

ONLINE COURSE INSTRUCTIONAL DESIGN FROM THE PROFESSORS' PEDAGOGIC KNOWLEDGE AND TECHNOLOGICAL SKILLS

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Abstract

The educational design of seven on-line courses was analyzed with the aim to relate the professors' pedagogic knowledge and technological abilities with the course design. The courses already imparted where analyzed in the LMS where they were designed (Virtual U, Moodle and Virtual UABC). Assessments were carried out to evaluate the quality of the designs, also semi structured interviews and questionnaires were done to determine the professors' knowledge and perceived abilities. The professors were selected looking to cover all the possible combinations among high (T) and low (t) technological abilities and high (P) and low (p) pedagogic knowledge. Seven courses were selected; two with professors who had high technological abilities and high pedagogical knowledge (TP); two with professors with high technological abilities and low pedagogical knowledge (Tp); two with professors with low technological abilities and high pedagogical knowledge (tP); and finally one with low technological abilities and low pedagogical knowledge (tp). The analysis showed no relationship between the coherence and structure of the course design with the professors' technological abilities and pedagogical knowledge. Analysis of the interviews suggests that the most important element for a coherent and well structured educational course design is the professor's interpersonal relationships and the informal fellowship communications with experience in on-line education.

Key words: *online education, technological skills, pedagogical knowledge.*

Introduction

The growth and development of the online education, among other things, is due to the ongoing technological development applied to the Information and Communication Technologies (ICT), hence it is not surprising its ability to integrate the latest technological innovations to its repertoire, thereby increasing their possible applications in teaching and learning settings. Inherent in its origin, are the possibilities to virtually incorporate any kind of multimedia, simulations, and synchronous and asynchronous communication.

Authors such as Harasim, Hiltz, Teles and Turoff (1995), have developed models that were incorporated into distance education programs, learning networks, virtual classrooms or online education, which have the potential to reduce, or eliminate, the feelings of isolation and loneliness expressed traditionally by students in this modality. In education, the Internet ubiquity not only expanded the options for distance education programs, but also gives alternatives to traditional educative programs to incorporate these ICT in the everyday practices. In this convergence, between technology and face to face teaching,

the web provides important support tools for better learning in traditional settings (Mahony & Wozniak, 2005). Is in this context where mixed or blended models have their niche, where face to face session are interspersed with periods where the educational process is mediated by technology (Belanger & Jordan, 2000; W. Horton & K. Horton, 2003).

Online education as increased over time, since 2003 the Sloan Foundation has reported increased numbers of students enrolled in online education in the USA. By 2009 *over 2.6 million students were taking at least one online course during the fall 2008 term; a 17 percent increase over the number reported the previous year* (Allen & Seaman, 2010, p. 5). Also Allen and Seaman (2010) report that the chief academic officers in 74 percent of public institutions believe online education is critical to their long-term strategy. Online education has become so important that institutions contingency plans for H1N1 virus propose *that moving face-to-face classes online could become an important component of academic continuity planning* (Ibid., 6). These strategies have been implemented not only in USA, in 2009, similar strategy was implemented in the University Autonomous of Baja California (UABC), México.

Technological Abilities and LMS

Although is common knowledge that the adoption of new educational modalities depends largely on the contextual variables of the institution, for teachers and for Higher Education Institutions, foray into online education has become something seemingly simple thanks to the development and availability of Learning Management Systems (LMS). These systems proclaim, as an advantage, that its use is so simple that a teacher can use it with a minimum of training and effort. On the other hand, it notes that this simplicity, that gives the ease to “upload” to the LMS the course contents, could become a great disadvantage because it can create the illusion that the transfer of the course content to a web server, by that fact alone, creates an online course. Usually that content is designed for courses meant to be conducted face to face (Elgort, 2005; Phillips, 2005).

Even so, it is possible to say that with the proliferation of these options to offer online courses, the requirement that teachers were experts in the use of the educational technologies has been almost eliminated, leaving the technological basic problem practically resolved. However, this does not imply that the ease of use ensures the efficient and effective use of all the choices offered by this array of LMS, nor its proper application to promote learning. However, the inherent technological component of a course mediated by technology, would lead us to think that teachers with higher technological skills would tend to make a more efficient use of the options than the teachers with less technological skills.

In the Universidad Autónoma de Baja California, México (UABC), several LMS have been used since 1999, from commercial platforms like Virtual-U and Blackboard, locally developed as UABC-Virtual, to open source systems like Moodle. Because de lack of institutional support some of them as been abandoned, and actually only Moodle and Blackboard are used.

