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INTERDISCIPLINARITY IN SCHOOLS:
A Comparative View of National Perspectives[1]

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Introduction

by

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1. Background of the thematic journal issue

The present journal issue came into being in February 2006 following a meeting of Yves Lenoir with Julie Thompson Klein at the University of Sherbrooke, where she was invited by the Canada Research Chair in

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Educative Intervention to present lectures at the University's faculty of medicine and the Centre de recherche sur l'intervention éducative (CRIE) in the education faculty. Observing a gap in the literature, we felt it important to conduct a comparative review of the status of interdisciplinary education in various national cultures. Following conception of the journal issue, which we will briefly recall, a call for submissions was issued in various English-, French-, Spanish-, and Portuguese-speaking countries. A substantial task followed. After an initial submission of articles whose subjects had obtained prior approval, the editors asked the authors to make changes of varying magnitude to meet the full structural and other content requirements for this work. The modified versions then went through an external referee process based on explicit criteria in line with the theme and the stated requirements. Only accepted articles have been included in this issue.

This introduction to the thematic journal issue is organized as follows. First, we will present the general theme and propose a brief socio-historical contextualization to situate interdisciplinarity in the field of education. Next, we will present the various articles using a comparative analysis grid based on the requirements given to the contributing authors. Finally, only by way of indication and without pretending to exhaustiveness, we will highlight a few publications in French and English concerning the question of interdisciplinarity in primary, secondary, and teacher education.

2. Theme

2.1 Requirements

To ensure strong internal consistency and provide the basis for the editors' comparative analysis, the authors of each chapter were asked to address the five following criteria:

- a brief contextualization of the educational system of the country in question, implying a presentation of the structure and organization of this system;
- the conditions and circumstances leading to the emergence and conceptualization of interdisciplinarity in the country;
- the evolution of the concept of interdisciplinarity from its origins of use in the country to modern times, ending with a description, as exhaustive as possible, of the dominant conception(s) today, while highlighting the epistemological foundations of these conceptions as well as conceptual, educational, and social stakes involved. This task requires the distinguishing of discourses from government, academics, and practice settings.
- a description of current practices related to interdisciplinarity, which notably necessitates approaching the question of the definition of interdisciplinary practices and presenting the place and function of knowledge relating to teaching disciplines according to the interdisciplinary perspective (hierarchization of academic disciplines, social functions of the disciplines, relations between didactics [management of school knowledge and of the curriculum for English-speaking authors] and pedagogical relations, aims pursued, etc.);
- the presentation of past and present conceptual sources and references drawn on by these conceptions.

In addition, each article was to begin with a brief introduction specifying the object dealt with (the "what"), the rationale chosen (the "why"), and the structuring of the article's content (the "how"). Finally, each chapter was to include a conclusion stating the fundamental aspects addressed and a possible future outlook on the use of interdisciplinarity in primary and/or secondary education in the society concerned.

2.2 Educational and Socio-historical Context

Re-examining the history of the notion of interdisciplinarity, even cursorily, allows us to contextualize and outline its evolution, as well as to avoid implying that it emerged recently. It is important for the portrait sketched of the conceptions and use of interdisciplinarity in schools to be solidly contextualized—epistemologically, historically, culturally, and socially, if not economically and politically. "Incomprehension of the present," Marc Bloch (1974) wrote, "is a fatal consequence of ignoring the past" (p. 47).[2] According to the same author, however, "it is perhaps no less vain to tire oneself trying to understand the past if we know nothing of the present" (Bloch, 1974). We have heard countless times that, "after all, interdisciplinarity, pluridisciplinarity, integration, and all those terms mean the same thing." This is the ignorance of the present!

The question of interdisciplinarity is not new, but rather dates back principally to the 20th century, having first emerged in the United States in the mid-19th century. And although it is not always explicitly formulated—

[2] All translations in the text are ours unless otherwise noted.

or is expressed using other designations that nuance its meaning—it nevertheless is strongly present in a number of spheres of human activity in our contemporary societies. In French, the following terms can be found: *hybridation, polydisciplinarité, codisciplinarité, transdisciplinarité, décloisonnement, fusion, holisme, intégration des matières, coordination,* etc. In the United States, authors such as Klein (1990, 1998) and Pinar, Reynolds, Slattery and Taubman (1995) recall how the concept of interdisciplinarity was inscribed in curricular problems under other names: co-ordination, new fields, overlapping projects, interrelated research, borderline research, interpenetration, cross-relationships, etc.

