THE INTEGRATION OF EDUCATIONAL TECHNOLOGY AS AN ALTERNATIVE FOR BROADENING THE COVERAGE OF HIGHER EDUCATION

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Abstract:

Given the insufficient coverage of institutions of higher learning in Mexico, the article proposes organizing the course content in a model by separating tacit knowledge, inherent to the classroom, from explicit knowledge, which may occur through technology. The study attempts to estimate the classroom hours that would be freed if explicit knowledge were delegated to technology, and the classroom were used to transmit tacit knowledge. For this reason, the study was carried out in three institutions of higher learning. The results indicate that classroom capacity can be increased by 60%, and the attention given to students by 120%. The possibility of additional space and time is discussed, as well as a simplistic use of the results, which could deteriorate learning. With an increase in classroom capacity, the freed time would be used for follow-up, tutoring and the design of learning experiences.

Key words: educational technology, higher education, educational coverage, educational strategies.

Introduction

In the past three decades, Mexico's higher education has experienced growing student demand, mainly by the middle- and low-income sectors of society. For this reason, institutions of higher learning are permanently pressured to increase their capacity for attending to students.

The National Plan of Education 2001-2006 recognizes coverage as one of the most serious problems faced by institutions of higher learning, principally in poverty-stricken undeveloped zones. In this respect, the federal government has assumed the commitment of "progressing in the attainment of educational equity and encouraging the broadening of coverage in zones and regions with little attention" (SEP, 2001:184). The response of institutions of higher learning to this demand has been in the form of four alternatives, which are not mutually exclusive: *a)* construction of more classrooms; *b)* hiring of more teachers, usually by the hour to prevent long-term labor commitments; *c)* increasing the academic load of teachers, by assigning them more subjects or groups; and *d)* a larger number of students per group, with the problems inherent to follow-up and the resulting deterioration of the teaching/learning process.

As an additional alternative to the solution to these problem, information and communication technologies (ICT) have been added, mainly in order to improve the teaching/learning processes, and to a lesser degree, to broaden coverage. The benefits of these technologies in the field of higher education have been widely disseminated by international and national organizations (Organization for Economic Cooperation and Development, 1996; UNESCO, 1998; ANUIES, 2000; World Bank, 2002). Although institutions of higher learning have carried out extensive research in technological infrastructure, the process of integrating technology into teaching/learning dynamics has experienced differentiated growth; in some cases, progress has been almost null. One of the reasons for this unequal, hazardous development has been teachers' lack of knowledge about the efficient educational use of technology as well as the lack of interest in sensible, realistic planning by the corresponding educational authorities.

The unmet promise of technological magic of the 1960s for technologically developed countries (specifically, computers as the solution to educational concerns), seems to have been repeated in developing nations in the 1980s and 1990s. This second wave of technology with educational purposes coincided with the lowered prices of computers. Easy access to computers revived the old illusion that investment in technology was equivalent to buying a solution to age-old educational problems (Rukeyser, 1998; Seltz, 1999). History repeats and will continue to repeat itself as long as we are not aware that technology alone is not the solution (Horton and Horton, 2003; Horton, 2000; Anderson and Elloumi, 2004; Bates and Poole, 2003). Problems of quality, fairness, and coverage cannot be solved solely with technology, regardless of its degree of advancement.

This reality of traditional practices in high-technology settings creates a paradox: most schools function practically the same as thirty, sixty or one hundred twenty years ago, and can be catalogued as institutions from the industrial revolution, with underutilized elements from the knowledge age (Clegg, 2004). Reference to traditional practices does not imply, as Bates and Poole (2003) would state, that such practices are necessarily mistaken, and that modernity for the sake of modernity, is the best. What such references wish to emphasize is that technological development has not kept up with our pedagogical progress (McAnally-Salas, 2005).

In spite of numerous proposals and educational alternatives for improving learning processes, as suggested in abundant literature on the topic, their adoption and incorporation into teaching practice would seem to be minimal or inexistent. The impression given is that such practices are acquired through tradition and individual experience: we teach as we were taught, and the appropriation of teaching is more a product of improvisation than conscious, critical incorporation (McAnally-Salas *et al.*, 2004).