Pedagogical Knowledge and Beliefs

Nowadays, although it is true that the technology issue is practically resolved, at least in part, by the use of LMS, what the teachers do with these technologies to design its course corresponds more to the scope of their pedagogical knowledge and beliefs.

It is known that although teachers can identify the main Theories of Learning, it is not surprising that many are unaware of the core theories of educational design and of the need to design their courses to achieve the desired learning. For Pozo (Pozo, 2001), when teachers are facing situations relatively new or feel pressure by unknown situations, as would be the need to provide its class online, they tend to resort to simplified heuristic rules that reduce the search through a comfortable shortcut that provides them a solution to what is facing. That is, they resort to their implicit theories, which emerge from its previous experience as students or as teachers. For this author, these are implicit theories that rely on associative processes, both in the form as the information was acquired as well as in the form of organizing and activating it. These teaching implicit theories relate to the pedagogical beliefs and help to explain the frameworks on which “the teachers perceive and process information, analyze, make sense and guide their teaching practices” (Vogliotti & Macchiarola, 2003). A direct consequence of the above is a possible inconsistency between the declared pedagogic theory and the theory in practice, guided by the professor’s implicit theories.

UABC maintains a permanent teacher-training program offering courses to teachers in a variety of subjects often related to education and technology area. However, the articulation between courses is not always clear and because the courses are not compulsory to the teachers, as can be expected, is difficult to identify a training path to train online teachers.

Considering the above, it is interesting to recognize that the effort of many educational institutions when promoting online education, don't have a clear understanding of the teacher's pedagogical and technological requirements to design an online course coherent with contents and learning goals. Many training programs privilege separately pedagogical knowledge and technology skills.

Thus, in order to have a better understanding of the reasons that guide professors in the design of their online courses the objective of this paper was to analyze how the professor's pedagogical knowledge and his/her technological skills influences this process.

Methodology of Research

Teachers and courses

To attain the objective of this work, teachers were identified based on two main characteristics: their technology skills and pedagogical knowledge.

Replication procedures were used to select the teachers using six theoretical replicas as recommended by Yin to select case studies (Yin, 2003); thus, the criteria for the selection of theoretical replicas were the courses in which contrasting results are expected based on the teachers technological skills and pedagogic knowledge.

Three possible combinations were used to select the teachers; high technological skills / high pedagogic knowledge; high technological skills / low pedagogic knowledge; and low technological skills / high pedagogic knowledge.

Two teachers were selected, *a priori* based in the author's prior knowledge of the teachers, for each combination of characteristics. In addition to the six selected teachers in the theoretical replicas, one more teacher was considered because of its particular characteristics; low technological skills / low pedagogic knowledge besides that the course was designed to be conducted entirely online.

To keep the anonymity of the seven teachers participating in the study, they were identified by letters depending on their characteristics as follows: letters "T" for high technological skills and "t" for low technological skills and, "P" for high pedagogic knowledge and "p" for low pedagogic knowledge. This way, the first professor with high pedagogic knowledge and low technological skills was identified as Pt1.

To select the online courses the following criteria were used: (a) courses designed and conducted by teachers of the University Autonomous of Baja California; (b) courses been offered at least once; (c) courses designed to be offered mainly online; (d) availability of course records for analysis and; (f) teacher permission to evaluate his/her course design.

The courses selected were classified according to Allen and Seaman (2005) into four categories depending on the percentage of contents taught online:

1. traditional, are courses with no online technology used, the content is delivered in writing or orally, that means that the proportion of content delivered online is 0 %;
2. web Facilitated, are courses which uses web-based technology to facilitate what is essentially a face-to-face course using a Learning Management System (LMS) or web pages to support the learning process, delivering online between 1 and 29 % of course content;
3. blended/ hybrid, are courses that blends online and face-to-face delivery, with substantial proportion of the content delivered online , between 30 and 79 %; and
4. online, courses where most or all content is delivered online, 80 % or more, typically with no face-to-face meeting.

Technological skills

In order to know the technological skills of professors an adaptation of the survey, Teaching and Learning with Technology in Higher Education Patterns of Computer Technology Use (Jacobsen, 1998)

was used. This instrument assumes that the technological skills of the teachers are directly related to the amount of software that has been used as well as their perception of their expertise in their use. The Likert scale used comprises five options ranging from *None* to *Extensive*, with which the professor assesses their expertise in the use of 57 software packages that include a range from common software to specialized programming languages. The relative percentage of the perceived expertise using software by the teachers where used as an indicator of their high or low technological skills.