Despite the fact that the emergence of the word is at the origin and at the heart of the development process of the scientific disciplines institutionalized in university establishments (Morin, 1990; Stichweh, 1991), the problem of interdisciplinarity cannot be reduced today solely to a scientific debate. It must be interrogated taking into account the migration of the concept of interdisciplinarity to other spheres of activity (Hermerén, 1985), primarily the sphere of professional activities to which education belongs. Also socio-historically speaking, it should be added, in keeping with Stichweh (1991), that this socio-historical process led in the 18th and 19th centuries to the constitution of disciplines and professions—which had previously fallen under the concept of erudition as a common form of knowledge—by establishing two distinct social systems, the system of professions being subjected and subservient to that of the disciplines.[3] This dichotomization of research, training, and practice reveals a dual conception of the sciences—some were "fundamental sciences" and others "sciences turned toward projects" (Fourez, 1994), also called "field sciences" (Stengers, 1993)—and of interdisciplinarity, which could be academic or instrumental (Lenoir, Larose & Dirand, 2006). It also led to the split between disciplinary training and professional training, which was gradually brought into question, in particular by the pragmatic current that developed in the United States starting in the 1880s. The revalorization of professional training today in French-speaking Europe undoubtedly attests to the tension between these two tendencies, which can also be observed within interdisciplinarity. Klein (1985) and Lynton

[3] Based on the work of Turner, Stichweh (1991) writes that "the disciplines are no longer a *propédeutique* [foundation course for first-year university students] or an auxiliary science for professional studies—instead, professional knowledge is now partly an application of science; it thus comes after science and is subject to it" (p. 42).

(1985) have shown that interdisciplinarity has to do with two broad and distinct orientations previously mentioned: the search for a conceptual synthesis, that is, one might say, a quest for the unity of knowledge; and the instrumental approach. Palmade (1977) has also pointed out the existence of this potential conceptual (and operational) conflict by distinguishing between interdisciplinarity that makes relations between scientific disciplines explicit and a "project" interdisciplinarity centered on practice and articulated "in the field." Klein (1990) pointed out that "[t]he escalation of instrumental interdisciplinarity since mid-century has created an inevitable tension in the discourse between those who define interdisciplinarity as a philosophically conceived synopsis and those who believe interdisciplinarity is not a theoretical concept but a practical one, one that arises from the unsolved problems of society rather than from science itself" (p. 42, original quote).

In its tension, this dual interpretation of the interdisciplinary perspective is quite present in the field of education, but is expressed differently according to different cultures, socio-political and economic stakes, educational traditions, etc. This is why the object of this thematic issue is to present a detailed, analytical, and historical portrait of interdisciplinary practices in various countries for primary and secondary levels. The question of interdisciplinarity is increasingly debated in education in the frame of current reforms in education and in teacher education in most Western countries. It constitutes an increasingly central problem in governmental and scientific discourse, as attested by myriad publications—especially in English, but also in French, Portuguese, Spanish, and other languages. The concept even constitutes one of the mainsprings of a number of current reforms concerning education and teacher education in French-speaking Belgium, in Brazil, in Colombia, in the United States, and in French-speaking (Quebec) and English-speaking Canada, as well as in other Western countries. Furthermore, the introduction in these curricula of groupings between school disciplines, transversal perspectives, the concern for an anchoring of teaching/learning objectives in the realities of social life, and hybrid programs of citizenship education, environmental education, and the like leads to the need for interdisciplinarity. At the beginning of the 20th century and in a context of increasingly internationalized exchanges between people, interdisciplinarity in education proves to be a major issue which, beyond the development of new knowledge and new approaches to human reality that it favors, relates to the social and cultural dimensions of human communities.

These recent transformations raise many questions. How do various Western countries intend to favor the use of an interdisciplinary approach in primary and secondary education? Why is this choice made? Where does the choice come from? How do teachers interpret the directives promulgated by curricula and how do they actualize these directives in their teaching practices? What are the epistemological—but also social, cultural, political, and educational—bases of this call for interdisciplinarity by government powers, academics, and practitioners? What sources have inspired the conceptions of school interdisciplinarity and what contemporary references do they draw from? What are the effects of these conceptions on educational knowledge carried by academic disciplines in schools? On new knowledge introduced by current curricula (environmental education, peace education, etc.)? These questions especially relate to the third and fourth criteria given to the contributing authors concerning a presentation of the use of interdisciplinarity in their country's primary and secondary education system.

3. What the Articles Reveal

3.1 The Comparative Perspective Adopted

Although the tendency to resort to interdisciplinarity at least on a discursive level is widely shared and can easily be seen in each of these countries, its conceptual and operational modes of declension can vary substantially. This is why the present thematic journal issue aims, using a comparative approach, to present respective origins and evolutions, as well as their specific conceptions and actualizations in various national contexts.

The comparative approach we have adopted is based on what Bouchard (2000) calls the integral model, as opposed to the referential model. The referential model is based on a comparison of elements from various social worlds (e.g., various school systems) according to a viewpoint that serves as a system of reference (e.g., the school system of a given country).[4] This model enables comparison of various aspects of reality according to one same standpoint, a segment of reality, an element of reference. Comparison is carried out based on this unit of reference and requires that the dimensions

[4] Using such a model to analyze the interdisciplinary perspective in various countries would prove dangerous owing to ideological biases it might introduce in terms of values attributed to aims analyzed from a given standpoint, normally ours, that of our society, values, and culture.

considered be present in each unit, and previously identified. This model discards specificities, idiosyncrasies, and singularities in a concern for standardization, for seeking invariants, elements shared according to a standard, a rule, a value.