Increasingly common in academic discourse and debate are concepts such as paradigms centered on teaching or learning; the industrial age and the information age; individual learning and communities of learning; management of knowledge, and so on. All these concepts have important implications for traditional teaching practice; however, they are not understood in their totality. For the topic of this article, it is sufficient to say that the essence of such concepts implies processes of change and innovation made more powerful by the mediation of information and communication technologies (ICT). In this scenario, still unresolved is the discussion on the possibilities offered by ICT for making teaching and learning processes more efficient, as well as broadening attention and coverage. According to this logic, the proposal attempts to contribute knowledge on incorporation of ICT to teaching strategies, to make teaching processes more efficient.

Theoretical Referent

The confluence of technology and teaching strategies should not be left to chance because the coherence and integration of their parts increase the probabilities of student learning (Reigeluth, 1983). During the educational design of courses, the selection of teaching strategy has determining repercussions on course dynamics. This article will address only the application of a model proposed by Fink (2003), which is compatible with most teaching strategies suggested in constructivist approaches to learning, as well as the integration of educational technology.

In this article, teaching strategy is understood as a particular combination of learning activities in a particular sequence (Fink, 2003:130). Educational technology includes all communication with the student, other than direct face-to-face contact or personal contact (Bates and Poole, 2003:5).

Castle-top Model

Selected for this study was the castle-top or merloned model (merlons are the battlements on top of the walls of ancient fortresses) developed by Dee Fink (2003), based on the postulate by Walvood and Anderson (1998:53-55) that all teachers face two tasks: *1)* that their students learn the course content, and *2)* that they learn to use this content in some manner. The main issue, according to these authors, is that teachers spend the greater part of class time entangled in the first task, while allowing little time for the second: teaching the significant use of knowledge.

Based on the above, Fink (2003) proposes a castle-top model for organizing courses. The proposal consists of separating classroom activities from non-classroom activities. The model can be represented as in Figure 1. Classroom activities occupy the shaded rectangles, and non-classroom activities the white rectangles.

Figure 1

Castle-top Diagram as Model for Teaching Strategy (modified by Fink, 2003).

By using this model, Fink (2003) attempts to optimize the time dedicated to instruction, while leaving homework and other tasks the students can complete on their own, without the teacher's support, as non-classroom activities. According to this model, non-classroom activities are an integral and systematic part of the design: since they are not isolated events, greater student participation and responsibility are implied. Therefore, the model is compatible with teaching strategies centered on students and the learning so desired for education in the 21st century. Such teaching strategies include: learner-centered teaching (Weimer, 2002); transformative learning (Cranton, 1994); learning with cases (Mauffette-Leenders, Erskine and Leenders, 2001); collaborative learning (Bruffee, 1993), and problem-based learning (Boud and Feletti, 1997; Savin-Baden, 2000).

Technology in Educational Processes

According to Bates and Poole (2003), educational technology, like all components of an integrated system, requires the appropriate use of tools and equipment to achieve its ends. As a result of this definition, the following elements must be included: *a)* tools and equipment currently used to support teaching, like computers, software, networks, slide projectors, overhead projectors, video, audio, television, and so on; *b)* the necessary skills for developing or using tools and equipment efficiently, such as writing, programming, and producing; *c)* an understanding of teaching and learning processes and the way educational tools and equipment are selected and used appropriately to support this process; *d)* the human support necessary for making more effective use of tools and equipment, including technical personnel, educational designers, and web programmers, as well as expert teachers in content; and *e)* the organization required for allowing tools and equipment to be developed and used appropriately (Bates and Poole, 2003:5-6).

Out of the wide variety of technology available for educational ends, computers have long been recognized as excellent tools for transmitting content and instruction: they can repeat topics, indications, presentations or explanations as many times as necessary. The possibility of incorporating color, audio, video, animations and multimedia in general permits enriching interaction with contents, improving comprehension, encouraging motivation, as well as broadening the perception and acceptance of learners. Based on these considerations, computers have become one of the most important tools for acquiring declarative or explicit knowledge.