For the evaluation of the Structure and Educational Quality of the course design, two instruments designed by the Virtual University System of the University of Guadalajara, México (Chan Núñez, 2003), and adapted to the needs of the study, were used. These instruments allowed us to assess the course and its educational quality in five dimensions: course structure, contents, learning activities, cognitive components and communication approach, with five Likert scale values; Absent = 1, Rarely = 2, Occasionally = 3, Frequently = 4 and Always = 5. This instrument also assesses the technology use by teachers with three possibilities depending of the LMS used; Technically possible and used, Technically possible and not used, and Not supported by the LMS.

The relative median values for each dimension for the courses where used as a indicator of the structure and quality of the teachers design of the course. Likewise, the percentage of tools used, in relation with the tools available in the LMS used, where considered as the technological use in the course.

Pedagogic knowledge

The pedagogic knowledge level was inferred based on the teacher's curriculum vitae and corroborated later on by an interview. The interview was the opportunity to let the teachers "tell us" how they acquire their knowledge.

Results of Research

As seen in Table 1, of the courses analyzed four are Blended with percentage $\geq 50\%$ taught online, two with a percentage $\geq 70\%$ and three online with percentages $\geq 80\%$. The courses are distributed among three technological platforms: four in Moodle, two in UABC-Virtual and one in Virtual-U.

Table 1. Characteristics of the selected courses for the study.

Teacher characteristics	Type of Course and Proportion of Content Delivered Online	LMS
Pt1	Online ($\geq 80\%$)	Moodle
Pt2	Online ($\geq 80\%$)	UABC-Virtual
PT1	Blended ($\geq 70\%$)	Moodle
PT2	Blended ($\geq 70\%$)	Moodle
pT1	Blended ($\geq 50\%$)	UABC-Virtual
pT2	Blended ($\geq 50\%$)	Virtual-U
pt	Online (100%)	Moodle

The greater number of blended courses is explained by the trend in the UABC to promote the incursion of teachers in online education with blended courses. However, in Table 1 it is worthwhile to notice that the teachers with low technological skills „t“ are the ones imparting online courses ($\geq 80\%$); even more, the professor „pt“ is the only one teaching 100% of the course online.

The results of the survey to assess the teachers' technological skills confirm that the selection *a priori* made of the teachers was correct. Table 2 shows the percentage of teachers Expertise using Software, where teachers "T" express high values to the percentages in Substantial and Extensive software use. As expected, the low values correspond to the "t" teachers with less expertise.

Table 2. Teachers characteristics and their expertise using software.

Teacher characteristics	Percentage of Expertise using Software			
	A little	Fair	Substantial	Extensive
Pt1	67.57	27.03	0.00	5.40
Pt2	45.16	41.94	9.68	3.23
PT1	18.92	8.11	35.14	37.84
PT2	20.00	22.86	37.14	20.00
pT1	0.00	2.63	39.47	57.89
pT2	31.58	18.42	28.95	21.05
pt	68.75	25.00	6.25	0.00

Table 3 shows the results of the analysis about how much of the technical tools, available in the LMS, the teachers use. As can be seen, teachers were not using all the possibilities available on the LMS; four of them, PT2, Pt2, pt1 and pt, used the largest number, using between 50 and 58 percent of the tools available in their LMS. There is no relationship between the percentage of tools, the percentage of content offered online or the LMS used. It seems that the technological skill *per se* does not determine a greater use of these tools as might be expected. Teachers with high technological skills use similar percentages to those teachers with low technological skills.

Table 3. Tools available on the LMS and the percentage used by the teachers.

Teacher characteristics	LMS used	Tools available	Used	Not used	% Used	% Not used
Pt1	Moodle	19	8	11	42	57.9
Pt2	UABC-Virtual	11	6	5	55	45.5
PT1	Moodle	19	7	12	37	63.2
PT2	Moodle	19	11	8	58	42.1
pT1	UABC-Virtual	11	6	5	55	45.5
pT2	Virtual-U	12	5	7	42	58.3
pt	Moodle	19	10	9	53	47.4

The teacher's pedagogic knowledge was confirmed with the teachers' *curriculum vitae* analysis of their subsequent interviews as can be seen in Table 4.

The pedagogical knowledge source is varied among the teachers in question, three of them, with high pedagogic training (PT2, Pt1 and Pt2) have postgraduate studies in education; one of them by institutional courses (PT1), two, acquired their pedagogical knowledge through UABC non-curriculum courses (pT1 and pT2) and the last one (pt) have only one non-curricular course as can be seen in Table 4.

