INTERDISCIPLINARITY IN SWISS SCHOOLS:
A Difficult Step into the Future

by

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Abstract: Multi- and interdisciplinary education is a major postulate in the Swiss school system and has considerable weight in educational programs and learning objectives, both in compulsory school and at the upper secondary school level. However, materializing this postulate still poses problems at the political and institutional level, where the fragmentation of educational system due to Switzerland's federal structure does not foster wide-scale reform; in certain programs at the secondary school level, where disciplinary logic remains predominant; and in teachers' everyday practice, which is only slowly adopting an interdisciplinary posture. Following a presentation of the specifics of the Swiss educational system and an attempt to define the notion of interdisciplinary, this contribution will offer an analysis of developments in the discourse surrounding interdisciplinarity in Switzerland from the 1970s onwards and present the most noteworthy initiatives in this field.

Key words: Interdisciplinarity, multidisciplinarity, disciplinary teaching, skills, learning objectives, school programs, school system, Switzerland.

Introduction

The purpose of this contribution is to retrace the main impacts which debates and practices relating to interdisciplinarity have made on teaching and school reality in Switzerland.

The Swiss Confederation, a small Alpine republic located at the heart of Western Europe, represents on the one hand an example of the language, cultural, and political multiplicity of the Old Continent and on the other hand

has been and is still considered as a test lab for the democratic functioning of complex modern societies.[1]

Over the past two centuries, the diversities and specificities of pedagogical thought and educational practice in Europe have tainted the Swiss landscape with different trends in each of the country's three major regions: the Italian-speaking part (to which one can add the small Romansh minority), the French-speaking part, and the German-speaking part—the latter having the greatest weight in demographic, economic, and political terms.

The *complexity* of the Swiss model and its educational system derives from its administrative model and structure—typically federalist and based on direct democracy—which is still today reflected in school systems specific to each of the 26 cantons making up the Swiss Confederation.

This complex structure, which developed in ways that led the country to contemplate the most painful events in European history without actually being involved, has produced a specific identity marked by conservatism, a reluctance to follow international innovative trends, and a slow implementation of internal change processes.

This has both advantages and disadvantages; however, it is clear that since 1848—the year of the liberal revolution and the establishment of one of Europe's most modern constitutions of the time—Switzerland has not introduced any particularly noteworthy innovation. Evolution follows a slow pattern, conditioned by the lengthy procedures involved in direct democracy and by the people's determination to avoid any adventure which might put a wrench in the complex works of their peaceful daily lives. Although there have been Swiss educators with novel ideas—Rousseau, Pestalozzi, or Piaget for example—vision is one thing, and implementing it is another.

It should nevertheless be noted that the overall structure and practice of Swiss compulsory school are not radically different from those of other European countries. Cantonal microcosms may, however, harbor differences which serve to preserve regional cultural specificities. Therefore, the three language regions naturally tend to draw on the three supranational language-cultural areas to which they refer. This is particularly true of Italian-speaking Switzerland, whereas the weight of the German-speaking and French-speaking regions enable them to distinguish themselves from Germany or France, respectively.

From the 19th century onwards, the numerous attempts to implement a Swiss schooling system whose identity went beyond regional and cantonal peculiarities collided with the resistance of a people who have always

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[1] For a presentation of Swiss history and identity by a neutral external expert, see *Why Switzerland* by Jonathan Steinberg (1996).

feared the grip of the central government—of the national *Schulvogt*[2]—and systematically promoted an idea of school as a prerogative fiercely defended by regional and local communities.[3]

It was only on the occasion of a popular vote in 2006, under the pressure of mobility and globalization requirements mainly applied by economic circles, that the "sovereign people" finally conceded to the central government greater authority in the field of schooling, in particular to establish a national educational platform. The pilot project which ensued, called *HarmoS* to stress the need for harmonization, also encompasses the educational content which should be aligned with standards applicable nationwide.

We shall revert to this project which concerns first and foremost compulsory school, as upper secondary- and tertiary-level post-compulsory education has always had a greater national identity. Both the academic baccalaureate and vocational training—historically marked by trans-regional economic interests—are located at a mainly national level of administration and competence, although the cantons are given much leeway in implementing national provisions.

This cultural and institutional background also governed the emerging conceptualization of interdisciplinary educational content and practice by inspiring diversity in languages, curriculum design, and teaching approaches. The case of citizenship education *(éducation à la citoyenneté)* is an interesting example. This theme, which is significant both in the interdisciplinary discourse and in French-speaking cultural and teaching tradition, has no explicit equivalent in the discourse and educational practice of German-speaking Switzerland, which relies more on the overall educational value of the notion of *Bildung*, aiming at shaping an individual's personality and inner resources. On the other hand, environmental concerns have led to various forms of environmental awareness-raising in all three regions

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[2] The German term "Schulvogt"—school bailiff—is used in the educational policy discourse in both Italian and French to denounce any attempt by the central federal authority to widen the scope of its control in the field of education.

[3] An enlightening example of the dynamics of Swiss school management, constantly torn by the conflict between local and national interests, is the establishment of the *Swiss Conference of Cantonal Ministers of Education (*Conférence suisse des directeurs cantonaux de l'instruction publique—CDIP)*, founded in 1897. Although this is the only coordinating body for compulsory schooling at the national level, it does not have any executive power. (See http://www.cdip.ch/dyn/11586.php / accessed September 30, 2008.)

(éducation à l'environnement, Umwelterziehung, educazione ambientale). This makes for a highly complex educational panorama, so much so that it can hardly be reduced to specific patterns or easily identifiable trends.

It is in the integration of a language and cultural plurality that considering the case of Switzerland may lend added value to the debate which prompted this review.

We shall first examine the theme of interdisciplinarity by providing an overview of the Swiss educational system, and then proceed to outline our reference conceptual and theoretical framework, while naturally taking into account the analytical criteria which are the common thread in this work. We then propose to provide a glimpse of the discussion of interdisciplinarity currently taking in place in Switzerland and how this is reflected in the different implementing regulations at various levels in the educational system. This latter part, which is the core of our thought process, in no way pretends to be complete, especially as regards examples of teaching practice which cannot be systematically considered in this context. Analysis of the various documents regarding implementation—or at least, given the structure of the Swiss educational system regarding coordination of regional implementation— nevertheless enabled us to identify guidelines governing interdisciplinarity and possible prospects for interdisciplinary approaches. Nor can our field experiments be representative of the overall educational framework in Switzerland. The field approach to vocational training is less problematic given its structure (although implementation falls under the cantons, the guidance and coordination role of central government bodies remains decisive) and our firsthand field experience. As we shall see, it is indeed in this field that the interdisciplinary approach finds its most explicit applications.

Our—occasionally critical—considerations regarding the development of interdisciplinary approaches in the Swiss school system presented below are based on our interpretation of current trends. Thus they cannot completely escape the risk of a partial and biased analysis.

1. The Swiss Educational System

The Swiss educational system features major regional differences reflecting the country's federalist organization, the influence of the three cultures of reference (German, French, and Italian) and the coexistence of four national languages. The 26 cantons making up the Swiss Confederation enjoy a large degree of autonomy in education, especially at the compulsory school level.[4]

[4] For further information on the educational system please see the CDIP website

The central government, in contrast, plays a greater role in upper secondary school, both concerning general education (Matura School or *gymnase*) leading to the academic baccalaureate and giving access to the university, and regarding vocational training, where the *dual-track (*training combining school and business) traditionally plays a predominant role. This latter training also makes it possible to obtain a vocational baccalaureate providing direct access to Swiss Universities of Applied Sciences (*Hautes écoles spécialisées—HES*).

Vocational education and training (VET) is managed in partnership among the Confederation (central government), the cantons, professional organizations, and companies based in the country.[5] In this framework, the central government has legislative, supervisory, and, for a large share, financing authority. The cantons play a limited role, by implementing the relevant federal provisions, organizing education in school, and partly contributing to funding. As for professional organizations, they are in charge of the content and organization of in-company training. This *dual-track* vocational training system, which integrates education in a vocational school as well as in a host company into the apprenticeship, has been complemented in recent years with business-to-business (B2B) training courses to ensure a training capacity for small and medium enterprises (SMEs) unable to provide full in-company training. The introduction of this third VET axis coined the expression "three-track system."

