# RESEARCH AND LEARNING IN A CONSTRUCTIVIST ENVIRONMENT: THEORY AND PRACTICE WITH THE USE OF ICT IN HIGHER EDUCATION

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**Abstract**

This paper examines an experiment carried out in the Information and Communication Technologies (ICT) in Education module of a post-graduate programme of Education and Curriculum in one academic term for a group of student-researchers using a Computer-Supported Collaborative Learning environment. The study is based on questionnaires completed by the student- researchers. The aim of this paper is to examine the use of ICT in teaching and learning processes in the light of the student-researchers' practices by applying a constructivist perspective to the use of ICT in Education.

## Introduction

The aim of this paper is to examine an exploratory study of the use of the Computer-Supported Collaborative Learning (CSCL) environment called LabSpace [1] and Web 2.0 tools, carried out by a group of fourteen practitioners experimenting with ways of introducing digital technologies, while studying the use of Information and Communication Technology (ICT) in education.

The analysis is based on data from a semi-structured questionnaire completed by the group, in which they gave their opinion about the activities carried out with the support of the CSCL environment. As the CSCL was a new technology being tested as a virtual learning environment, the group involved with it was given guidance by the two lecturers who coordinated the module and one student who acted as a monitor.

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[1] LabSpace is a virtual laboratory of open learning, a project of KMI-Knowledge Media Laboratory, of Open University. The experiment quoted may be seen at LabSpace website http://labspace.open.ac.uk/course/view.php?id=3310. It can be considered a Computer-Supported Collaborative Learning (CSCL) environment. It is based on MOODLE (http://moodle.org), an open source virtual learning environment.

This kind of experiment raises research issues, such as those arising from the experience of practitioners discussing their own practices in the role of researchers, when studying the use of ICT in their teaching activities. This study recommends forming a link between a constructivist approach and blended learning and using CSCL to provide a constructive perspective for teaching and learning. There is also a discussion of some of the pedagogical implications arising from the use of CSCL environments. It is argued that pedagogical practices could play a key role in a teaching and learning environment that is mediated by digital technology. This is because the different ways people deal with technology, and the difficulties they have in handling ICT may have an effect on the success or failure of an educational initiative based on the use of the CSCL tool.

To contextualize the exploratory study, the article briefly presents the use of ICT in educational initiatives in Brazil and the ICT projects conducted by the research group at the university where the exploratory study was carried out.

## ICT in Education in Brazil

The use of Information and Communication Technology in Education in Brazil started at the end of the 1970s and the beginning of the 1980s with the employment of computer science as a strategy for technological development. At the end of the 1990s, computers and the Internet began to be included in classroom activities at primary and secondary level. In 1996, distance education policies and strategies for higher education were set up by the Secretary of Distance Education, Ministry of Education and there was a project to supply schools with computers and train teachers to use them in their practices. In the last few years, some teacher-training courses have been run with the aid of academic researchers who are responsible for overseeing public policies regarding the use of technology in education (Secretaria de Educação a Distância do Ministério da Educação (http://mec.gov.br). Another important Federal Government educational scheme is UCA-Um Computador por Aluno ("One Computer for each Student") (MEC-SEED, 2008).

In higher education, the aim of the public policies in the use of ICT is to support the implementation of programmes of distance-learning, and recently the Universidade Aberta do Brasil (UAB) was set up, which is a Federal Government educational scheme (http://www.uab.capes.gov.br).

## Research of ICT in Education

Training teachers is one of the major concerns regarding the use of digital ICT in education in Brazil. A group of researchers at the post-graduate programme in Education and Curriculum are working on projects aimed at integrating teaching and research with methodology and new pedagogical approaches (Valente & Almeida, 2007).

This exploratory study has examined the use of digital ICT incorporated in LabSpace in a teaching and learning process that adopts a collaborative pedagogical approach. This approach is discussed in the light of theoretical constructivism and has become part of the curriculum. The research being conducted at the Centre for Curriculum and Education (Post-Graduate Educational Program) at the Pontifical Catholic University of São Paulo is based on a constructivist perspective of the teaching-learning process. In this perspective, the learning process is influenced by pedagogical approaches and the social and technological environment in which learning occurs.

