Journal of Innovation in Psychology, Education and Didactics	Vol. 16, No. 1 2012	57 - 63

THE UNITY BETWEEN THE MODEL OF APPLIED DIDACTICS AND THE MODEL OF SCIENCE DIDACTICS

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Abstract

The didactics of science gives didactics, as discipline, a larger framework placed beyond the pedagogical school frame. The models constituted in the last decades have a very clear purpose, to provide support, the processes of learning, and to prepare the student for professional social complex situations, also related to the cultural environment and family. The curricular decisions in this direction are not just external in the perspective of applying general didactics to the specific of mathematics as a discipline. The theoretical framework of science didactics is outlined at the epistemological level by means of a set of notions introduced by specialists when they analyze the didactics of disciplines from the perspective of the process of science assimilation, starting from representation and deepening the concepts and their articulation in theories and paradigms.

Key words*:* applied didactics, science didactics, didactic transposition, didactic contract

1. Introduction

Firstly, this unity is necessary in the conditions of curricular paradigm, which brings a global and open view on training. Secondly, this unit is required by the specific construction of a paradigm in the field of discipline didactics. Such a paradigm should combine the concept application and the methodology of general didactics with the epistemological and psychological mechanisms of properties, as well as the materialization of scientific concepts in the learning process. Thirdly, we are talking about the unity of the two models, given the separation tendency existing in recent years. The tendency to change the name of teaching methodology into discipline didactics has sometimes been presented as a condition for growing the quality of teacher training.

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2. The model of applied didactics

The time of methodology is apparently gone because it is mainly a pedagogy applied to the learning discipline which is taught in school, concerned more with the organization of the learning situation and the teacher-student relationship. In this vision, science didactics is apparently a superior version because: it integrates two types of thinking (epistemological and psychological), predicting the consequences, yet without dictating the possible pedagogical practices".

We consider that the tendency to separate the two models is justified, as the method is designed in a restrictive sense, suggested by its name of teaching methodology. Also, this tendency of separation is partially justified if we consider the construction mode (the relationship between whole and part). The fact that they approach just some aspects: didactic methodology, training contents, the training ways, teaching technology etc. In reality, the model should propose the methodology of discipline as applied didactics. The conception errors are the result of the fact that sometimes there is no clearly stated relationship between general didactic (training theory and methodology) and discipline didactics (understood as applied didactics).

Analyzing the subject, we found that:

a) The foundation of applied didactics is related to the relation general didactics-discipline didactics, which are inter-correlative.

b) The study object of applied didactics, which is the training made in the context of the discipline.

c) Applied axiomatic didactics, which includes the criteria for defining the didactics applied to a discipline (the type of activity, functions and finalities, the basic structure, contents and general forms, internal and external content).

d) Objectives, contents, methodology, assessment addressed in the spirit of curricular pedagogy, that conceive the activity in the framework of the simultaneous process of learning as an activity of teaching-learning-evaluation.

The model of this kind of applied didactics cannot be seen without reserve and not in opposition with the model of science didactics. So, we underline the fact that the reservations in expressing the teaching method are justified. This applied pedagogical science is artificially reduced to the study object (teaching, methods, strategies etc.). Another cause is the methodological nature (the research methodology used by applied didactics). We consider changing the relationships

between general didactics and discipline didactics. This unacceptable situation can generate very serious phenomena (see for example the expansion of many applied didactics). The status of general didactics itself may be challenged. To avoid confusions and interpretations, we will advance the formula of applied didactics.

The model of applied didactics is based on valuing the basic pedagogical concepts (objectives, contents, methodology, evaluation, projection, curriculum, teaching, learning etc.) in the educational context and of the training made in the general process of education. Applied didactics, seen from the curricular paradigm perspective, is in opposition with science didactics as well as a methodological premise of it success. We refer to the fact that all the pedagogical concepts applicable to the learning process, follow the improvement of the curricular design of learning, which involves the appropriation by students of contents, scientific concepts, their full internalization and psychological valuing in large contexts, on the long and medium term (*Dictionnaire actuel de l'éducation*,1993, p. 258-359). In its turn, science didactics offers applied didactics the methodological premises and the content structures (epistemological, psychological, psychosocial), which contribute to its improvement. We will exemplify by two papers, which value the model of science didactics in the analysis of the training systems or in the analysis of an important area of applied didactics-evaluation.

The famous Romanian didactician I. Cerghit (2002) proposes a test which reconsiders the learning process, valuing many themes from science didactics. It reveals the construction role and the individual knowledge in the continuous rethinking of the learning process. Processuality is regarded as a source of knowledge. There are analyzed many alternative and complementary training systems, based on transmission, interaction, operational models. It insists on the informational system, on the interpretation of the learning process in terms of partnership and mediation of the cognitive and meta-cognitive styles. These reorganizations are valued by analyzing three actions which determine training:

a) Teaching, treated as decision making, interaction, educational experience offer.

b) Learning, treated as the relation level between cognitive and meta-cognitive styles.

c) Evaluation, treated as an integral part of the training process, in terms of content standard and efficient criteria.

3. The model of science didactics

The evaluation approach from the perspective of science didactics can be also an example of valuing the model of science didactics through applied didactics. We mean the design of the evaluation, which supports the regulation and self-regulation of the training in the context of teacher evaluation and student self-evaluation of the interiorization and application of the scientific concepts.

