, Pezzimenti, 2012), al fine di operare una selezione dei contenuti da trattare. Successivamente l'azione richiesta è la traduzione didattica del sapere esperto del docente al fine di renderlo accessibile agli studenti. In questa fase le norme, gli assunti ideologici, filosofici e valoriali dell'insegnante giocano un ruolo fondamentale (Shlmann, 1987). Si sottolinea pertanto l'apporto della soggettività del docente nel processo di trasformazione e adattamento dei saperi, evidenziando il collegamento fra il sapere che questi insegna e la sua identità professionale.*

**Abstract:** *This paper describes teaching transposition (Chevallard, 1985) as a teacher primary task. The teaching transposition process involves a teacher reflection on the epistemological structure of knowledge. The adoption of epistemological vigilance principle (Chevallard, 1985; Bachelard, 1939; Develay, 1995; Astolfi, 2008), and social relevance perspective (Damiano, 1999, 2007; Rossi, Pezzimenti, 2012) is required in order to operate a selection of topics to teach. The next action is a transposition of expert knowledge in order to make it accessible to students. In this phase teacher rules, ideological and philosophical assumptions and values play an important role (Shlmann, 1987). This paper underlines teacher subjectivity influence on the process, highlighting the link between knowledge and professional identity.*

**Keywords:** *teaching transposition, knowledge, professional identity*

Teachers need to know how they can translate their disciplines in teaching practice able to reach their students, beyond the great worry of being able to “survive” managing the class dynamics. In other words the teacher devotes to the task to become a knowledge mediator, making

what Chevallard defined teaching transposition it is to say: the process on the basis of which the matter context to teach are selected and organized to shape them in a school “form” teachable and accessible to pupils (Chevallard, 1985, 39).

As Berta Martini states, the more or less explicit and conscious questions arising since the first admission in class regarding the professionalism and identity of teacher of a certain learning can so be expressed: “Why am I teaching my learning?”, “Why should the youngsters in front of me become passionate for my learning?” “What is suitable to be taught of this learning?” “What is essential?” Also they consider the issue: “What would I that the young people will learn in a certain setting of knowledge today, next month, or may be the lifespan?” (Martini, 2005). These questions are central role in young people learning, because following D’Amore statement through the proposed content more or less consciously the teacher builds a relationship with the pupil and at the same time sets the pupil attitude toward a certain learning and the image the young person will form of that learning leading him or her to success or failure influencing so the personal concept of pupil about oneself and this learning. These conceptions set in the future choices of pupil for his personal and social improvement, for his drive to learning and for the awareness included in it. (D’Amore, 2007, 1-2).

The report *“Equity and Quality in Education: Supporting Disadvantaged Students and Schools”* published by OECD (Organization for Economic Co-operation and Development) underlines that the young Italians register the uppermost rate of school desertion in the OECD Countries: 30% of population between 25 and 34 years didn’t get the high school diploma and the school desertion often happens in the poorest social classes and the causes of this behavior lies also in the wide gap between the teaching modes of the Italian school and the real world in which the youngsters live. The problem so is how to make sense of the teacher knowledge for the pupils, to give meaning and to understand what is the learning aspect for this group of teens. Each kind of learning has different rules to organize the mind, tanks to original concepts introduced, shall compose with the unique and unrepeatable mode of each knowing subject to relates to object to be known.

## Teaching transposition

The studies about teaching transposition show that we must start from the consideration on the epistemological framework of a specific knowledge to proceed in this direction.

Following the Lakatos's definition a scientific learning is made up by a concepts net. Every concept finds its own meaning only inside a specific paradigm (Lakatos, 1976). At the basis of the considered learning there are elements, concepts or propositions which are its foundation (Chevallard, 1985), the way which that knowledge proceeds toward the reality awareness (Schwab, 1971): in other words, the specific questions of that peculiar science and the way attempting to respond, the methodology of survey and the used parameters of effectiveness, its referring theories and its specific language (Develay, 1995).