In addition to the advantages indicated, using technological media to present and distribute content involves a compression factor; i.e., the required time is reduced. This reduction is explained by Belanger and Jordan (2000), who assume a process of design of materials, due to two factors: *a)* during educational design, the selection of materials reduces waste and eliminates the normal processes of socialization in face-to-face sessions before and after class; and *b)* a more accelerated pace of learning, due to the multi-sensorial alternatives of content, under a more holistic approach to the learning process. The use of compression factors permits calculating *compressed hours;* i.e., the real time in which content can be presented by using technological media.

Types of Knowledge and the Mediation of Technology

Independent from the teaching strategy used, we can classify knowledge as explicit and tacit (Nonaka and Takeuchi, 1995). According to Lam (2000), the fundamental differences between the two types of knowledge correspond to three aspects: *a)* the possibility of their codification and the mechanisms for their transferal, i.e., the complexities underlying their graphic representation and distribution; *b)* the methods for acquiring and accumulating this knowledge; and *c)* the potential of aggregation and modes of appropriation.

With regard to the first aspect, while explicit knowledge is easily codified and transferred, tacit knowledge is intuitive, disarticulated, and oriented to action. Because of the personal qualities that hinder its codification, its formalization and communication are difficult. This knowledge is represented by mental models like schemes, paradigms, perspectives, thoughts and viewpoints that help individuals to perceive and define their world. On the other hand, the technical element of tacit knowledge includes concrete knowledge, and skills relative to a certain art and trade. The key for innovation is the mobilization of the mental schemes in processes that generate new knowledge. Tacit knowledge is created here and now in a specific, pragmatic context; sharing this knowledge among individuals requires a type of simultaneous processing of the complexities of the topics (Nonaka and Takeuchi, 1995).

Regarding the second aspect, explicit knowledge can be generated through logical deduction and acquired through formal study, while tacit knowledge can be acquired only through personal experience in a relevant context. In this manner, the freeing of time dedicated to explaining the content of subjects, can create a space for manipulating, applying and recuperating knowledge beyond simple content.

In terms of the third aspect, explicit knowledge can be aggregated in a specific location, stored in objective forms, and appropriated without the participation of the knowledgeable individual. Tacit knowledge, in contrast, is contextual and personal; it is distributed and cannot be easily aggregated; utilizing it in its entirety requires the involvement and cooperation of the knowledgeable individual. Up to the present time, technology has served as an excellent means for communicating, transferring and recuperating codified and stored knowledge; the challenge, however, consists of creating mechanisms and strategies of virtual teaching that can be retransmitted in real time, through which individuals can enrich their tacit knowledge.

This article assumes that the incorporation of educational technologies for explaining explicit content allows students to acquire this content outside of the classroom, on their own time and at their own convenience, thus leaving classroom time for the face-to-face, personalized, and group interaction that is essential for acquiring tacit knowledge. On the other hand, simulated models can be designed through technological media that students use to situate themselves in a virtual setting where they can interact, manipulate, exchange and model essential practices for developing the knowledge and experience that produce tacit knowledge (Schön, 1987).

These differences are relevant for the efficient utilization of teaching strategies and for the integration of technologies in course design.

Objective

Taking into account the recommendations made by ANUIES (2000) and SEP (2001) to increase educational coverage and encourage flexible education centered on the student and on learning, this article seeks to use a model for organizing course activities which integrates educational technology and considers explicit knowledge in order to decrease requirements for classroom time and optimize the time focused on students.

Method

In order to exemplify, in the context of Mexico's institutions of higher learning, the effect of integrating the three key components—the castle-top model, educational technology, and the type of desired knowledge—an estimate was made, in three public universities, of the time professors dedicate to explaining course content in the classroom. To make the estimate, an exploratory study was carried out on professor perceptions at the autonomous universities of the states of Nayarit and Baja California, as well as the Durango branch of Pedagógica Nacional. The intention of that study is to exemplify, not represent. Through personal contact and E-mail, professors were asked to make an estimate of the amount of classroom time dedicated exclusively to explaining the content of their subject(s), without considering workshops or laboratories. They were also asked not to include in their estimate the amount of time dedicated to questions and answers or any type of classroom interaction. Some professors preferred, however, to ignore the second request, and offered a global estimate. The subjects taught were grouped into three major areas of knowledge: natural and exact sciences; social and political sciences; and technology and engineering.

