A MODEL OF INSTRUCTIONAL DESIGN FOR DISTANCE LEARNING CONTINUING EDUCATION COURSES IN TELECOMMUNICATIONS ENGINEERING (DIGITAL TV)

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Rosimara Beatriz Arci Salgado – Instituto Nacional de Telecomunicações (Inatel) – rosimara@inatel.br

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ABSTRACT

This article aims to introduce the techniques, methods and strategies of instructional design employed in the first Distance Learning project of Instituto Nacional de Telecomunicações – Inatel, which constituted the basis for the author's scientific research[1] in obtaining the title of Specialist in Instructional Design for Virtual Distance Learning: Technologies, Techniques and Methodologies.

The purpose of this paper is to invite reflection on the importance of Instructional Designers' work to Virtual Distance Learning. To that end, it has been attempted to problematize the working field of Instructional Designers through the presentation of basic competences that are inherent to their education and performance, by means of the implementation of the virtual continuing education course named "Introduction to the Digital TV System".

The results demonstrate the educational potential of this learning modality to meet the needs of Inatel's on-site and distance learning programs, having led to the creation of the institute's NEaD (Núcleo de Educação a Distância – Nucleus for Distance Learning). Thus, the role of Distance Learning in the education and permanent qualification of human resources for Engineering gained significant importance with a new educational culture, committed to the democratizing of knowledge in multiple languages.

Key-words: Distance Learning; Virtual Instructional Design, Continuing Education; Telecommunications; Digital TV.

1. Introduction

In considering the outline of the concept of Distance Learning, i.e., a technology-mediated teaching-learning process, in which teachers and students are temporally and/or spatially separated, it is understandable that there is a great difference between **teaching** and **learning**. In order for education to take place, a number of diagnostic elements need to be considered in the planning of an online course, aiming at reaching educational goals, which will characterize learning on the part of students.

In such context, assembling a multidisciplinary Distance Learning team whose members specialize in the different areas of knowledge, are familiar with technology, pedagogy, management and communication, and who work cohesively, will guarantee better results in students' learning. Therefore, more importantly than whatever technology is used in Distance Learning, a pedagogical language must be found which is suitable for the learning supported by the different available media. Therein lies the distinction between **Distance LEARNING** and **Distance TEACHING**.

According to Almeida [1], it is necessary to create an environment that favors meaningful learning, "sparks the willingness to learn [2], makes available pertinent information in an organized way and, at the right moment, brings about the interiorization of constructed concepts". And it was on such conception that the whole instructional design of Inatel's "Introduction to the Digital TV System" course was developed, based on the interactionist theories of Ausubel (cognitivism), Vygotsky (social interactionism) and Piaget (constructivism), which defend the construction of knowledge through the individual's interactions with others and with the environment, and also the relation of new knowledge with the mental construction of meanings, which leads the designer to create motivating and facilitating strategies for Distance Learning

> The main aim of education is to create people that are able to do new things, and not simply repeat what other generations have done – people who are creative, inventors, and discoverers. The second aim of education is to form minds that are critical, that can verify, rather than simply accept everything that is offered to them [3].

2. Overview of the Project

Founded in 1965, Inatel is a pioneer learning and research institution in Telecommunications Engineering in Brazil. It is Inatel's belief that the role of higher education in today's society is to educate citizens and professionals who are capable of identifying problems, elaborate and propose solutions and produce results for the political, economic and social development of the country, in each area of human activity.

At the time this research work was carried out, Inatel did not have a permanent multidisciplinary team exclusively dedicated to the development of virtual courses. For the development of the course on "Introduction to the Digital TV System", some employees of the institution and others, outsourced, were made available, in a multidisciplinary team under the management of the instructional designer, with the support of the institution's management and sector coordinators.

The estimated total cost for making the project viable is R$ 25.000,00 (twenty-five thousand reais), there included fixed and variable instructional design costs, contents development, media production, testing, training, monitoring and evaluation (follow-up reports), certificates and other consumables.

The initial attending audience was comprised of 29 students. Therefore, the average cost per student was R$ 862,07. Such cost tends to be diluted in the years ahead, with the perspective of a growing market for the training of a skilled workforce in Digital TV. Exceptionally in the project's inaugural run, between May and July 2010, Inatel did not charge the students any fees, given its goal of gauging the students' level of satisfaction with the different determining aspects of a high-quality virtual course.

The technical objective of the "Introduction to the Digital TV System" course was to introduce the whole TV system, showing the different techniques applied to each phase of the system, from the capture of audio and video signals to the process of reception, going through the digitalizing and audio and video compression techniques, as well as the signal transmission phase.

The target public consisted of senior Electrical Engineering students from Inatel, as well as Inatel's partnering professionals with knowledge and/or

experience connected with the technical area (electrical engineering, electronics and/or telecommunications). A minimum secondary-education-level was required. The students' ages ranged between 20 and 60 years old.