1.1 Compulsory Schooling (Primary and Lower Secondary Levels)

In Switzerland, compulsory schooling lasts nine years and starts at age 6 with entry into primary school (International Standard Classification of Education—ISCED 1). Prior to that, children have the possibility of attending pre-school institutions (ISCED 0) from the age of 3. In certain cantons, pre-school attendance is compulsory from the age of 5. Organizing primary school and pre-school is the province of municipalities and cantons. The duration of primary school varies from four to six years according to the canton.

After primary school, children in Switzerland enter lower secondary school (*secondaire I*), which lasts from three to five years and comes under cantonal authority. This is the level which shows the greatest structural and educational differences. Indeed, the offerings range from a single middle school system

(http://www.cdip.ch/dyn/11586.php / accessed March 9, 2010).
[5] For an overview of vocational training please see
(http://www.bbt.admin.ch/themen/berufsbildung/00127/index.html?lang=fr / accessed March 9, 2010).

open to all pupils at the end of primary school without any particular selection (in Ticino and partly in Cantons Geneva and Jura), to systems offering three curricula with different content and requirement levels in most Swiss-German cantons, where the German tradition of a highly selective educational culture has become the rule. The latter system is also partly found in French-speaking Switzerland, and it has withstood all attempts at structural reform in recent decades. The lower secondary level ends at the age of 15, usually with a diploma providing access to the upper secondary level.

1.2 Upper Secondary School (Secondary II)

After compulsory schooling in Switzerland, youngsters can generally choose among three options: either pursue their studies in a Matura school (ISCED 3a), or enter a full-time vocational school (ISCED 3b), or undertake dual-track training through an apprenticeship (ISCED 3c). About 90% of people in the 25-34 age group have had upper secondary education. In 2006, 27% of youngsters opted for general education while 73% preferred the vocational path. In this respect there are notable regional differences: Whereas in German-speaking Switzerland, eight youngsters out of 10 choose vocational education, in the Italian- and French-speaking parts this share is fewer than six out of 10. Among those who undergo vocational training, a majority of over 80% opt for dual-track education in order to obtain a Federal VET Diploma *(Certificat fédéral de capacité— CFC)* which entitles holders to exercise the profession for which they have trained.[6] Here again one observes major regional differences: The percentage is 88% in the German part against 72% in the Italian- or French-speaking areas.

Matura schools lead to a Federal Academic Baccalaureate *(Maturité fédérale),* providing access to universities and Federal Institutes of Technology. Vocational education provides the opportunity of obtaining a Federal Vocational Baccalaureate *(Maturité professionnelle),* which ensures entry into Universities of Applied Sciences (HES).[7] Between the secondary and tertiary levels, the Swiss system foresees intermediate education possibilities (ISCED 4) leading to federal certificates and diplomas.

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[6] Full data available on the website of the Swiss Federal Statistical Office (FSO): http://www.bfs.admin.ch/bfs/portal/en/index.html / (accessed March 9, 2010).

[7] Here again there are major regional differences. The average percentage of baccalaureates (both academic and vocational) nationwide in 2007 was 31%, whereas the Italian-speaking part accounted for 45%.

1.3 Tertiary Education

In Switzerland, tertiary education (ISCED 5) is shared among universities, Federal Institutes of Technology (now harmonized according to the Bologna system, which foresees a three-year Bachelor, a two-year Master and, at ISCED 6-level, a three-year PhD), and Universities of Applied Sciences which, like universities, also foresee a curriculum made up of a three-year Vocational Bachelor and, increasingly, a Master. Also on the tertiary level are Universities of Teacher Education *(Hautes écoles pédagogiques— HEP)*. The Swiss Federal Institute for Vocational Education and Training (SFIVET) is in charge of training to VET/PET professionals in the upper secondary level.[8]

2. Conceptual Framework and Criteria for Analysis

Since its introduction in the Western world, the form and content of our institutional school have been modeled based on time-slots and scholarly knowledge organized into scientific disciplines of a modern and positivist origin. Thus until the 19th century, scholastic tradition structured educational content into two blocs—the *trivium*, consisting mainly of language disciplines, and the *quadrivium*, focused more on mathematics—which forebode the composite organization of disciplinary knowledge.

For a few decades now, in the framework of a reform of school programs, pedagogy and didactics have made remarkable efforts to find new approaches to educational content, so as to break down the barriers of a learning process too encroached in specific disciplines and the corresponding school subjects, in order to produce knowledge which can be taught and transposed at a didactic level. From the onset, redefining educational substance was at the core of some of these efforts, whose theoretical background can be found in the thought of the Active Schools *(école active)* in the French- and Italian-speaking traditions, and in "Reformpädagogik" for the German-speaking reform. These endeavors more specifically led to:

   a.   a more integrated, systematic and cross-disciplinary organization of knowledge;

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[8] Universities are under the authority of cantons, as are HES and HEP, but federal coordination is increasingly strong. In contrast, Federal Institutes of Technology and the SFIVET are supervised by the central government (performance agreements).

    b. an adjustment of knowledge transfer to the pupils' cognitive functioning, interests, and perception of reality;

    c. a reinstatement of the practical dimension with the strongest possible reference to real-life situations.

In contrast, another trend in the reform movement—more technology-oriented and of Anglo-Saxon origin—focused on systematization of program content in terms of controllable and verifiable learning objectives, against the background of a more structural vision of knowledge which is less open to interdisciplinary thinking.

François Audigier clearly set out the question at the crux of these efforts and the fundamental problem of disciplinarity: "Students are not disciplinary, neither is the world—what about knowledge?" (Audigier, 2001). The answer seems to us so obvious as to be self-explanatory. However, it is difficult to move away from the dialectic of the three fundamental epistemological dimensions—humans, the world, and knowledge—raised in Audigier's question. The learning and teaching processes cannot avoid—at least theoretically— taking this dialectic into account.

Part of the debate and innovative trends of the 1970s and 1980s did try to avoid this constraint, spurred as they were by an almost over-naïve challenging of the educational and teaching value of disciplinary knowledge. In one of the most representative publications reflecting the debate of that time in Switzerland on the purpose of primary school, one may read that "The duty of schools is not mainly to transmit scientific findings in a systematic and simplified fashion to primary school pupils (and consequently to the population). Rather, the choice of the subject taught should be adjusted to the pupils' educational and psychological needs. Thus the main goal is not the transfer of knowledge, but the pupil's education [*Bildung*]" (CDIP, 1983, p. 49). A few lines further, the text adds that "The traditional disciplinary canon must be toned down to favor interdisciplinary [*fachübergreifende*] subjects. Knowledge must be transferred via experiences which grip the pupil's 'head, heart and hand'" (CDIP, 1983, p. 49ff.).[9]

This document sets out principles which were to play a decisive role: on the one hand, the precepts of *Bildung*, in the authentically German sense of the word, which focus on the harmonious development of an individual's

inner resources and, on the other hand, a reference to the—somewhat more romantic—component of Pestalozzi's thinking, with his holistic vision of the child—and humans in general—as a being encompassing all three dimensions of reasoning, feeling, and doing.

It is in this order of didactic thinking that the knowledge-action dyad fits in, which integrates knowledge within the realm of action both for motivational (what is knowledge for?) and cognitive (how does one build and acquire knowledge?) reasons. On the other hand, one observes an emergence of educational practices which highlight the transversal aspects of knowledge, in particular with the more or less systematic adoption of the notion of competence or skills, despite their multiple meanings. In this context, the pedagogical language—depending on the language region and theoretical position—begins to display such terms as "methodological, social and personal skills," which refer to dimensions only partly rooted in the framework of a single discipline.

The reflection on interdisciplinarity is therefore set against the background of various school reform movements, which are at the root of approaches towards redefining the organization of knowledge into curricula—designed as educational models focused on active construction—which are often at the heart of project-based learning.

