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Iolanda Garcia

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CONTENTS

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INTRODUCTION

Emerging research pathways about time in online learning

This special issue compiles the research work carried out by 1st and 2nd year PhD candidates from the eLC Doctorate Program in Education and ICT (e-learning) and their contribution to the eLC Research Program on the time factor in e-learning.

The papers included in this issue do not correspond to a thematic grouping and the time factor is not dealt with from a specific perspective, but in a broad sense as a variable to be considered, either centrally or tangentially, in different research studies in the field of online learning.

These articles are developed from different approaches and at different phases in the research process. Thus, from a structural perspective of research design, three different sections of contributions can be distinguished: the first section includes two articles focusing on the development of the theoretical framework and the conceptual clarification of the time factor in the research, in order to substantiate a possible framework of analysis; the three articles of the second section go a step further, considering the elements that should be incorporated in the methodological design of the research, to support the analysis of the time factor for a given context. Finally, the third section features a single article that, in addition to proposing a design methodology and a theoretical framework, develops an empirical study regarding the impact of the time factor in the field of e-learning.

The research topics addressed by the papers in this issue, and therefore the expected research results, are also diverse in nature and can be placed in the three study areas or dimensions of e-learning identified in the eLearn Center: 1) online teaching and learning processes; 2) online learning organization, management and policies, and 3) technological resources for online learning.

Thus, Llorens and Sangrà, from the first study area, develop a conceptualization of the impact of temporal aspects in shaping the functions and role of the online teacher.

Esposito, Sangrà and Maina, also in the same area of study, propose a theoretical model for the analysis of the configuration in time and space of learning trajectories followed by junior researchers, emerging from the formal and informal learning ecologies of which they take part.

The work of Arguedas and Daradoumis, can be located both in the first and the third area of study, as it proposes a theoretical model for the analysis of the role time plays in the emotional states of online students, while the goal of the research is the design of an affective virtual agent/tutor able to intervene and mediate in students' e-learning processes.

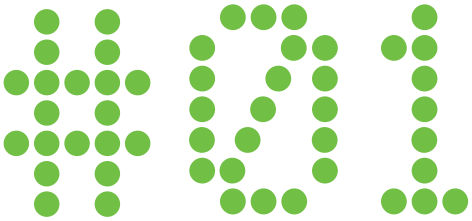
Usart, Romero and Barberà place their work in the context of the first area of study and develop a comprehensive literature review to determine the most appropriate methodologies and tools to measure two temporary variables, the time spent on tasks and the subjective perception of time in computer-based learning and game based learning situations.

The research of Franco, Barberà and Romero also focuses on the study of online learning processes. In this case, an extended literature review provides the basis for the proposal of a methodological design to analyze time regulation patterns and learning efficiency in collaborative online learning contexts.

Finally, the last article by Grau and Minguillón can be placed in the area of organization and management of e-learning processes. They address the issue of dropping out in online universities. Specifically, from a large data set showing students' enrolment at the UOC, they analyze the relationship between taking a break and the probability of dropping out from their studies.

These six research works, along with those to be included in the next issue, represent the first fruits of the eLC Doctorate with respect to the research program. We believe this is a good example of the many possible angles from which the relevance of time in online learning can be studied, which in turn opens new and promising pathways for future research.

Iolanda García



Llorens Cerdà, F. & Sangrà Morer, A. (2013). Teaching Presence and Time Management in the Virtual Classroom: The UOC's model. *eLC Research Paper Series, 6, 06-14.*

TEACHING PRESENCE AND TIME MANAGEMENT IN THE VIRTUAL CLASSROOM: THE UOC'S MODEL

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Teaching Presence and Time Management in the Virtual Classroom: The UOC's model

ABSTRACT

Abstract: One of the most important conceptual pillars that make up the educational model of the Universitat Oberta de Catalunya (UOC) – as recognized in the organic document that develops it – is the "teaching presence". The notion of teaching presence, along with both cognitive and social presence, are the structural basis of the educational scenario known as e-learning, as assumed by the UOC. These concepts are not merely theoretical constructs. Properly focused, they can provide indicators to develop tools for assessing some aspects of virtual classroom organization and designing educational activities, including those involving the teacher's effective time management. Starting from an analysis of the components of teaching presence – along with some theoretical developments concerning the notion of time in online education– this paper aims to look at the concepts that have implications on the improvement of these activities, so they can be subsequently included in the development of evaluation scales.