All these elements must be transposed in the taught discipline and will lead to a consideration on the educational "form" of the knowledge self and on their definition depending on epistemology of the discipline in vogue in a specific period (Martini, 2005). Indeed since the age of Enlightenment the knowledges are organized in scientific learnings in a conventional approved and encoded way in the boundary which Kuhn indicated the dominant paradigm in a certain community, it is to say the combination of theories, rules and instruments defining a survey tradition in which the theories are universally accepted in a certain community of experts, in a specific period and in a certain social and political context (Kuhn, Carugo; 1969). Following Foucault, the control of order and regularity which a certain learning imposes to the matter changes following the aims for which they are produced, the historical spans, the epistemologies shared with the dominant mindset (Foucault, 1971, p.27). For instance, we may wonder with Foucault "how come the botanists and the biologists of XIX century didn't ever see what Mendel saw (...) Mendel told the truth, but it wasn't the "truth" of biological discussion of his time (...). It was necessary a whole change of scale and the deployment of a new plan of issues in biology for Mendel could enter in the truth and his propositions seem then correct (in the most part). "Mendel was a real prodigy and for this the science of the time couldn't mentions him" (Foucault, 1971. p.18). Astrology till Seventeenth century was considered a out-and-out true science but this couldn't be acceptable and accepted by the modern astronomers. Mercatore map had its own meaning in the Sixteenth century and benefits

of a real scientific authority in a world of navigators and in the community of cartographers of his time who build their world depiction starting from their stars knowledge and from the study of the angles. Surely the same community shouldn't ever imagine to be allowed to accept Peters's map exactly in contrast to Mercatore's distortions. Peters's Map was realized to keep relations between the areas of dry lands and those represented in the map itself. It achieved a great fame at the end of the Twentieth century precisely for the political involvement.

Knowledge couldn't be considered a stockpile of data, dates, formulas, rules, quotes as often is presented in school, but establishes the entry in an expert interpretation of the world more powerful of that of common feeling [...]. (Astolfi, 2008, 22-23).

The teaching and professional implication means that the teacher should has knowledge beyond the contents of his teaching but also everything characterizing deeply and the whole sequences of changes in the times and in the different historical, social and political contexts in which aroused and developed. Achieving a successful teaching transposition, taking the pupils close to the learning we teach, so that they may appreciate the overlook opening on the world and get fond of the learning of the used tools, methods and sources means trill them on the course which those sciences followed in history with all the complications and obstacles they meet, with the mistakes made on the way of the knowledge, with the route changes and creative leaps. It means get them close to the idea that knowledge nature is polymorphic, historically set and typified by interchanging of paradigms.

Following this perspective therefore we must wonder about the role which the teacher knowledge (*pedagogical content knowledge*) plays in effectively teaching his topic as Lee S. Shulmann did in an article published in the Harvard Educational Review (1987): *What a teacher knows? When did he learn it? Where from originate the accounts of the teachers and what are their sources? Which kind of representation they have of their topic? How they decide what to teach, how they represent it, what they ask to their pupils in relation to what they hope to be learnt?*

Develay states that the knowledge of learning structure and the image every teacher draws of it allow the teacher to understand the reason for which he/she was interested in that topic and to find the way to get also his pupils close to that learning. Every learning is a window on the world, its principle of understanding using specific tools, materials, sources and doesn't look like to any other (Jean-Pierre Astolfi, 2008, 16-22). Shulman

declares that the way by which the teacher interprets his learning, the way of proposing it to the students, derives from norms and from ideological, philosophical assumptions of the teacher self. The way a teacher uses for understanding and communicating contents states to the students what is central and what is marginal in the debated discipline and imparts, more or less consciously, [...] a series of attitudes and values which influence strongly the student understanding. (Shulman, 1987, 9).

To teach chemistry thinking that the basic concepts are transformation, reactions is different than doing it considering only the study of elements (as often the students are forced to think in schools). In the same way choosing to teach biology just like science of molecules instead as science of ecological systems or also as science of the biological organisms means choosing a fundamental structure of learning, which will have a different theoretical system from another fundamental structure of the same learning discipline.

In a more banal way, it is different teaching chemistry for someone with a chemistry degree or with a biology degree.

Develay also underline the influence of teacher subjectivity in the process of transformation and the link between the knowledge and teacher professional identity.