It is not our intention to review each of these reflections in depth, although they do provide the background of the context to which we refer. However, we shall seek to integrate into this context *multi-* and *inter*disciplinary considerations in developing curricula and teaching and learning strategies. Although validating this approach obviously comes up against theoretical and conceptual barriers, it should be based first and foremost on evidence of practical applicability and effectiveness.

With this in mind, two aspects seem particularly important to us. The first, of an epistemological nature, relates to knowledge as the subject of teaching and learning, considered from the relationship between disciplinarity and interdisciplinarity. This first aspect may be specified with the following questions: What do we refer to when discussing interdisciplinarity? To what extent does interdisciplinarity influence the skills which the students are supposed to acquire? The second aspect, in contrast, is of a pedagogical order and relates to the organizational and structural requirements which should characterize interdisciplinary educational practice. In this case, one should ask how educational activities should be organized to promote *multi-* and *inter*disciplinary learning.

We accept that there is a close link between disciplinarity and interdisciplinarity. The latter may be construed as a form of propensity for

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[9] The SIPRI *(Situation Primarschule)* project was initiated by the Swiss Conference of Cantonal Ministers of Education at the end of the 1970s in order to conduct an in-depth analysis of the status of primary school at the national level and to make reform proposals. During the 1980s the project's findings provided the reference framework for numerous educational innovations in Switzerland.

continuous transgression of barriers between disciplines. A brief reflection on the identity of knowledge will enable us to develop this hypothesis.

As soon as knowledge takes on a shareable form, i.e., accessible to anyone, it proceeds from a *definition*, or better even, a *delimitation*. To define or delimit—in other words to set down limits or draw boundaries—is a fundamental act of knowledge-building. The definition of what belongs to the mathematical realm, for instance, simultaneously clarifies the specific attributes of physics or statistics.

These preliminary observations allow us to highlight fundamental elements to understand the relationship between disciplinary and interdisciplinary knowledge. First, delimitation—and therefore definition—is a construction based on a form of reality or specific requirements, which presents a social and historic dimension. Therefore, it is impossible to provide an absolute definition; quite the opposite: Any definition is based on conventions, and therefore subject to change and adjustments.

Secondly, any definition has a *communication function*—contributing to understanding and mutual understanding. As soon as one establishes what is on either side of a boundary, one introduces a dimension of communication and complementarity. In other words, boundaries both separate and join. Both the communication and complementarity dimensions stress that what is within a boundary (or definition) depends on what is outside or opposite.

Knowledge-building is fundamentally an act and process of delimitation. This appears obvious in scientific disciplines which, throughout the history of science, have been developed through a process of epistemological determination of their subjects of study and methods. Each of these disciplines finds its identity in relation to others, with which it communicates and on which it is dependent. Although modern history of knowledge shows us that disciplines gradually attempted to specialize, i.e., to specify and restrict their field of research, we know that the thinking process cannot be constricted within disciplinary boundaries, but that rather, as suggested by Jean-Blaise Grize (1994), "thinking is overstepping boundaries."

In fact, the most recent developments in the world of knowledge are gradually moving away from the boundaries and rigid conception of the Cartesian analytical approach—which attempts to break down reality or a given problem into simple independent units—to open up to systemic approaches which, based on the principle according to which the whole is more than the sum of its parts, promote a holistic vision to describe a phenomenon's whole complexity.

These dynamics meet a basic requirement of any attempt to understand reality, whose complexity precisely requires the contribution of multiple knowledge stemming from various disciplinary matrices. The thinking process, as an act of transgressing limits and overstepping boundaries, therefore displays an interdisciplinary nature per se.

It follows that what we call interdisciplinarity is basically an attitude, a way of thinking, or even represents the essence of thought, which cannot be restricted to a given sector of knowledge. In other words, we perceive interdisciplinarity as a *forma mentis* which results in a particular way of confronting (representing and acting on) reality and which, in specific circumstances and given the operational framework, may be put forward as a method and provides a systemic and integrative way of perceiving and apprehending the world. Based on these assumptions, interdisciplinarity cannot constitute a form of knowledge determined according to disciplinary logic and requirements, but is rather an approach to convey contextualized knowledge, i.e., which changes according to the situation and problem encountered.

This makes it difficult to talk about *interdisciplinary knowledge* to be codified and taught as such.[10] Any interdisciplinary discourse necessarily refers to several disciplines, which together constitute the indispensable knowledge base to approach reality. As a way of thinking and in practice, interdisciplinarity therefore presupposes the disciplines as, without them, the notion would be devoid of identity and prospects. By integrating differentiated contributions to focus on actual problems, interdisciplinarity fosters the emergence of specific, contextualized knowledge, which provides added value both to the disciplines themselves and in enriching humankind's experience and knowledge heritage.

Such a definition entails major assumptions, especially regarding implications for didactics and school organization. Indeed, interdisciplinarity cannot be presented as a new discipline, nor as a school subject, nor can it be taught as a method independently from practical applications and experiments. The related methodological tools, knowledge, and capacities are linked to specific situations or problems and only take concrete form in an actual situation. Teachers are required to be intellectually open and able to cross boundaries, to have a way of thinking and of tackling reality beyond an analytical approach which separates and distinguishes, and to develop an ability to interrelate elements so as to build the big picture. Learning

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[10] There is no consensus on this issue. Fourez, for instance, considers that interdisciplinarity may form a discipline to all intents and purposes, and that interdisciplinarity and multidisciplinarity should become school subjects (*"L'interdisciplinarité et la pluridisciplinarité doivent devenir des disciplines scolaires"*) (Fourez, 2003, p. 34).

interdisciplinarity can only be done in practice, by applying it to various training contexts, under teachers' careful supervision.

Within a discipline, such learning may be effected by becoming aware of the limits of the discipline itself, as well as by being open to looking for references beyond those limits. In contrast, in *multi-* or *inter*disciplinary contexts, the learning process may bring together knowledge from various disciplines to converge on a specific theme or situation/problem.

As a pedagogical and didactical model, interdisciplinarity therefore finds its ideal application in project development, implying of necessity close cooperation between teachers as specialists in the various disciplines involved. School can and should therefore make space for interdisciplinary development, taking care, however, that it does not evolve into separate modules (i.e., new educational subjects), but that it remains a forum for interaction between and elaboration of the various subjects involved in interdisciplinary work.

Until now we have discussed a conception of interdisciplinarity *stricto sensu*. Such a conception is probably difficult to find in the context of everyday school, for several reasons partly linked to the limits inherent to the varied nature of educational systems, but also due to the system's difficulty in adjusting to new forms of knowledge transfer. One might attempt to define this problem by introducing the neologism *polydisciplinarity* in reference to the many and various ways of referring to knowledge and its teaching (Audigier, 2006). In our opinion, however, adding a new notion to the already numerous terms to describe the various forms taken on by knowledge, including in the educational context, does not much contribute to its understanding. We would rather focus on those definitions and terms which seem to have achieved some consensus. Rather than distinguishing knowledge as such at an epistemological level, we shall set out the learning and teaching methods arising from consideration of the themes, situations, or problems to be solved. We shall therefore refer to *intradisciplinary learning* (providing transversal openings within a given school subject), to *multidisciplinary learning* (referring to learning situations where tackling a theme or problem involves several disciplines) and to *interdisciplinary learning* (which not only involves several disciplines but also integrates components of them in a project or problem-solving dynamic approach) (Ghisla & Bausch, 2006).[11]

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[11] This terminology favors as a theoretical framework the in-depth research performed in Belgium around the didactic discourse on interdisciplinarity (Fourez et al., 2002, Maingain & Dufour, 2002) and on integration pedagogy with a competence-based approach (Roegiers, 2000).

The above considerations allow us to specify the major criteria in our analysis of the Swiss reality, which takes into account:

i)   fundamental educational choices, including—if identifiable—related epistemological positions and notions of disciplinary and interdisciplinary knowledge;
ii) the definition, as part of the curriculum, of educational content, and thus its structure towards its deployment as part of educational activities;
iii) the institutional and normative conditions on which interdisciplinary education is based;
iv) the specific teaching modes foreseen by interdisciplinary education;
v)   teachers' attitudes in relation to their vocational identity and preparation in basic training and continuing education.

