

## 2. Teachers Learning For A Learning Society – Literature Review

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### INTRODUCTION

Our societies are engaged in a complicated, and unplanned, process of transformation that is affecting the way we work, relate, live and learn. Such change has a discernible effect on the school as an institution charged with educating new citizens. Students today have many more sources of information than even ten years ago, thanks to the new technologies of information and communication. As a result, it is necessary to reconsider the functions traditionally assigned to the school, and to the professionals working in it: the teachers.

A characteristic of the society in which we live is that knowledge is one of the main values of its members. The importance of present-day societies is directly related with the educational level of their citizens, and of their capacity for innovation and enterprise. However, in this age, knowledge has an expiry date, and we must ensure by formal and informal means that citizens and professionals constantly update their competence. Today's society demands of its professionals a permanent activity of training and learning.

How do these changes affect teachers? How should we reward the work of the teacher in these new circumstances? How should new teachers be trained? How can we adapt teachers' knowledge and attitudes to respond to and take advantage of the new opportunities offered by the information society? What new educational and school scenarios are possible/desirable?

These questions form a catalogue of concerns leading numerous academics, professionals, researchers, parents, and teachers, etc. to ponder the school's ability to give a prompt response to the looming challenges. A response directly related with the capacity to offer the best education to which all students have the right. We have to look at the teachers, working side by side with our students. How are they trained? What knowledge do they really need? What changes must be made in their training so that they will again be the leaders in satisfying society's demands? How do teachers learn? What new strategies and commitments are needed? How does a teaching profession fit into a society of knowledge where anyone can gain access to information and — perhaps — become an educator?

Changes in the way of learning, affecting working teachers, are stressing the idea that the responsibility for training falls increasingly on the professionals themselves. Making our schools into areas only for teaching but in which the teachers learn, is the radical shift needed. The guiding principle of training must be to understand that our students have the right to learn. Training has to be directed towards ensuring quality learning in our students, and committed to innovation and up-to-dateness. It must overcome the traditional isolation of the teaching profession, and at the same time consolidate a professional grid via the use of networks of teachers and schools to facilitate flexible and informal learning. In short, training that contributes to re-professionalizing teaching against those who want to simplify the complexity of the act of teaching.

## II. TEACHING PROFESSION IN THE KNOWLEDGE SOCIETY

The changes and new realities lead the gaze inexorably towards the teachers. Day states that "*teachers are potentially the most important asset in the notion of a learning society*" (Day, 2001:495). This is true; we must pay very specific attention to teachers, their initial training, the period of their professional induction, and their professional development. Life-long learning is not only a good axiom. It represents an urgent need to revitalize a profession too punished and professionally demotivated. Craston (1998) asked whether teachers are educated to teach in the new millennium, and answered that if we look at the work of the students in their classes and schools; the model we find speaks more of the 20<sup>th</sup> century. A change is required in the way the profession teaching is seen: a professional who does not spend his or her whole professional life in just one educational system or even in a single country, a worker in knowledge. Furthermore, in the same way as the students, teachers must be prepared to work in a changing and unpredictable environment, in which knowledge is constructed from different sources and viewpoints.

Hargreaves refers to teaching as a paradoxical profession. Of all the jobs that are or aspire to be professions, only teaching is expected to create the human skills and capacities that will enable individuals and organizations to survive and succeed in today's knowledge society. Teachers, more than anyone, are expected to build learning communities, create the knowledge society, and develop the capacities for innovation, flexibility and commitment to change that are essential to economic prosperity. At the same time, teachers are also expected to mitigate and counteract many of the immense problems that knowledge societies create, such as excessive consumerism, loss of community, and widening gaps between rich and poor. Somehow, teachers must try to achieve these seemingly contradictory goals at the same time. This is their professional paradox (Hargreaves, 2003:9).

The teaching profession is a key mediating agency for society as it endeavours to cope with social change and upheaval. But the teaching profession must be trained and equipped so that it will have the capacity to cope with the many changes and challenges which lie ahead. If it is to retain the confidence of society, the teaching profession must adapt a great deal so that it can act in a constructive manner within a fast-changing society (Coolahan, 2002).

For this to be possible, certain changes must be made. We will discuss these in some detail next. Thus, if schools are to educate virtually all students for "knowledge work" and for complex roles as citizens in a technological world, teachers will need to know how to design curriculum and adapt their teaching so that it responds to student understandings, experiences, and needs, as well as to family and community contexts. This task cannot be pre-packaged or "teacher proofed." It stands to reason that teaching challenging content to learners who bring very different experiences and conceptions would depend on the capacity of practitioners to create powerful and diverse learning experiences that connect to what students know and how they most effectively learn (Darling-Hammond & McLaughlin, 1999)

However, teachers generally face the task of teaching alone. The only witnesses of the teacher's professional activity are the students. Few professions are characterized by greater solitariness and *isolation*. In contrast to other professions or jobs, teaching is an activity conducted alone. As Bullough succinctly observes, the classroom is the teacher's sanctuary. This sanctuary is central to the culture of teaching — preserved and protected by isolation, and which parents, principals, and other teachers hesitate to violate (Bullough, 1998). This most common scenario remains one in which teachers labour on their own to decide what instruction works, what standard of student work is good enough, and what additional knowledge, skill, or insights would best serve them and their students (Little, 1999). Further, they do so in the crowded interstices of the day and week. Huberman elaborates: "*It is probable that this version of private, is the modal one across most school settings and at most points of the career. Both the architectural and social organization of schooling make it difficult to work otherwise*" (Huberman, 1995:207).

Isolation is a real barrier to the possibilities of training and improvement. The changes taking place in society affect the demand for a *redefinition of the teacher's work* and probably that of the teaching profession, of its training, and of its professional development. The roles traditionally assumed by teachers, conservatively teaching an academic curriculum, today seem totally inappropriate. Information gets to the students in various ways: television, radio, computers, Internet, cultural resources of the city, etc., and teachers cannot opt out of their part in this. Salomon offers a metaphor regarding the teacher's changing role from transmitter of information: a flautist before a not very respectful audience, a designer, a tourist guide, the conductor of an orchestra (Salomon, 1992:42). Thus, the teacher's role has to change from that of an authority who distributes knowledge to that of a subject who creates and directs complex environments of learning, involving the students in activities allowing them to build their own understanding of the subject matter, and working with them as colleagues in the learning process.

The changes affecting teachers cannot take place without an awareness of how the teachers themselves understand the learning process. How does one learn to teach? How does one generate, transform, and transmit knowledge in the teaching profession? These changes are particularized in different ways of understanding learning, teaching, tasks, and the media and evaluation (Blumenfeld, 1998).

Such changes mean *redefining the work of the teacher* in the classroom and in the school, resulting in a school structure that is more flexible and adapted to the individual possibilities and needs of the students. This requires a rethink in primary and secondary education, in both content and form of teaching. With regard to the academic content, there is a tendency to expand the subject matter and the syllabus, increasing the number of hours given to school exercises. Thus, if what is wanted is not the storage of information and the routine repetition of tasks, but the understanding of what is learned, the principle quoted by Gardner and Boix will have to be assumed: *less is more*. They confirm that the main enemy of comprehension is the need to complete the syllabus, the compulsion to go through the entire textbook, rather than give time to presenting the subject-matter from multiple viewpoints (Gardner & Boix-Mansilla, 1994). However, ensuring that students understand — and not merely remember — is not easy for the teacher. It requires learning the way to involve students so that they build knowledge more actively, participating and co-operating with colleagues; it also requires a deeper knowledge of the subject matter to be taught, and how to present it to make it understandable to the children.

*Understanding what is learned*, and learning to learn, are two essential demands of today's school. This is applicable to both teachers and students. We have remarked earlier that the economic globalization of today's society is having a great effect on the forms of work and on the skills and attitudes that companies demand of workers. The capacity and mood to survive (in all meanings of the word) are now more than ever associated to the capacity and motivation to learn. In this, the schools — primary and (particularly) secondary — are failing. The high dropout levels are of course affected by factors associated to poverty, but perhaps also by a curriculum that is fossilized and not very well-adapted to the needs and possibilities of the students.

The demand, therefore, is for a teacher who is a "*worker knowledge*", a designer of learning environments, with the ability to profit from the different areas in which knowledge is produced, and for a teaching profession characterized by what Shulman (1998) has termed *a community of practice* through which the "*individual experience can be converted into a group one*" (p.521); a profession that needs to change its professional culture, branded by isolation and obstacles to learning from others and with others, in which it is frowned on to ask for help or recognize difficulties.

### III. THE DEMAND OF LIFELONG LEARNING FOR TEACHING

We have already mentioned the difficulties encountered by teachers in adapting to the changes taking place in our societies. But perhaps the greatest change today's teachers have to make is to reconsider their commitment to learning and training. While it is true that teachers have carried on with their continued training, it is equally true that these efforts cannot continue being individual and exclusively formal initiatives — we must try to achieve the principle, goal, or orientation that is *lifelong learning*.

In the introduction to their *International Handbook of Lifelong Learning*, the editors (Aspin, Chapman, Hatton, & Sawano, 2001) remark that lifelong learning has arrived. The idea has long been accepted that education and learning are activities and processes that do not begin and end with the start and finish of the individual's attendance at formal institutions of education. However, there are some phenomena that have made learning not a choice but an obligation. As those authors state, "*We are living in a new era in which the demands are so complex, so multivariate, and so changing that the only way we will be able to survive is by the commitment to a process of individual, group, and global learning throughout our life and for everyone*" (xix). A process of open learning, combining formal, non-formal and informal training, and individual and group training.