The course of education of the teachers in the boundary of topic educational can only start from activities and proposals helping the teachers to think over their valuable, epistemological and cultural principles on which is based the image which they have of their discipline and, indeed, their mode to present it to the youngsters. It is to say, it is essential to go along with them toward a growing awareness of a polymorphous and dynamic nature of knowledges, the various paradigms and the different overlooks from which the experts of a single field use the instruments and the methods of their own topic and the position of these.

The systemic paradigm, for instance, rebuilds upside down the processes of knowledges and interpretation of the facts in the various fields of knowledge, from psychological learnings to the agronomical ones, from the biological topics to geographical ones. Being clear and defining the reference to this paradigm instead of the pure experimental paradigm or the linear model can produce educational plannings very different between them and support motivations and/or modalities of knowledge very different in the pupils.

Knowing and recognizing the various epistemological transitions occurred to a certain topic, its evolution in different historic periods end in the various cultural contexts may influence very directly the educational real practices.

For example: knowing and telling to the pupils that Galileo spent time making the horoscopes may help motivating the young peoples, getting more lively and up to the today the discipline but also linking to historic and cultural period when astrology was considered a science, at the same mode, referring that Newton attempted transforming items in gold may help connecting chemistry to its alchemic origins. In both cases, this knowledge and this epistemological awareness may on one side help getting the appeal these topics had in the times as well as outlining the evolution in the times; on the other side they may contribute to identify and recognize some of our misunderstanding related to the above knowledge which still remain implicit in the common sense, unrealized and above all irrespective of candid knowledges of our pupils. In effect, as the most up-to-date learning theories point out, the informal knowledge absorbed by the teenagers through their experience in the real word may constitutes a great resource for the building of new knowledges. At the same time, these informal knowledges may contribute to stabilize misunderstandings often barely breakable and removable when undeceived and unaccepted. Considering that Copernicus believed that the sun turned around the earth, may contemplating the possibility that the children are still referring to this candid concept deduced from a “wrong” interpretation of a “right” observation. In any case remembering that the ideas the children have of above the sea lands and of earth are deduced mostly from two-dimensional maps may help thinking that the representation they will have of the earth will probably flat.

Going back to chemistry, a study carried out in primary schools, it turns out the way the children have assimilated the idea that chemical may be synonym of “noxious”, “polluted/pollutant”, “unnatural, artificial”, “damaging”, “dangerous”, (Ferrari, 2014). Similarly when we click the term chemistry in Google search engine, the synonyms of word “chemical” given by the engine are indeed “artificial, unnatural, factitious, manipulated by man, industrially manufactured. As if the pasta wouldn’t be industrially manufactured and the biological farming wouldn’t manipulated by man. Always on Google, if we press the word “chemist” the first image which coming out is a chemist in a laboratory causing explosions by confusing the substances which should reacting the next one are related to chemical industrial disasters (Chernobyl, Seveso, ...). For all those reasons the chemistry acquired shades which go from simple disaffection ending by crossing over in hostility toward this school subject.

To oppose the misunderstandings coming from the world of inexpert (e.g.: chemical=noxious; farming=bucolic), as Shulman states, it is necessary the “epistemological watch” operated by the teacher, the knowledge of various modes of understanding and realizing the discipline (paradigms) and its distortion. So the teacher can produce alternative explanation of the same principles or concepts to face the diversity and complexity of pupils. Also because the knowledges which the teachers built in the course of time regarding his topic, its paradigms and its time evolution, don't make immediately an open sense for *inexpert* and it is necessary that is the teacher to enlighten it, illustrating to his pupils the sense which those portions of knowledge, those cognitive structures, that rank of reasoning, that specific paradigms may be attribute by youngster of different age, social e cultural class.