The integral model comparison implies, at the opposite, that all units are treated equally, each being compared to all others, with the objective of bringing the diversity observed back to a particular rationality, to identify one or two general principles serving to organize the various figures (classifying and identifying models, types of ideals, and so forth). This is done while taking into account differences resulting from various cultural and historical heritages, from the standpoint of both theory and practice. The result is to impose a prerequisite establishment of criteria. It is also important in this approach to consider the units observed—these social segments—by re-situating them in their environment, in their more global context, and inserting them into the interactions between these environments and social segments.[5] This comparative approach allows us to place a situation, a sequence of events, or a given evolution into the spatio-temporal groups in which it belongs. It also enables us to identify the true specificities of one or more societies and thus to better understand their characteristics, their similar or different evolutionary dynamics. Among other things, it also provides means for refuting excessive generalities and false singularities resulting from a lack of understanding or ignorance of otherness, as well as an ethnocentric perspective, which can be the case, for example, in individual conceptions of an educational system, a culture, of citizenship, and the like... or of professional training. This is the approach that we adopt to compare interdisciplinarity among schools in many countries.

3.2 Comparative Analysis Grid

To carry out internal and external evaluation followed by comparative analysis of the articles, we designed an analytical grid stemming from questions raised by the theme, as well as the imposed requirements. Table 1 on the following page presents this grid.

[5] Many works are based on such an approach. Among these can be cited the book of Gundem and Hopmann (1998), who compare the notions of curriculum and didactics. One could also cite Goldring (2000), who compares the formation of elites in France and Great Britain; or Vaniscotte (1996), who compares European school systems; or Coulby (2000), who analyzes the place of teaching contents in various curricula in Europe and the United States.

Table 1
Comparative Analysis Grid

Criteria
Geographical entity
Education level
Contextualization of the educational system
- Structure and organization of the country's educational system.
- Conditions and circumstances that led to the emergence and conceptualization of interdisciplinarity in the country.
- General place of interdisciplinarity in the structure of curricula.
Evolution of the concept of interdisciplinarity from its emergence to the present day
- Currently dominant conceptions.
- Underlying epistemological foundations.
- Other foundations: social, cultural, political, educational.
- Conceptual, educational, and social stakes.
- Official discourse.
- Current place and importance of interdisciplinarity in the discourse.
- Past and present conceptual sources and references drawn on by these conceptions.
- Modes adopted to favor the use of an interdisciplinary approach in primary and secondary education.
- Understanding of teachers.
Description of interdisciplinary practices
- Definition of interdisciplinary practices.
- Place and function of knowledge related to the teaching of disciplines according to the interdisciplinary perspective.
- Place and function of school disciplines in the interdisciplinary perspective.
- Interdisciplinary modes implemented.
- Current place and importance of interdisciplinary practices.
- Other(s) to be specified.
Future perspectives

3.3 Analytical Results

3.3.1 Contextualization of the educational system:
Geographical entities and education levels. Nine articles were ultimately accepted for publication. Three texts are from the English-speaking world, from the United States (Boix Mansilla and Lenoir), Australia (Long, Moran, and Harris) and the province of Ontario in Canada (Clausen and Drake). Two articles are from the Spanish-speaking world, specifically Colombia (Gregorio Rodríguez and Miñana Blasco) and Spain (Segovia, Lupiáñez, Molina et al.). Three other articles are from the Francophone world: two from France—one on primary and secondary education (Baillat and Niclot), the other on professional agricultural education (Bouillier-Oudot)—and one from the province of Quebec in Canada (Lenoir and Hasni). Finally, a last article came from Switzerland (Ghisla, Bausch, and Bonoli) and stands apart, as it takes into account three languages (French, German, and Italian). It is in this order that the articles appear in the present journal issue.

Although the articles all respect the stated criteria and especially present the evolution of the curricular perspective in their respective country or province, they also highlight aspects that set them apart and underline their specificities and local interpretations. The Boix Mansilla and Lenoir article on interdisciplinarity in education in the United States emphasizes the historical evolution of the concepts of interdisciplinarity and integration by situating them in the broader context of emerging trends in American life, thus taking stock of today's educational landscape and new contemporary demands on education imposed by the global, digital, and biological revolutions. The article by Long and colleagues addresses interdisciplinarity in preschool, primary, and secondary education in the various Australian states and territories. That of Clausen and Drake centers on the province of Ontario in Canada and relates a fluctuating, "pendulum-like" evolution of the place of interdisciplinarity in public primary and secondary education. In their article, Rodrígez and Blasco present an overview of institutional and teacher discourses and practices concerning curricular integration and interdisciplinary practices at the primary and secondary educational levels in Colombia. Segovia and colleagues, in their analysis of the place of interdisciplinarity in public education in Spain, particularly examine compulsory education. The two articles on interdisciplinarity in France point to the existence of two distinct perspectives: first, primary and secondary education overseen by the national ministry of education and in which the introduction of interdisciplinarity is recent; and second, agricultural

education overseen by another ministry and in which interdisciplinarity is a much older phenomenon. The article by Lenoir and Hasni concerns Quebec and deals with interdisciplinarity essentially at the primary school level, as it has only recently been introduced at the secondary level. Finally, owing to a fragmentation of the educational system which is overseen by individual cantons in Switzerland, Ghisla, Bauch, and Bonoli treat various education levels; they offer an analysis of developments in the discourse surrounding interdisciplinarity in the country and present the most noteworthy initiatives in this field.

