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INFORMATION AND COMMUNICATION TECHNOLOGY
INTEGRATION IN HIGHER EDUCATION:
HEALTH AND SCIENCE PROFESSORS' EXPERIENCES WITH AN AUTHORING TOOL

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Summary

Several studies show that teachers experience different stages when they adopt ICT in their practices. The Concerned Based Model (CBAM) by Hall and Hord (1987), and the Diffusion Model (Rogers, 2003) suggest frameworks for understanding the integration of educational innovations. West et al (2007) highlight that professors confront technical and pedagogical challenges when implementing Virtual Learning Environments (VLE). An authoring tool for creating VLE named as Constructore has been implemented and adopted by professors at Federal University in Rio de Janeiro. This paper presents an analysis of the integration of VLEs in the teaching practices of nine science and health professors. The analysis followed a framework adapted from the literature. Results indicate that teachers use Constructore because it is easy to learn and facilitates different forms of information representation and communication with students. The study also found that professors experience technical challenges related to infrastructure and to tool use. The pedagogical challenges are related to the nature of the content and to the ways of incorporating technology to solve contextual problems. The study also revealed personal concerns related with the management of activities and the impact of the use of VLEs in their teaching practices.

1. Introduction

ICT facilitates the implementation of different teaching strategies, including those that promote active student participation. Several studies show that teachers go through several stages when they adopt and integrate Information and Communication Technology (ICT) in their educational practices. Some authors proposed frameworks for describing and analysing these stages, such as the "Concern-based Adoption Model – CBAM" (Hall and Hord, 2005) and the "Diffusion of Inovations Model" (Rogers, 2003).

In order to understand the individual process of innovation adoption, Rogers (2003) suggested a model based on five stages: Knowledge, Persuasion, Decision, Implementation, and Confirmation. The Implementation stage is critical because it is when the individual

integrates the innovation in his practice and faces challenges which become relevant factors for its success and confirmation.

West et al (2007) focus on two main aspects related with the new technology innovations: "challenges related with technical competencies", such as time and effort to deal with and to organize resources, need for effort compensation, and difficulties with access and system instability; and "challenges related with competencies for hardware integration in teaching activities", such as need to review current practices to adapt to new tools, to organize adequate blended teaching activities, to manage communication tools, and to perceive students' recognition.

Hall e Hord (2005) categorized professors concerns as they experience the process of an innovative practice. "Self-concerns" include work overload and time invested for learning a new ability; "Task-concerns" include fear, doubts, and needs related with the demands for building competence for developing a VLE structure. Finally, "Impact concerns" involve colleagues' opinions and students' acceptance.

This study sought to analyze the challenges and concerns experienced by a group of university professors as they adopted the use of VLEs in their educational practices. The analysis was based on Rogers (2003) framework, and on West et al (2007) and Hall and Hord (2005) contributions.

3. Methods
3.1 Subjects and their disciplines

The study was conducted in a Brazilian public university, and subjects were nine professors in different biomedical sciences areas. Since Semester 1, 2007, they have decided to adopt *"Constructore"*, a VLE authoring and management tool, in their teaching activites. Table 1 presents the courses' environments implemented by the professors with the support of *Constructore*.

Table 1. Courses implemented with the support of Constructore

Professors	Course	Target Audience Area	Teaching Level
P1	Pedagogy for the Health Sciences	Health sciences	Graduate
P2	Computational Methods in Biomedical Engeneering	Health sciences and engineering	Graduate
P3	Mathematical Methods in Biology 1	Health sciences and engineering	Graduate
P4	Physiology – Neurophysiology Module	Physical Education	Undergraduate

P5
General Psychopathology
Psychology
Undergraduate
P6
Especial Psychopathology 1
Psychology
Undergraduate
P7
General Physiology – Neurophysiology Module
Biosciences
Undergraduate
P8
Biological Phenomena Measurement;
Health sciences and engineering
Graduate
P9
Biochemistry Complementary activities
Medicine
Undergraduate

All courses were basically face to face and counted with the complementary support of the VLE developed with the *Constructore* tool (Giannella et al., 2006).

3.2. VLEs developed by Professors

In general, the VLEs developed present a variety of learning objects in different formats (text, graphics, animation, links etc.), activities, exercise forms, and communication tools. The use of these resources differed among the VLEs according to the nature of their application in the nine teaching contexts. Table 2 presents the main purposes stated by the professors for integrating VLEs in their teaching activities.