A characteristic of lifelong learning that I consider extremely interesting is the understanding that EVERYONE can learn, and that learning does not have to be limited to formal institutions and traditional training. In other words, the learning considered of value is not only formal learning, but that non-formal and informal learning take on the importance that they have always had, although unrecognized. Aspin and Chapman (2001) state that objective knowledge is not only stored in libraries and watched over by authorities belonging to formal institutions situated in schools and universities. It can also be found in places where people are creative and develop imaginative responses to questions, and solutions to problems, that can be proposed as hypotheses to be debated in public discussion.

The development and generalization of teacher networks, the possibility of distance learning with others, the creation of open, distributed scenarios currently possible thanks to the new technologies of information and communication, are facilitating the visibility of this form of learning that we have termed informal. This is shifting the sedate foundations of the formal institutions of accreditation. The words of U indicate the change that lifelong learning is bringing about in institutionalized education and training. That author says "*Educational institutions increasingly find it difficult to claim a monopoly in the generation and dissemination of knowledge. When knowledge takes the form of information, it circulates through networks that evade the control of educational institutions. Moreover, educational institutions become part of the market, in the business of selling knowledge as a commodity and therefore reconstructing themselves as enterprises dedicated to marketing this commodity and to competing in the knowledge 'business'. Not only do they become geared to producing the personnel of post Fordism, they are themselves expected to behave in post-Fordist ways.*" (Usher, 2001:175).

### IV. WHAT DO WE KNOW ABOUT HOW TEACHERS LEARN? THE REVIEW OF RESEARCH LITERATURE

Learning to teach has been a constant concern of educational researchers in recent decades. Hundreds of studies and dozens of reviews have attempted to understand this process. In both the third and the recently published fourth *Handbook of Research on Teaching* (Richardson, 2001; Wittrock, 1986) we find chapters that review and blend knowledge about teachers and their training and development. Similarly, the *Handbooks of Research on Teacher Education* (Houston, 1990; Sikula, Buttery, & Guyton, 1996), the recent *International Handbook of Teachers and Teaching* (Biddle, Good, & Gooson, 1998), the *International Handbook of Educational Change* (Hargreaves, Lieberman, Goodson, & Hopkins, 1998), and the *Handbook of Educational Psychology* (Berliner & Calfee, 1996) cover more or less broadly the research on teachers'

learning. These books, and more-recent reviews appearing in specialist journals, such as those of Wilson & Berne (1999), Cochran-Smith & S. Lytle, (1999), Feiman-Nemser (2001), Putnam & Borko (2000), Wideen, Mayer-Smith, & Moon (1998), and Zeichner (1999), allow a reasonably up-to-date perception of the accumulated knowledge about the process (and nuances) of learning to teach. It is not our intention to summarize the hundreds of pages of other researchers' reviews. But nor will we pass up the opportunity to put back together the pieces of this big puzzle of what makes a good teacher.

I believe this purpose could be served by providing some conceptual scheme enabling us to understand the breadth, complexity, and prospects of the research on learning to teach. The cube presented below is an attempt to sum up in three dimensions the studies that have been carried out. The first dimension differentiates the **phases** by which the process of learning to teach takes place. The first phase is **initial training** — the teacher's progress along a training path designed specifically to provide the knowledge, skills, and aptitude needed for the task of teaching. The second phase comprises the first years of teaching, denominated years of professional initiation, induction, or **insertion**. The last phase analyzed in the process of learning to teach refers to those teachers who have generated their own professional repertoire and who progress by experiences of **professional development**.

The second dimension should be included in any review of research into the process of learning to teach concerns **topics**. Using the work carried out some years ago by (Katz & Raths, 1985), we have striven to reduce the possible topics to eight. These pertain to the teachers; their knowledge, beliefs, aptitudes, attitudes, perceived self-effectiveness, etc.; training content; training methods and strategies; the educators of the teachers; teaching practice; the environment; and evaluation. In many studies, these topics are obviously jumbled, but they can act as a framework of reference to classify research.

The third dimension concerns the **approach** adopted by researchers to cover the chosen topics. Although at the risk of oversimplifying, we think it appropriate to differentiate between quantitative and qualitative approaches. This option was also used by Richardson and Placier (2001) in their review of research related with teachers' change. Those authors, basing their work on that of Chin and Benne, distinguish two main approaches to change, learning, development, and socialization of teachers. One is an empirical-analytical approach, considering teachers as receptors and consumers of proposals of change posed by assessors, politicians, educators, and researchers. This is a linear process of change originating outside the classroom and contributing a new idea, way of thinking, or teaching programme — usually based on research or theory. Teachers are told what the change is about, it is demonstrated, and they are expected to put it into practice. From this standpoint, the change is complex. The second approach, termed normative/re-educational, starts from a broader movement of phenomenological study on the way that people accept and contribute to their work circumstances. This approach to change assumes the need for deep reflection on beliefs and practices, and that dialogue becomes habitual.

Sykes (1999) identified three models of current research into the process of learning to teach: a) the teacher as *consumer* within a quasi-regulated market structured by bureaucratically provided services. In this case, the training is planned, and regulated by hierarchically organized structures; b) the teacher as *independent craftsman*, building knowledge, skills, and materials in an *ex officio* approach. This model has the teacher working alone in class, accumulating wisdom and experience, and analyzing how to acquire and renew knowledge; c) the teacher as a *professional*, setting his/her work according to common norms.

This difference in the approaches to research, used by (Fenstermacher, 1994) as a grouping procedure to review and critique research on teachers' knowledge, has been used recently by Cochran-Smith and Lytle (1999). Fenstermacher posed the questions *What is known about effective teaching? What do teachers know? What knowledge is essential in teaching?* and *Who produces knowledge on teaching?* as a way of distinguishing and classifying different approaches to research on learning to teach. Obviously, behind these questions are quantitative approaches (portent-product and process-product) and qualitative approaches

(cognitive intervention, ecological). Cochran-Smith and Lytle (1999), following the idea of Fenstermacher, have classified research into learning to teach on the basis of the relationships between the knowledge produced and its application in the practice of teaching. Thus, they distinguish between

- **Knowledge for the practice:** In this first notion, the relationship between knowledge and practice is that in which knowledge serves to organize practice, so that greater knowledge (subject matter, educational theory, instructional strategies) leads more or less directly to increased effectiveness in practice. Knowledge for teaching is formal knowledge, derived from university research, and is what theoreticians refer to when they say that teaching has generated a body of knowledge different to common knowledge. Practice, from this standpoint, is about the application of formal knowledge to practical situations.
- **Knowledge in the practice:** The emphasis in research on learning to teach has been the search for knowledge in action. It has been estimated that what teachers know is implicit in practice, in the reflection on practice, in the investigation of practice, and in the narrative of that practice. This assumes that teaching is an erratic and spontaneous activity, contextualized and built as a response to the particularities of everyday life in the school and classroom. Knowledge is located in the actions, decisions, and judgments of the teachers. It is acquired by experience and deliberation, and teachers learn when they have the opportunity to reflect on what they do.
- **Knowledge of the practice.** This last trend is included in the qualitative research line, but close to what is termed *teacher as researcher*. The root idea is that in teaching it is nonsense to speak of one knowledge that is formal and another that is practical, rather that knowledge is built collectively within local communities, formed by teachers working in school development projects, training, or co-operative research (Cochran-Smith and Lytle, 1999).

Because the competence is based on knowledge (being propositional or procedural knowledge), it is fundamental that the teachers know the main object of its task: the content that they teach and the people that have to learn that content: the students.

Since the contributions of Shulman (1986) and Schön (1983) pointing out that teaching was not a technical activity, but was governed by a type of knowledge linked to action and practice, thousands of studies on teacher training have attempted to discover what teachers know, how they got to know it, and — more importantly — how teachers' knowledge can be improved. We have already referred to the different modalities of knowledge established when distinguishing between knowledge *for*, *in* and *of* the practice (Cochran-Smith & Lytle, 1999). Different forms of knowledge have led to different ways of understanding research on learning to teach. Earlier, we referred to the works carried out within the process-product pattern, which enabled identifying a relationship linking teaching competence to student performance (Brophy, 1999), (Shuell, 1996).

The recent OECD report (Knowledge Management in the Learning Society) (OECD, 2000) refers to four types of knowledge that could be object of attention for professional training. We will use this reference to describe the different types of knowledge that have been developed in research on learning to teach:

*Know-what:* refers to knowledge about “facts”

*Know-why:* refers to knowledge about principles and laws of motion in nature, in the human mind, and in society.