KEYWORDS

time factor, teaching presence, e-learning, UOC, time management.

INTRODUCTION: THE UOC AND ITS ASYNCHRONOUS EDUCATIONAL MODEL

The Universitat Oberta de Catalunya (UOC) started in 1995. It emerged as an institution with a clear commitment to educating people in a highly diverse society in terms of "age, activity, incomes, residence and personal situation[1]". The vocation of the UOC is expressed in its mission, which summarizes its orientation towards lifelong learning and proposes a framework to support cutting-edge technology in the teaching process. Its educational and management model, based on personalization and on supporting students through networking and intensive use of Information and Communication Technologies, overcomes the barriers of space and time, using the knowledge generated for the development of the individuals and the improvement of the society (UOC, 2012).

Unlike other universities, the UOC has developed its own educational model. According to Bautista (2011), this model initially focused on the student, but, in the most recent reformulation (UOC, 2009), "the pedagogical approach of this university focuses on student learning activity" (pp. 53-54). Although the change seems minor, says Bautista, this is not so, because the shift to activity implies a capital emphasis on students' responsibility for their own learning. Given this central shift, the educational model of the UOC, under current analytical approaches (Sangrà, 2001; Duart, Solomon & Lara 2006; Mas, Gros & Garcia, 2009; UOC, 2009), is built on four principles:

- **Flexibility**. By "flexibility", the UOC means students' ability to organize their own learning process. Educational tools such as the syllabus[2], class schedule, etc., allow students to know from the beginning how the semester will be structured, and plan their work in each of the course subjects.
- **Customization**. This means adapting curricula, schedules and activities to the needs of the students and their particular pace of learning. It takes t experience and knowledge into account and tends to recognize the peculiarities and cognitive styles of students, especially lifelong learners.
- **Interaction**. The communicative dimension is key to designing the educational processes of the institution. Interaction is multilateral: it integrates students, faculty and learning contents into a single model.
- **Cooperation**. In the UOC's educational model, cooperative and collaborative activities are encouraged by the possibilities of the platform, according to a model in which asynchronous training becomes fundamental (Duart, Salomon & Lara, 2006). However, cooperation as a philosophy does not exclude autonomous and independent work. On the contrary, it requires high levels of individual reflection, which is ultimately what allows the students to contribute their experiences to the workgroup.

Taken all together, the above features mean the UOC virtual classroom is the space where interactions occur based on the activities that are the true core of learning. We are dealing with a third-generation e-learning model placing the emphasis on flexibility and participation (Gros, 2011). In it, says Gros, agents undertake new cooperative habits in which a key factor is "planning (individual and group) and time management, taking into account the allocation of roles, task distribution, etc." (p. 28).

From the above identity notes it is easy to understand the importance of the time factor.

1. Act recognizing the Universitat Oberta de Catalunya, 3/1995 dated 6 April. (1995).
2. "Plan Docente" in the UOC's language.

Flexibility, for instance, requires effectiveness in managing the teachers' tools allowing students achieve structure during the course. The customization involves adaptation to individual learning rhythms. The interaction demands good communication control through asynchronous tools (forums, message boards, e-mail...). And cooperation calls for the ability to self-organize to produce smoother cooperative and effective group dynamics. In short, the concept of online learning as a set of communicative and cooperative processes implies a redefinition of traditional teaching roles. Now, asynchronous communication time becomes essential, forcing us to define strategies to better manage and to evaluate such management.

This article intends to look at some educational concepts that have implications for the improvement of the activities involving time management in e-learning environments, so they can be taken into account in developing evaluation scales. We want to provide indicators to develop tools for assessing some aspects of virtual classroom organization and the design of educational activities, including those involving the teacher's effective time management.

We have divided the article into three main parts in addition to this introduction and the corresponding conclusion. They include the rationale explaining the notion of teaching presence at the core of the UOC's educational model, the theoretical background, in which we relate the two main topics of the article: teaching presence and time management. There is also a final part where we propose the foundations of a framework for analysing the time factor in the educational model of the institution.