To deploy our analysis we shall summarily consider developments from the 1970s to the present day, focusing first on compulsory schooling, and then on the upper secondary level, and particularly vocational training.

3. Analysis of the Swiss Situation

Over the past three decades in Switzerland, as in most Western countries, school has undergone a form of "reform fever" which affected structures and contents throughout the educational system. Due to the federalist nature of political and institutional responsibilities in education, but also to the sometimes fierce defense of a school tradition strongly anchored in regional and local realities, the willingness to develop a global perspective went unheeded. A UNESCO report on the status of education (Kübler, 2001, p. 10) mentions Switzerland's rather fearful attitude in relation to any project of major scope. This fearful and circumspect attitude, strongly attached to the advantages arising from specificities, does not favor openness and attempts at coordination, thus protecting a composite system tangled up in a host of individual solutions, unable even to find a consensus on the duration of education, the start of the school year, or mutual recognition of qualifications.

This applies not only to the educational system, structure, and organization, but also to educational programs and curricula and consequently to choices regarding substance and the adoption of *multi-* and *inter*disciplinary perspectives. It is difficult to imagine a more multifaceted framework of interdisciplinarity than that of Switzerland, whose evolution from the 1970s onwards has been particularly fitful. At the primary school level, *multi-* and *inter*disciplinary integration solutions, characterized by an approach more

focused on pupils and their life experience, started to emerge, thanks also to greater attention to educational methods and content than to structure.

Structural reform problems, however, continued to plague the upper secondary level, at least until the 1990s, when one started to wonder about curricula and content, under widespread innovative pressure, leading both Matura schools and vocational training into a series of reforms.[12]

3.1 First Approaches to an Interdisciplinary Discourse in Primary School

In Switzerland, one project particularly bears witness to the debate and reforms which emerged at the primary school level. The SIPRI *(Situation Primarschule)* project to review the status of primary school, initiated by the CDIP in 1978, sought "to identify, in close cooperation with school practice, research and administration, the essential aspects of the current status of primary school in Switzerland, and to draw up and experiment proposals towards its concrete improvement" (CDIP, 1986, p. 8).[13] In most cantons, this gave rise to an in-depth coordinated debate on issues of common interest, whose findings were widely distributed, which was a real novelty in Swiss school reality. Four fields of investigation were retained:

- Educational objectives of primary school: goals and realities;
- Functions and forms of school assessment;
- Transition between pre-school and primary school;
- Contacts and cooperation between school and family.

We shall mainly focus on the first issue relating to content and knowledge taught in school, although the way the question is put reveals the trends of that time, which were clearly centered on the "objectives" dimension. According to the final report, the analysis performed in this field served

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[12] In this debate, reflection on education in the Switzerland of tomorrow also took a major place (CDIP, 1990).

[13] Among the various publications stemming from the project work, we shall focus on the 22 theses for the development of primary school, which marked the end of the project in 1986 (CDIP, 1986); the report entitled *Guidelines for Primary School, Leitideen für die Primarschule* (*Les idées directrices*), which contains texts in both German and French (CDIP, 1983); and the document on *Didactic Trends in Primary School, Didaktische Entwicklungstendenzen in der Primarschule* (*Tendances didactiques à l'école primaire*) (Ghisla, 1983).

to highlight "the three main problems affecting school: a more and more questionable ranking of objectives and content which only takes into account certain aspects of education; an over-atomization of education into the various school disciplines; a lack of weighting and selection of educational content…" (CDIP, 1986, p. 68).

After glossing over the lack of distinction between objectives and content —a recurrent problem in today's pedagogy and didactics—our attention is called to the problem of atomization into the various school disciplines. One of the common threads in the many projects to define guidelines, which were initiated in those years, proposes "substituting a global and interdisciplinary education for the atomized teaching in subjects instated in recent decades" (CDIP, 1983, p. 4). It is hardly surprising, therefore, that one of the main consequences of this diagnosis of the school's problems aims at a "functional integration of knowledge," as indicated in one of the 22 theses, while retaining the value of subjects: "The structure of the curriculum and teaching by subject retains its value. However, at primary school level, it is important to often work in multidisciplinary themes. This will allow pupils to experience a global approach to phenomena, facilitating the integration of knowledge" (CDIP, 1986, p. 73).

However, as indicated earlier, this discourse criticizes school as being over-focused on knowledge, neglecting many "interesting things outside the traditional subjects…" (CDIP, 1983, p. 51), hence the need to give teachers the freedom to carry out transversal projects beyond disciplines if they provide a formative value.

This is a clear opening towards education and teaching forms able to take on interdisciplinary principles. In several reform projects, this opening is evidenced in the form of an interdisciplinary treatment of specific themes from the point of view of various disciplines, while simultaneously marked by the promotion of a global and ecological train of thought[14] (CDIP, 1983, p. 62, 86 s).

Two further trends emerge from the reform projects considered. The first reflects an apparently wide consensus as to the opening of school activities towards pupils' life experience, which reminds us of the need to correlate

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[14] A premise to the trend of interdisciplinary integration emerges in the principle of a global vision of reality: "This trend may appear in the in-depth review of a specific theme from the point of view of various disciplines. [...] this trend finds its origin in the postulate of interdisciplinarity and aims at contributing to the construction of curricula, while coordinating the knowledge from the various scientific disciplines" (Ghisla, 1983, p. 62).

contents and their presentation with concrete everyday life. The second trend refers to the now well-established practice of communicating the didactic stakes through learning objectives. The proposed reflection is particularly interesting: On the one hand, it integrates the "objective-setting technique" issue into the debate of that time, and, on the other, it highlights the risks inherent to this didactic strategy, precisely in relation to interdisciplinary openings.

By referring to the objectives set in the various projects, one stresses the fact that "they are no longer the objectives set in the early 1970s (i.e., operational objectives linked to exam results), but most of the time represent a description of complex capacities and attitudes, or even learning processes. Criticism of the original principles of teaching by objectives, further to the publication by R.F. Mager (1962), does not seem to have ended the trend. Quite the opposite: It led to an acquaintance with learning objectives. One observes an evolution towards a description of qualifications close to life, inviting teachers, when they prepare for their courses, to think less of the subjects and more of the capacities and abilities to be achieved and of the quality of the teaching process. Learning objectives expressed in an articulate fashion help to focus on essential knowledge and a realistic assessment of how successful the teaching is" (Ghisla, 1983, p. 64).

3.2 Lower Secondary Level (Secondary I)

Thanks to efforts in the 1970s and 1980s, primary school in Switzerland has managed to find, if not a common identity, at least a fairly consistent image in the wake of European primary education. However, in compulsory secondary education, the picture is very different—highly fragmented in its guiding principles, structures, and content organization. However, major efforts were also made at this level to give the system greater coherence and cohesion. In a 1995 study, the CDIP outlined the sector's future prospects and expressed the following guideline regarding content delivery and teaching methods: "Courses are organized in the prospect of interdisciplinary education. Lower secondary school organizes education so as to strongly interrelate the various subjects. Without giving up teaching by subject, it aims at a unity of education by reducing subject partitioning and the breakdown of courses. Education aims not only at acquiring and mastering basic knowledge and work techniques in the various disciplines, but also at using and combining this knowledge and know-how to solve problems beyond individual disciplines. This requires interconnecting the various subjects and their respective approaches."

This postulate, while outlining trends which often remain isolated with a limited impact in the country, shows us what could potentially be done. Another study at the same time as the one we have just mentioned stressed the fact that breaking down learning contents is not only a constant source of concern, but that proposed solutions obey three guidelines:

i.   the creation of fairly consistent educational fields;
ii.   putting forward interdisciplinary fields "presented with their own curriculum or integrated into the teaching of the various disciplines, along with their specific objectives and contents. Such is the case, for instance, in IT, media education, health education and ecology";
iii. the establishment of new disciplines of an integrative nature, such as e.g., "School and Society" or "General and Social Education" (CDIP, 1995a, p. 44).

