

## Scientific and technological education and emancipation

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### Summary of articles

#### ■ FRANÇOIS GALICHET

*Emancipation by knowledge : what conditions ?*

During a long time, emancipation was associated with knowledge. Education was supposed making freedom. Recently, this link between emancipation and knowledge is questioned. Within the critical sociology of Bourdieu, knowledge does not make free but causes selection and inequality. This separation puts back the importance of pedagogy in education. Knowledge is emancipating only if it is bound to definite educational conditions. Therefore, any pedagogy is also ethics and politics

#### ■ MARYLINE COQUIDÉ

*Ignorance, chance, uncertainty, risk: challenges for an emancipatory science education*

The school is primarily concerned with learning and knowledge. The knowledge, especially scientific knowledge, is presented as liberating, which corresponds to a figure of emancipation, described by Galichet (2014) as "classic" and based on reason. I present here a complementary figure, which is based on the will and autonomy, "modern" according Galichet. I develop emancipatory potential of demonstration of ignorance and treatment of chance, uncertainty and of risk, in a scientific education. These approaches often neglected develop critical thinking and autonomy which are factors of emancipation.

#### ■ JOËL BISAUULT

*An emancipating scientific education for nursery school's pupils and their teacher*

In this paper, we propose to examine how scientific education can be emancipating for the pupils and the teacher. The actor's ability of thinking by themselves is put ahead to consider in the same time emancipation of pupils and teacher. Emancipation's indicators are definite for the pupils and tracks are suggested to conceive a teacher's emancipation. School moments aiming on balloons are analyzed to illustrate this point of view.

#### ■ DENISE ORANGE-RAVACHOL

*Science education, between emancipation and subjugation ?*

French institutional texts on science education are now strongly focused on students' problem-based learning and take into account their investigations. Given this development it seems particularly interesting to study what happens during debates where students' explanatory ideas are expressed and confronted and during subsequent discussions, when the teacher aims at leading the class towards a reasoned and scientifically acceptable explanation. This is what we have sought to accomplish in this study, which is based on two «forced sequences» (body movements, volcanism, 9-11year-old students). We attempt to identify how this situation allows for the emancipation and the scientific acculturation of students. We show that the debates can allow each student to open up to other possible explanations, and thus to free himself/herself from his/her own production while bringing it into a common pool of ideas (acculturation/emancipation). But this movement towards emancipation is not immediate because students can confine themselves to their prejudices. Didactic devices such as caricatures of the different explanatory models of the class or classification of arguments, appear to be facilitators of both emancipation and acculturation.

■ **ESTELLE BLANQUET & ÉRIC PICHOLLE**

*Investigation based science education, frontal pedagogy and authority: the heliocentric system example*

"Doing science" involves belonging to a community and consenting to the knowledge established by others; but it also involves questioning it to better actualizing it. The article questions the dual relationship with authority that allows to build the investigative approach. The question of heliocentrism constitutes a striking example of the difficulty to emancipate oneself from the paradigmatic pressure of the dominant culture. A traditional astronomy sequence centered on purely physical skills appears ineffective to overcome the naive Copernicanism of participants. Its association with a sequence specifically designed to legitimize unusual viewpoints allows 30-50% of students to access the Galilean (ie relativistic) paradigm. The analysis and assessment of the evolution of the participants' relationship to authority show that, beyond its interest in science education, IBSE can be a powerful tool to become aware of the nature of the most established prejudices of the dominant culture, and therefore to emancipate oneself from them.

■ **CORA COHEN-AZRIA**

*Students in science museums : the emancipation studied by analyzing subject*

This text is a contribution to thinking about emancipation functions and their conditions during academic visits in museums. From a didactical point of view, studying those situations leads us to analyse them through the notion of subject. Indeed, it comes to analyse together, on one hand, the didactic subject during singular situations like academic visits in museum, on an other hand, the institutional subject according to the reference institution involved in this partnership, finally the subject author of speeches (scientific, museological or scholastic sciences). Although emancipation deals with an individual in relation to a group, academic visits in museum are, most of the time, based on a collective experience. Those are the dimensions elaborated in this article leading us to question about (de)personalization of the speeches produced by scientists, museologists and school-visitors.