CSCL environments like LabSpace can act as appropriate digital tools to mediate collaborative work and knowledge construction. Some of the modules taught in the Centre of Education and Curriculum in the Post-Graduate Educational Program (http://www.ced.pucsp.br) at PUC (Pontifical Catholic University of São Paulo, http://www.pucsp.br) have been using LabSpace as a resource to support pedagogical practices. The same applies to the research conducted in the Programme and the exploratory study carried out in 2008, which is the subject of this paper.

## The Study

A constructive learning environment fosters collaborative learning among students with a supportive teaching approach, in a space where teachers work together with students with common goals, and, as Freire (2004) points out, one learns *with* someone else, hence, teaching is a form of communal learning that allows knowledge to be constructed. The student's active role in the teaching and learning process is essential and the responsibility of the teacher should be strengthened to ensure that the right learning conditions are established to enable this process to be carried out. Knowledge is constructed and not simply conveyed, and construction results from a learner being engaged in an activity, which means that knowledge must be embedded in a context; thus, the process of acquiring meaning, which is an inherent part of learning, "requires the articulation and representation of what is learnt" (Jonassen, 1999).

The module of the exploratory study analysed here had a constructivist perspective in its design and implementation. It was carried out by integrating classroom and online activities, and was supported by LabSpace, a computer-supported collaborative learning (CSCL) environment. This type of course can be categorized as "blended learning." According to Walker and Baets (2008) the term blended learning describes a mixture of delivery methods and the integration of different media with face-to-face courses. There has been a trend that associates blended learning with pedagogical approaches (Walker & Baets, 2008), and together with this trend there is an increasing interest in theories such as social constructivism and collaborative approaches in the teaching and learning process (Dziuban, Hartman, & Moskal, 2004). Hence, the learning process is shifting away from a situation in which knowledge is provided by teachers to one where it is a product of collaborative experience; this conception of learning means that students have a social role as active and collaborative learners (Walker & Baets 2008). Learning through the adoption of an experiential and collaborative approach has also been

connected to the concept of "situated learning", as outlined by Brown, Collins, and Duguid:

> The activity in which knowledge is developed and deployed. . .is an integral part of what is learned. Situations might be said to co-produce knowledge through activity. Learning and cognition, it is now possible to argue, are fundamentally situated. (1989, p. 1)

By integrating the concept of social constructivism and situated learning, blended learning combines classroom and virtual activities, where the virtual activities work as a medium to share ideas and knowledge building; thus technology is used to support a learning environment in which students share knowledge together with teachers and their peers (Walker & Baets, 2008). In this kind of environment, students use their virtual learning space to negotiate meaning, share ideas and experiences, collect information, and solve problems. These activities can be supported by a variety of Web 2.0 tools such as wikis, blogs, and discussion boards (Peña, Córcoles, & Casado, 2006; Walker & Baets, 2008). In LabSpace some Web 2.0 tools are integrated, which allows the learner to play a participatory role in the learning process.

Digital technologies — like the CSCL LabSpace — mediate learning in a way that affects the traditional design of the curriculum in the same way that the knowledge being mediated is influenced by the "nature of the medium," as Laurillard (2005) argues. This author also states that: "as we create and generate knowledge and information, we naturally use different media, depending on the nature of the content and the objective we want to achieve (Laurillard, 2005, p. 77). In this way, the curriculum can be modified, in a context where new ideas are shared by teachers and students when experiencing new ways of interacting in an active and meaningful learning process.

## The Course Design

The course analysed here was called Digital Technologies and the Curriculum, and was part of a Post-graduate Programme of Education and the Curriculum, and the sample comprised 14 Masters' and Doctoral students.

The purpose of the course can be seen in the syllabus:

> The use of technology in education has recently stimulated a debate in two important areas of research in the educational scene. The study of these two areas has been carried out in established academic courses and undertaken in an independent way. Moreover, it has led to the production of theoretical conceptions and practical activities that often lack coherence. However, the use of technology in education seeks support in the educational field and the technologies can bring about a significant contribution to education if there is clarity in their pedagogical objectives, i.e. if it is integrated with the conception and undertaking of a curricular project, that is aimed at improving students´ capacity to think and learn with technologies. Thus, the aim of this course is to study the convergence and connections between these two terms and define the

> kinds of action and investigation that can be employed to integrate them. (Almeida, 2008).