RATIONALE: TEACHING PRESENCE AS AN AXIS OF THE UOC'S EDUCATIONAL MODEL

In its teaching model, the UOC (2009) has explicitly acknowledged the influence of Garrison & Anderson's conception of technology-mediated learning (Garrison & Anderson, 2005). Such recognition has been recently confirmed by Begoña Gros: "The community of inquiry framework developed by Garrison & Anderson is an attempt to provide educators with a deeper understanding of the characteristics of e-learning" (Gros, 2011, p. 17). These authors analyse virtual interactions that result in "learning experiences" – in which teachers, students and content come together – in terms of the concept of presence. Three types of presence are distinguished: social presence, cognitive presence and teaching presence. Social presence is concerned with the involvement of teachers and students in a common virtual space (classroom, groups, etc.) and with common objectives. It has an inclusive, empathetic dimension. Cognitive presence is the educational intervention in the processes that relate the students to the learning content. This is a dimension that focuses on training and development of critical thinking and research. Finally, the teaching presence encompasses the processes of design and planning, facilitation of discourse and direct instruction. Garrison & Anderson justify the teaching presence from the analysis of the teacher roles proposed by other researchers (e.g. Berge, Paulsen & Mason[3]).

The effective application of the interpretive framework – represented by these different types of presence – to learning situations occurs through the interaction of educational agents in the virtual platform where learning takes place: the *virtual campus* (De Laat & Lally,

3. Cited by Garrison & Anderson (2005, p. 97).

2003). Here, the teacher is responsible not only for the vehiculation of information, but for a host of complex processes that have been analysed by Gilly Salmon under the concept of e-moderating (Salmon, 2001, 2003).

This article only focuses on the concept of teaching presence, and its objective is to provide the theoretical basis for developing an evaluative tool to asses the aspects of teaching that have relevant implications for improving time management in the virtual classroom.

Figure 1 shows the components of the teaching presence, according to Garrison & Anderson. *Design and organization* refers to behaviour patterns, organization and teaching planning in the virtual classroom. *Communication* (or "facilitation of discourse", in the words of the authors) falls into the interactive dimension, with consensus, the discussion of points of views and the establishment of an adequate working environment in the virtual classroom. Finally, *direct instruction* covers the processes traditionally associated with transmission and content delivery, monitoring and evaluation. Table 1 details the teaching actions with which each component is achieved. As can be seen, the components are expressed in the form of a division of time that virtual trainers should implement in the classroom –if they are to follow the teaching model assumed by the institution.

We must now look at the aspects of time management involved in individual actions making up the components of teaching presence, in order to establish an analytical framework that includes aspects such as an

Figure 1. Types of presence and teaching presence components (Garrison & Anderson, 2005).

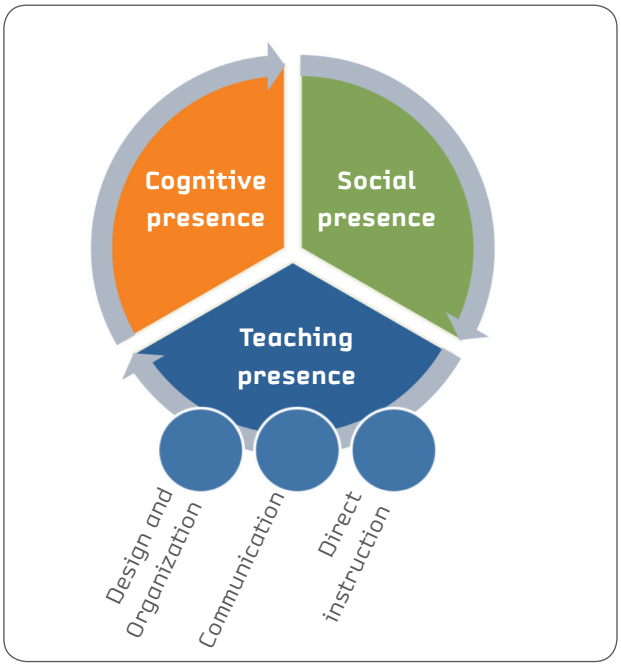

Table 1. Teaching presence: virtual classroom division. Adapted from Garrison & Anderson, 2005

Design and organization	Communication (facilitation of discourse)	Direct instruction
• Design methods. • Syllabus. • Calendar. • Effective use of technological resources. • Standards of conduct and courtesy. • General feedback to the classroom (response times).	• Identifying areas of agreement / disagreement. • Trying to reach a consensus. • Encouraging, recognizing and reinforcing student contributions. • Establishing a climate of study. • Promoting discussion (extract views of participants). • Evaluating the effectiveness of the process.	• Submitting content. • Focusing discussion on specific topics. • Summarizing the discussion. • Confirming understanding through explanatory feedback. • Diagnosing misconceptions. • Injecting knowledge from different sources (multisource, multimedia). • Addressing technical problems.

instructor's job evaluation scale. The next section deals with this issue.