Based on the estimated percentage of average explanatory time reported by the professors, the number of hours of explanation of content (*HEC*) was calculated for a hypothetical course of ten hours that followed the castle-top model by applying teaching strategies that integrate educational technologies for developing explicit course content. The *HEC* were transformed into compressed hours (*CH*) according to the proposal by Belanger and Jordan (2000). The following formula was used to calculate compressed hours:

$$H_{EC} - [H_{EC} \times CF] = CH$$

where H_{EC} represents the hours of explanation of content, *FC* is the compression factor and *CH,* the compressed hours.

The compression factor of media was taken from these same authors, who considered, among others: computer-based training (CBT); web-based training (WBT); television-training by video (TEV); and teleconferences (TC) (Chart 1). These compression factors assume that the media's potential as educational technology is taken advantage of during content design (Bates and Poole, 2003; Belanger and Jordan, 2000).

The difference among compression factors is due primarily to two factors: *a)* the level of interaction with the means of distribution and user, and *b)* the incorporation of multimedia in content design. Thus the use of videotapes and television training by video has a relatively low compression factor (20%) because of null interaction with the media and the limited variety of multimedia uses. Teleconferences increase their compression factor by 5% by incorporating interaction between the student and the distant professor, and the greatest compression values (35%) correspond to media that by nature incorporate multimedia and high levels of interaction.

CHART 1

Rate of Compression of Media (modified by Belanger et al., 2000)

Media of Distribution	**Compression Factor (%)**
Computer-based training (CBT)	35
Web-based training (WBT)	35
Teleconferences (TC)	25
Television training by video (TEV)	20
Videotapes	20

Results

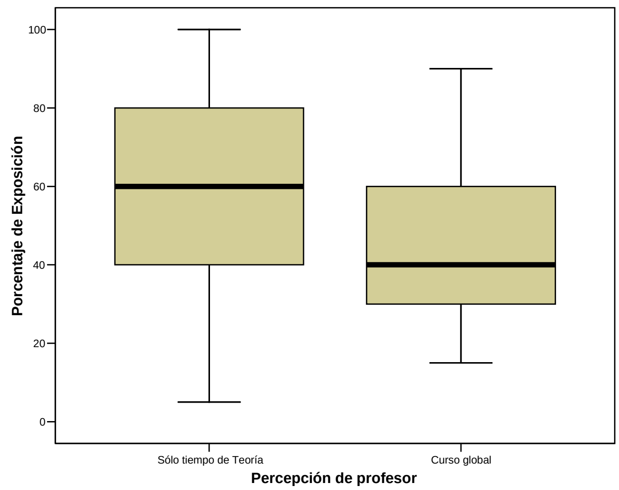
Information was obtained from 161 courses: 60 in the natural and exact sciences, 63 in the social and political sciences, and 38 in technology and engineering. The professor's perception of explanatory time—excluding workshops and laboratories (EEWL)—was obtained for 42 courses, global estimates (GE) were obtained for 119.

Professors' Consideration

The median of the estimated percentages of explanation time was 60% and 40% for EEWL and GE, respectively. As expected, the analysis of medians of Mann-Whitney and Wilcoxon showed significant differences (p = 0.002) between EEWL and GE; therefore, the analyses are carried out separately (graph 1).

