

The emergence and affiliations of current research in science education in France

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We can have no claim to completeness about the affiliations and orientations of current research in the didactics of science and technology in France. Science education was initially based on other fields in the humanities (developmental psychology, social psychology, sociology, anthropology, epistemology, philosophy, etc.). Science education was built on matters of disciplinary learning and sharing constructivist and socio-constructivist approaches.

Some research in science education (biology, physics and chemistry) and techniques has relied initially on didactics of mathematics, others are more inspired by social psychology (Giordan, Girault & Clement, 1994; Astolfi & Develay, 1989), others have opted to develop curriculum research (Lebeaume, 1999), while others are based on Bachelard's approach in developing the current problematization (Orange, 1997, Fleury & Fabre, 2005). We situate in this article these current aspects of research as well as the Socially Acute Questions (SAQ) trend and affiliations between the different current areas of research (see Fig.)

All current French approaches in didactics of biology use qualitative approaches.

In *Théorie Anthropologique du Didactique (TAD)* Chevallard (1985) within the school institution, individuals, teachers and students performed tasks relating to apprenticeship of knowledge. Any human action (such as actions of teachers and students) can be analyzed in a system called *praxéologie* (praxeology), which includes types of tasks associated with technology speech, justified by a theory. *Transposition didactique* (didactic transposition) is the activity of transforming an object of scholarly knowledge (produced at an academic level) into an object of knowledge to be taught. There is external transposition where the noosphere decides the transformation of knowledge and practice for the curricula (formal or prescribed curriculum); and internal didactic transposition of knowledge involving the choices made by the teachers in effective educational content.

Sensevy, Mercier & Schubauer-Leoni (2000) developed another model of analysis of joint action between students and teacher (TACD) based on management of chrono-, meso- and topogenèses. They define 'mésogenèse', the genesis of the medium, as the development of a common system of meanings between the teacher and the students in didactic transactions which find their meaning. Chronogenesis Management is related to developing knowledge objects on a time axis. Topogenesis (land management) is relative to the space occupied by the teachers and students throughout the teaching / learning process, and the sharing of responsibilities in the advance of knowledge.

The "problematization" the framework.

This was developed by Orange (1997, 2000) and Fleury and Fabre (2005) under the problematization based on Bachelard and Popperian approaches. Scientific activity is not confined to describing reality or enumerating facts, it is an attempt to explain phenomena by the articulation between two registers: the models and the empirical facts considered. Appropriating such knowledge is developing the problem that knowledge answers, since it is in their relationship with the problems that scientific knowledge makes sense. It is therefore appropriate for students to engage with such knowledge and problems (e.g. through scientific debates in

class) (Lhoste, Peterfalvi & Orange, 2007).

Analysis of social representations / designs.

This concerns analysis of students' (and teachers' and mediators')' conceptions (alternative knowledge, misconceptions, preconceptions, etc.). Derived from Piaget's constructivism and used in active teaching in Montessori and Decroly à Freinet. Students build their knowledge on their: " *déjà-là*" ('what's already in their mind') (Astolfi & Develay, 1989). Didacticians can refer to the field of social representations (Moscovici, 1974) when the knowledge is linked with social impacts. (Clement, 1994) refers to situational conceptions, ie related to a given context or model: K (knowledge), V (values) and P (social practices).

Curriculum Approach (Lebeaume 1999, 2010; Martinand, 2003; Coquidé, Lasson & Fortin, 2010), and Victor Lange (2006). The curricular approach is inspired by Anglo-Saxon approaches, it aims to analyze the aims and objectives of an educational program in the context of its implementation (sociological dimensions, political, educational and teaching). The purpose of the curriculum approach is to examine the consistency between the required tasks, the educational goals and the epistemological and social meanings.

Emergence of didactics of Socially Acute Questions (SAQ)

SAQ Didactics studies the process of teaching and learning in buoyant objects of controversy and debate in the scientific sphere, society and media, and therefore in the classroom (Legardez & Simonneaux, 2006).

This takes into account:

- The epistemological question in teaching, especially in the wake of the current Anglo-Saxon view of the Nature of Science (Lederman, 1992), emphasizing the social dimension of science - in connection with the current Science-Technology-Society (STS) approaches.
- Anglo-Saxon Socio-Scientific Issues (SSI) - (Sadler, Chambers & Zeidler, 2004; Zeidler, Walker, Ackett & Simmons, 2002). Current teaching of SSI has become one of the main trends in research in science education. This focuses on the social consequences of the applications of science and technology. There are similarities and differences between SSI and SAQ currents (Simonneaux, 2013).

The SAQ current analyses the socio-epistemological constructions of controversial knowledge (non-stabilized scientific knowledge, citizenship knowledge, professional knowledge, whistle blowers knowledge, etc.), reasonings of students, uncertainties and risks involved in these questions, etc.

Conclusion

The structuring and restructuring of didactics around disciplines certainly continues, but it is also changing simultaneously to a cross-over with different didactics; and the didactics of experimental science has drawn heavily on the didactics of mathematics, whether the TAD or TACD. The emergence of SAQ is involved in this cross-over because these questions are interdisciplinary in nature. This is amplified with the emergence of "éducatifs à" especially in Education for Sustainable Development and Citizenship Education, or Education for Health in which research on the issues involves SAQ. The "éducatifs à" incorporates interdisciplinary and multi-reference didactic questioning, which partially removes the

disciplinary division (Simonneaux J & al, 2009).

Didactics remain defined by disciplinary inputs and have been legitimized in the form of "veneration of the discipline" (Chevallard, 2006). Now we are witnessing a paradigm change in education: an inventory of knowledge based on a pedagogy of exposure to knowledge, education is moving to a questioning of the world based on a pedagogy of inquiry (Ladage and Chevallard, 2010). Education research needs to be undertaken in this area as the discipline is an essential component of the learning paradigm.