Education level. The articles address interdisciplinarity in primary and secondary school education, with only two exceptions. In Quebec, because the question of interdisciplinarity in the secondary school context has only been considered at the curricular level since the last reform in 2004, the article deals with only primary education. The Bouillier-Oudot article examines professional agricultural education in France, where interdisciplinarity has been firmly established for the past 40 or so years.

Structure and organization of the country's educational system. These nine geographical entities are also distinguished by the structure and organization of the educational systems for which they are responsible. In France, the educational system is centralized and overseen by the government, thus leading to a high level of curricular homogeneity. The educational system of Colombia is likewise overseen by the central government and managed by municipalities. In Spain, the central government establishes the basic general curriculum, which is adapted, enriched, and managed by regional and autonomous governments. The organization—this time decentralized—of the school system and the designing of curricula are the responsibility of individual states in the United States (with standards established at the federal level) as well as in Australia (where a national curriculum is in place), and of each province in Canada and each canton in Switzerland.

Conditions and circumstances that led to the emergence and conceptualization of interdisciplinarity in the country. Excepting the United States—where the concern for interdisciplinarity in primary and secondary education is closely related to the concept of integration and stems from twin revolutions (industrial and Darwinian) at the turn of the 1880s with significant impacts on education—this preoccupation is

recent in all other geographical entities. It is even very recent, excepting in Quebec and Switzerland, as well as in French agricultural education, where it emerged around the 1970s. In most cases, the interdisciplinary perspective was not introduced into curricula until the last reform. It is especially associated with problem- or project-based pedagogical approaches and with the recourse to transversal competencies. Such is the case in Australia, in Quebec, in French agricultural education, and in Spain, which draws on integrated activities. Elsewhere, in Ontario, Colombia, and France, recommended methods are globally centered on the teaching of individual school disciplines. Switzerland stands apart owing to the variability of situations, as a result of weak national homogeneity. Finally, the emergence of the concept can essentially be traced to two sources: government decisions and economic pressures in line with the requirements of a global market economy.

General place of interdisciplinarity in the structure of curricula. The importance of interdisciplinarity in teaching curricula is low in Colombia, where the concept is recent, but also in Ontario, where it underwent significant variation over time and has been on the decline since 2009. Its importance is growing in Australia (where it has been applied only recently), Spain, and Quebec, while in Switzerland its importance is variable and often still nascent, depending on the canton. In France, interdisciplinarity is addressed in the scientific and pedagogical literature, but little present in curricula. In the United States, it has occupied an important place for more than a half century, and in French agricultural education, for roughly 40 years. One could undoubtedly conceive of the existence of a close link today between the competency-based approach and the recourse to the interdisciplinary perspective in curricula.

3.3.2 Evolution of the concept of interdisciplinarity from its emergence to the present day:

Currently dominant conceptions. The currently dominant conceptions behind the various curricula are different. Three broad tendencies nevertheless stand out: preparation for life in society and for the job market, the acquisition of new ways of thinking centered on the development of autonomy, and an improvement in learning processes through the establishing of links. An integration of traditionally separated disciplines into larger groups can also be seen in the various curricula.

Epistemological foundations. The curricula are based on various epistemological foundations. Articles concerning Australia, Ontario, the United States, and Colombia do not mention these foundations, undoubtedly for reasons that warrant examination. Spain draws from the currents of the New School and Active School of the early 20th century, France from the conceptions of Edgar Morin and Yves Lenoir, French agricultural education from the current of the new pedagogy of Montessori and Freinet, and Switzerland from the dialectic perspective. Extensive variation in these conceptions can be observed in the United States, given, among other things, the long history of interdisciplinarity in the country's educational system. Finally, most are also underpinned by a constructivist epistemology, though it is very rarely made explicit.

Other foundations: social, cultural, political, educational. The other foundations are essentially socio-economic in nature and relate to the introduction of competencies in curricula. The neoliberal and/or utilitarian perspectives are called upon by many geographical entities (Australia, Colombia, France, Ontario, Quebec, Spain, Switzerland); Ontario also borrows from the private business of the "Enterprise Method" (Kilpatrick, 1918), which recommends a change in focus in education from a conception of students as passive information gatherers to the valorization of the subject's active participation in a problem-solving process. Colombia, in response to influence from the North, promotes an approach aiming to answer the social needs of communities and to solve local problems.