THEORETICAL BACKGROUND: TEACHING PRESENCE AND TIME MANAGEMENT

Learning takes time, and deep learning requires more time (Stoll, Fink & Earn, 2003). The time factor is even more crucial, if possible, in online learning, since, here, teaching processes require control of an added variable: *technology*. Furthermore, virtual teaching requires a stable presence of the trainer in the classroom, continuous monitoring of students and special handling for social time (McVay Lynch, 2002).

It is easy to see that the time factor is present in each component of the teacher presence described by Garrison & Anderson. So, in a summary analysis, the *Design and Organization* component involves planning the contents, programs, activities and classroom schedule. The Communication component helps teachers to manage the classroom climate, promoting involvement and student participation. The Direct Instruction component will include activities such as releasing content or regular educational assessment tasks. The issue, then, is to identify, in accordance with existing theoretical proposals, a set of indicators that underlie the temporal components of teaching presence that can be evaluated in research on virtual learning and teaching.

There are many different approaches to the notion of time in education. Some of them refer to the times or "watches" of institutional change and administrative structures of the school (Cuban, 1995; Thrupp & Willmott, 2003). These approaches are beyond the scope of this article. In most cases, however, the problem of time is tackled from an operational perspective, trying to propose formulations that enable the researcher to understand its role and to assess its control and management. Willis (2007), for example, focuses on the processes of design and communication. Race & Brown (2004) propose practical recommendations on the organizational aspects of student time. Stoll, Fink & Earn (2003), Gros, Barbera & Kirchner (2010) and Bates (2010) cover the three components of teaching presence from different perspectives. The study by Gros, Barbera & Kirchner is particularly interesting because it contains an in-depth analysis of the time factor literature, distributing it in three dimensions, one of which is precisely teaching and learning online. This dimension has a strong correlation with the components of teaching presence. Meanwhile, Perez-Mateo & Guitert (2011) explores the role of time in collaborative learning processes. Table 2 organizes the collection of temporal factor analysis in virtual education, highlighting which components affect the teaching presence.

If we study the third column carefully, it can be seen that the aspects of the teaching presence involving time tend to concentrate in three groups: firstly, those relating to students' learning time (for example, most of the Race & Brown's considerations). Secondly, those that have to do with the uses of technology: tools, platforms and software that can be part of active learning (as in the analysis of Bates). Finally, the set of processes that affect the teaching task itself, including the organization of the curriculum and materials and the production of feedback strategies in the classroom (very much present in the review of Stoll, Fink & Earn).

These clusters of activities involving effective time management are not arbitrary. For instance, the study of 28 specialized papers carried out by Gros, Barbera & Kirschner fits well, in terms of virtual teaching and learning with the "times" mentioned: the time involved in the use of technological tools and the student

Table 2. Studies on time management.

Authors	Teaching presence components	Time management implied aspects
Gros, Barberà & Kirschner (2010)	The study affects all three components.	• Technology time. • Social and participatory time. • Student time. -Progression in content development. -Individual evolution
Stoll, Fink & Earn (2003)	The study covers areas of the three components.	• Planning time. • Time for learning new techniques and development experiences. • Time for observing lessons by peers and trying out new practices. • Time for researching. • Time for working collectively, to create a community.
Willis (2007)	This focuses on the *Design and Organization* component and *Communication* component.	• Guidelines for participation. • Control class size. • Manageable amount of materials. • Scheduling time. Establishing milestones and limits. • Creating habits to organize time. • Identifying priorities. Having realistic plans.
Race and Brown (2004)	The study focuses on the component *Design and Organization*. The recommendations have more to do with tutorial processes than teaching processes.	• Helping students to become better at time management. • Making students aware of the learning pay-off. • Helping students to stop and look back. • Helping students to spare themselves the effects of procrastination. • Getting students to set stage deadlines for themselves. • Helping students feel positive about getting ahead of schedule. • Getting students to do a risk assessment, helping them to identify the consequences of poor time management. • Convincing students that minutes can count for more than hours.
Pérez-Mateo & Guitert (2011)	The study focuses on collaborative learning processes in virtual environments.	• Time to learn the tools. • Time to organize work and learning processes. • Time to optimize the networking process. -Interaction between members. -Organization and process management. -Knowledge construction.
Bates (2010)	The study affects all three components, from the viewpoint of the student.	• Time of the learner. • Time of the learning activity. • Time affordances of different media and technologies.