The course was run in a blended mode and lasted 16 weeks. The teaching methods consisted of observation and a description of teaching practices, seminars, and group discussions; the activities were supported by LabSpace tools, namely, discussion forums, videoconferences, and wiki. Two workshops were held at the beginning of the course to explore the LabSpace tools; the purpose of this was to help students undertake the activities that depended on the use of environment.

The design and implementation of integrated classroom and online activities were supported by the following tools: a discussion forum; the FlashMeeting, a tool for videoconferences; and a wiki, which use is briefly described as follows.

**Discussion forum.** The forum served as a tool for discussions and uploading and downloading materials for the course. It was of great value, because as the students were familiar with it, it enabled them to use the VLE, and thus, the objectives of the activities were achieved

**Videoconferences.** The purpose of using FlashMeeting for the videoconferences was to allow the students to make use of this tool for presentations and debates about pedagogical practices, and research presentations to be given by academics from other countries. Three conferences were held.

**Wiki.** The wiki was opened to serve as a pedagogical resource, and the task was to compose a wiki to define the meaning of "curriculum" for the group.

## Analysis of the Experiment

The analysis is based on questionnaires sent by e-mail to 13 students in the Course and was answered by 6 of them.

The questionnaire was divided into three subject areas: technology as a pedagogical aid; technology as a tool in carrying out activities; and technology as a part of the Curriculum.

These three subject areas are analysed as follows.

**Technology as a technical aid.** Five of the six participants in the group of respondents stated that they had faced difficulties in gaining access to Lab Space; in the case of one, the reason was low connection and two others had problems with the login and password. There were two other reasons given: a lack of knowledge about how to use VLE and uncertainty about the sequence of commands, "at times caused by a lack of clarity in the navigation." The use of a range of e-mail addresses set up to enable the students to communicate with their teachers was found by five of the respondents to be helpful in following the stages of the course. However, five of the respondents also thought that the setting up of the e-mails distracted the students' attention away from the LabSpace and had led them to stop gaining access to it. It was clear from the data gathered on this item

that the LabSpace in VLE was new to the students and initially caused some technical difficulties in gaining access. The use of the e-mail system of communication seems to have been adopted as a way of overcoming difficulties encountered by some of the students in using VLE at the beginning of the programme.

**Technology as a tool for carrying out activities.** On the basis of the answers to questions on the forums and videoconferences, the tools used were suited to the activities carried out with them. The forums held for debates and sending out work were regarded as useful by four respondents and the FlashMeeting used for the Videoconferences were regarded as useful by five. However, the Wiki used to form a collective definition of the Curriculum was regarded as unhelpful by five of them.

Of the participants 50% thought that navigating in LabSpace made it difficult to carry out the activities. Four of the respondents also found that the arrangement of the activities in the order chosen made it hard to do the activities. Some of them saw it as another "hindrance" that "amounted to a difficulty in navigation" or "confusion" while one of them thought "the arrangement of the activities. . .is pretty chaotic." At the same time, one of the participants stated that "the arrangement made it easier to carry out the activities."

In contrast, all (100%) of the respondents stated that the fact that LabSpace was only available in English did not make it difficult to carry out the activities. It seems that the use of LabSpace as a tool for teaching activities was made difficult by technical issues such as the architecture designed for navigation which is complex and has a wide range of available resources. As mentioned by the respondents, the design is different from that of the virtual learning environment previously used at the University, it is not possible to customize the page and different passwords are needed to gain access to the university portal and the LabSpace. It is worth drawing attention to the fact that if there are technical and logistical constraints in the learning environment, these can have an effect on the way people interact with the environment and influence the way students and teachers get involved in the recommended teaching practices and hence affect the learning process.

**Technology as part of the curriculum.** The teaching of technology carried out in the workshops, with regard to LabSpace, Wiki and FlashMeeting, was regarded as adequate by a third of the respondents and inadequate by two-thirds. The inadequacy is illustrated by the following comments:

> As regards FlashMeeting, I believe that we must create it step by step. Either we lacked a close knowledge of the technology involved or perhaps there wasn't enough time to use the tools outside of the workshop and there was no incentive (in terms of being awarded marks) to use it outside of the classroom; or else, it was adequate as a user but inadequate as a means of support. I would like to have learned more about the functions of FlashMeeting. For example, I would like to have learned what to do to arrange for the slides in the PPT to be shown during the presentation.