Conceptual, educational, and social stakes. In Ontario, Colombia, and Spain, few publications have been devoted to conceptual, educational, and social issues. In Spain, many other problems curb the introduction of interdisciplinary approaches. In the United States, as Klein (1998) notes, "Interdisciplinarity intersects with the most fundamental needs of contemporary culture and the defining traits of contemporary knowledge" (p. 70). In France, while disciplinary logic is dominant in the practice and in the curricula of primary and secondary education, problems of management, teacher education, and the weakness of epistemological reflection characterize agricultural education. In Australia, the lack of a definition of concepts and difficulties in connection with the transition to problem-based pedagogy apparently constitute the two major difficulties relative to interdisciplinarity. In Quebec, the absence of conceptual clarification of interdisciplinarity and of related notions results in confusion among teachers and their administrators.

Official discourse. Official government discourse, absent in Colombia, sees interdisciplinarity above all as a means, using the acquisition of new competencies, to meet the demands of modern life, of the job market (in Australia), of globalization (in Spain), of the economic system (in Quebec), and of changes in society (in France), and additionally as a way to favor the profitability of the school system (in Ontario). Of course, these various discourses also involve educational legitimizations. In the United States, disciplinary perspectives are currently re-valorized along with the view that they should be anchored in social realities. In Switzerland, interdisciplinarity favors the functional integration of knowledge (*connaissances*[6]) insofar as it allows primary students to experience a global apprehension of the phenomena and problems they encounter. At the secondary school level, it is related to the use and combination of knowledge and know-how aimed at solving problems.

Current place and importance of interdisciplinarity in the discourse. The official discourse grants an important place to interdisciplinarity in Australia and in the United States, where it is inseparable from the concept of integration; an important place in French agricultural education; a growing place in Spain and in primary and secondary education in France and in Quebec; a less important place in Ontario; and a variable place according to the canton in Switzerland. In Colombia, the official discourse on interdisciplinarity is present only in the natural sciences. Although interdisciplinarity is invoked everywhere as a new mode for educating young people and is seen as an important perspective, the articles clearly show the existence of sometimes significant nuances, even in official discourses. Further analysis may enable an understanding of the motives behind this phenomenon.

Past and present conceptual sources and references drawn on by these conceptions. Among the mentioned past and present conceptual sources and references to the conceptions of interdisciplinarity, readers will find the following: in Australia, Dewey, Hopkins, and Rugg; in Ontario, Irish and Prussian models, the Humanities and Liberal Arts, Neill, Piaget, and Holt; in Colombia, Dewey, the European New Education and School movements; in the United States, first the Herbartians, then Dewey and the Project method; in Spain, Decroly, Kilpatrick, the Integrated Didactic Units, the

[6] The French makes a distinction between *savoir* (knowledge in a general sense) and *connaissance* (loosely translated as "acquired information" or "what is known" in a more basic sense); *savoirs* therefore subsume *connaissances*.

New School and Active School currents; in France, Lenoir in general, and Morin for primary and secondary education, but also learning by objectives, the systemic approach, and Fourez for agricultural education; in Quebec, Rogerian humanism, Artaud, Lenoir, and collaborators; and in Switzerland, the systemic approach, the holistic perspective, and Pestalozzi. The various articles thus refer to currents and authors from different periods. Here again, further study may enable an identification of the roots and modern thinkers and architects of interdisciplinarity, as well as of breaks and continuities in interdisciplinary conceptions in the field of education,

Modes adopted to favor the use of an interdisciplinary approach. In general, curricula are seldom explicit about the modes to adopt in order to bring about interdisciplinarity in teaching practices. The idea of disciplinary merging can be found in Australia (in addition to problem-based pedagogy), in Ontario (in addition to the harmonization of objectives and to group work), and in Quebec and Switzerland (in addition to the competency-based approach). In Colombia, national and municipal policies have never seriously proposed the integration of curricula, school disciplines, and knowledge; nor have they favored interdisciplinarity. In Spain, as previously mentioned, initiatives are external or depend on the personal initiative of teachers. In the United States, a close link exists between the concepts of integration and interdisciplinarity, and their implementation generally comes down to the personal initiative of teachers. In French primary and secondary education, a *Socle commun des savoirs et des compétences* (common base of knowledge and competencies) has been introduced, which requires the use of an interdisciplinary approach. In agricultural education, according to a logic of action, learning is turned toward a goal requiring the integration of knowledge (*connaissances*).

Understanding of teachers. The understanding teachers have of interdisciplinarity remains weak and generally blurry, but it often varies. The absence of a fleshed-out and articulated official discourse, along with the absence of conceptual clarification or even the absence of the concept in primary teaching curricula in France and Quebec, hinder the interpretation and implementation of the concept in teaching practices. Teachers' reception thus remains lukewarm (in Spain); they must interpret the concept in their own way (in Ontario, in French agricultural education, in Quebec, and in Switzerland). Seen as the integration of other disciplines into one's own teaching in Australia, it is perceived as a source of long and complex tasks

in Ontario, and generally ignored in France, where traditional education through school disciplines is maintained.