GRAPH 1

Graphs of Median, Quartiles and Extreme Values of the Estimates of EEWL and GE



Excluding Workshops and Laboratories (EEWL)

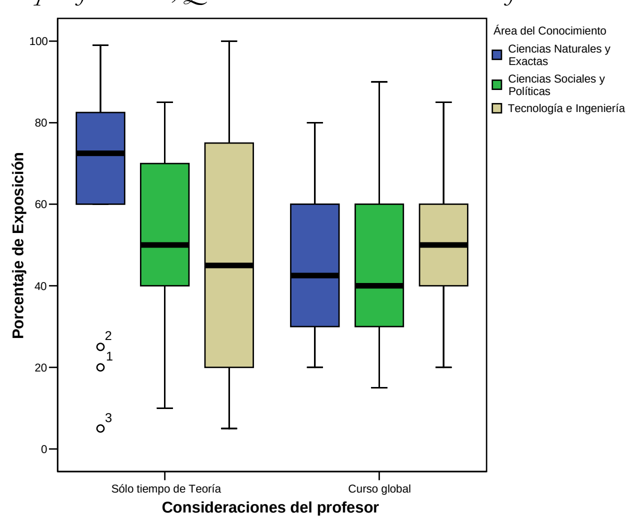
The comparative analysis of medians indicates that no significant difference exists among the three areas of knowledge. The numbers corresponding to the natural and exact sciences, social and political sciences, and technology and engineering are 72.50, 50 and 45, respectively, with a general median of 60%. As shown in Graph 2, although there are no significant differences among the areas of knowledge, the quartiles and the median reveal a tendency of lower percentages of explanatory time in technology and engineering. The same graph also shows the dispersion of estimates in technology and engineering, from 5% to 100 percent.

Global Estimates (GE)

The analysis of medians did not show significant differences among areas of knowledge. The numbers corresponding to natural and exact sciences, social and political science, and technology and engineering are 42.50, 40 and 50, respectively, with a general median of 40% (Graph 2).

GRAPH 2

Graph of Median, Quartiles and Extreme Values for EEWL AND GE, by Area of Knowledge



Compressed Hours (CH)

The medians for EEWL and GE are 60% and 40%, which correspond to 36 and 24 minutes/hour, respectively. The above is equivalent to six and four hours of explanation of content *(HEC)* in a course of ten hours. In this case, the value of *HEC* is equivalent to the freed hours/classroom; i.e., to the time dedicated to explaining contents that can be offered outside of the classroom by using technology. Without greater consideration, from four to six hours out of every ten hours of explicit content would be freed.

In addition to the above, the efficient use of technology permits increasing the freed hours/classroom, due to the previously mentioned compression factors. Chart 2 shows the compressed hours for comprehension factors of 20, 25, 30 and 35 percent.

Chart 2 offers an example of a course programmed for ten hours of explanation of explicit knowledge in the classroom. With a value of *HEC* = 6, without calculating the compressed hours, the freed time/classroom will be six hours, leaving four hours for the transfer of explicit knowledge in the classroom from professor(s) to students.

CHART 2

Compressed Hours for H_{EC} *= 4 and 6, with Diverse Compression Factors for a Course of 10 Hours of Explanation*

	Compression Factor			
H_{EC}	20%	25%	30%	35%
4	3.2	3	2.8	2.6
6	4.8	4.5	4.2	3.9

The calculation of compressed hours (CH) shows that if the contents are designed for distribution by internet or multimedia (compression factors of 35%), it is possible to program only 3:54 hours (3.9) for the same explicit contents. This is equivalent to decreasing the time programmed for contents by 6:06 hours, or to adding the free additional hours (2:06 hours in this case) for the transmission of tacit knowledge (Chart 3).

CHART 3

For a Course of 10 Hours of Explicit Content, the HC and Free Additional Hours (FAH) are Shown for the Explanation of Contents H_{EC} *= 4 and 6**

Media of Distribution	**FC**	**HC= 4**	**HAL**	**HC= 6**	**HAL**
CBT	0.35	2:36	1:24	3:54	2:06
WBT	0.35	2:36	1:24	3:54	2:06
TC	*0.25*	*3:00*	*1:00*	*4:30*	*1:30*
TEV	0.20	3:20	0:40	4:48	1:12
Videotapes	0.20	3:20	0:40	4:48	1:12
*Different media of distribution were considered: CBT, WBT, TEV, TC and videotapes.					

Implications of CH Excluding Workshops and Laboratories (EEWL)

Taking into consideration the teachers' estimates, and deducting the workshop and laboratory times, classroom capacity can be increased by 60%, equivalent to an increase of 120% in the possibility of giving attention to students.