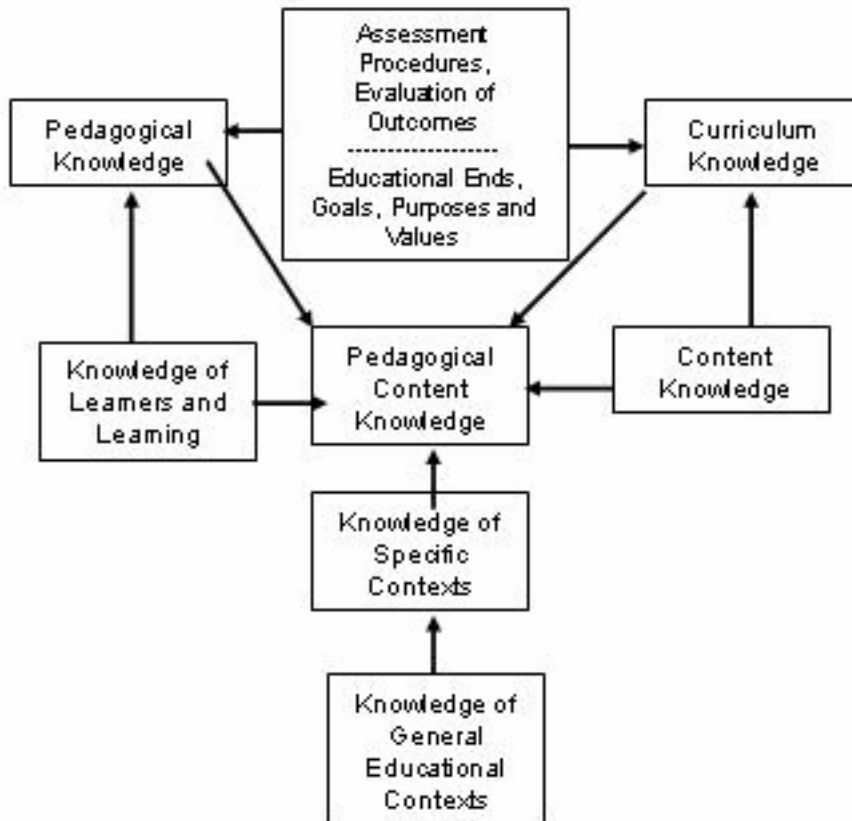
*Know-how:* refers to skills — the ability to do something. It may be related to the skills of production workers, but it plays a key role in all important economic activities

*Know-who:* involves information about who knows what and who knows what to do. But it also involves the social ability to co-operate and communicate with different kinds of people and experts.

Teacher training programmes have generally been centred on the first two types of knowledge, whereas know-how has been of recent investigation. This is because know-how is primarily tacit knowledge; that is, knowledge that has not been documented and made explicit by whoever uses and controls it. There is much tacitness in teachers' know-how. Teachers often have their own ideas about how to teach, and they seldom write them down in a form that is accessible to others.

Now we will mention the studies into what types of knowledge are used and generated by teachers in their professional practice. One of the contributions most widely accepted for its synthesizing labour was that of Grossman (1990). Morine-Dershimer and Todd (2003) have reworked the model from that study, incorporating later research findings. In this reworked model, teachers' knowledge comprises the following elements:

Categories Contributing to Pedagogical Content Knowledge. Morine and Kent, 2003.



### The Teacher Subject Matter Knowledge

Teachers must have a knowledge of the subject they teach. This has been traditional in teaching. A popular belief says that to teach, it is enough to know the content of what is taught. Buchmann states that "*Knowing something enables us to teach it; and knowing a subject deeply means being mentally organized and well prepared to teach it generally*" (Buchmann, 1984:37). When the teacher does not have an adequate knowledge of the structure of the discipline being taught, the teaching can impart the content inaccurately to the students. The knowledge that teachers have of the subject to be taught also affects what and how they teach. At the

same time, a lack of knowledge on the part of the teacher can affect the level of discourse in class, the type of questions teachers frame (Carlsen, 1987), and the way teachers critique and use textbooks (Hashweh, 1987).

*Content knowledge* includes various components. Two of these are the most distinguishing: syntactic knowledge and substantive knowledge. *Substantive knowledge* includes the information, ideas, and topic to know; that is, the body of general knowledge on a subject, the specific concepts, definitions, conventions, and procedures (Ball & McDiarmid, 1989). This knowledge is important as far as it determines what the teachers are going to teach, and from what standpoint. For example, in the case of history, the framework of cultural, political, or ideological analysis chosen can determine what is taught, and how it is taught.

*Syntactic knowledge* of the content completes the former, and concerns the mastery the teacher has of the patterns of research in each discipline, knowledge regarding questions such as validity, trends, and perspectives in the specialist field, and research. In mathematics, it would be the distinction between convention and logical construction; in history, it would include the different points of view for interpreting a single phenomenon; in science, it would include knowledge of empiricism and method in scientific research, etc. (Ball and McDiarmid, 1989).

There appears to be general agreement regarding the need for teachers to have an adequate knowledge of the subject they have to teach. However, as Kennedy (1990a) states, there is open debate about what type of subject knowledge teachers must have. In first place, it has been argued that teachers need to know *less* about the subject content than other specialists in the same field do: they need to know what is required by the curriculum and textbooks.

Secondly, the opposite has been posited: that teachers need to know *more* than others about their subject matter, above all in aspects concerning social norms (of what social use is knowledge, what values are cultivated — minorities, discoveries, wars...) and the usefulness and relevance for everyday life. Lastly, it is argued that teachers' knowledge has to be *different*, because it must be explicit and self-conscious. Those who share this opinion state that the subject knowledge of teachers is different in that it is knowledge to be taught, meaning that it must be organized not only according to the structure of the subject itself, but considering the students to whom it will be directed. In short, and as an introduction to the next section, it deals with training teachers so that they have a didactic knowledge of the subject matter to be taught.

In a recent work on this topic, Gess-Newsome (2003a) indicates that the subject matter knowledge of most novices is fragmented, compartmentalized, and poorly organized, making it difficult to access this knowledge efficiently when teaching. As a result, many novice teachers are forced to rely on teaching the algorithms and facts that they remember from their own school days. Low levels of poorly organized subject matter knowledge impact instruction in a number of ways. When planning instruction, novice teachers overly rely on the textbook — as opposed to students' understanding — as an appropriate point of departure for the lesson. Learning is equated with remembering information, and thus reinforcing the belief in and use of algorithmic and fact-based knowledge. Such superficial content coverage hurts students by limiting conceptual understanding, misrepresenting the structure of the discipline, and preventing the construction of a strong conceptual knowledge base, thus limiting future learning opportunities. In order to keep the content within the expertise level of the teacher, lower-level questions predominate, and activities are constrained by strict procedural rules. The novice teacher is unable spontaneously to connect student comments and questions back to the formal lesson, and often rejects alternative student answers. The result is the management of student work rather than the monitoring of student understanding. Teachers with strong conceptual knowledge have a more-detailed knowledge of the topic, more connections and relationships to other topics, and can easily draw upon this knowledge in teaching and problem-solving situations. Lesson planning begins with knowledge of the student, and draws upon teaching activities and content representations previously found to be effective in achieving lesson goals.



Knowledge of the subject matter to be taught is an important factor in quality of teaching. If teachers do not master the content, it is difficult for their teaching to be understood. So, *How much content is necessary?* In a recent review of 300 studies on learning to teach, Wilson, Floden and Ferrini-Mundy (2001), it was recognized that research shows a positive connection between teachers' preparation in their subject matter and their performance and impact in the classroom. But, contrary to the popular belief that "more subject matter study is always better," there is some indication from research that teachers can acquire subject matter knowledge from various sources, including subject-specific academic coursework and study in an academic field. However, there is little definitive research on the kinds or amount of subject matter preparation; much more research needs to be done before strong conclusions can be drawn. Some researchers have found serious problems with the typical subject matter knowledge of pre-service teachers, even of those who have graduated in academic disciplines (Wilson et al., 2001).

### **Teacher Pedagogical Content Knowledge. A Special Mention to Math and Science**

*Pedagogical Content Knowledge* is a central element of the teacher's knowledge in the model of Morine-Dersheimer and Todd (2003). It is the correct combination between knowledge of the content to be taught and the pedagogical and didactic knowledge of how to teach it. In recent years, work has been done in various educational contexts to elucidate what are the components and elements of this type of professional knowledge for teaching.

*Pedagogical Content Knowledge*, as a line of research, is the confluence of the work of didactic researchers with that of researchers in specific subjects concerned with teacher training. *Pedagogical Content Knowledge* leads to a debate regarding the form of organization, of representation, and of knowledge via analogies and metaphors. It raises the need for pre-service teachers to acquire an expert knowledge of the subject matter to be taught, so that they can develop a teaching that is comprehensible to the students.

Shulman (1992), showed the need for teachers to build *bridges* between the meaning of the curricular content and the construction students make of that meaning. As that eminent researcher states, "*teachers perform this deed of intellectual honesty through a deep, flexible, and open understanding of the subject matter; understanding the most-probable difficulties that students will have with these ideas...; understanding variations in the teaching methods and models in order to help students build their knowledge; and being ready to re-view their goals, plans, and procedures in so far as interaction with the students is developed. This type of understanding is not exclusively technical, nor simply reflexive. It is not just content knowledge, nor the generic mastery of teaching methods. It is a mixture of all these, and is mainly pedagogical*" (Shulman, 1992:12).

Pedagogical content knowledge is a teacher's understanding of how to help students understand a specific subject matter. It includes the ways of representing and formulating the subject to make it comprehensible to others, and an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of the most-frequently taught topics and lessons (Borko & Putnam, 1996). According to Magnusson, Krajcik & Borko (2003), pedagogical content knowledge includes knowledge of how particular subject matter topics, problems, and issues can be organized, represented, and adapted to the diverse interests and abilities of learners, and then presented for instruction.

Those authors conceptualize pedagogical content knowledge for **science teaching** as consisting of five components:

1. **Orientations toward Teaching Science:** teachers' knowledge and beliefs about the purposes and goals for teaching science at a particular grade level.
2. **Knowledge and beliefs of the Science Curriculum:**

*Knowledge of Goals and Objectives:* includes teachers' knowledge of the goals and objectives for students in the subject(s) they are teaching, as well as the articulation of those guidelines across topics addressed during the school year.

*Knowledge of Specific Curricular Programme:* knowledge of the programmes and materials that are relevant to teaching a particular domain of science and specific topics within that domain.

### 3. **Knowledge and beliefs of Students' Understanding of Science:**

*Knowledge of Requirements for Learning:* teachers' knowledge and beliefs about prerequisite knowledge for learning specific scientific knowledge, as well as their understanding of variations in students' approaches to learning as they relate to the development of knowledge within specific topic areas.