3.3.3 Description of interdisciplinary practices:

Rather than treat separately the four dimensions aiming to describe interdisciplinary practices—their definitions, the place and function occupied by the school disciplines and by the knowledge relating to the teaching disciplines, the modes of implementation of interdisciplinarity—we consider them in their interactions to better synthesize what is revealed on this subject by the different articles.

First, a number of levels or types of interdisciplinarity can be identified following analysis of the texts. This observation is no doubt related to the fact that, on the one hand, interdisciplinarity does not always refer to the same objective; and on the other, great confusion exists regarding the very definition of the term, as well as of related terms. Among other things, this confusion can be observed in the meanings of the terms of integration and interdisciplinarity. First, few definitions of the terms are given and second, they are sometimes considered synonyms and thus become interchangeable.

At the risk of eliminating many potentially important nuances, we can identify four interpretations of interdisciplinarity that thread their way through the articles:

- A utilitarian interdisciplinarity allowing teachers to solve what they see as a set of time-related or administrative problems, by "merging" school disciplines to gain time or to legitimize the teaching of certain disciplines. This conception is underpinned by many curricula. Such a perspective, pointed out in a number of articles, can clearly be found in the discourse of Quebec teachers starting in the 1970s, irrespective of the curriculum in place (Lenoir, 2006). This utilitarian orientation has even been explicitly advocated by the Quebec ministry of education (Conseil supérieur de l'éducation, 1982). It is important to recognize that recourse to interdisciplinarity based on this logic may lead to a neglect of intentions to improve learning processes with a view to increasing and enriching understanding of human, social, and natural phenomena of the world in which we live, in addition to increasing our ability to act on this world, whether through thought or action.

- A professional interdisciplinarity in which teachers of various disciplines gear their practices to the achievement of a common goal, namely the global and integrated learning of the student. This type of interdisciplinarity especially concerns collaboration devices, mechanisms established to support interdisciplinarity (for example, course coordination, the adoption of a similar approach, knowledge exchanges between teachers, and the like). This form of interdisciplinarity relates to the new arrangements for learning presented by Davis (1995), among others. According to this last author, "the ability to work collaboratively, and the capacity to cope with complexity are leitmotifs of reform across the academy, industry, government, and public life" (p. viii, original quote).
- A "disciplinary" (or "academic") interdisciplinarity based on the introduction, in teaching, of certain contents from other disciplines, often to support the learning of the teacher's discipline. This form is tied to knowledge as such, and to its teaching. The "product" of this reference to other disciplines is perceived as favorable to the development of richer competencies among students. Such a conception of interdisciplinarity, which is not a priori without interest and hence not to be rejected, nevertheless refers more to pluridisciplinarity, which can take many forms in school: a thematic approach, pseudo-interdisciplinarity via a cumulative and distinct teaching of disciplinary content, polydisciplinarity, etc.
- Finally, an integrative interdisciplinarity targeting the integration of practices and knowledge, teachers, students, and the community/society, so as to favor the development of a critical mind, of reflective and complex thought, of competencies preparing students to play their role as citizens. This is a dynamic process calling upon all players involved. In a closely related perspective, one can identify an interdisciplinarity tied to students in which interdisciplinarity becomes their responsibility. It enables them to develop critical, complex, reflective thought. The student's adoption of an interdisciplinary posture is a tool for learning and integrating knowledge. It relates to the role of the student in learning and in the integration of the varied knowledges (involvement, participation in the definition of contents, actions undertaken to integrate knowledge, the establishment of links between disciplines, and so forth).

Second, these texts clearly reveal that the practice of interdisciplinarity comes under the responsibility and initiative of teachers. Confusion regarding the term "interdisciplinarity," which is not explained, and the lack of a definition of standards or mechanisms permitting its actualization, make interdisciplinary practices depend more on the commitment of teachers based on their individual interpretation than on a clear orientation provided by curricula. Furthermore, where the interdisciplinary perspective has been advanced for several decades (for instance in Ontario, in the United States, and even in Quebec), as Clausen and Drake mention in the conclusion to their analysis of the Ontario situation, "we can assume that there will be some pendulum swing from a disciplinary to an integrated approach."

Third, disciplinary knowledge, the contents of courses of study, is approached as a means to learn, often in a problem-solving perspective, rather than as an end to reach, as in traditional education. Interdisciplinarity is seen as a means for adjusting to the world context, to the new requirements of society. And yet, these requirements are associated with the development of competencies among students, which cannot take place without the recourse to formal knowledge. It appears necessary to specify the place and function of knowledge, as much as the theoretical, empirical, and operational meaning to accord to the concept of interdisciplinarity. Although the idea of developing understanding is clearly associated with knowledge in Colombia and Switzerland, the question of integrating processes and integrated knowledge largely remains up in the air.