In summary as Develay explains the mode of teaching the various disciplines by individual teacher derives from the integration and from the possible compromise which the teacher in question succeeds to see through different reasons. First of all indeed the principle of *epistemological vigilance* (Chevallard, 1985; Bachelard, 1939; Develay, 1995; Astolfi, 2008) – following which, as told before, the teacher wonder about the inner logic of a certain discipline, about its evolution in different historical, political and cultural contexts about the contrast and the possible integrations between the different paradigm in that field. In the second place, *social relevance perspective* (Damiano, 1999, 2007; Rossi, Pezzimenti, 2012), that think about the basis, in view of what aims and uses the teacher works the choice of contents. Eventually, as we see later the planning of the tutorial action itself shall be driven by the logics derived from studies of psychology of learning and didactic, depending on which the teacher identifies the conceptual nucleus act as organizer (Ausubel, 1994) and maps (Novak, Gowin, 2001) and makes a content more accessible in terms of progression and joint of the complexity (Bruner, 1995, 354) and of research of sense (De Vecchi, 2000).

Disciplines, indeed, don't merely represent “conversational knowledges”, but refer to a world of a social and/or productive meanings which constitute its “genuine” reason. The teacher could recreate the three levels of meaning: topic epistemology, teacher representation and pupil's sense – helping students to understand the connection between scientific knowledge and social practices (Develay, 1995; Jean-Louis Martinand, 1986).

## Teaching and tacit knowledges

The need to interface the wise knowledges - showing their own inner formalized structure, language and logic recognize inside a community of experts - with the social practices from which originate and also attention toward the problem of misunderstandings, in our opinion, recalls the interesting studies in the field of anthropology of education and of psychology of learning which examine the connection between informal knowledges on one side and the expert formal knowledges on the other.

The studies that deepen these last aspects representing one of the most interesting and pioneering trans-cultural surveys related to cognitive processes, are the ones related to what in English is named *everyday cognition*: the knowledge produced in everyday activities when attempting to solve everyday life problems. In other words, the studies on the genuine knowledge of informal type, which someone identifies also as “traditional” or “folk” knowledge, in conflict with the scientific, academic or specialized knowledge. The *everyday cognition* is a common feature for all societies from the more simple and/or ancient ones to the more complex and highly institutionalized<sup>1</sup> ones. United States surveys carried out in North America revealed that the arithmetical skills disclosed by adults in everyday activities (shopping in a supermarket, procedures calculating a diet calories or the solution of everyday life problems), display skills outside and sometimes beyond the academic skills regarding efficiency and accuracy.

The ethnographical studies first examined how this type of knowledge is built and transmitted. They work hardy in defining, following the concept we indicate as ethnic, how members of a certain society learn to decipher their world, how every culture contribute to present this world following an order which allows a common explanation and processing for all its member.

These surveys start from idea that the learning processes which individuals carry out depend on the modes in which social subjects organize reciprocally their social activity (Rogoff, Lave, 1984; Chaicklin, Lave, 1993; Hutchins, 1995; Engestrom, Middleton, 1996; Fasulo, Pontecorvo, 1999; Luff, Hindmarsh, Heath, 2000; Zucchermaglio, 2002; Engestrom, 2001). There are numerous surveys showing how the acquisition of skill is extensively linked to the study of the connection between the human action (i.e. action in professional setting), the tasks and the connected tools (LeBaron, Koschmann, Goodwin & Feltovich, 2003; Hutchins, Klausen, 1996; Zucchermaglio, Talamo, 2000; Heath, Luff, 1992; Firth, 1995; Zucchermaglio,



2002; Talamo, Zucchermaglio, 2003; Alby, 2004; Suchman, 2000), biochemical or theoretical physics in their laboratories (Latour, Woolgar, 1986; Ochs, Jacoby, 1997).

Recent surveys in cross-cultural setting analyzed the modalities for acquiring skills studying geometry and in particular the angles by the children of workers of fishing boats of Northern seas where these knowledge/skills are utilized more or less intuitively every day for the navigation. In the same ways African children show to acquire skills in calculation through the operation of braiding utilized in the handicraft of bags where are created elaborate drawings, thanks to calculation related to different points and colors; or these surveys mention teenagers which conduct very prematurely trades in countries with a high inflation who learn calculating the percentages very quickly and more efficaciously than school pupils.