Basic computer knowledge and fluency in the Portuguese language were prerequisites. Listed as features of the behavioral profile of the student were motivation, interest, commitment, organization, discipline, perseverance, pro-activity, initiative, autonomy, reading habits, availability (average dedication of 10 hours per week) and, essentially, a collaborative spirit with the ability to interact and communicate, since many of the activities would be done through cooperative group work.

According to Aretio [4], Distance Learning offers **opening** to the democratizing of knowledge, eliminating or reducing the barriers to access to courses; **flexibility** as to location, time and pace of study; **permanent personnel training**, in that it meets the demands and aspirations of different people; **effectiveness**, in that it allows a dynamic and innovative learning experience, one where the student is seen as an active subject in his or her own education, and **savings**, in that it reduces the students' transportation costs.

Below are the justifications for the project:

▪ At present, there is a dire need in the market of professionals who are knowledgeable about Digital TV, and through this course Inatel will keep on meeting the demand for education and training, becoming a model for technical training in telecommunications through Distance Learning.

▪ The educational design used in the course will become a structural and pedagogical benchmark for other courses at Inatel and elsewhere.

3. Instructional Design

The choice of information and communications technology (ICT) platform to be used in the course was based on the following:

▪ Profile of the target public (accessibility for students; students' educational level, academic area, technological fluency, interests, among others).

- Infrastructural resources available at Inatel (hardware, software and human resources).

- Positive cost-benefit ratio.

- Pedagogical potential for Distance Learning.

- Capacity to meet the needs of different learning styles.

The great value of a virtual course lies in that it creates educational methodologies for the tools used in the virtual learning environment, in order to provide innovative models for education which escape a paternalistic conception, a mere virtualization of traditional teaching. The TelEduc[2] environment, adopted as this project's virtual classroom, was seen by the project's educational designer as a technological medium that does not necessarily guarantee the students' learning by virtue of the nature of its operation, that is, instructional design strategies, techniques and methods need to be created in order for that learning to take place. Thus, the technological potential of TelEduc's computational tools combined with the creation of appealing educational methodologies afforded continued interest, awareness and curiosity on the students' part. Such was the instructional design professional's role: to use technology in transforming learning.

TelEduc also enabled working with Open Virtual Instructional Design, which meant that it was possible to reconfigure the course as it was being carried out in response to feedback from the students.

The entire course material was structured by means of a Web format digital book, through which the students read the assigned texts, watched videos, looked at animations, graphs, tables and figures, listened to audio files, played quiz games and learned the course contents more deeply through glossaries and supplementary reading material. Also, they were able to store all of the material in PDF format for printing or reading it offline.

All of the course activities (both theoretical and practical) comprise a large and rich universe of tools, including several media resources compatible with the different learning styles. That feature accords with the principles of Felder's [5] theory, in which each student is seen as a being who can learn more effectively as his or her learning style, which is related to his or her personal characteristics, is taken into account. Thus, as stated by Richard M. Felder, students' learning styles can be active, reflective, rational, intuitive, visual,

verbal, sequential, global, inductive, deductive, and some learners may have a mix of more than one style.

The virtual activities in the course consisted of theory and practice: reading texts; videos; multiple-choice, matching, and true-or-false exercises; essay assignments; scenario analyses; discussions and exchange of ideas over TelEduc's Forums and Chat tools; research assignments; virtual team work; games played individually (crossword puzzles and minefield games); dynamics activities and virtual challenges. Such a wealth of activities that take advantage of media resources aims at promoting dynamism in the course, that is, the student is considered at each module, since the educational design was developed with the goal of intensively linking the student to the course through techniques that foster collaboration, group work, collective production, teacher-student, student-student and student-teacher interactions, preserving humanization and strengthening relationships among all participants. The course also envisaged didactic strategies that proposed to develop the learner's autonomy, encouraging the students to do research, as well as appropriate activities that stimulated meaningful learning, making the learners critical, reflective thinkers, opinion makers rather than passive receivers of the information in the course content. The role of the teacher-tutor in this context was paramount, given that he was the articulator between theory and practice, who inspired the students' cognitive side, who supported their autonomy and their constant quest for knowledge by creating new problem-situations besides the ones originally proposed, acting as a facilitator of interactions by mediating them, both through synchronous and asynchronous tools.

Thus,

> a student who interacts with his or her teacher remotely online may feel closer to the teacher than if he or she were attending an in-site lecture, alongside a hundred other classmates, all of whom unable to adequately interact with the teacher or with each other [6].

The in-site activities involved two moments: the inaugural class, in which students had the opportunity to get to know Inatel; to meet the Distance Learning team members as well as heir fellow classmates; to understand the pedagogical model proposed for the course; to become familiar with TelEduc and interact with the guests who participated in a round table on that day,

whose theme was "Digital TV and its impact on Brazilian society,"; and the final meeting, in which students presented the papers written by each virtual team in the last module of the course (Module 5), conducted practical activities on Inatel laboratory equipment and took a written test on the theoretical content of the entire course.