It is therefore hardly surprising that teaching practices are implemented which promote learning organized around specific themes—especially in the form of individual or group projects. Theme weeks and other similar experiments gained some ground in this context, as did various forms of *team teaching* and those involving action and direct experimentation.

Slots specifically dedicated to interdisciplinary education in the strict sense began to be foreseen in school timetables and were no longer rare exceptions (CDIP, 1995a, p. 37).

The problems in legitimating teaching and learning formats open to various forms of interdisciplinarity are therefore not (or not mainly) found at the level of pedagogical and institutional choices, but rather in daily practice and the habits of actors in the field.

The case of Canton Ticino (Italian-speaking Switzerland) is an excellent example of this difficult practical implementation of guidelines which take into account interdisciplinary approaches. The lower secondary school educational plan,[15] developed at the end of the 1990s and which entered into force in 2004, bears witness to a considerable effort towards integrating knowledge and translating it into teaching.[16] The core of the educational plan (Ufficio dell'Insegnamento Medio—UIM, 2004) is made up of a *map* representing educational content, while simultaneously serving as a tool for school operators to structure this content (Ghisla, 2002, p. 143 s.). The term

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[15] *Scuola media* in Italian.
[16] For the theoretical bases, a summary of the model and project strategy, see Beltrani, Ghisla (1999).

map *(carte)* itself metaphorically suggests the vocation as directions for integration of a common education project able to reconcile the educational requirements of society with the personal needs of the students. It serves as a common basis for subject sub-maps that detail the specific skills and resources to be acquired by the students: "In the architecture of the secondary school educational plan, disciplines are one of the axes. They should focus on essential cultural and scientific content, aim at developing skills and contribute to the common educational project. Simultaneously, so-called transversal skills represent the second axis, which serves to identify subjects for a coordinated and concerted educational practice" (UIM, 1999, p. 43ff.). Based on these assumptions, the educational plan focuses on three transversal dimensions across disciplines:

- Transversality of instruments specific to education first in the field of languages, IT, and then communication technologies;
- Transversality in relation to the capacities and attitudes inherent to "doing" and "being," i.e., to cognitive capacities, work methods, personal attitudes, values, etc.;
- Transversality in relation to themes arising from social concerns such as peace, civic responsibilities, citizenship, intercultural approaches, ecology and the environment (see UIM, 2004, p. 16).

From the didactic point of view, the educational plan highlights a constructivist approach to knowledge, and particularly the idea of the educational project as a vector fostering various forms of multidisciplinarity.

The approach which led to the development of the curriculum for the pre-specialization stage *(cycle d'orientation)* in Canton Geneva is similar to that adopted in Ticino for secondary school. The definition of an educational project provided the basis and a form of reference point to organize contributions from the various disciplines. The selected pedagogical concept stems from a systemic approach which refrains from focusing the curriculum on unilateral elements—knowledge or pupils—while avoiding any "child-centered drift discarding any reference to established knowledge" (Varcher, 1999, p. 197).

In Canton Zurich—which we offer as a representative example of German-speaking Switzerland—a new framework program for compulsory, including lower secondary school, was introduced in the mid 1990s.

A 1998 evaluation showed that the assumption of transversal education across disciplines posed considerable problems and was essentially restricted

to theme weeks organized by the schools. Hence an almost physiological difficulty arises in integrating interdisciplinary approaches into everyday teaching activities (Landert et al., 1998, p. 8). Another survey of French-speaking Matura schools in the early 1980s had already highlighted how difficult it is to go beyond the experimenting stage (pilot projects) to consolidate transversal approaches across disciplines (Tschoumy, 1982).

3.3 Intercantonal Harmonization and Interdisciplinary Discourse

The new mandate of the Federal Constitution to further the popular vote in 2006 spurred the school authorities to launch initiatives towards establishing a national educational platform. Regarding compulsory schooling, the main measure is the HarmoS[17] agreement *("concordat")* which should serve, for the first time ever, to coordinate the duration of educational stages and their main learning objectives by creating the premises for better school mobility at national level.[18] Regarding the content of education and interdisciplinarity, HarmoS refers to compulsory standard levels of competence to be achieved after two, six and nine years of schooling. These standards are currently being

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[17] On June 14, 2007, the HarmoS agreement was unanimously approved by the CDIP Plenary Assembly, which simultaneously initiated the cantonal accession procedure. In most cantons, it is Parliament which has authority to ratify such an agreement, and such a decision is subject to optional referendum. The agreement will enter into force as soon as 10 cantons have ratified it. A few cantons have already acceded to it; however, one of them (Lucerne) refused it by popular vote on September 28, 2008.

[18] In particular, the agreement: defines a single school starting age and single duration of school stages; identifies the goals of Swiss education for compulsory schooling; sets out instruments to ensure and develop the quality of the educational system at national level; defines compulsory national standards of education and the procedure to set them.

In parallel with the HarmoS agreement, a regional convention was adopted in 2007 by the Intercantonal Conference for Education in French-speaking Switzerland and Ticino *(Conférence intercantonale de l'instruction publique de la Suisse romande et du Tessin—CIIP)* in order to establish a regional educational platform. The German-speaking cantons, in contrast, do not yet have regional plans. At the end of 2006, the three German-speaking regional conferences initiated a project to develop a joint curriculum, to be defined by end of 2009 and implemented by 2011. In the Italian-speaking part—Ticino in particular—there are fewer organizational and structural adjustments needed as the system is already partly compatible with HarmoS requirements, and enjoys derogations [exemptions] due to the canton's status as a language and cultural minority.

developed for three educational fields: i) *languages* (schooling language, second national language, and a foreign language); ii) *mathematics*; iii) *natural science*. Similar standards are also being defined at the regional level for other educational fields.

The interdisciplinary approach to learning is often referred to in the various reports and presentations regarding HarmoS and the various cantonal framework plans (Bättig, 2004; Szlovak, 2005b). A brief analysis of these documents serves to highlight a few common trends in interdisciplinarity, which is mainly mentioned in connection with the following subjects:

- the concept of competence-based learning, particularly regarding so-called transversal skills;
- the so-called "thematic" fields (e.g., water or acoustics in natural science);
- so-called general education, such as e.g., learning to learn, learning to do, learning to live together…

Furthermore, it should be noted that, generally speaking, the issue of interdisciplinarity is not considered as central in defining standards, except in the realm of transversal skills.[19]

3.4 Academic Baccalaureate (maturité gymnasiale)

"Over the past 25 years, several attempts to further develop Matura school education have failed" (CDIP, 1996, p. 108). This brutal statement introduces a description of the efforts made to develop a new curriculum for Matura schools and shows the difficulties inherent to any proposed reform of this stage of the upper secondary level. However, the 1994 Framework Curriculum *(Plan d'Etudes Cadre—PEC)* is a major step towards interdisciplinarity, despite a trend which remains essentially linked to individual disciplines. Educational objectives and content are set out in a coordinated and transversal way, based on the concept of competence, which provides a link between and common logic to educational subjects, as well as introducing the idea of fields of study.[20]

[19] See e.g., the field of schooling languages, for which preliminary findings of the analysis of basic standards are already available (DePietro et al., 2007).

[20] Five fields of competence are introduced (social, ethical and political; intellectual, scientific and epistemological; communication, cultural and aesthetic; the person, health and human body; information, learning techniques and technology) for four study domains (languages, human and economic science, mathematics and experimental science, artistic education and sport) (CDIP, 1994).

The Curriculum puts forward a "transdisciplinary interpretation" of each subject, highlighting both the value of disciplinary knowledge in understanding real-life phenomena, and the possible links with other subjects. Three main axes relate to interdisciplinarity in Matura school education: interdisciplinary (or multidisciplinary) teaching formats, training on so-called "transversal" skills and the baccalaureate thesis. An assessment initiated in 2001 and concluded with a report in 2005 provides the necessary elements to judge reform implementation along these three axes (Staatssekretariat für Bildung und Forschung—SBF, 2005):

- regarding so-called interdisciplinary education, it is noted that this is restricted to interrelations between disciplinary knowledge, i.e., to an *intradisciplinary* effort;
- the baccalaureate thesis is normally regarded as a classical, theoretical and sometimes empirical research exercise. Considering *multi-* or *interdisciplinary* criteria or work methods plays a very secondary role;
- transversal skills are appreciated by the teachers, who find them interesting in the framework of subject-specific education. However, they generally remain very much in the background.