Conclusion

The intent of this work is not to be pessimistic, but rather to lucidly and objectively consider the situation of interdisciplinarity in primary and secondary school systems. A comparative reading of articles comprising this journal issue reveals the difficulty of implementing interdisciplinarity in primary and secondary education. It especially suffers from the absence of clarification—but also visibility—on the curricular and conceptual levels, as well as the absence of real political will to provide means to favor its implementation. As a result, a gap of varying size can be observed between discourse and action, thus generally leaving teachers on their own to interpret the meaning to give to interdisciplinarity and to identify the modes of its operationalization in their teaching practices.

In general, though we see within curricula an effort at integrating school disciplines into larger groups, this curricular integration runs the risk of

remaining at a formal level, as Baillat and Niclot, for example, note in the case of French education. Strong acculturation to the system of scientific disciplines leads to the consideration that the foremost aim of learning, at the primary and secondary levels, is the retention of knowledge. The interdisciplinary perspective shakes up this conception: Disciplinary knowledge becomes an indispensable and inescapable means to reach a richer and more complex understanding of natural, human, and social realities.

Such an orientation imposes the adoption of several theoretical and operational positions. On the one hand, it must be recognized that interdisciplinarity subsumes disciplinarity and disciplinary knowledge, which remain indispensable. To eliminate them would be to reject a part of the meaning of school and of instruction, as well as socialization through the passing on of cultural tradition, based in part on official and formalized knowledge. But professional and school interdisciplinarity also require the recourse to use-related knowledge or *connaissances* (belonging to common sense), to current practices, and the like, which are anchored in daily life or characterize professional practices.

Moreover, the integration of school disciplines in the curriculum is not enough. On the level of the school as well as that of professional teacher training, that connotation of integration in the context of primary and secondary education must be clearly distinguished from interdisciplinarity, even if the authors of the articles from Spain, the United States, and Quebec point out that the two terms are often considered synonyms. Quite to the contrary, integration is characterized by a dual process. First, the teacher establishes facilitating conditions (integrative approaches), consistent with the interdisciplinary perspective chosen, to support student learning. Second, internal integration relates to the action of the students and concerns their relationship to knowledge. This internal integration is both a cognitive process—that is, the integration of learning processes (integrating processes), particularly by calling upon appropriate learning approaches—and a product, that is, a cognitive construct, the integration of knowledge (integrated knowledge). Consequently, integration is operationalized in concert with interdisciplinarity. From this standpoint, integration brings to the fore a dual aim of the learning process: an integration of learning processes (integrative processes), and the product of this process or integration of knowledge (integrated knowledge), the two being both indissociable and necessary. On an educational level, one can no longer interpret interdisciplinarity without referring to the concept of integration.

Furthermore, the question of interdisciplinarity in the field of education

must be re-conceptualized by various educational systems so as to exceed the scope of political-economic utilitarian preoccupations. A re-centering on epistemological and conceptual foundations, as well as on operational modes in a concern for education, stands out as one requirement to favor a real and adequate establishment of interdisciplinarity in training. In support of this and other needs, there is no lack of high-quality publications to support and guide the reflection of curriculum designers and trainers working with practicing and future teachers.

Prior Literature on Interdisciplinarity in Education

By way of indication and without pretending to exhaustiveness, we would like to highlight a few publications that will be helpful to the reader interested in the question of interdisciplinarity in the field of education, in both English and French. We have indicated only publications dealing mostly or entirely with primary and secondary education and with teacher training for these levels. We first suggest what we consider to be a few fundamental and prerequisite texts in both languages.

Selected Publications on Interdisciplinarity in Education

In English

K-12 Literature

Beane, J. (1997). *Curriculum integration: Designing the core of democratic education*. New York: Teachers College Press.

Beane, J. (1993). *A middle school curriculum: From rhetoric to reality* (2nd ed.). Columbus, OH: National Middle School Association.

Burns, R.C. (1995). *Dissolving the boundaries: Planning for curriculum integration in middle and secondary schools*. Charleston, WV: Appalachia Educational Laboratory.

Clarke, J., & Russell A. (Eds). (1997). *Interdisciplinary high school teaching: Strategies for integrated learning*. Boston: Allyn & Bacon.

Hedtke, R. (Ed.). (2006). Disciplinarity and interdisciplinarity in civic and economic education. *Journal of Social Science Education*, *5*(2), 1-104

Jacobs, H.H. (Ed.). (1995). *Interdisciplinary curriculum: Design and implementation*. Alexandria, VA: Association for Supervision and Curriculum Development.

Integrated curriculum. (1995). Alexandria, VA: Association for Supervision and Curriculum Development. A resource packet.

Interdisciplinary/Integrated curriculum. (n.d.). ERS Info-File #128. Arlington, VA: Educational Research Services.