The lack of practice in the use of FlashMeeting, together with some technical problems that came up during the videoconferences, gave rise to some discussions in the classroom lessons, as is evident from the following comment: "As there are difficulties with navigation, a lot of things which should be done in virtual worlds are carried out in classroom learning instead."

A similar situation can be found in the answers about the time spent in the classroom discussing technology, which was regarded as useful and relevant by two thirds of the respondents. However, the fact that this had been undertaken in a classroom format where everybody met on a weekly basis, in the case of four of the respondents, did not affect their involvement in the virtual environment although two of them stated that it did.

A comment by one of these two students illustrates this concern:

> I think that if the course had not been largely classroom-based but only partially in the classroom or only distance-learning, the students would have applied themselves more diligently to working in the environment of LabSpace because there would not have been any alternative way for them to follow the course other than communicating with each other or with the teachers and carrying out the set tasks.

On the basis of an analysis of the answers to this set of questions, it can be inferred that, in some ways, the initial workshops in which the LabSpace was explored, were useful insofar as they helped the students to get involved in the online activities but that they were not enough to enable the students to participate effectively in the debates held by FlashMeeting. Since this tool was used at conferences with lecturers invited from foreign universities and also for presentations and discussions of pedagogical practices observed in pair work, the students clearly felt a sense of frustration when the FlashMeeting did not function properly. As a result, the discussions generated around the activities associated with FlashMeeting took up the time of the classroom learning and this explains why there was some discussion about the time spent discussing technology in the classroom.

This point raises the question of how far technology invades the space of the Curriculum and the definition of terms like "digital literacy", or rather the question of how much time and effort should be spent on the technical and logistical factors regarding a particular technology, in the study of the Curriculum.

## Discussion

The students in the experiment in LabSpace came from the Brazilian education system. With regard to their digital literacy — their previous experience of using ICT — some had had previously used it in their teaching practices. The existence of a wide range of levels of abilities in the use of ICT for learning purposes provided an opportunity for a collaborative learning process with the students' peers, a process in which everyone could

help each other in the process of participating in the activities and benefiting from the previous learning experiences.

The question of teaching how to use a selected technology as a teaching resource for a particular curriculum can be approached in various ways, depending on what concept one has of the curriculum. A conventional way would be to ensure that all the technological resources are available to the students before embarking on the activities recommended for the subject and making a degree of proficiency in these areas a prerequisite for participation.

On this basis, the students would not have any technical problems and they could get involved in the activities more quickly and easily. In this way the participation of everybody could be ensured and they would also be able to overcome the problems of obtaining access to the Internet, connection and logistical questions such as making sure they are using their login and password correctly, and finding an easy way of obtaining access to the virtual learning environment. This advanced preparation could either be undertaken at their own university within a post-graduate programme or could be outsourced to an academic support department or, as happens in some European universities such as the Institute of Education, University of London, the digital literacy of the students could be taken on as one of the responsibilities of the Library, which offers training and workshops as well as giving back-up support to students in tasks involving Information and Communication Technology for academic purposes.

However, this was not the path pursued by the research team that supervised this exploratory study. It was not the purpose of the supervisors of this line of research to teach technology but rather, to explore the new digital technologies that are available and integrate the concepts of the technology with the Curriculum, as can be seen in the syllabus of this subject.

This kind of experiment calls attention to the importance of employing user-friendly interfaces for a virtual learning environment used for educational activities. Moreover, these technologies must have tools with a sufficient degree of interactivity to motivate students to participate in the activities, while also having the potential to act as a teaching resource (Assis & Almeida, 2009).

## Pedagogical Implications

As there is an increasing trend in the direction of e-learning, there has been an interest in constructivism and the use of collaborative models to underpin the methodologies adopted in this kind of educational approach. However, there is a need for redesigning pedagogy. Teachers must adopt the best possible practices to introduce innovative pedagogies with ICT support in their learning designs. Teachers should also reflect on their own practice, and be willing to experiment with new technologies as action-researchers. Post-graduate courses (for masters' and doctoral studies) are also of value as their purpose is to train researchers for their educational practice.