Following these surveys "*individuals participating to social and cultural activities of their community*", beside inheriting cultural practices and traditions also build knowledge. Following Rogoff and others, the cognitive development and the knowledge in the different settings of learnings, doesn't consist in acquiring passively knowledges and skills but it works an active process of transformation of mode of thinking, perceiving, communicating, remembering, classifying, reflecting, planning, placing and solving problems of individual – in activity in which are present other persons sharing the same practices and cultural traditions (Rogoff, 1990; 1998).

This is not a question of mutual influence between individual development and culture, but the case that the individual development and the activity of building of knowledges in various settings consist in a dynamic participation in culturally defined activities, which in turn progress over the generation thanks to the contribution of single individuals. Human beings act cultural practices, inherited from the previous generation, interacting with others, and in the same time build their knowledge unformalized in different fields of learning and participate to their transformations.

At this point, it is essential asks how a teacher could act out an internal teaching transposition – or, as Damiano defines it, a teaching mediation – starting from the premises and the considerations so far driven. First of all as Perrenoud describes (2003) the teacher should consider the knowing as resources to mobilize to relate the school proposals with the life experiences and the real problems in which the young people are immersed in going toward a smaller pettiness of learning because the complexity of reality doesn't foresee to pigeonhole in single learnings, but needs a multi-

plicity of gazes. Secondly the teacher should keep present that the building of knowledge may only start from what Piaget calls candid knowledge but which other authors define tacit knowledge (Nonaka, Tacheuki; 1995), unexpressed knowledge (Polanyi, 1979) or informal following the definition of the above mentioned anthropological studies. The teacher could only start from what Bachelar defines “ignorant knowings” surfacing them and compare them with experiences, materials, activity and incentives up to confirm and/or modify them.

Starting from the observation and of the “patient and passionate listening” of the pupils the teacher shall try to understand how they “attempt for the first time to get an impression of things”, how aim to find connection between the different elements of the reality that are studying, in which mode the young people “could enrich of meanings the words of the experiences” to be incentivated to acquire languages and formal nomenclatures – pertinent to different learnings - adapted to describe complex phenomena (Rimondi, 2003, p.13).

The choice to start from the surfacing of tacit knowledges, from the mode in which the youngsters “get an impression of things” and name the experience, appraising genuinely the course of knowledge linked to them correspond to a double aim: on one side in succeeding to “engage” the pupil on their ground, to incentivate them, on the other side it will be possible planning activities and tasks that could consult their candid conception and/or call into question to build formalized scientific knowledge. Already Piaget stated (1975) indeed that the pupil put “connection” with a new learning explains it starting from his own knowledges, sills, experiences and from his behaviors. The pupils rearrange therefore what they know depending on new knowledges for evoking them and using them in the right way. This process of appropriation of the knowledges drives the pupils to understanding the concepts in a certain learning setting in a way more or less in depth relating to processes of building previously developed.

In particular, following Piaget, starting from the exploration and the implicit knowledge that everyone has of reality, the acquiring of new knowledges and the building of meanings happens through three transfer:

- the reality representation (conception), in formal and informal contexts where the subject isn't always aware
- the identification of links between the previous description and the new phenomenal reality, the new activities and tasks to which one is approaching;

- the rebuilding of a hierarchical system between the different elements of it and between the different concepts to which one is resorting to understand the operation and the laws regulating the system itself.

This therefore allows us to build a knowledge socially relevant and legitimated (Develay, 1995; Damiano, 1993; 2007) to be up to connect concepts and knowledge to the real life and to the experiences of young people through the participation to tasks of sense with social and cultural implications. “The action of the human mind doesn’t exist without tasks which in turn doesn’t exist without tools, like so the tools don’t exist without task and these without a mind which plans them and carries them “ (Mecacci, 2000; 236). So, one respects the character radically set locally built and socially founded of social practices besides of the practices of building of knowledge. For the teacher, like so, for the researcher in a learning setting, the unit of psychological analysis couldn’t therefore be the single individual, his cognitive construct or his mind, but rather the system of activity and in particular the social players who also in connection of the ties and of the peculiarity of setting in which operate, orchestrate in complementary jointed and shared lines of activity.

From these theoretical and epistemological choices depend the methodological and educational combination of choices who could be implemented in the different school contexts.

## Notes

<sup>1</sup>For in-depth analysis see Nigris, 2015.

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