With the technologies of lower compression factors like televised training with video and videotapes, which have a compression factor of 20% (0.20), a course programmed for the same ten hours of instruction requires only 4:48 hours, leaving 5:12 hours available for other activities. On the other hand, programming ten hours of explicit contents with a compression factor of 20% is equivalent to covering 108% of additional content (Chart 4).

Considering technologies with greater compression factors like teleconferences, 25% (0.25), the hours necessary for covering programmed content decrease from ten to 4:30 hours, leaving 5:30 hours for other activities. If this time is dedicated to explicit contents, 122% more coverage can be added.

As expected, considering the same programmed course of explicit knowledge, but incorporating educational technologies like CBT; computer aided instruction (CAI) or WBT, with a compression factor of 35% (0.35), the hours necessary for covering contents decrease even further. Thus only 3:54 hours would be needed, leaving 6:06 hours available for other activities or for covering an additional 156% of content (Chart 4).

CHART 4

*Hours and Percentage Available for Additional Activities for Explanation of Contents H_{EC} = 6, Based on Different Compression Factors**

Compression Factor	CH= 6 (minutes)	Hours Available (minutes)	Additional Percentage
0.35	3:54 (234)	6:06 (366)	156
0.25	4:30 (270)	5:30 (330)	122
0.20	4:48 (288)	5:12 (312)	108
*HC = 6 is the number compressed hours for a course programmed for ten hours of explanation of explicit contents.			

Implications of CH Values for Global Estimates (GE)

In the case of teachers' estimates that do not deduct workshops and laboratories, we cannot calculate precisely the freed hours/classroom because the estimates consider activities outside of the classroom like workshops and laboratories. What we can calculate, taking into consideration that the explanations and examples the teacher gives his students are based on his tacit experience, is the time that is dedicated and potentially could be dedicated to transmitting tacit knowledge.

Thus the time dedicated to explicit knowledge is 40%, and to tacit knowledge, 60%. Note that in this case we cannot refer to hours available for a course of ten hours dedicated exclusively to the transmission of explicit knowledge, since the teachers' estimates also include time dedicated to the transfer of tacit knowledge.

With these considerations, we see that by using educational technology with a lower compression factor, 20% (0.2) of TVE, out of the four hours dedicated in a course of ten hours, including laboratories and workshop, only 3:20 hours are required. Thus 40 additional minutes can be assigned to incorporating activities to transmit tacit knowledge, or to covering a greater amount of explicit knowledge, equivalent to an additional 20%

(Chart 5). The chart shows that the use of technologies with a higher compression factor gives 1:24 additional hours or increases the coverage of contents by 88%.

CHART 5
*Hours Necessary (HC = 4) for Covering the Content of 4 Hours of Explanation of Explicit Content**

Compression Factor	CH= 4 (minutes)	Hours Available (minutes)	Percentage (Additional)
0.35	2:36 (96)	1:24 (84)	88
0.25	3:00 (180)	1:00 (60)	33
0.20	3:20 (200)	0:40 (40)	20
Use was made of technologies with diverse compression factors, available time and additional percentage, as a consequence of the use of educational technologies.			

Discussion

It is difficult to imagine that a simple change in the instruction model and teaching strategies could free from 40% to 60% of the time currently used in the classroom. Such an approach could certainly be described as simplistic if we did not take into consideration that teaching/learning processes are multidimensional, and that a balanced solution will permit decreasing pressure by covering demand and reducing the academic overload of today's professors, assuming that additional hiring does not take place.

A balanced solution must consider the advantages and risks (temptations) of having an "additional" 60% in classroom capacity and teachers' time.

Using classroom time more efficiently, for strictly indispensable needs, allows more space—which can result in substantial savings for the institution. No further investment is required for attending to 60% more students. This percentage could decrease to 30%, if we consider that many institutions of higher learning currently have oversized groups of 40 to 60 students per classroom. The availability of classroom space could be taken advantage of to decrease student density to between 20 and 30 students per classroom, by hiring more teachers. The result would be a learning process with greater follow-up, better evaluations and tutoring. By following this same line of reasoning, we discover a strong temptation among the authorities of institutions of higher learning, to use a simplistic approach of broadening their coverage by 60% by accepting 60% more students, with the same student density per classrooms and the same teachers: in other words, *more with the same*.