*Knowledge of Areas of Student Difficulty:* teachers' knowledge of the science concepts or topics that students find difficult to learn.

### 4. **Knowledge and beliefs of Assessment in Science:**

Knowledge of Dimensions of Science Learning to Assess, and Knowledge of Methods of Assessment

### 5. **Knowledge and beliefs of Instructional Strategies:**

*Knowledge of Subject-specific Strategies:* Teachers' knowledge related to the "orientations to teaching science" component of pedagogical content knowledge in that there are general approaches to science instruction consistent with the goals of particular orientations.

*Knowledge of Topic-specific Strategies:* teachers' knowledge of specific strategies that are useful for helping students comprehend specific science concepts.

It is important to highlight that the proposal carried out by Magnusson, Krajcik and Borko (2003) makes stress in **differing among knowledge and belief**. This is not casual. Beliefs are understood to be like propositions: assumptions that people make about what they consider real. Beliefs, unlike propositional knowledge, do not need a condition of proven truth. They fulfill two functions in the process of learning to teach. First, beliefs affect the way teachers learn; and second, beliefs affect the processes of change that teachers may attempt (Richardson, 1996).

Although sometimes confused in the literature, belief and knowledge should be distinguished. Knowledge is most often described as evidential, dynamic, emotionally - neutral, internally structured, and develops with age and experience. Conceptual knowledge, or knowledge that is rich in relationships, is used in problem solving situations. The amount, organization and accessibility of conceptual knowledge has been shown to distinguish experts from novices. Beliefs, in contrast, are described as both evidential and non-evidential, static, emotionally- bound, organized into systems, and develop episodically. Beliefs have both affective and evaluative functions, acting as information filters and impacting how knowledge is used, organized and retrieved. Beliefs are also powerful predictors of behaviour, in some cases reinforcing actions that are consistent with beliefs and in other cases allowing for belief compartmentalization, allowing for inconsistent behaviours to occur in different contexts (Gess-Newsome, 2003a:55).

Reference must be made to Pajares (1992), one of the researchers contributing most to the analysis of beliefs. That author drew attention to the diverse semantics characterizing this line of research, in which have been used terms such as belief, attitude, values, judgement, axioms, opinions, ideology, perceptions, conceptions, conceptual system, preconceptions, aptitude, implicit theories, explicit theories, personal theories,

internal mental processes, rules of practice, practical principles, etc. This semantic dispersion means that research results cannot be compared because they do not share the same conceptual framework.

From such differentiation, research has shown that pre-service teachers bring to the training programme personal beliefs about teaching, with an image of the good teacher, an image of themselves as teachers, and the memory of themselves as students. These personal beliefs and images generally remain unchanged throughout training, and persist during teaching practice (Feiman-Nemser, 2001; Kagan, 1992; Wideen, Mayer-Smith, & Moon, 1998). Along these lines, Feiman states that the images and beliefs that prospective teachers bring to their pre-service preparation serve as filters for making sense of the knowledge and experiences they encounter. They may also function as barriers to change by limiting the ideas that teacher education students are able and willing to entertain. The paradoxical role of prior beliefs in learning takes on special significance in teacher preparation ((Feiman-Nemser, 2001:1016).

Pajares (1992) summed up the results of research into teachers' beliefs as the following principles:

1. Beliefs are formed early in life, and tend to remain, overcoming contradictions arising from reason, time, school, or experience.
2. Individuals develop a system that structures all the beliefs acquired throughout the process of cultural transmission.
3. The systems of beliefs have an adaptive function, helping individuals to define and understand the world and themselves.
4. Knowledge and beliefs are interrelated, but the affective, evaluative, and episodic nature of beliefs makes them a filter for the interpretation of all new phenomena.
5. Substructures of beliefs, such as educational beliefs, have to be understood in terms of their connections with other beliefs of the system.
6. Because of their nature and origin, some beliefs are more indisputable than others.
7. The older a belief is, the more difficult it is to change. New beliefs are more vulnerable to change.
8. A changed belief in adults is very rare. Individuals tend to maintain beliefs based on incomplete or incorrect knowledge.
9. Beliefs are instrumental in defining tasks and in choosing the cognitive tools with which to interpret, plan, and take decisions related to these tasks; as such, they play a crucial role in defining conduct and organizing knowledge and information.

In the same way that we develop knowledge and general beliefs about teaching, the students, the school, or the teacher, the material we teach (or endeavour to teach) does not remain outside our conception. The way we know a particular subject or curricular area affects the way we teach. There is much evidence showing the pre-service teachers follow certain "archetypes" in the subject they are studying, whether it be mathematics, language, or physical education. Questions such as *What are mathematics, language, physical education, etc., and what are they for?* need to be raised when we attempt to "start out from what the student already knows".

The elements that we have described reveal the crucial role of pedagogical content knowledge in the training of a teaching professional. Research shows the failure of training programmes to ensure that teachers begin teaching with a knowledge that is well structured and linked to practice. Borko and Putnam (1996) conclude their review of studies on this topic by establishing that the pedagogical content knowledge of novice teachers is often insufficient for thoughtful and powerful teaching of subject matter content. And although experienced teachers have generally acquired a good deal of pedagogical content knowledge, their knowledge often is not sufficient or appropriate for supporting teaching that emphasizes student understanding and

flexible use of knowledge. Teachers' overarching conceptions of teaching a subject can limit their efforts to learn to teach in new ways, and they can be resistant to change through pre-service courses or in-service workshops. Novices have limited knowledge of subject-specific instructional strategies and representations, and of the understanding and thinking of their students about particular subject matter content. Experienced teachers typically have more knowledge of instructional strategies and of their students, but they often do not have appropriate knowledge and beliefs in the areas to support successful teaching for understanding.

In relation with the **mathematics**, teachers has to become aware of the specific epistemological status of the students' mathematical knowledge (Steinbring, 1998). The teacher has to be able to diagnose and analyze students constructions of mathematical knowledge and has to compare those constructions to what intended to be learned in order to vary the learning offers accordingly. One endemic problem arises in the course of trying to figure out what students understand as they work on mathematical problems, do written work and offer their methods and solutions (Ball, 2001). Children represent their ideas in ways often unfamiliar to adults, with idiosyncratic language and unusual syntax. Another problem, according to Ball (2001) are problems of managing and using multiple representations and solutions generated in the course of work. These multiple representations arise from both mathematics and from students. Students because they think differently from one to another, see problems in a range of ways, and represent and solve them in multiple ways.

One of the demands that are making in connection with the teaching of the mathematics-also referred to other disciplines - has to do with what has been denominated *learning with understanding*. Carpenter and Lehrer (1999) affirm that "*In order to prepare mathematically literate citizens for the 21<sup>st</sup> century, classroom need to be restructured so mathematics can be learned with understanding. Teaching for understanding is not a new goal of instruction: school reform efforts since the turn of the 20<sup>th</sup> century have focused on ways to create learning environments so that students learn with understanding*" (9).

According with these authors, *learning with understanding* is central for reforming mathematics education because it provides a basis for students to apply their knowledge to learn new ideas and to solve new and unfamiliar problems. When students do not understand, they perceive each topic as an isolated skill, and they cannot apply their skills to solve problems not explicitly covered by instruction. As a consequence, unless students learn with understanding, whatever knowledge they acquire is likely to be of little use to them outside of school. So, the teachers has to be able to build classroom activities that promote:

- **Constructing relationships:** People construct meaning for a new idea or process by relating it to ideas or processes that they already understand. Unless instruction helps children build on their knowledge and relate the mathematics they learn in school to it, they are likely to develop two separate systems of mathematical knowledge: one they use in school and one they use outside school.
- **Extending and applying Mathematical Knowledge:** Developing understanding involves more than simply connecting new knowledge to prior knowledge; it also involves the creation of rich, integrated knowledge structures.
- **Reflecting about experiences:** reflection involve the conscious examination of one' own actions and thoughts. To be reflective in their learning means that students consciously examine the knowledge they are acquiring and the way it is related both to what they already know and to whatever other knowledge they are acquiring.
- **Articulating what one knows:** articulation involves the communication of one's knowledge, either verbally, in writing, or through some other means like pictures, diagrams or models. Articulation requires reflection in that it involves lifting out the critical ideas of an activity so that the essence of the activity can be communicated.

- **Making Mathematical Knowledge One's Own:** understanding involve the construction of knowledge by individuals through their own activities so that they develop a personal investment in building knowledge (Carpenter & Lehrer, 1999).

To achieve these changes there are several changes in mathematical teacher education. Cuevas (1998) propose a methodological change related with pedagogical content knowledge in mathematics:

- Model a **problem-oriented classroom environment:** in teacher education, complex tasks can be integrated into classroom activities to begin to study particular mathematics topics.
- Provide experiences with tasks at all levels of **mathematical complexity:** some students have difficulties with some tasks demands. Teachers should develop strategies to identify tasks that provide a challenge to students without being impossible to complete.
- Promote **discussion of mathematical tasks**, their content and solutions: several approaches: small-group exploration and discussion of a given task, individual or group presentation of solutions to tasks, and class discussion
- Emphasize development of **communication skills:** communication skills and the promotion of classroom discourse should be approached developmentally
- Provide **opportunities of reflection** about the tasks and their implementation with students

### **Teacher Knowledge of the context and of the students.**

Another component of the knowledge that teachers must acquire concerns where and whom they teach. Teachers have to adapt their general knowledge of the subject to the particular conditions of the school and the students who attend it. Yinger has posed the ecological dimension of knowledge, understanding that knowledge exists not in individuals but in the relationships produced between them and their environment. Classroom life, in this sense "*comprises the cultural, physical, social, historical, and personal systems that exist both within and outside the class... The teacher's responsibility in the class is to understand the dialogues taking place within and between all the systems, and to recognize which are appropriate for class activity. The teacher acts as guide and subject, translating the structure, action, and information contained in each system*" (Yinger, 1991:31).