Table 4. Teachers general and specific online education pedagogic knowledge.

Teacher	General pedagogic knowledge	Pedagogic knowledge about Online education ^a	Notes
Pt1	Extensive pedagogic training via postgraduate studies in education. Two diploma-certificates related with education. Ten courses related with distance education, online education and use of ICT.	Practice. Self learning. Friendship and tutoring.	Extensive teaching experience. Like to teach.
Pt2	Extensive pedagogic training via postgraduate studies in education. Seven diploma-certificates related with education. More than 40 institutional courses related with teachers development and training.	Institutional and non-curricular courses. Practice. Friendship.	Extensive teaching experience.

Continued to table 4

Teacher	General pedagogic knowledge	Pedagogic knowledge about Online education ^a	Notes
PT1	High pedagogic training via institutional formal courses. Aprox. 12 teaching related courses. Aprox. Five courses related with distance education, online education and use of ICT.	Non-curricular courses. Practice. Self learning. Friendship.	Extensive teaching experience. Like to teach.
PT2	Extensive pedagogic training via postgraduate studies in education.	Self learning. Practice. Friendship.	Extensive teaching experience. Like to teach.
pT1	Pedagogic training via institutional non-formal courses. Six courses related with teaching. Three courses related with online education.	Institutional and non-curricular courses.	Experienced teacher.
pT2	Limited pedagogic training via non-curricular institutional courses.	Institutional course.	Like to teach.
pt	Non formal pedagogic training. One non-curricular course related to instructional design.	Non-curricular courses. Friendships and hands-on tutoring.	Little teaching experience.

a: **Friendship**, refers to knowledge gained through discussion and interaction with coworkers; **Tutoring**, refers to the individualized co-workers support; **Self learning**, refers to the independent search for information about online education; **Institutional course**, refers to courses organized by the UABC institutional training programs; **Non-curricular courses**, refer to non-formal courses organized by UABC members; **Practice**, refers to hands-on learning.

Table 5 shows the frequency that the teachers mention how they acquired pedagogic knowledge about online education during the interview.

Although two of the teachers have a postgraduate studies in education, none of them mentioned their postgraduate studies as a relevant source for their pedagogic knowledge in online education. However, as shown in Table 5, teachers mentioned mainly informal sources as a way to acquire pedagogical knowledge for online education. Of 22 mentions, 15 refer to these informal sources, 19 mentioned non-curriculum courses. Only 7 mentioned formal courses of which only 3 were institutional courses.

Table 5. Frequency that teachers mentioned the way they acquired their pedagogic knowledge in online learning.

How the pedagogic knowledge in online learning was acquired	Number of teachers that mention it	Teachers that mention it
Friendships	5	PT1, PT2, Pt1, Pt2, pt
Hands-on	5	PT1, PT2, Pt1, Pt2, pt
Non-curricular courses	4	PT2, Pt2, pT1, pt
Self learning	3	PT1, PT2, Pt1
Institutional course	3	Pt2, pT1, pT2
Tutoring	2	Pt1, pt
Total	22	

The result on the assessment of courses' educational design are shown in Table 6 where can be observed the Median obtained for each dimension; Course structure, Content, Cognitive Components, Learning Activities, and Communication Approach.

Table 6. Median values for the five dimensions (Likert scale; Absent = 1, Rarely = 2, Occasionally = 3, Frequently = 4 and Always = 5).

Teacher characteristics	Course Structure	Content	Cognitive Components	Learning Activities	Communication Approach
Pt1	5.0	5.0	4.0	1.0	1.0
Pt2	5.0	2.0	1.0	2.0	2.0
PT1	5.0	2.5	4.0	1.0	1.0
PT2	5.0	3.0	4.0	4.0	4.0
pT1	3.0	2.5	1.0	1.0	2.0
pT2	4.0	2.5	2.0	1.0	1.0
pt	5.0	3.0	4.0	4.0	4.0

The first evident issue in Table 6 is that not a consistent pattern between the characteristics of the professor and the Median value obtained can be identified. On the other hand, a general trend found is that all teachers, independently of their pedagogic knowledge or technological skills obtain their maximum value in their Course Structure. This dimension obtained the highest values of all.