However, it is noteworthy that the new ordinance on recognition of academic baccalaureate certificates welcomes the interdisciplinary approach by entrusting the schools with implementing it: "Each school shall see to it that students are familiar with interdisciplinary approaches."[21] The ordinance foresees that, in order to obtain a baccalaureate, an "autonomous project of a certain scope" must be completed.[22] In certain cantons regulations (educational plans) include the possibility for this project to have an interdisciplinary nature,[23] whereas other cantons do not mention this.

[21] Art. 11a of the June 27, 2007, amendments to the Federal Council Ordinance/ CDIP Regulation on the recognition of academic baccalaureate certificates *(Ordonnance du Conseil fédéral/Règlement de la CDIP sur la reconnaissance des certificats de maturité gymnasiale—RRM)* of January 16/February 15, 1995.

[22] Art. 10—Baccalaureate thesis: each pupil must autonomously complete, alone or as part of a team, a project of some scope. This project is documented by a text or written comment and presented orally.

[23] A few examples: in one canton, the baccalaureate thesis amounts to research on a theme which can also be interdisciplinary, whereas another canton states that the baccalaureate thesis must relate to one or more fields, and may provide a favorable opportunity for interdisciplinarity.

The ordinance thus envisages interdisciplinarity on two levels: as a general training objective (awareness of interdisciplinary approaches) and, partly, within the framework of the baccalaureate thesis. Interdisciplinarity plays a greater role in framework curricula; however, it remains to be seen to what extent these recommendations are actually implemented, which goes beyond the objectives of this research. A few negative indicators regarding their effective implementation are given in the curricula of the Universities of Teacher Education, which leave only a small space—if any—for interdisciplinarity in teacher education.

Although interdisciplinarity in compulsory school and the academic branch of secondary school is present in relation to objectives, it is much less explicit at the level of curricula. The fact that, in addition, the latter are extremely heterogeneous due to the various interpretations given by the cantons to global instructions prevents us from specifically reviewing interdisciplinary practice. This would require a comparative survey which cannot be undertaken in this context.

4. Vocational Education & Training and the Federal Vocational Baccalaureate

4.1 Basic Vocational Education and Training (VET)

In Switzerland, VET has a special place in the school system for both traditional and institutional reasons. A majority of youngsters who opt for vocational training choose the so-called *dual-track* education by becoming, to all intents and purposes, employees having agreed to an apprenticeship contract with a company. Apprenticeships are thus conducted in several places—at school, in a host company, and in B2B courses organized by professional organizations.

Any professional reality is interdisciplinary by definition (Wild-Näf, 2005): any task in any profession—as simple as it may be—and the resources employed stem from different knowledge bases. In this sense, vocational training almost naturally implies integrating several disciplines. The ordinances (curricula) for the various professions integrate into training schemes a field with direct reference to the given professional activity, as well as a field of more general education. Although legal texts rarely mention interdisciplinarity, the latter occupies a major place in various forms:

• First, school subjects themselves display an interdisciplinary

character. In most educational plans, one distinguishes two categories: the so-called professional subjects and those which can be related to general education.[24] The first category is directly linked to the given profession, and teaching is targeted accordingly: for instance, in a painter's apprenticeship, chemistry is taught in relation to the composition of paint, with direct reference to practice, i.e., in this case product treatment, storage, etc. The vocational situation, in all its complexity, provides the background to education in professional subjects. In certain professions (e.g., artistic), vocational schools are open to the market by taking on assignments. Concerning the second category of subjects, general education encompasses several disciplines by definition, as the goal of such training is to ensure that everyone acquires basic education as a person and as a citizen. The general education ordinance and related framework curriculum define the themes to be dealt with regardless of the chosen profession. Passing the subject implies providing a personal in-depth research work. The framework curriculum for general education (Wild-Näf et al., 2006) is based on an educational concept which foresees, among other things, "*thematic education* to ensure that educational content is organized in themes and does not follow a logic inherent to any specific discipline" (Wild-Näf et al., 2006, p. 5).[25]

Its structure foresees two educational fields (language/communication and society) and their integration is explicitly recommended. The first field should essentially meet its objectives by dealing with the themes making up the second field: "promotion of language skills is performed through the content of the themes to be dealt with" (Wild-Näf et al., 2006, p. 6). The themes to be dealt with should be defined by taking into account the "aspect" characterizing the "Society" field: culture, law, ecology, economics, ethics, identity and socialization, politics, and technology. One might justifiably object that this framework does not really favor an interdisciplinary approach, as its "aspects" actually refer rather directly to classical disciplines and school subjects. However, integration should

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[24]   The law allows two methods to integrate general education into training programs: either through individual subjects (generally: first language, second language, and a subject relating to society, economics and law), or by implementing a single framework scheme common to all professions taught.

[25] The framework curriculum is available online: http://www.bbt.admin.ch/themen/berufsbildung/00104/00358/index.html?lang=fr / (accessed March 9, 2010).

be promoted by selecting themes which lend themselves to a transversal development across disciplines. Secondly, individual practicals *(travaux pratiques individuels—TPI)* are generally of an interdisciplinary nature. They are an in-depth practical project which trainees carry out in the workplace and which are decisive in qualification procedures. Practicals are designed to check and assess the skills acquired *in situ*, and therefore to evaluate the ability to use acquired resources in various areas of training.

- Furthermore, so-called methodological and social skills, which have an interdisciplinary dimension by definition, are now an integral part of all basic VET training schemes[26] and subject to assessment. We have already discussed the role of such skills in an interdisciplinary approach to knowledge, which can be decisive provided that these skills are taken into account—and assessed—in relation to others, if possible *in situ*.

- Finally, cooperation among the various training venues is relatively important in interdisciplinary discourse. To some extent, cooperation is based on the activities which trainees perform in their host company. Therefore the acquisition of knowledge and know-how should be related to professional practice. This approach, stipulated by law, takes a particularly concrete form in the ordinances for certain professions which have structured their training scheme around professional situations and activities, which are both the foundation of training itself and one of the main educational strategies.

4.2 Federal Vocational Baccalaureate

This is the only program in the whole Swiss educational system which requires interdisciplinary work to obtain certification. Indeed, framework programs for the vocational baccalaureate state that, for all branches, "an interdisciplinary project shall be carried out within the set criteria… involving two or more subjects. 40 periods at least should be devoted to this. The project shall be extensively documented by the learners" (Ghisla & Kolb, 2001, p. 14).[27]

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[26] At least those which have been reviewed in the framework of the VET reform initiated in 2004 further to entry into force of the current Vocational and Professional Education and Training Act. The reform process should be completed for all 280 or so professions by 2011-2012.

[27] Framework curricula for the vocational baccalaureate in all branches (natural

The whole framework program is indeed focused on an interdisciplinary approach. On page 13 of the framework program (natural science branch) one identifies two different ways to apprehend interdisciplinarity: on the one hand as a method to grasp concrete problems in a reality which becomes increasingly complex and fascinating as knowledge increases and, on the other hand, as a form of knowledge to cross the traditional boundaries between subjects, thus opening out new creative opportunities (Ghisla & Kolb, 2001).

4.3 Models and Guidelines

Experience in recent years in the field of interdisciplinarity has led to the development of numerous models, guidelines, or handbooks for interdisciplinary education. The surprising thing is that most identifiable handbooks were developed in the framework of vocational training, whereas in other educational sectors, there does not seem to be any particular interest in developing such educational tools to help teachers and educational institutions in their work. This is due to several factors, among them being the obvious benefits which *multi*- or *inter*disciplinary learning brings to VET in preparing youngsters to confront a complex reality, and which cannot be restricted to educational aspirations centered on the cultural and intellectual dimensions. Vocational schools are practically obliged by a certain pressure from professional circles to adjust their contents and training methods. In addition the professional sector is less fragmented into regional specificities and closer to a nationwide approach, and consequently has a larger market which fosters—including economically—a wider production of educational materials.