This makes it necessary for teachers to be sensitized to the socio-economic and cultural nature of the neighbourhood, the opportunities for integrating it into the curriculum, students' expectations, etc. This type of knowledge also includes knowledge of the school, its culture, the teachers, and the working norms. If all children are to be effectively taught, teachers must be prepared to address the substantial diversity in experiences that children bring with them to school; that is, the range of languages, cultures, exceptionalities, learning styles, talents, and intelligences that require, in turn, an equally rich and varied repertoire of teaching strategies (Darling-Hammond & Sclan, 1996).

With regard to teachers' knowledge about the students, (Ladson-Billing, 1998; Ladson-Billings, 1999; McIntyre & Byrd, 1998) announce the limited amount of research that has been completed on the important topic of preparing teachers to work with diverse populations. Some important findings, however, do emerge:

- Significant numbers of student teachers lack knowledge and empathy about the effects of institutional racism; they do not perceive that education has the power to change peoples' thoughts and actions, and they view diversity as a problem, not as a resource.

- Student teachers lack empathy in regard to the effects of institutional racism, and they show a lack of confidence in the ability of education to change the ways people think and act.
- Pre-service programmes in multiculturalism teach students to have greater awareness and understanding of multicultural concepts; however, there tends to be little implementation of these concepts during field experiences.
- Trainee and experienced teachers often have low expectations of poor non-white students, and trainee teachers are often reticent about working in diverse settings and interacting with students and parents from such settings.
- Pre-service teachers need encouragement and the opportunity to use a rich range of teacher strategies, experience the maintaining of high expectations, and reflect on the outcomes of their efforts.
- Community field experiences for pre-service teachers can help them to develop cultural sensitivity and intercultural teaching competence.
- Student teachers are likely to be apprehensive and have misconceptions about working in diverse settings.
- Teacher educators are reluctant to address their own culpability in reproducing teachers who cannot (and will not) effectively teach diverse learners. Teacher educators are overwhelmingly white and male, and their own experience with diversity is limited.
- Even when teacher educators who want to teach students about inequity teach against the grain, their work runs counter to the beliefs, attitudes, perceptions, and perspectives of most of their students.

### **Proposal of a Map of Teacher Competencies:**

The literature revised previously comes to highlight the necessity that the teachers possess knowledge and abilities in relation to the matter that they teach, as well as to the way to teach it. Recently the movement in favour of the standards has highlighted the necessity to assist to the domain of educational competence. Martinet, Raymond and Gauthier (2001) have developed in Canada a work that we find interesting for highlighting in this report. For these authors, a competence is always a competence for action. Its characteristics are the following:

- Competence is developed in real, rather than simulated, professional contexts
- Competence is situated on a continuum that ranges from the simple to the complex
- Competence is based on a set of resources: a competent person makes use of resources mustered in contexts of activity
- Competence concerns the capacity to mobilize in a context of professional activity
- Competence, like know-how, is intentional
- Competence is effective, efficient, and immediate know-how that is demonstrated continually
- Competence constitutes a project, an endless goal.

They have developed a listing of competencies that can be very useful to guide the development of programs of the teacher education. This listing is extremely coherent with the results of the research on learning to teach that we have revised previously. Basing us on this work, we have supplemented the proposal of Martinet, Raymond and Gauthier (2001) with the results of the research that we have revised in the previous chapters. The competencies are the following:

## Professional Domain

- 1. Acting critically as a professional, interpreting the objects of knowledge or culture in performing one's functions:** Situating the basic points and the axes (concepts, postulates, and methods) of knowledge in the subject in order to make possible a significant learning for the students; Critically distancing oneself from the subject taught; Establishing relationships between the culture prescribed in the teaching programme and that of the students; Making the class a place open to multiple viewpoints in a common living space; Taking a critical look at one's own origins and cultural practices, and at one's social role; Establishing relationships among different fields of the subject matter knowledge.
- 2. Becoming involved in an individual and collective project of professional development:** Evaluating one's own competencies and adopting the means to develop them using available resources; Interchanging ideas with colleagues about the suitability of pedagogical and didactic options; Reflecting on one's practice (reflective analysis), and putting the results into practice; Developing pedagogical projects to resolve problems in teaching; Encouraging colleagues to participate in research aimed at the acquisition of competencies set out in the training plan and educational targets of the school.
- 3. Acting ethically and responsibly in the performance of functions:** Being aware of the values at stake in one's performance; Encouraging democratic conduct in class; Giving students due attention and support; Keeping high expectations: believing that the students are capable of learning and that they are capable of and responsible for teaching them successfully; Explaining, in function of the public interest, the decisions taken concerning students' learning and education; Respecting confidential aspects of the profession; Avoiding all forms of discrimination by students, parents, and colleagues; Situating the moral problems presented in class within the great currents of thought; Making judicious use of the legal and authorized framework governing the profession.

## Teaching Domain

- 4. Designing teaching-learning situations for the subject matter to be learned, and doing so in function of the students and of the development of the competencies included in the teaching programme:** Basing decisions and performance on recent data from didactic and pedagogical research; Knowing the ways of representing and formulating the subject to make it comprehensible to others; Understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of the most-frequently taught topics and lessons; Analyzing the students' misconceptions in connection with the subject matter taught; Selecting and interpreting subject knowledge with regard to the aims, competences, and elements of the teaching programme content; Planning sequences of teaching and evaluation bearing in mind the logic of the content and progress of the learning; Bearing in mind representations, social differences (sex, ethnic origin, socio-economic, and cultural), needs, and special interests of the students when preparing teaching-learning situations; Choosing varied and appropriate didactic approaches when developing the competencies included in the teaching programme; Anticipating obstacles to learning the subject matter to be taught; Foreseeing situations of learning that enable integration of competencies in varied contexts.
- 5. Directing teaching-learning situations for the content to be learned, and doing so in function of the students and of the development of the competencies included in the teaching programme:** Creating the conditions for students to become involved in situations-problems and in significant topics or projects, bearing in mind their cognitive, affective, and social characteristics; Establishing a learning orientation by beginning lessons and activities with advance organizers or

previews; Presenting the subject matter in networks of connected knowledge structured around powerful ideas; Provide experiences with tasks at all levels of subject matter complexity Making available to the students the resources necessary in the learning situations proposed; Giving the students with opportunity to learn, dedicating most of the available time to curriculum-activities; Questioning to engage students in sustained discourse structured around powerful ideas; Guiding the students in selecting, interpreting, and understanding the information available in the different resources, and in understanding the aspects of the situations-problems or in the requirements of a topic or project; Shaping students' learning by means of frequent and pertinent strategies, steps, questions, and feedback, so as to help the integration and transfer of learning; Helping students to work in co-operation; Giving the students sufficient opportunities to practice and apply what they are learning and to receive improvement-oriented feedback.

- 6. Evaluating the progress of learning and the degree of acquisition of the students' competencies in the subject matter to be learned:** In a learning situation, managing information in order to overcome students' problems and difficulties, and to modify and adapt the teaching to aid students' progress; Monitoring students' progress using both formal tests and performance evaluations and informal assessments of students' contributions to lessons and work on assignments; Establishing an evaluation of the students' acquisitions in order to judge the degree of acquisition of competence; Constructing or employing instruments to enable evaluation of progress and acquisition of competence; Communicating to students and parents, clearly and explicitly, the results achieved and the feedback concerning progress in learning and acquisition of competence; Co-operating with the pedagogical team to determine the desirable rhythm and stages of progress in the training cycle.
- 7. Planning, organizing, and supervising the way the group-class works, in order to help students' learning and socialization:** Defining and applying an effective working system for normal class activities; Communicating clearly to students the requirements of correct school and social behaviour, ensuring that they adopt them; Fomenting the students' participation — as a group and as individuals — in establishing the norms of class function; Adopting strategies to prevent incorrect behaviour cropping up, and to intervene effectively when it does; Maintaining a suitable learning environment.
- 8. Adapting teaching to the student diversity:** Designing learning tasks adapted to the students' possibilities and characteristics; to Organizing different learning rhythms in function of the possibilities of the students; to Organizing heterogeneous groups for the work of the students; Developing experiences of cooperative learning Helping the pedagogical and social integration of students who present difficulties in learning or behaviour, or are handicapped; Seeking pertinent information from human resources, including parents, regarding students' needs; Suggesting to the students learning tasks, challenges, and roles in the group-class enabling their developmental progress; Participating in the preparation and putting into practice of a plan of adapted performance.
- 9. Integrating the technologies of information and communication into the preparation and development of teaching-learning activities, classroom management, and professional development:** Adopting a critical and well-founded attitude to the advantages and limitations of the TIC as medium for teaching and learning, and for society; Evaluating the didactic potential of IT and computer networks in the development of competence in the teaching programme; Using a variety of multimedia tools for communicating; Using the TIC effectively to investigate, interpret, and communicate information, and to resolve problems; Using the TIC effectively to set up networks of interchange and of continuous training related with the subject taught and its pedagogical practice; Helping the students use the TIC in their learning activities, to evaluate such use, and to analyze critically the data gathered by these networks.