■ **MARIE ODILE LAFOSSE-MARIN**

*Emancipatory impact of a scientist-teacher cooperation in primary school, on the representations of children and their engagement in science learning*

Does a science education in which a scientific student cooperates with a school teacher increase the emancipation of the pupils? The impacts of this practice on children's learning are studied through linguistic interactions in science sessions at primary school. The representations built by girls and boys are analyzed through 1500 captioned pictures drawn by third cycle pupils. Various factors emerge: emancipation from a subjugation to a definite type of knowledge; freeing both from being assigned to a definite location in the classroom and from the permanent control of the teacher; release from confining social representations. The multifaceted and interactive dynamics between the teacher, the accompanying student and the pupils act in a circular scheme which does emancipate the teaching, the knowledge and the learning. The pupils are more open to respond and to agree to a teaching program proposed by the teacher-student binomial, than imposed by the teacher alone: they adopt new learning postures. Unprecedented motivation follows by identification with the young scientist. It leads also to emancipation from self-censorship related to stereotypes. This presses specially on girls, and disadvantaged children sometimes deprived from Science lessons, because so-called fundamentals "reading, writing and computing" would be more important.

## Varia

■ **SUZANE EL HAGE & CÉCILE OUVRIER-BUFFET**

*Research processes in Physics and Mathematics. Didactic issues of a new epistemological approach*

Inquiry-based Education (IBE) is presented as derived from scientific approaches. In this paper, we examine the epistemology used by didacticians in Science and Mathematics; we show the need to adopt a new epistemological posture in didactics to enrich the teaching of scientific approaches in Science and Mathematics. In particular, we have questions about the research processes used by the contemporary researchers, in Physics and Mathematics; we model them in a comparative perspective. The theoretical framework chosen (a model of conceptions) is demonstrated that

efficient and transdisciplinary. The results show, especially, convergences and divergences between the researchers in both Physics and Mathematics fields; the findings bring also new questions for the research in didactics of Sciences and Mathematics regarding the transposition and the implementation of scientific approaches in classrooms.

■ **ALAIN FIRODE**

*The critique of classical epistemology and its educational implications in J. Dewey and K. Popper*

Dewey and Popper have both criticized classical theories of knowledge by opposing them with a naturalistic and evolutionary epistemology in which knowledge is thought to be an extension of vital activity. Although they aim at the same target, the two philosophers do not criticize classical epistemology for the same reasons. The error of most philosophers, for Dewey, is to have accepted "the spectator theory of knowledge" which identifies knowledge with an adequate representation of the reality; according to Popper, it is to have remained prisoner of the "subjectivist epistemology" which limits knowledge to what is known by a subject. These two ways of looking at the fundamental error of Western philosophy result in two different criticisms of traditional pedagogy.

■ **CYRILLE GAUDIN, JÉRÔME AMATHIEU & SÉBASTIEN CHALIÈS**

*Principals' Contact with Students' Parents: Complex Activities as an Interface between Teachers and Supervisors*

Although the training of principals in France is strongly established, referenced and defined by a body of theoretical and practical knowledge, their daily professional activities are not specifically addressed. The purpose of this study is therefore to identify, formalize, and analyze some of these activities, particularly those involving contact with students' parents, as they are underrepresented in current scholarship. As part of a research program dedicated to professional training, this study consists of analyzing the meetings between two principals and parents of students. Each meeting was recorded, and self-analysis interviews were carried out with these high school principals. The results demonstrate the complexity of their work: on the one hand, the intricacy is due to the diversity of the activities they undertake with students' parents (convincing them, giving them examples, offering explanations, reaffirming their idea of the high school's identity, responding to their questions, and bringing them together), and then on the other hand, it is because these activities are combined with others that they carry out with teachers and/or their supervisors. The complexity of the principals' activities as they work to interface between their supervisors and teachers is amplified by the specific context of a major teaching reform. Based on a discussion of these results, leads for future research and potential training tools for principals will be suggested.

■ **CAROLE LE HÉNAFF**

*Learning a language, discovering a culture: experiencing a social game. An example at primary school, during a videoconferencing session between an English class and a French class*

Our paper examines, for the learning of a foreign language, how the consideration of the practice of linguistic and cultural experience, associated with an expert practice, can permit to better understand others, their language and their culture. We rely on a case study at primary school during a videoconferencing session, with French students who learn English, and English students who learn French, while both classes are simultaneously cooking pancakes. For our analysis, we refer to the theoretical framework of the Joint Action in Didactics (JATD), and to its associated epistemology of language, notably through the concepts of language game / form of life, and of social game. Our aim is to re-problematize how languages and cultures are learnt and transmitted, through joint actions, particularly in order to provide elements of a response to the question of the complex link between the learning of a language and the discovery of cultural practices at school.