Table 2. Professors´ purposes for using VLEs

Professors
Course Name
Main objectives for using the VLE
P1
Pedagogy for the Health Sciences

Provide additional case discussion spaces
P2
Computational Methods in Biomedical Engineering

Make images and exercise lists available
P3
Mathematical Methods in Biology 1

Make software available for mathematical modelling exercises
P4
Physiology – Neurophysiology Module

Offer audiovisual material to help students´ visualization of the organization and the dynamics of the Nervous System
P5

General Psychopathology

Make course material and psychiatric patient narratives available
P6
Especial Psychopathology 1

Organize the course and provide students with psychiatric pacients' narratives
P7
General Physiology – Neurophysiology Module

Offer reliable information sources in different content presentation formats
P8
Biological Measurement

Offer information sources for consultation and exercises for concepts applications
P9
Biochemistry Complementary activities

Provide students with course content scientific articles and exercises based on their reading

3.3 Data Collection and Analysis

In order to understand professors experiences when adopting new tools in their practices, semi-structured interviews were conducted with the nine professors who used *Construtore* to integrate VLEs in their courses. The questions were related with each course and with the VLE characteristics, and also with professors' perceptions of facilities and challenges experienced in the process of development and integration of VLEs in their teaching practices.

Thematic content analysis (Minayo, 2003) was the method which guided the interviews' transcript analysis in order to identify and discuss the subjects' experiences in their educational innovation activities. The basic categories used to conduct the analysis are described in Table 3.

Table 3. Analytical Categories and their Definitions

Categories
Definition
Technical Challenges (West et al, 2007)
Challenges related with technical conditions and competencies necessary for accessing, understanding, and using the technological tool.
Pedagogical Challenges
 (West et al, 2007)
Pedagogical challenges are those experienced by teachers when using a technological tool to meet their educational objectives.
Change Challenges (Hall e Hord, 2005)
Challenges related with changes in teachers work: self-concerns; task-concerns; impact-concerns.

4. Results

The main challenges reported by teachers about the process of VLE implementation were related with technical aspects, such as difficulty to access the server. The pedagogical aspects, were those related with the need for discipline restructuring and with the role of ICT in their teaching context, in addition to consequences of this integration in their educational practice. Changes in teaching practices have also generated concerns related with new tasks and responsibilities.

4.1. Technical Challenges

Access to Server

Teachers reported difficulty to access the server on weekends, when they and their students were available to use the VLEs. They also considered that this problem influenced student use.

> By the weekend, the VLE was unavailable more than once. This is a problem because most of these activities are part of students' evaluation ... If they miss the assignment because access was impossible, our credibility become in danger. (P5)

Space for supporting files

Limited space for file upload was a technical concern, as mentioned by professor P6 :

> The most complex task was and still is space availability to upload large files. We were unable to compress video and audio files (P6).

4.2. Pedagogical Challenges

Professors experienced pedagogical challenges as they integrated *Constructore* as a web based authoring tool in their educational practices. These challenges related with demands for reconstructing their courses to adapt to the new context, for defining the role of ICTs in this process, as well as to review their current pedagogical practices.

Courses' reconstruction and ICT role definition

In general, teachers based the construction of their VLEs on structure and material from previous practices. The main changes concerned resource configuration and format which had been already produced in electronic format.

> As I already used to produce all material in electronic format, it was very easy. The only necessary adaptation was to convert from ppt format to pdf. I think this was very simple. (P2)

The possibility to offer content in different formats has provided facilities for integrating new educational material for the students.

> I had the opportunity to integrate graphics, images, and animations to the students, motivating them to learn more about the topic (P7).

In general, professors developed VLEs which served as support for their face to face teaching activities offering information resources for student use.

> The objective of *Constructore* use was to offer resources and information sources as auxiliary material to the students.... if they missed a class, they could access the material (P4).

In their opinion these facilities has helped students throughout the course work:

> For them this is very important; the links available represented "givens". They can search directly through the links. (P1)

In some cases, the VLE was used as a space for enable active student participation, such as independent initiative for searching information sources (P1 and P4), collective knowledge construction base on text discussion (P1 and P9), or experiment' simulation, as was the case of teacher P8:

> The problem is: we are going to build a virtual thermometer. How to create and to design the thermometer, how to read signs; before reading the signs, how to design them. The objective was to transform the computer into an instrument (P8).

All VLEs offered communication tools, although the only course which made

effective use of them was that of professor P1, since it supposed student discussion for collective text production. Other professors did not feel the need to communicate using the VLE because of the face-face classes, as can see in the following statement:

> Since it was a face to face course, we used to meet three days a week. And this was enough. (P3).

The use of VLEs also offered professors the opportunity to follow their students' activities more closely.