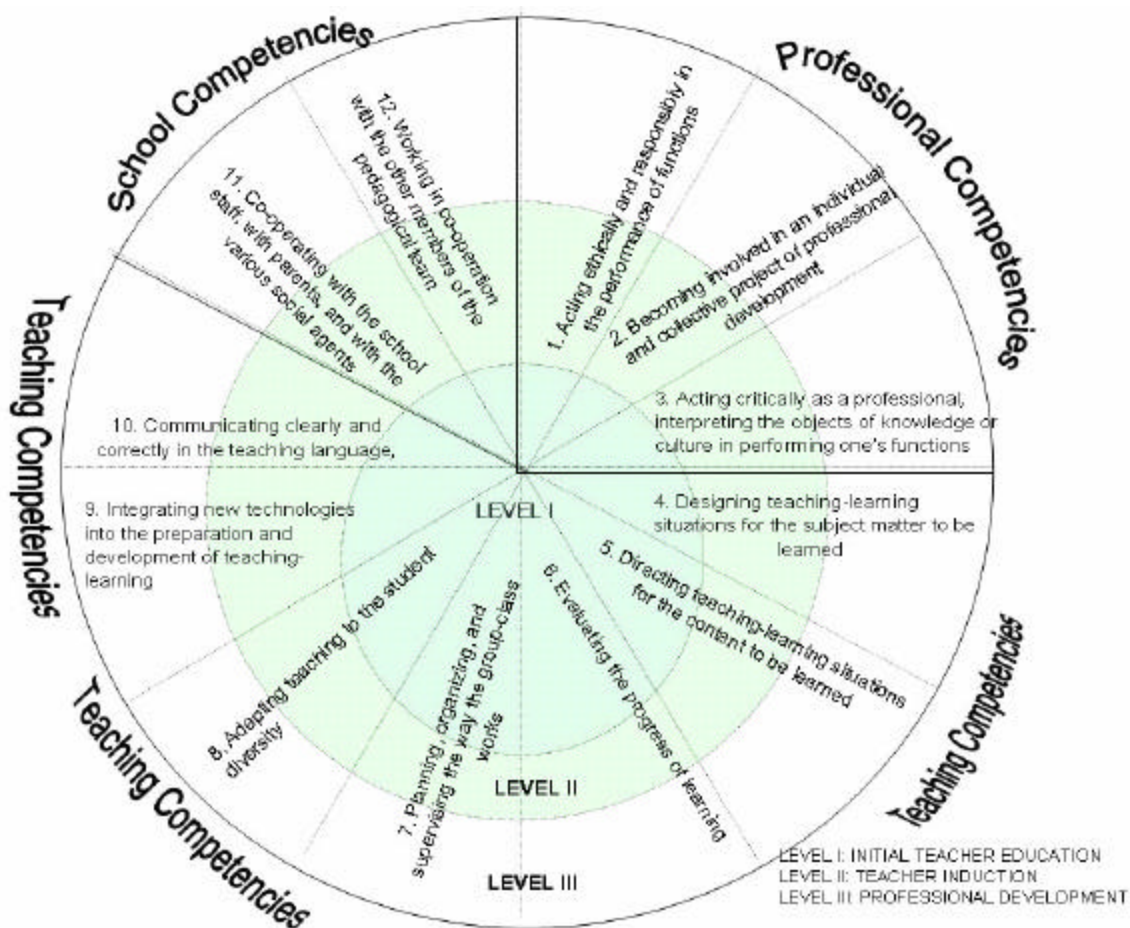
- 10. Communicating clearly and correctly in the teaching language, both oral and written, in the different contexts related with the teaching profession:** Using a variety of appropriate oral language when addressing students, parents, or colleagues; Respecting the rules of written language in documents aimed at students, parents, and colleagues; Knowing how to take a position, and maintain one's ideas and discuss coherently, effectively, constructively, and respectfully; Using questions to stimulate students to process and reflect on content, recognize relationships among and implications of its key ideas, think critically about it, and use it in problem solving, decision making or other higher-order applications; Communicating ideas rigorously, using precise vocabulary and correct syntax; Correcting errors made by students in their oral and written work; Constantly seeking to improve oral and written expression.

### **School Domain**

- 11. Co-operating with the school staff, with parents, and with the various social agents to achieve the school's educational targets:** Co-operating with the other members of the school staff in defining targets, and in the preparation and putting into effect of projects on educational services, in the ambit of the responsibilities assigned to the school centres; Fomenting participation and information flow with respect to parents; Co-ordinating performance with that of the various school agents; Encouraging student participation in the management of the school and in its activities and projects.
- 12. Working in co-operation with the other members of the pedagogical team in tasks enabling the development and evaluation of the explicit competencies of the training plan, and doing so in function of the students:** Knowing what are the situations requiring collaboration with other members of the pedagogical team for the design and adaptation of teaching-learning situations, the evaluation of learning, and mastery of the competencies at the end of the period; Defining and organizing a project in function of the targets of the pedagogical team; Participating actively and continuously with the pedagogical teams that handle the students; Working to achieve the required consensus among the members of the pedagogical team.

### **Mapping the Proposal of Teacher Competencies**

Trying to give answer to the question to this epigraph: How should to map of teaching competencies and skills be drawn to match and respond to the new key competences that every student needs to acquire? Which are the teaching competencies and skills that should be incorporated into the curriculum of Teacher training Colleges, and which are those that should become the preferred focus of teachers' professional development activities and policies?, we have designed the following graph that next explain:



The twelve basic competencies that previously we have described, based on the work of Martinet, Raymond and Gauthier (2001) can be grouped in three big domains:

- Competencies related with the teacher as **professional**
- Competencies related with the **teaching** and the **classroom** work
- Competencies related with the **school** work.

We consider that these three domains should be approached with different grade of intensity depending on the moment or formation level in which we are. This way, we have differentiated three levels:

- Initial Teacher Education
- Beginning Teacher Induction
- Continuous Professional Development

We consider that the list of 12 basic competencies should be part of any program of teacher education, being this in initial teacher education, induction or continuous professional development, but not with the same intensity.

We consider that are the competencies related with the work of the teachers in the classroom those that should be constituted in the axis of the initial teacher education, and this is why we have marked in our graphic with a wider circle in this area. We justify this option considering that the research shows the im-

portance for the beginning teachers of a repertoire of abilities and basic knowledge that allow him or her to begin their professional itinerary.

This research aims to establish differences between teachers depending on age and what has been termed “expertise”. Except in special cases, such evolution has begun to be analyzed from the first year of teaching experience. On one hand, we have those studies that attempt to understand the process of becoming an expert, and on the other, those that analyze what expert teachers do and what characterizes them. These studies have classically shown the contrast between expert teachers and novices.

### **Why to consider the induction period?**

One of the stages clearly identified in the various studies concerns the first years of teaching, denominated period of initiation or professional induction. This period has received much attention from researchers.

Professional induction into teaching is, as we have said, the period covering the first years, when teachers have to make the transition from student to teacher. It is a period of tension and intensive learning in contexts often unknown, during which the novice teachers must acquire professional knowledge besides achieving a certain personal equilibrium. This is the concept of induction assumed by Vonk, a Dutch author with a decade of research centred on this situation: “*we define induction as the transition from pre-service teacher to autonomous professional. ... Induction can be best understood as one part of a continuum in the process of teachers’ professional development*” (Vonk, 1996:115).

According to Feiman (2001), novice teachers have two tasks: they must teach and learn to teach. Independently of the quality of the initial training programme they have followed, there are certain things that can be learned only during practice, and this makes the first year one of survival, discovery, adaptation, learning, and transition. Novice teachers face various prime tasks: to acquire knowledge about the students, the curriculum and the school context; to design the curriculum and the teaching appropriately; to begin to develop a repertoire of teaching enabling them to survive as a teacher; to create a community of learning in the classroom; and to continue developing a professional identity. The problem is that they must do all this burdened with the same responsibilities as the more-experienced teachers (Marcelo, 1999).

Ray Bolam, an English author who has also dedicated years to studying the period of induction, defines it as “*the process of support and training that is increasingly deemed necessary for success in the first year of teaching. Politicians tend to be more interested in induction when there are problems of teacher recruitment, seeing it as the means to improve retention, encouraging novice teachers to remain in education. The professional tends to consider induction a bridging period between initial and permanent training, and therefore a period serving as basis of continuous professional development*” ((Bolam, 1995:613).

The period of professional induction is one of importance in the trajectory of the future teachers. Important because they have to make the transition from student to teacher, causing doubts and tensions, and must acquire an adequate knowledge and professional competence in a short period. In this first year, the teachers are novices, and in many cases even in their second and third year may still be struggling to establish their own personal and professional identity (Esteve Zaragaza, 1997).

The changes undergone by the teacher on passing from student to novice teacher, and from there to being expert or experienced, take place via a series of states “*that are normally seen as in some way irreversible*” (Burder, 1990:311). The factors leading to the change are, essentially, maturative ones in the individual, and of interaction between personal characteristics and the stimulation received from the environment.

Simon Veenman (1984) has popularized the concept of “*shock of reality*” to refer to the situation encountered by many teachers in their first year of practice. According to this Dutch author, the first year is charac-

terized as, in general, a period of intense learning — mostly by trial-and-error — and by a principle of survival and a predominance of the value of what is practical. Initiation programmes aim to establish strategies to reduce or redirect the so-called "crash with reality". Novice teachers face certain specific problems of their professional status. Valli (1992) suggested that the most-threatening problems for novices are the uncritical imitation of behaviour observed in other teachers; isolation from colleagues; difficulty in transferring the knowledge acquired in the training stage; and the development of a technical conception of teaching.