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science; business; technical, artistic and artisanal; health-social) are identical from the point of view of interdisciplinarity. By defining requirements in relation to interdisciplinary projects, they explain that there "has to be a direct link to the professional context, without excluding reflection on broader social and cultural aspects. The themes arising from the various subjects and focused on problem-solving are interconnected through a coherent interdisciplinary approach and dealt with in the context of professional experience. Languages are included in the project not only as tools, but also for their own cultural contribution. The main objective of the project is to foster the integrated and creative use of resources to build competencies … in particular: to analyze a situation/problem, select, plan and implement problem-solving strategies, to have a critical reflection on processes and results and be able to adequately assess these" (Ghisla & Kolb, 2001). For further information, see http://www.bbt.admin.ch/themen/grundbildung/00131/00570/index.html?lang=fr / (accessed March 9, 2010).

The following publications are currently available:

1. *Fächerintegrierender Unterricht. Handbuch zu fächerintegrierenden Unterricht. Anleitung für Lehrpersonen* (Landolt et al., 1999).
2. *Fächerübergreifender Unterricht planen und durchführen: Ein Leitfaden für Lehrpersonen und Günstige Rahmenbedingungen für fächerübergreifenden Unterricht schaffen: Anregungen für Schulleitungen und Lehrplanverantwortliche* (Szlovak et al., 2004).
3. *Interdisziplinarität. Materialien zur Interdisziplinarität auf der Sekundarstufe II. Wege zur interdisziplinären Berufsmaturitätsarbeit* (CD-ROM) (Höheres Lehramt Berufsschulen am Zürcher Hochschulinstitut für Schulpädagogik und Fachdidaktik—HLB, 2006).
4. *TIP—Document d'accompagnement du Travail Interdisciplinaire centré sur un Projet* (Jaccard et al., 2003).
5. *L'interdisciplinarità nella maturità professionale. Come realizzare un progetto didattico interdisciplinare. Una guida per le scuole e gli insegnanti* (Ghisla, 2006).

It should be noted that the first of these publications are in German and edited by private publishers with a sizable market. The first handbook, dated 1999, reviews multidisciplinary education in VET in the general sense, basing its educational legitimacy on an essentially cognitive argument: the need to develop a networked thinking ability as a transversal skill. The document mentions several examples of *intra-* and *multi*disciplinary education, complemented with proposals for assessment and suggestions for teaching delivery. The second publication focuses on ideas and concrete proposals to optimize framework conditions, mainly at an institutional level, and is aimed in particular at school management and those in charge of educational programs. The three latter texts are specifically centered on interdisciplinary activities in the framework of the vocational baccalaureate.

We shall now focus on the last handbook (concerning the vocational baccalaureate), developed by the authors of this contribution in cooperation with numerous teachers. However, it should be noted that the penultimate publication, *TIP—Document d'accompagnement du Travail Interdisciplinaire centré sur un Projet*, developed for French-speaking Switzerland, also reflects the same pedagogical and didactical spirit and puts forward similar proposals.

Among the three forms of learning transversal to the above-mentioned disciplines *(intradisciplinary learning, multidisciplinary learning, and*

interdisciplinary learning), the latter is the highest target to aim for, particularly when ideal conditions prevail. But let us be realistic. The Vocational Baccalaureate learning objectives and institutional framework mainly allow the development of projects of a *multi*disciplinary nature, involving teachers of at least two disciplines. With this in mind, the educational model put forward by this guidebook is developed in six stages: (1) *development of the idea and preparation*; (2) *confrontation and exchange with the students*; (3) *problem (or situation/problem) structuring*; (4) *organization of work*; (5) *explorations* and (6) *preliminary and final conclusions*, with a presentation of achievements and the related assessment. It should be noted that this sequence is more logical than chronological, and that we cannot go into each stage in depth in the context of this contribution. However, we deem it important to stress a few essential considerations arising from this publication.

First of all, identifying a key idea is important in defining the targeted objective and serves as a constant benchmark throughout project development. This key idea may prompt a large part of students' motivation. Two basic criteria should essentially dictate the choice of the key idea and project theme:[28] On the one hand, the teachers concerned must see a concrete possibility of making a cross-disciplinary contribution while integrating the learning objectives of their own subject. On the other hand, one should be able to identify a *concrete operational goal* to interest and motivate students, beyond the mere drawing up of a document.

4.4 Interdisciplinary Training for Teachers

A brief overview of the educational programs—available online—of the Universities of Teacher Education (Hautes écoles pédagogiques—HEP) in charge of training compulsory school teachers shows that although the interdisciplinary viewpoint is mentioned occasionally in training modules, there is a general lack of teaching focused on the specificities and didactics of interdisciplinarity. There are exceptions, however. The (French-speaking) Canton Vaud HEP, for example, offers a module entitled *Interdisciplinarity*, which foresees courses on interdisciplinary didactics in various domains.[29] In the field of basic and continuing education for

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[28] Key ideas may be very different: For instance, one might select a theme such as "mobility in modern society," or a problem like "drugs in young trainees," or "job prospects in the advanced technology industry."

[29] See: http://www.hepl.ch/index.php?id=95, (accessed March 9, 2010).

upper secondary teachers, we can cite as an example the training model in natural science. This is designed around the following seven training units: curriculum comparison, legitimation of interdisciplinary teaching, interdisciplinary education categories, an example (raw materials—energy), teaching key questions, team cooperation, and from research-based learning for empirical research (Labudde, 2004).

In recent years, the main effort towards training on interdisciplinarity has focused on teachers in the professional sector. This effort started with a course at the Ecole Polytechnique Fédérale de Lausanne (EPFL) aimed at vocational baccalaureate teachers (Bänziger & Goldschmid, 1998). Subsequent developments of this course enabled the Swiss Federal Institute for Vocational Education and Training (SFIVET) to offer this category of teachers systematic training based on the interdisciplinarity models set out in the vocational baccalaureate (Ghisla & Kolb, 2001).

4.5 Interdisciplinary Teaching Research Projects and Assessment

It is not obvious to follow Peter Labudde when he claims, in a summary of research into interdisciplinarity, that interdisciplinary education has a relatively major role in Switzerland, at least in comparison to neighboring countries (Labudde, 2005, p. 59). Should one restrict oneself to the wishes and statements in official documents and school curricula, or only consider the VET sector, such a claim might appear plausible. However, when considering the frequency of research into interdisciplinary teaching and learning, one can but observe that there are only a handful of such projects of a certain scope, which do not seem to indicate that the sector is particularly lively. Thus in recent years, it was precisely within the institute headed by Labudde at Bern University that interconnected projects were carried out on multidisciplinary education in industrial VET, on assessment procedures for multidisciplinary teaching in natural science, and on interdisciplinary didactic models.

The findings of this work were the subject of numerous publications. For example, Barbara Szlovak provides an account of an experiment conducted with a group of teachers having participated in multidisciplinary teaching activities and followed targeted training units. This account stresses in particular difficulties in relation to cooperation processes between the teachers confronted with project experiments, and the importance of certain didactic hurdles notably related to the preparation work for interdisciplinary projects and the resulting institutional conditions (Szlovak, 2005a).

The didactic model developed by Labudde's research group is particularly interesting. While meeting requirements specific to the natural science domain, it has heuristic value. Indeed, it starts from a subjective attitude to a discipline and goes on to develop various dimensions of interdisciplinary dialectics, including teaching methods (Labudde et al., 2005).

An assessment of a project combining biology and philosophy is presented in an account drawn up by two Matura school lecturing researchers. From their experience, they draw three major conclusions for didactics, which may also be seen as the prerequisites to interdisciplinary teaching: to start by elaborating on disciplinary knowledge, to base oneself on concrete examples, and to explain the (inter-) disciplinary nature of knowledge and of the production of knowledge (Hofer & Wolfensberger, 2006).

Another major project conducted by Zurich University dwelt on issues concerning the relationship between "multidisciplinary teaching and sustainable education" in the field of ecology (Kyburz-Graber, 2003; Kyburz-Graber et al., 2000).