It is very important to reiterate that freeing teachers from explaining explicit content in the classroom does not imply that they should be loaded with 60% more work (given that they will be free while their students acquire explicit knowledge through educational technology). As mentioned, free time will be necessary for follow-up, tutoring, and the design of learning experiences. With no fear of being mistaken, we can state that all teachers miss *the time for doing well what we know we must do*.

The effect of compressed hours in a subject, on the distribution between hours of theory and hours of practice, can be utilized by curriculum designers in two ways: available hours can be added to practical activities and used to attain greater coverage of explicit content; or content can be taught in further depth. Or the two possibilities can be combined.

A requirement for using the castle-top model to organize course activities is that teachers must understand the essential difference between explicit and tacit knowledge.

Not only must this difference be conceptually clear in teachers' minds: it must be expressed in writing and coherently articulated. It is precisely this difference that allows us to use educational technology, with no risk for student education. However, because of the nature of explanatory practice, which is often separate and disarticulated from workshops and laboratories, the teacher finds it difficult to integrate explicit and tacit knowledge.

It is clear that this differentiation of knowledge is fundamental for implementing any teaching strategy, especially of a constructivist type. Separating the types of knowledge that are included in a subject is facilitated by using models of instruction like that proposed by Marzano and team (1988; 1992), which make a distinction between simple and complex mental processes. Simple mental processes are often related to explicit knowledge, such as concepts, facts, episodes, principles, and so on, while tacit knowledge is related to the knowledge of procedures. The interaction between explicit and tacit knowledge involves complex mental processes, such as decision-making, problem-solving, research, and system analysis (Marzano *et al.,* 1988; Marzano, 1992; Reich, 1992; Wiggins and McTighe, 1998; Lam, 2000).

The adoption of the castle-top model, with the characteristics indicated here, at first may seem simple; however, its successful implementation would not be feasible without institutional commitment to permit its application in the diverse contexts of Mexico's institutions of higher learning. We must not lose sight of the underlying assumption of compression rates for the differing media of distribution: that contents are designed and produced by using the media's potential and considering the desired goals of learning. It is not sufficient to use content that is "uploaded" on a web server without any educational treatment and announce that web-based training is being used, while expecting a compression rate of 35%. Identifying, defining, designing and producing explicit contents are not easy tasks, and cannot be the sole responsibility of the teacher. Neither can these tasks be carried out by succumbing to one of the most common and attractive temptations: ordering them by decree. Since each institution of higher learning has its own, delimitating context, appropriate solutions for all cannot be ventured. Nonetheless, some premises exist for making helpful suggestions.

Believing that all teachers must be experts in educational design and technology is an expectation easy to reject. We must look around us. Teachers are experts in content: they are hired as experts in their field. Some teachers have a profile that allows them to become involved in innovative strategies—the lone rangers, in the words of Tony Bates (1997), or innovative teachers according to Everett Rogers (1995). This group is 2.5% of the social structure of teachers. But these innovators cannot be assigned the task and responsibility of implementing innovations. Institutional viewpoint and commitment are necessary, ideally in an attempt to create an organization that learns from accumulated knowledge and incremental innovations (Lam, 2000).

If we assume that common teachers are only experts in content, then the institution must search for an institutional mechanism to support teachers in transferring the explicit knowledge of their subjects to some form of educational technology. Yet teachers will also need support to design learning experiences that facilitate the transfer of their tacit knowledge to students. It is not sufficient to support them only in "what": they must also be supported in "how".

The additional advantage of entering into this process is precisely the obligatory reflection of teaching practice and the structuring of significant learning experiences with processes of dialogue, and with lasting professional challenges that are significant for teachers' professional lives (Fink, 2003). The potential is real. What we are able to achieve is a matter of personal and institutional decision.

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