> One Sunday I logged at *Constructore* and observed that one student have accessed the course environment, browsed all VLE, but did not undertake any of the possible activities! He had not inserted one comma! During the class I asked him: Where is your contribution? (P1).

Reflections on Technology Integration in Educational Practices

Technology integration involved professors' dedication in course structure adaptation. These activities led them to undergo reflections about their previous educational practices. P3 suggests that structuring the VLE was an important tool for rethinking teaching practices and for reviewing course objectives:

> I was proud to, based on my 30 year experience, rethink my terminal objectives (P3).

As students could access course content independently, professors redefined their roles in the teaching process. P4 offered opportunities for interactions among participants in the teaching-learning process, transforming his relation with the students in his face to face classes.

> Even if the student missed the classes, I was secure to demand him to work on the contents. We could exchange and talk to each other much more (P4).

Professors also reported that the use of VLE has created the need for student active behavior for information seeking, changing their roles in the teaching-learning process.

> Now they are supposed to log in the VLE to access and to discuss in the forum, to select material for their reports, to undertake active searches. I used to take many texts to class and I do not take anymore. Now, students are supposed to search for themselves. (P1)

Students' management facilities was another experience reported. According to P3, this facility promoted better integration with students and also more individualized attention e monitoring: "for the first time I knew all my students' names" (P3).

4.3. Change Challenges
Work Overload

In general, professors reported they felt overloaded all over the course process using the VLE, but they all emphasized the work load demanded for constructing the learning environment. They stressed the importance of tutors and assistant students support for course construction and management. These concerns are exemplified in the following statements.

> Without an assistant teacher it is very difficult, we end up using all the time on course management (P3).

> If I implement these activities in the Constructore, in addition to face to face classwork, I would not have the time to do anything else in my life(P8).

Exposure

Professors felt the need for better planning and organizing their courses when Integrating the use of VLEs in their teaching activities. As we can observe in their narratives, their main concerns were related with exposure of their course activities in the Internet:

> By the moment I realized that myself, the content selection, or even my Portuguese written language would be more exposed, I became concerned with organization and program development (P3).

Expectations about the Innovation

Professors revealed high expectations in relation with the impact of technology use in their teaching activities. They believe that this initiative aggregates value to their courses, as well as to their students and their own work. This is possible to observe in the following statement:

> I think students view this teaching model as modern. Students believe VLEs are indicators of modernity and their professors adaptation to new times. This influences their point of view, their feelings, and their attitudes toward learning. This is fundamental and essential (P2).

5. Discussion

In general, professors blueprinted in the VLE the traditional face to face course structure. Therefore, the VLE served basically as support for professors' face to face regular course activities. Its effective use was highly dependent on student interest to look for material made available by their teachers, since most of the VLEs did not include compulsory student course work. The only exception was professor P1, who also used the virtual environment to implement student activities. Therefore, professors adopted VLEs basically as learning resources repository for students. This approach to VLE use is compatible with results from a study by West et al (2007). These authors concluded that when becoming involved in new practices, individuals tend to apply models which are familiar to them. In the case of the VLEs studied, professors included new resources but did not transform their pedagogical practices. Because it is an educational innovation, it seems that professors began with this approach because of the uncertainties and risks involved in changing processes.

The main technical challenge experienced by professors was the difficulty to access the server. This was also reported in other studies which analyzed ICT integration in learning processes (Fox, 2007). Overcoming technical challenges is essential for effective VLE integration in teaching contexts. West et al. (2007) state that as teachers become more familiar and more comfortable with the tool, they are able to perceive new uses and to overcome limitations, tailoring resources according to their specific needs.

The main challenges reported by the professors were related with time requirements, also reported in Fox (2007) study, and with pedagogical competence to integrate technology in their teaching practices. Van den Berg (2002) remarks that professors concerns in changing current practices involve different levels of uncertainty which reflect, among other factors, feelings about lack of the necessary competence to conduct new teaching initiatives with responsibility. In relation with the impact of using the *Constructore* tool, professors showed high expectations in relation with students' recognition for his work.

6. Conclusion

Results suggest that, in professors perceptions, technology integration was also an opportunity to review their teaching practices. Based on these reflections, new pedagogical practices can be created and implemented. As professors become more acquainted with the authoring tool, they feel more comfortable to manage and to experience new practices. Once familiarized with the innovation, they become more capable to model its use to demands of their teaching-learning contexts.

This study identified critical elements involved in the process of educational technology innovation which are compatible with the literature in this field. In addition, this study reinforced the thesis that introducing the use of ICT may lead professors to rethink teaching approaches and to introduce changes in their current practices.

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