In order to meet the deadlines, it was important to establish a timeframe for the multidisciplinary team that specified the duration of various stages of the project (planning, development, dissemination, implementation and evaluation). The elaboration of a map of activities alongside the content manager also allowed the designer to obtain a multidirectional view of the course through the detailing of the classes (units, sub-units, specific objectives, theoretical and practical course activities, among others).

The continuing education course "Introduction to Digital TV System", contained 62 hours and was divided into two in-site sessions (12 hours total - 6 hours each session) and 5 virtual modules (50 hours total - 10 hours each module).

The evaluation system was related to the desired educational goals: to train people capable of analyzing, reflecting individually and collectively in order to acquire technical skills and savvy to operate in the society where they live.

Filatro [7] defines the moment the evaluation of the learning process should take place within the planning of a Distance Learning course:

> It is important to note that the assessment of learning can begin even before the start of classes, by performing diagnostics to check the students' characteristics and whether they have certain knowledge and skills. The results of the diagnostic evaluation can determine groupings of students according to common characteristics or offer alternative routes according to the identified profiles.

Thus, the adopted evaluation system was a diagnostic, procedural and summative one, in which student performance was measured according to the definition below:

Weight of participation in virtual activities: 61%.
Weight of participation in classroom activities: 39%.

Minimum grade for certification: 70 points

As a strategy to promote interaction, collaboration and affectivity, the communication style used for the course was "Non-formal", the tone of language adopted was personal and the text of the digital book was adapted to simple, clear and direct language.

4. Results

At the end of each module, the students answered an electronic questionnaire analyzing the different categories that constituted the model designed for the course. A significant result was that 66.67% of students said they had never done a distance learning course. As the course ended, of the 29 students initially enrolled, 11 obtained their certificates (39.93%), 4 did not qualify for certification (13.79%) and 14 did not finish the course. The reasons given by 85.71% (12 students) as justification for abandoning the course was lack of time and organization to carry out the activities. The other students, equivalent to 14.29% (2 students), reported having technical problems with their computers.

The course had a positive impact within Inatel's academic community in the city of Santa Rita do Sapucaí-MG and elsewhere through the dissemination on the media (newspapers and websites).

The following are the main strengths of the project. Most of them reported by the students:

- High quality of Inatel-produced media.
- Reliability of Inatel's infrastructure (servers, links, etc.).
- Potential of Inatel's Distance Learning multidisciplinary team.
- Affective bonds built among participants of the course.
- Good degree of interaction and development of a collaborative network that included the participation of two Argentinean students.
- Well-structured, coherent activities with simple, straightforward language.

- Good performance of the participants in the written evaluation, taken at the final in-site session.

- Little risk of obsolescence of the course.

- Advantages over the competition.

As points to be improved, it is worth mentioning:

- Apply technical diagnostic of the students prior to the start of the course.

- Create virtual libraries in order to provide a greater number of bibliographical references for the assignments.

- Extend deadlines for carrying out the activities, providing greater flexibility for students and lower drop-out rates.

- Increase the number of animations on the Inatel digital book and improve the animation on the "Broadcaster Diagram."

- Increase the number of words in the glossary and improve some of the definitions in it.

- Promote more synchronous (real time) virtual meetings, using other media: web conferencing, video conferencing, etc.

- Increase the number of questions in quizzes and interactive exercises.

- Produce more content-focused videos.

- Provide a week of virtual environmental adaptation prior to the start of the course.

- Customize TelEduc with some other features or use another Virtual Learning Environment that possesses them.

5. Conclusion

This project allowed Inatel to understand the potential of Distance Learning to diffuse knowledge, leading the institution to devise a set of possibilities for continuing education in telecommunications, as well as the development of its in-site educational programs.

Consequently, its NEaD - Nucleus for Distance Learning - was created, bringing together a multidisciplinary Distance Learning team, researchers and

teachers to promote personal, social and professional development of people in the Telecommunications Engineering area. In order for the NeaD to fulfill its mission, the institution will need to keep its focus on student learning on the one hand, and on the other, progressively strengthen its structure to face the challenge of providing quality Distance Learning, by mastering its cultural, social, educational, operational, legal, financial and managerial aspects, as well as the training of professionals involved with the preparation and implementation of these courses.

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[1] Monograph entitled **Instructional Design of the Virtual Course "Introduction to the Digital TV System"**, submitted to the Lato Sensu Post Graduation Program Specialization in Instructional Design for Virtual Distance Learning: Technologies, Techniques and Methodologies at UNIFEI / Cambuí Center – MG. Work supervised by Professor Benedito Donizetti Bonato and approved by examining board on November 20th, 2010.

[2] Freeware open-source platform used to mediate the distance teaching-learning process developed at UNICAMP - Universidade Estadual de Campinas (Campinas State University).

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