The process teachers follow for learning to teach, that is to acquire competence and skill as teachers, has been explained from various theoretical standpoints. One case may stress *teachers' concerns* as indicators of different stages of professional development. Another may conceive the teacher from an essentially *cognitive* standpoint, and learning to teach as a process of intellectual maturity. A final framework for analysis of the initiation process puts greater stress on the *social* and cultural elements of the teaching profession and on their assumption by the novice teacher.

This last approach treats the initiation period as a process by which new teachers learn and adopt the norms, values, behaviour, etc. that characterize the school culture into which they are integrating. Socialization is understood as "*the process by which an individual acquires the knowledge and social skills necessary for taking up a role in the organization*" (Van Maanen & Schein, 1979:211).

The period of initiation for teaching is the ritual that has to enable transmission of the teaching culture (knowledge, models, values, and symbols of the profession) to the novice teacher, the integration of the culture into the teacher's personality, and the adaptation of the novice teacher to the social environment in which teaching activity takes place. This adaptation can be easy when the nature of the socio-cultural environment coincides with that of the novice. However, it can be more strained when the novice has to integrate into cultures that are unknown prior to beginning to teach. Such is the case of novice teachers teaching in multicultural classrooms, about which they have had little information up to the moment of being sent to one.

### **What about teacher professional development?**

What conclusions can we draw from the reviews of programmes of professional development? One obvious result is that the traditional pattern in which continuous training is organized around discrete units of knowledge or skills, is given by experts, takes place outside the schools, and has a limited duration, with little follow-up and practical application, has no chance of changing teachers' beliefs or teaching habits. Joyce found that the probability of implanting changes following this model was 15% (Richardson and Placier, 2001). Shallow and fragmented are terms that critics commonly use to describe conventional approaches to professional development (Fenstermacher & Berliner, 1985). Ball and Cohen, referring to their own country, state that "*although a good deal of money is spent on staff development in the United States, most is spent on sessions and workshops that are often intellectually superficial, disconnected from deep issues of curriculum and learning, fragmented, and noncumulative. Rarely do inservices seem based on a curricular view of teacher learning*" (Ball & Cohen, 1999:4-5). In the Latin American context, Messina observes a few attention to the content in continuous teacher training, and authoritarian relationships in the classroom, citing the case of teachers who do not participate in either the design or the choice of such courses. She states that the course of improvement is a mechanism of pedagogical and social control that ignores the teacher's prior experience (Messina, 1999).

How then can we develop programmes that affect teachers by improving their teaching habits? Feiman (2001) summed up an idea that had already been taking shape in the work of other researchers and educators: the fact that teachers' learning has to come from practice. Teachers need to learn how to learn from practice, given that teaching requires improvisation, conjecture, experimentation, and evaluation. However,

learning by practice is not a casual process. Ball and Cohen (1999) established three conditions for expecting to learn from practical experience: a) teachers have to learn to fit their knowledge to the situation — which means investigating what students do and think, and how they understand what they have been taught; b) teachers must learn to use their knowledge to improve their practice; and c) teachers need to learn how to frame, guide, and review students' tasks. They say that *"the key to our response is that being focused on practice does not necessarily involve real-time classroom situations"* (14). That is, in order to learn, teachers need to use practical examples, materials such as case reports, multimedia cases, observations of teaching, teachers' diaries, and examples of students' tasks. These materials could enable teachers to investigate practice and analyze teaching.

Other researchers have attempted to summarize the features of those continuous training programmes that have been shown to be effective. Abdal-Haqq (1995) identified them as being progressive; they include training, practice, feedback — giving opportunities for individual reflection and group investigation on practice — and follow-up; they are school-based and involve the work of the teacher; they are co-operative, providing opportunities for teachers to interact with each other; they are focused on student learning, which should serve to evaluate the effectiveness of training; they stimulate and support teachers' initiative in the schools; they are based on the essential knowledge to be taught; they incorporate constructivist approaches to learning and teaching; they recognize teachers as professionals and adults who learn; and they provide adequate time and follow-up (Wilson & Berne, 1999).

There seems to be agreement on the need to realize that teachers have a great responsibility in responding to the new social demands generated by the changes mentioned in the first part of this report. Teachers are expected to respond to the need for changes in knowledge and learning; the need to develop skill in using the new technologies; the need to redirect their pedagogical approaches towards more-personalized teaching and learning; the need to adjust to the presence in class of students of different ages and level of cognitive development; the need to develop a different concept of authority and styles of classroom management; the need to contact other agencies and institutions that promote formal or informal learning (Chapman, 1996). Faced with these needs, it is necessary to seek new formulas more in accord with learning for change.

An outstanding contribution to professional development is that made by (Hawley & Valli, 1999). They have systematized the following set of six principles that should guide the practice of professional development:

- **Principle One: Goals and Student Performance:** Professional development should be driven by analyses of the differences between goals and standards for student learning and student performance. Such analyses will define what educators need—rather than want—to learn, make professional development student centred, and increase public confidence in the use of resources for professional development. This idea is also highlighted by (Sykes, 1999): *"First and most obvious, the teacher-student learning connection should serve as a criterion for selection of professional and school development activity"* (Sykes, 1999).
- **Principle Two: Teacher Involvement:** Professional development should involve learners (such as teachers) in the identification of what they need to learn and, when possible, in the development of the learning opportunity and the process to be used. This engagement increases educators' motivation and commitment to learn; affirms their strengths and enhances their sense of efficacy; empowers them to take instructional risks and assume new roles and responsibilities; increases the likelihood that what is learned will be meaningful and relevant to particular contexts and problems; improves instruction; and makes the school culture more collaborative and improvement oriented. If teachers are denied input in their own professional development, they are likely to become cynical and detached from school improvement efforts and to reject what they experience as imposition

- **Principle Three: School Based:** Professional development should be primarily school based and integral to school operations. This does not mean denying teachers access to out-of-school learning experiences through professional associations or net works, graduate study, or teacher centres. However, opportunities to learn in powerful ways are most often connected with the recognition of and solution to authentic and immediate problems.
- **Principle Four: Collaborative Problem Solving:** Professional development should provide learning opportunities that relate to individual needs but for the most part are organized around collaborative problem solving. Activities can vary from interdisciplinary teaming to curriculum development and critique to collaborative action research to study groups. In each case, educators working together to address issues of common concern facilitates the identification of both the causes and potential solutions to problems.
- **Principle Five: Continuous and Supported:** Professional development should be continuous and ongoing, involving follow up and support for further learning, including support from sources external to the school that can provide necessary resources and an outside perspective
- **Principle Six: Information Rich:** Professional development should incorporate evaluation of multiple sources of information on outcomes for students and processes that are involved in implementing the lessons learned through professional development. Teachers' knowledge and experience, as well as research studies and outside consultants, should be valued sources of information.
- **Principle Seven: Theoretical Understanding:** Professional development should provide opportunities to engage in developing a theoretical understanding of the knowledge and skills to be learned. Results of research, in comprehensible forms, need to be made accessible to teachers, who cite lack of understanding and limited access as reasons that they do not put theory into practice. New knowledge in itself does not effect change. Professional development must engage teachers' beliefs, experiences, and habits. Creating effective professional development opportunities means helping teachers (re)consider both their formal and their practical teaching knowledge. Such beliefs are difficult to change. Teachers must experience different types of learning themselves, spend time adapting their instruction, and see positive results in their students. However, since beliefs filter knowledge and guide behaviour, significant transformations of teaching practice are unlikely to occur if they are ignored.
- **Principle Eight: Part of a Comprehensive Change Process:** Professional development should be integrated with a comprehensive change process that deals with impediments to and facilitators of student learning.

Some of the foregoing principles have also been highlighted and qualified by other researchers in the field of teachers' professional development. One of the aspects stressed is the importance of co-operative work among teachers. Thus, Hargreaves (2003) calls for teachers to offer a new professionalism in order to be the catalysers of the knowledge society. This new professionalism would be typified by, among other aspects, working and learning in collegial teams. (Little, 2002) demonstrated that research spanning more than two decades points consistently to the potential educational benefit of vigorous collegial communities. Despite some caveats, that research has steadily converged on claims that professional community is an important contributor to instructional improvement and school reform. Researchers posit that conditions for improving teaching and learning are strengthened when teachers collectively question ineffective teaching routines, examine new conceptions of teaching and learning, find generative means to acknowledge and respond to difference and conflict, and engage actively in supporting professional growth.

## **V. IS THERE A GAP BETWEEN WHAT THE RESEARCH LITERATURE ABOUT TEACHER TRAINING AND TEACHING SKILLS IS SAYING, WHAT DEVELOPING COUNTRIES ARE ACTUALLY DOING IN TERMS OF TEACHER EDUCATION POLICIES, AND WHAT POLICY MAKERS AND OTHER KEY STAKEHOLDERS THINK IS IMPORTANT FOR THEIR COUNTRIES?**

The research literature that we have presented previously shows us that to learning to teach is a complex process which incorporates information, knowledge, representations and beliefs that come from different sources and experiences. The research literature is consistent when affirming that the initial teacher education has many difficulties to overcome the preconceptions and beliefs that the students bring when they begin their studies to become a teacher. Those beliefs and preconceptions are generic (on the teaching in general, the students, the classroom) as specific of the contents that become trained (scientific misconceptions).

To modify those preconceptions, as well as to form the teacher in an understanding domain of the matter that they will teach (especially in secondary education) a teacher education is required that integrates appropriately different types of knowledge that are generally presented separate.