Studying the monitoring and assessment of various types of teaching experiments produced various categories of outputs, including evaluations towards the introduction of related programs into compulsory school as a rule. Although these studies do not focus on interdisciplinarity per se, they occasionally offer interesting clues, which is why they deserve to be mentioned here, as do surveys on transversal skills in compulsory school and academic baccalaureate courses (Grob & MaagMerki, 2001; MaagMerki, 2005).

The implementation of the framework curriculum (see chapter 4.4) of the academic baccalaureate was assessed in the (above-mentioned) EVAMAR study (SBF, 2005), where the major place devoted to interdisciplinarity deserves particular attention. Furthermore, certain documents specifically analyze experiments made in the framework of the vocational baccalaureate, with the *interdisciplinary didactic project* which students have to complete in order to obtain their qualification. This includes in particular an analysis providing a comparison with the Matura thesis required of academic baccalaureate students (Zillig, 2003) and research at the regional level to assess the quality of vocational baccalaureate projects carried out in Italian-speaking Switzerland (Boldrini & Cattaneo, 2004). Finally, it is interesting to note that many accounts document a host of experiment cases at the regional level (Jaccard, 2006) as well as isolated projects relating in particular to vocational training (Denier & Koch, 2005; Keller, 2006; Plüss, 2006).

These studies and the considerations which we have developed here provide a series of indications about the state of the art of interdisciplinary education in Switzerland, which may be summarized as follows:

- *Multi-* or *inter*disciplinary education is a major postulate in the Swiss school system and finds considerable space in the curricula and learning objectives, both at compulsory school and upper secondary levels, in all three language areas;
- The various language and educational traditions which characterize the three main language regions are a non-negligible source of confusion in terminology and concepts, which should be clarified;
- As a consequence, delivery of interdisciplinary content in the curricula is heterogeneous;
- In current didactic practice, one may encounter the most diverse forms of teaching, which can be referred back to the principles of the *intra-*, *multi-* and sometimes *inter*disciplinary approaches. In these contexts, highlighting transversal skills may be instrumental in providing a global vision of apprehending reality. However, it might also send the knowledge and capacities stemming from the various disciplines into the background;
- It is in vocational education and training that multi- and interdisciplinary learning finds its most systematic and consistent applications, especially in vocational baccalaureate curricula;
- Generally speaking, the actors in the school system (teachers and administrators) display a positive attitude towards transversal teaching practices. However, they show their limits when having to implement the related assumptions and objectives;
- Pupils and students involved in interdisciplinary teaching experiments seem to appreciate these and show stronger motivation than in relation to more traditional didactic models;
- There are few studies on the effectiveness of such approaches, and the rare findings available are heterogeneous, both in relation to learning disciplinary knowledge and to acquiring transversal skills;
- Among the barriers to a practical implementation of interdisciplinarity and to spreading a related specific "culture," several are of an institutional and organizational nature (legal problems relating to assessment, organizing training space and time-slots, resources used by the teachers, ...).

Critical Reflections and Observations in Favor of a Culture of Interdisciplinarity

To conclude, we wish to summarize certain indications emerging from the reflections above. A review of the status of the interdisciplinary approach in educational reality in Switzerland shows that, from the 1970s onwards, the interdisciplinary spirit started to influence educational practice in compulsory school and at the upper secondary level. Even given the diversity typical of Swiss schools, efforts to lay normative and institutional foundations – such as curricula supposed to steer education towards interdisciplinarity, and thereby towards a practice open to innovative learning experiences —started to have a significant impact. Several of these experiments show that well-organized and well-supervised projects may yield surprising results, especially regarding their positive influence on student motivation and teacher satisfaction. In contrast, the impact on the outcome of subject-specific learning is less clear, maybe also because teachers seem to favor the development of transversal skills of a social or personal nature (Binggeli et al., 2005, p. 37). However, teachers will have to devote more energy than for their usual activities and will have to change a professional attitude which is still strongly rooted in disciplinary didactics. Moreover, the global framework appears anything but satisfactory due to the lack of an effective integration of interdisciplinarity, not only in organizational structure and everyday teaching practice, but also in the minds of the actors concerned.

Interdisciplinary practices have not escaped a series of criticisms of various origins and purposes. According to some, for instance, multi- and interdisciplinary openings are a fad which, if implemented at all, should be restricted to the world of academia, whereas at the level of compulsory school and upper secondary education, only a reversal to a teaching rigorously based on the various disciplines can guarantee sound and effective education. These people consider that the interdisciplinary trend was nothing more than a passing fancy. Others, sometimes rightfully so, fear utilitarian and instrumental drifts. In approaches calling for a form of schooling which is more sensitive to practical requirements or proposing a more pragmatic vision of knowledge, they see a threat to the cultural independence of school, which would thus become subject to specific interests, in particular of an economic or technological character.

This is why the indications below are absolute prerequisites to strengthen the movement towards an institutional, pedagogical, and didactical culture of interdisciplinarity.

i) Institutional Recognition and Integration

A large-scale implementation of innovative practices in school must meet

at least two requirements in order to succeed: on the one hand, the practices of particularly innovative teachers and schools (i.e., pilot projects) have to reflect identifiable trends in economic, social or cultural reality. On the other hand, a clear institutional will is indispensable, both as an instrument of pressure and, above all, as a tool to legitimate such new practices. Thus schools and teachers already engaged in this direction will be further motivated and, simultaneously, those who were cautious until then will be able to rely on the necessary guarantees.

The trends, which we have attempted to highlight, show that both these prerequisites are about to be met and that, consequently, interdisciplinarity is gaining legitimacy.

However, although there now seems to be a significant social and institutional recognition of interdisciplinarity, it remains to be determined to what extent the trend is actually present in everyday school practice. This is where the stakeholders' representations and scales of values are being constructed. One should therefore wonder how interdisciplinarity is perceived in practice and what measures are being taken to promote it. Without explicit support in everyday practice, it will be difficult for any innovation to become an integral part of the professional culture of people actually working in this context.

ii) Change in Teachers' Attitude

The overall requirements to effectively implement interdisciplinary education cannot be restricted to the structural, organizational, and institutional framework. Without having the actors concerned on board, such requirements will remain empty shells. In particular, it is essential to enable teachers to adopt interdisciplinarity as a thought process and approach to knowledge, while simultaneously developing appropriate teaching strategies. Such an attitude, together with the above-mentioned institutional recognition, may favor the development of a "corporate culture" able to combine several approaches to knowledge. This is naturally a lengthy and complex process which implies, at least in part, a questioning of the teacher's role and identity.

In actual fact, we consider it indispensable for cooperation between teachers and the trainers concerned to take place at several levels: in content integration obviously, but also in developing joint educational strategies, without forgetting an update of benchmarking approaches fostering a refection on one's own teaching practice. Thus the learning process for students will be constructed through multiple interactions giving the various knowledge contributions a common significance.

iii) Support Capacity

The autonomous work and learning processes required of students to develop interdisciplinary projects tend to alter the role of the teachers concerned, as the latter have to complement their traditional knowledge transfer role with a support role. This implies various activities including steering students and defining the framework in which to place their autonomy and meta-reflection. Setting and agreeing on clear and compulsory deadlines and defining precise criteria for presenting the work may favor the establishment of a framework within which autonomy as a skill can be gradually acquired, thus limiting the potential sense of confusion which might accompany the process. Meta-reflection practices also foster a structuring of acquired knowledge and contribute to clarifying individual learning strategies. These activities require specific support skills which may be developed in the framework of pilot projects supervised by specialists.

iv) Experimental Rigor in Relation to Students

For the students, developing an interdisciplinary project is a complex and demanding task which requires a clear reference framework and quality criteria to guarantee the acquisition and assessment of competence. Once imparted, these criteria must be consistently and methodically observed. Analysis of files produced by the students in the framework of pilot projects (Boldrini & Cattaneo, 2004) have highlighted major shortcomings, both in formal delivery (language, observance of ethical rules) and in content structure. In our opinion, such skills and capacities may be developed through systematic and rigorous supervision and support.

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