People learn in different ways, depending on their personal interests, background experiences, attitude towards the subject and the teaching methods applied, personality traits, learning styles, or other personal attributes. Some students might have divergent interests with regard to activities run in a CSCL environment, while others might have a collaborative aptitude in face-to-face activities and not have the same aptitude when having to participate in a discussion forum. Before they can fully understand the process of learning and teaching with ICT, teachers should be learners in a fully online course model or a blended model or else they should rely on best practices so that they can introduce new technologies to their teaching practices. They should reflect on their own practice, by experimenting with new technologies as action-researchers. In this way experimentation and theorising can enhance their practice and research within a learning practice community. Thus teachers should work as "action researchers. . .collaborating to produce their own development of knowledge about teaching with technology" (Laurillard, 2009, p. 5). In addition, according to Laurillard, "all the characteristics of new technologies that make them good for learning make them well suited also to supporting the innovative reflective practitioner" (2006, p. 5).

The best choices of appropriate teaching methods which can be employed for using ICT tools should be based on a learning theory that underpins the decision-making process. This would give support when changes are necessary.

## Conclusions

It is emphasized in this paper that collaborative and experiential learning as attributes of constructivist approach in education can be useful in pedagogical activities based on an ICT-based environment. In the Brazilian experiment referred to above, the practitioners had the opportunity to experiment with new pedagogical practices by introducing ICT pedagogical practices, reflecting on them, and basing this reflection on a constructivist-learning approach. Hence, the goal was not to train teachers in the use of new ICT or to learn how to design courses. However, the experience of reflecting about the pedagogical practices involved in using ICT leads to learning outcomes that may have the same value as a preparatory course. Pedagogical practices that accommodate individual differences can play a key role in the teaching and learning environment that is mediated by digital technology. The reason for this is that people deal with technology in different ways; in other words, people's preferences and the difficulties they have in dealing with ICT may have an effect on the success or failure of an educational initiative which relies on a CSCL tool.

The post-graduate course discussed in this paper was designed to train researchers for their educational practice. In this course, practitioners had the opportunity to experiment with new pedagogical practices and learn how to introduce ICT to students and researchers, reflect on them and combine this reflection with a constructivist learning approach. In this case, the goal was not to train teachers in the use of new ICT or to learn how to design courses; however, the experience of reflecting about the pedagogical

practices and the way they relate to ICT, may lead to learning outcomes that could have the same value as a preparatory course.

## References

Almeida, M. E. B. (2008). *Ementa da disciplina Tecnologias Digitais e Currículo. PUC/SP-Pontifícia Universidade Católica de São Paulo.* [Digital Technologies and the Curriculum, Post-graduate Program of Education and the Curriculum]. Pontifical Catholic University of São Paulo, Brazil. Retrieved February 19, 2010, from http://www.ced.pucsp.br, http://www.pucsp.br.

Assis, M. P., & Almeida, M. E. B. (2009). Collaborative learning in the digital learning environment — People, technology and pedagogical practices. *Proceedings of ED-MEDIA 2009-World Conference on Educational Multimedia, Hypermedia & Telecommunications*, Honolulu, Hawaii, USA (pp. 1567–1572).

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32–42.

Dziuban, C., Hartman, J., & Moskal, P. (2004, March 30). Blended learning. *Educause Center for Applied Research, Research Bulletin, 7.* Retrieved September 10, 2009, from http://net.educause.edu/ir/library/pdf/ERB0407.pdf.

Laurillard, D. (2005). E-learning in higher education. In P. Ashwin (Ed.), *Changing higher education*. London: Routledge

Laurillard, D. (2009). The pedagogical challenges to collaborative technologies. *Computer-Supported Collaborative Learning, 4*, 5–20.

Peña, I., Córcoles, C. P., & Casado, C. (2006). *El Professor 2.0: docência y investigatión desde La Red. Uocpapers Revista sobre La Sociedade Del Conocimiento*. Retrieved April 2008, from http://www.uoc.edu/uocpapers..

Valente, J. A., & Almeida, M. E. B. (2007). *Formação de Educadores a Distância e Integração de Mídias*. Campinas-SP, Brazil: Avercamp.

Walker, R., & Baets, W. (2009). Instructional design for class-based and computer-mediated learning: Creating the right blend for student-centered learning. In R.Donnelly & F.McSweeney (Eds.), *Applied e-learning and e-teaching in higher education* (pp. 241–261). New York: Information Science Reference.