Klein, J.T. (2002). *Interdisciplinary education in K-12 and college: A foundation for K-16 dialogue*. New York: The College Board.
Vars, G.F. (1993). *Interdisciplinary teaching: Why & how*. Columbus, OH: National Middle School Association.
Wineburg, S., & Grossman, P. (Eds). (2000). *Interdisciplinary curriculum: Challenges to implementation*. New York: Teachers College Press.

College Literature

Davis, J.R. (1995). *Interdisciplinary courses and team teaching: New arrangements for learning*. Phoenix, AZ: American Council on Education/Oryx Press.
Edwards, A.F. (1996). *Interdisciplinary undergraduate programs: A directory* (2nd ed.). Acton: MA: Copley.
Fiscella, J.B., & Kimmel, S.E. (1999). *Interdisciplinary education: A guide to resources*. New York: The College Board.
Klein, J.T. (1999). *Mapping interdisciplinary studies.* Washington, DC: Association of American Colleges and Universities.
Klein, J.T., & Doty, W. (Eds.). (1994). *Interdisciplinary studies today*. San Francisco: Jossey Bass.
Klein, J.T., & Newell, W.H. (1997). Advancing interdisciplinary studies. In J. Gaff & J. Ratcliff (Eds.), *Handbook of the undergraduate curriculum: A comprehensive guide to purposes, structures, practices, and change* (pp. 393-415). San Francisco: Jossey Bass.
Newell, W.H. (Ed.). (1998). *Interdisciplinarity: Essays from the literature*. New York: The College Board.

In French

Artaud, G. (1989). *L'intervention éducative. Au-delà de l'autoritarisme et du laisser-faire*. Ottawa: Presses de l'Université d'Ottawa.
Baillat, G., & Renard, J.-P. (Eds). (2001). *Interdisciplinarité, polyvalence et formation professionnelle en IUFM*. Reims: CRDP de Champagne-Ardenne.
Delisle, R., & P. Bégin (Ed.). (1992). *L'interdisciplinarité au primaire, une voie d'avenir?* Sherbrooke: Éditions du CRP.
Fourez, G. (1998). Se représenter et mettre en œuvre l'interdisciplinarité à l'école. *Revue des sciences de l'éducation*, *XXIV*(1), 31-50.
Fourez, G. (avec la collaboration de A. Maingain et B. Dufour) (2002). *Approches didactiques de l'interdisciplinarité*. Bruxelles: De Boeck Université.
Hasni, A., & Lebeaume, J. (Eds). (2008). *Interdisciplinarité et enseignement scientifique et technologique*. Lyon et Sherbrooke: INRP/Éditions du CRP.
Lenoir, Y. (1999). Interdisciplinarité. In J. Houssaye (Ed.), *Questions pédagogiques. Encyclopédie historique* (pp. 391-314). Paris: Hachette.
Lenoir, Y., Larose, F., & Dirand, J.-M. (2006). Formation professionnelle et interdisciplinarité: quelle place pour les savoirs disciplinaires? In B. Fraysse (Ed.), *Professionnalisation des élèves ingénieurs* (pp. 13-35). Paris: Éditions L'Harmattan.

Lenoir, Y., Rey, B., & Fazenda, I. (Eds). (2001). *Les fondements de l'interdisciplinarité dans la formation à l'enseignement*. Sherbrooke: Éditions du CRP.
Lenoir, Y., & Sauvé, L. (1998). De l'interdisciplinarité scolaire à l'interdisciplinarité dans la formation à l'enseignement: un état de la question. 1 – Nécessité de l'interdisciplinarité et rappel historique. *Revue française de pédagogie*, *124*, 121-153.
Lenoir, Y., & Sauvé, L. (1998). De l'interdisciplinarité scolaire à l'interdisciplinarité dans la formation à l'enseignement: un état de la question. 2 – Interdisciplinarité scolaire et formation interdisciplinaire à l'enseignement. *Revue française de pédagogie*, *125*, 109-146.
Valzan, A. (2003). *Interdisciplinarité et situations d'apprentissage*. Paris: Hachette.

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Interdisciplinary Research (2005). Her edited and co-edited books include *Interdisciplinary Studies Today* (1994), *Transdisciplinarity: Joint Problem Solving Among Science, Technology, and Society* (2001), *Interdisciplinary Education in K-12 and College (*2002), and *The Oxford Handbook of Interdisciplinarity* (2010). She also received the Ramamoorthy and Yeh Transdisciplinary Distinguished Achievement Award, and the Joseph Katz Award for Outstanding Leadership in General and Liberal Education. Klein has lectured on interdisciplinarity throughout North America, Europe, South Asia, Latin America, and Australia. She has also served on numerous national and international task forces and advisory councils on interdisciplinary studies and inter- and transdisciplinary research. At present, she is a co-editor of the University of Michigan Press series *Digital Humanities@ digitalculturebooks* and is working on a new book on "Mapping Digital Humanities: An Interdisciplinary Field Guide." Email: julietklein@comcast.net

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