The research has demonstrated the importance of the pedagogical content knowledge like the crucial, eminently professional element that characterizes the teaching. That type of knowledge is acquired when the teachers integrate the content to teach with the form of teaching it and assisting to the characteristics of the students. It is a type of knowledge that is generally missing in the curriculum of secondary teacher education. It has been understood with too much easiness that he who masters a given content can also teach it. For that reason we find like a very common practice in the organization of the curricula of the secondary teacher education the difference among scientific contents on one hand and pedagogical for another. The subject matter knowledge have bigger prestige that the pedagogic ones, that which is reflected in the quantity of time that are dedicated.

But it is being also a practice in some developing countries the tendency to the suppression or reduction of the duration of the initial teacher education attributed to the University or to specific institutions of training. The utilized argument that the teaching is a practical profession that should be learnt in the practice has contribute that to many developing countries incorporate to its classrooms teachers with low level in subject matter contents and without pedagogic formation. Nobody would hope a student learns medicine entering directly to a surgery. However, this case is given in the teaching.

The research on learning to teach shows clearly that the initial teacher education is necessary to contribute to develop in the future teacher a deep knowledge of the subject matter that they teach, as well as the conceptual tools for the transformation of that knowledge in pedagogical content knowledge to diverse students. But that initial teacher education should incorporate pedagogic components that contribute to an appropriate integration among the theoretical and applied knowledge.

To transfer the initial teacher education from the university to the schools supposes to increase the demands that these already have, as well as to reduce the learning to teach process to an outline of routine occupation that is learnt only through the observation and imitation of the master teacher.

The new competencies that we have identified previously require an appropriate integration among the teacher education institutions (being university or not) and the schools. Equally, the investigations have shown that a contextualized (situated) knowledge requires training scenarios around cases, simulations and problems that can be derived of the practical experiences of classroom.

But a change in the initial teacher education needs a special attention to the teacher trainers. What research has come showing is that the change toward a model according with the challenges of the knowledge soci-

ety requires of some teacher trainers committed with the enunciated competencies. The research has shown the persistence of the preservice teacher beliefs. But it has also shown the importance of the learning by observation and experience. In this sense the teacher trainers are “models” that the teachers observe and imitate when their behavior is coherent with its discourse. For that reason it is important that the pedagogical content knowledge concern and practice will be present in the practices of teacher trainers.

As Feiman-Nemser (2001) found in a recent review, separate courses taught by individual faculty in different departments rarely build on or connect to one another, nor do they add up as a coherent preparation for teaching. Initial training is organized with a classic division between conceptual and practical contents. This divide between theory and practice, however has left a critical gap unattended. Student teachers are often in the end most influenced by what they see their co-operating teachers do or by their own memories from school. The effect of teacher education is often small. Although they collect ideas, learn theories, and develop some strategies, beginning teachers often report that their knowledge was of little use or practicality (Lampert, 1999). This circumstance of initial teacher training has also been identified by Messina with respect to Latin America. That author suggested that in Latin America, training has remained trapped within traditional models of teaching and learning. On one hand, the training centres (and the educators of these centres) continue reproducing the traditional school culture, while the student teachers arrive with equally traditional school case histories (Messina, 1999).

However, as Berliner has shown, initial teacher training has a positive effect on the quality of teaching developed by the teachers. In a review of research on teacher training, Darling-Hammond and McLaughlin (1999) agree, showing that there is growing evidence that demonstrate that what teachers know has substantial influence on what students learn. *“Other research confirms that teacher knowledge of subject matter, student learning and development, and teaching methods, along with skills developed through expert guidance in clinical settings, are an important elements of teaching effectiveness. More than two hundred studies have found that teachers who have more background in their content areas and have greater knowledge of teaching and learning are more highly rated and more successful with students in fields ranging from early childhood and elementary education to mathematics, science, and vocational education. Not only does teacher education matter, but more teacher education appears to be better than less—particularly where it includes carefully planned, extended clinical experiences that are interwoven with course work on learning and teaching. Recent studies of redesigned teacher education programs offering a five-year course of study that includes a year-long internship find that their graduates are more successful and more likely to enter and remain in teaching than graduates of traditional undergraduate teacher education programs (Darling-Hammond & McLaughlin, 1999:377-378).*

With regard to teaching practice, the results of research on the practicum suggest that we seriously need to question this notion. The main theme emerging from this research on the practicum setting is the tension between teacher educators and pre-service teachers in their attempt to bridge the cultures of the school and the university. These tensions are fuelled by failed expectations of teacher educators and a sense among pre-service student teachers that they are poorly prepared for their work in school setting. However, some evidence suggests that certain of these problems can be alleviated when close collaboration exists between the players in student teaching (Wideen et al., 1998:152). Research documents also significant shifts in attitude among teacher candidates who work under close supervision in real classrooms with children. Whether that power enhances the quality of a teacher’s preparation seems to depend on the specific intent and characteristics of the field experience. Research shows that field experiences too often are disconnected from, or not well coordinated with, the university-based components of teacher education. Sometimes the field experiences are limited to mechanical aspects of teaching. Stereotypical views can shift when student teachers work in classrooms that enable this to happen. In field experiences with focused, well-structured activities, more significant learning can occur. And, finally, research shows that co-operating teachers have a powerful influence on the nature of the student teaching experience (McIntyre, Byrd, & Foxx, 1996; Wilson et al., 2001).



What must teachers know? Some answers have come from the research on teachers' knowledge that we have already referred to. Nevertheless, little research has been devoted to the overall programme of teacher training. There are many studies on specific elements of the programmes, in particular on teaching practice. These studies generally do not describe and analyze the components of teaching practice in the training institutions, nor the task of the trainers. It is an almost accepted fact that training programmes face difficulty in altering the beliefs that students bring with them when joining a training programme (Richardson and Placier, 2001). Feiman, who has spent a whole lifetime studying teacher training, concludes a review with the following words: "*traditional programmes of initial teacher training and of professional development are not designed to promote complex learning in either the teachers or the students. The typical initial training programme is very weak compared with the influence on pre-service teachers of their schooling and of practical experiences*" (2001:1014).

Darling-Hammond and MacDonald (2000) have analyzed seven North American teacher-training programmes considered to be effective. Their comparative analysis revealed certain identifying elements:

- *Conceptual coherence*: conceptual coherence is the most important element in an initial teacher training programme. It provides a guiding view about the type of teacher being trained, a view of learning, of the role of the teacher and the school, and includes the values and beliefs that later will later be seen in the curriculum and in the learning opportunities for the students during practice.
- *Integrated teaching practice with a purpose*: Coherence in the segment of teaching practice is essential: observations, orientation, guided practice, application of knowledge and investigation are important elements. In the programmes studied by Darling-Hammond and MacDonald, the practice is organized to promote reflection and theoretical learning, using diaries, tasks, weekly seminars, etc. Care is taken for multiple localizations of students during practice. All students work with supervising teachers who have completed special university courses, including mentoring and evaluation.
- *Attention to teachers as subjects who learn*: The goal of the teacher-training programme is that teachers learn. The teachers exert themselves because the students continue learning through support given to their new ideas, and the sharing of ideas and knowledge. Recognition of the student as a subject who learns begins with the recognition that pre-service teachers arrive with beliefs and images that have to be transformed.

How can we make initial teacher training a good launching pad for lifelong learning? This is one of the concerns of educators and researchers who continue believing in the importance of training. We could ask ourselves, as does Gees-Newton: *so what types of content courses should teachers take in order to gain such knowledge? As echoed by many of the authors included in this review, the issue is not the number of courses or their titles, but the manner in which these courses are taught. Most university courses can be characterized as factually-based, an instructional emphasis that has been shown to decrease attempts to gain more conceptual understandings. In addition, seat time in any classroom fosters the explicit learning of content as well as implicit information about the nature of the discipline, and assumptions about the teaching and learning of that discipline. Therefore, what is needed is a change in the nature of the teaching of content courses* (Gess-Newsome, 2003a:84).

The change being demanded in the content and methods of the initial teacher training requires greater involvement of and integration between the various types of knowledge needed for learning to teach. A curriculum grounded in the tasks, questions and problems of practice, collecting concrete records and artifacts of teaching and learning that teachers could use; promoting collective professional inquiry (Ball & Cohen, 1999). It is therefore about guiding teacher education around the investigation of the practices of teaching and learning, rather than to centre it solely on the provision of knowledge and skills to be applied in practice

(Lampert, 1999). These are proposals that incorporate a constructivist conception on the part of the teacher. For example, Borko and Putnam (1996) proposed:

1. Addressing teachers' pre-existing knowledge and beliefs about teaching, learning, and subject matter: because the knowledge and beliefs that prospective teachers bring to their teacher education programs exert such a powerful influence on what and how they learn about teaching, programs that hope to help novice think and teach in new ways must challenge participants' pre-existing beliefs about teaching, learning, subject matter, self as teacher, and learning to teach.
2. Providing teachers with sustained opportunities to deepen and expand their knowledge of subject matter: novice must have the opportunity to strengthen their subject matter knowledge and pedagogical content knowledge throughout the teacher education experience. Learning to teach a subject well entails learning the discipline's different ways of knowing, as well as integrating new information into one's existing knowledge systems.
3. Treating teachers as learners in a manner consistent with the program's vision of how teachers should treat students as learners
4. Grounding teachers' learning and reflection in classroom practice
5. Offering ample time and support for reflection, collaboration, and continued learning.

However, as demonstrated by Windschitl (2002), "*implementing constructivist instruction has proved even more difficult than many in education realize. The most profound challenges for teachers are not associated merely with acquiring new skills but making personal sense of constructivism as a basis for instruction, re-orientating the cultures of classroom to be consonant with the constructivist philosophy, and dealing with the pervasive educational conservatism that works against efforts to teach for understanding*" (131). Profound changes are therefore needed in the methods, in the processes of teaching and of acquisition of knowledge by the trainee teachers.

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