The model of science didactics should be seen as a very important model due to its epistemological, psychological, anthropological foundations involved in explaining the properties of the process of scientific knowledge in the didactic and extra-didactic context. This model defines "a socio-psychological epistemic didactics developed as a pedagogical science established on an interdisciplinary level, yet starting from the deep analysis of the reception and recovery modes (by multiple social applications, including research) of the scientific content of the discipline of Mathematics.

The psychological learning theories have an important role not only in the evolution of discipline didactics and the model of science didactics, but in rethinking the unity between science didactics and applied didactics. In the last part, we stopped to look at three theories, which we regard as very important in building a model of discipline didactics. Acknowledging the unity between science didactics and applied didactics is a proof of the aspiration to transform the psychological learning theories, to convert them into (didactic) pedagogical models of training.

The constructivist theories focus on the development of the student's cognitive structures during the learning process. Our preference for the constructivist theory does not mean neglecting the psychological theories of learning based on conditioning the act of training, starting from simple relationships, stimulus-response. For example, in building the perspective of a paradigm of discipline didactics based on the unity between science didactics and applied didactics, we consider that the conditioned learning theory of R. M. Gagne proves to be very interesting and useful. We refer to the fact that the learning process is thought in terms of hierarchic conditions which offer hierarchic conditions for controlled training. From the perspective of applied didactics, the pedagogical success is ensured by methods of teaching-learning-evaluation and, from the perspective of science didactics, by selecting and managing the objectives according to the different levels of reception and interiorization of scientific contents. We are interested in the models related to the superior types of learning: learning through concepts, learning through principles; learning through solving problems (M. Develay, 1996).

Not reaching this stage yet does not mean abandonment of the pedagogical fight for scholar success. There should by identified previous flaws at the level of the five other types of learning which, usually, can be stimulated by simple means of applied didactics, based on stimulus-response relations, learning the signal, learning stimulus-response; learning through chained stimulus-response; learning through verbal association; learning through discrimination (preliminary part and the premise for learning through concepts) . We believe that this theory can be interpreted as a constructivist model of learning, on one condition – its interpretation from the perspective of the curricular paradigm, necessary for correlating simpler methods of training studied by applied didactics with more complex training methods, which resemble scientific investigation, studied by applied didactics and science didactics. Mathematics offers from this point of view a relevant example. Its methods are close to scientific research, being developed at the level of applied didactics (demonstration, modeling, problem-solving). The exercise method, with its multiple algorithmic and heuristic techniques covers the initial learning requests and the consolidation of mathematical knowledge located at the limit between learning by verbal associations and discrimination between concepts. The cumulative hierarchical model of Gagne may be completed with a new type of learning: learning by solving the complex contradictory problems or problem situations which demand searching, creativity, problematization. It is the peak which ensures the unity between science didactics and applied didactics by using the problematization method.

Regarding the psychological theories of the constructivist type, we shall underline two important ideas for building a paradigm of discipline didactics for Mathematics:

a. The psychological function of the student's cognitive structures, involved in mathematical cognitive learning mathematical – Piaget's model generated, in this sense, numerous attempts of forming a teaching style based on the contact between applied didactics and science didactics.

b. The social, cultural and pedagogical functions of the student's cognitive structures involved in learning - brings an additional dynamic pedagogical approach by highlighting the role of the social cultural environment, of the relationships adult-child in anticipating the cognitive structures of training, in stimulating the scholar success (see Vygotsky's theory and Bruner's theory). At present, social cultural constructivism is considered a premise in improving the school curriculum, in developing programs and methods which value the social-cognitive conflict – interaction, mediation, tutoring, didactic transposition, didactic contract.

All these tools talk about the need to articulate the model of applied didactics with the model of science didactics, an articulation which is possible and beneficial in a social cultural

context friendly to society (family, in class room, in school, in relation to the mass-media, in partnerships etc.).

4. Conclusions

In conclusion, we consider that, in an analogical way, we have to think and relate the unity and complementarity between the model of applied didactics and the model of science didactics. In conclusion, we shall refer to a learning theory which continues Bruner's theory, based on social cultural constructivism with strong pedagogical and curricular accents, namely Ausubel's theory, interpreted as representing "the training complex model" [S. Cristea, 2003-2004]. This theory is important from the perspective of our paper because it proposes a unity in the interaction between two types of learning:

a) learning by reception- which is more problematic and open to applied didactics (valuing the objectives and contents with the help of some strategies of teaching- learning-evaluation based on exercise and programmed training);

b) learning by discovery - which is complementary to learning based on reception because "the student should regroup the received data, in order to generalize and incorporate them into cognitive structure" (this type of learning is related to the model of applied didactics, but involves especially the objectives pertaining to the model of science didactics - see concept formation, generalization formulation, solving problems and creativity).

The correlation between learning by reception and learning by discovery is important for building a paradigm of the didactics of Mathematics on the background of the complex training approach. Learning by reception is followed especially by the all resources of applied didactics, building a premise not only for reception of the scientific concept, but also for creative exploitation. In other words, without learning by reception it is not possible to learn by discovery and to amplify research in the science didactics.

The two types of learning, far from excluding each other, should not be seen in opposition, but in complementarity. So, both could be either positive or negative, within a complex didactic whole. There is a risk of learning by mechanical and superficial discovery, when creativity is elementary or mimicked, because the student does not have enough information, the concepts perceived and internalized are not actually creatively combined.

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