Apart from the Course Structure, the next highest values (4) were for the professor PT2 together with teacher pt. These teachers' present values in the five dimensions analyzed and the value of the smallest Median is 3 (Occasionally) which are considerably high, while in the five remaining courses minimum values of 1 (Absent) were obtained. Of these six, five teachers, PT1, PT2, Pt1, pt1 and pT2, have values of 1 (Absent) in two of the dimensions and professor Pt2 has a value of 1 (Absent) only in one of them. From these results is obvious that other factors other than pedagogical knowledge and technological skills are at stake in the online course design.

Although it is not fully consistent, if we consider only the percentage of the course which was offered online, it is possible to identify a relationship between the evaluation of the Structure and the Quality of the course. Thus, the course 100 % online and the one being ≥ 70 % online considered all dimensions and have relatively higher score values, while the two courses offered ≥ 50 % online tend to have lower score values.

The difference in technological skills of teachers does not show a consistent pattern in the evaluation on the Structure and Quality of the courses. However, is to draw attention that the generally better evaluated courses were designed by teachers identified with low technological skills, Pt1 and pt. As will be argued later, this could be related to interpersonal relationships of teachers.

Considering the analysis of the *curriculum vitae* and the information given by teachers during the interviews, it is not clear a relationship between the training alternatives offered by UABC for online education with the Structure and Educational Quality of the courses analyzed. Teachers "P" who had taken the majority of the courses aimed towards online education given by the institution, were not the best evaluated. Moreover, the study highlighted the high values in the course of professor "pt" who did not take the institutional courses geared to online education. A shallow analysis of the interview with this professor showed that for the design of her course she had pedagogic and technology support from co-workers with experience in online education. This leads us to think that informal social networks can play an important role in the decision of a teacher to venture into a modality that at first, seems to require good pedagogical and technological skills.

In no way we can say that the institutional training programs did not help to improve the structure and educational quality of the courses, but there are elements that indicate that the role of formal or informal social networks could play an important role in the training of teachers as was the case of teacher "pt". Although more research is needed on this specific topic, the importance of social networks on the teachers use of technology and their integration with pedagogy is supported by Becker (1998, 1999a, 1999b), Becker, Ravitz, & Wong (1999), Becker & Riel (1999, 2000) and Ravitz, Becker, & Wong (2000) among others. If this is true, is important that peer tutoring and support could be part of the strategies incorporated into the formal institutional training programs.

Discussion

The analysis of the results made evident that professors value interpersonal relationships as a source to online course design. Friendship relationships are related with informal discussions about academic work as well as with tutorships that, at the same time, have been associated to better pedagogic practices and with constructivist approaches (Becker & Riel, 1999, 2000; Riel & Becker, 2000). For Riel and Becker (2000), informal communication about the teaching experiences and practices that take place in halls and cubicles generating continuous reflexive processes of inquiring during the interchange of ideas that generate shared knowledge. This could be even more relevant when it is referred to online teaching practices.

On the other hand, the teachers value the “UABC training programs“, despite the perception that these programs were not important to acquire their online education knowledge, indicated us the recognition of the need to formalize training in institutional programs that cover the particularities of the modality. Riel and Becker (2000) point out the importance of incorporating in the teachers training programs, courses that recover and use the years of practical experience of teachers. The common practice of bringing in experts can lead to “canned” courses eminently theoretic that consider the teacher as a passive recipient of “objective research”. In this same line of thought, Rosenberg (2001) suggests that organizational processes to implement online learning and knowledge management, is the focus and purpose of the courses that must be aligned, thus the training courses should exist only if they fulfill a purpose in the institutional mission. Radical changes are necessary so the orientation of education and training system respond to real needs. Rosenberg mentions that, because of the vices and inertia embedded in these training systems, is not enough to restructure the existing system but a new system with very clear and defined goals is needed to achieve a radical change in the way of forming and training staff.

The approaches proposed by Riel and Becker (2000) and Rosenberg (2001) are not applied to teacher training and education programs implemented by the UABC. This could explain why four out of seven professors, despite the large number of formal courses taken, did not mention the training and institutional training as an important element to their online teaching.

Conclusions

It was found that the main source of educational knowledge about online education comes from personal interest rather than institutional courses. Although we must consider that UABC don't have a specific training program that integrates both, pedagogic and technological topics.

Similarly, the technology skills of teachers do not relate to a more extensive use of the available options in the technology platforms used. Despite of this, because the small size of the sample, we can not say without doubt that these relations do not exist. More detailed information about the reasons/beliefs about the educational benefits of different LMS tools.

Although results from the study contradicts the common sense that a highly technological form of education as online learning need teachers with high pedagogical knowledge and high technological skills, the few cases analyzed could only allow us to conclude that teachers interpersonal relationships could play a critical role on the online course design.

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