time are so clear. Moreover, one of the main ways teacher time shows up is in the evolution of the learning rates of students in the virtual classroom.

A FRAMEWORK FOR ANALYSIS OF THE TIME FACTOR IN THE UOC'S EDUCATIONAL MODEL

We now have sufficient theoretical elements to set up a matrix that enables researchers to correlate the approaches we have explained to temporary variables in e-learning to the components of teaching presence, as considered in the educational model of the UOC.

This was done in Table 3. The table develops a synthesis between the components of teaching presence and categories drawn from the theoretical review considered in this article. The teaching at the UOC is aimed at fostering interaction and creating active participation and collaborative dynamics, all about learning activities that make preferential use of technological tools. So, an analytical model

Table 3. Matrix of analysis for building evaluation scales that include the time factor in e-learning.

Design and organization		Teaching presence		
		Design and organization	*Communication*	*Direct instruction*
Time dimensions	Student time	• Awareness of the value of time in work organization. • Counteracting procrastination. • Setting partial and achievable goals. • Importance of the agenda and timetable. • Learning techniques and scientific data on optimizing study time.	• Development of collaborative habits. • Rules and *netiquette* communication in relationships in the virtual classroom. • Contribution to a climate of respect and dialogue in the classroom that supports working fluid dynamics. • Awareness of cultural time differences.	• Awareness of the importance of fulfilling the deadlines of the activities. • Forecasting volumes of information. • Right choice of technological tools to explain the educational content.
	Teacher time	• Time invested in organizing and designing of the virtual classroom. • Time spent in designing the syllabus and learning activities. • Time spent on managing the virtual classroom space.	• Time spent energizing and monitoring activities. • Time devoted to organizing workgroups in collaborative activities. • Time taken to create a working environment and promote discussion and self-criticism.	• Time spent in evaluating activities and tasks. • Time spent on assessment and feedback. • Time taken to promote independent student research.
	Technology time	• Decisions about what tools will be used in the teaching process. • Realistic design of time and skills required for an effective use of the tools.	• Time taken to generate dynamic communication with the tools available in the virtual campus. • Using social networking platforms to extend learning outside the virtual environment.	• Time spent on solving technical problems. • Time devoted to content integration from external platforms and web services.

seeking to establish indicators that can be used later in a broader teacher/student role appraisal should consider the temporal aspects that are located at each position in the array. As seen in the table, for each component of teaching presence we have identified specific guidelines regarding the time of the student, the teacher and the technology.

The development of an instrument for assessing the effectiveness of the teaching-learning process should look for indicators that materialize the concepts presented in the matrix. For both quantitative and qualitative research, the time factor assessment of online teaching must consider at least some of the highlighted aspects, as they are embedded in the teaching nucleus of the institution examined.

CONCLUSIONS

Throughout this article we have shown the relationship between the teaching core of a virtual university, the UOC, and the aspects of effective time management in online education derived from theoretical approaches, some of which include a set of comprehensive studies of the literature. The UOC's identity notes show a significant dependence on processes involving communication time management in asynchronous environments.

The UOC exposes the this teaching core in its educational model. It gives a privileged position to the concept of teaching presence. This paper has detailed the temporary implications of this notion by examining its components in the light of a consistent theoretical review.

As a result of this process, it has been determined that there are three dimensions of time that bind most of the factors outlined by the authors we considered: firstly, the teaching dimension, materialized in teacher time. Second, the student's time, with its scheduling, learning strategies and self-paced ways of working. Finally, a key factor in technology-mediated learning is the productive control and use of the tools and platforms: the so-called technology time.

Alongside this exchange of data, we have designed a matrix or double-entry framework that is intended as a guide for evaluating the temporal aspects involved in virtual education. It is also proposed that in the reference institution, the UOC, an evaluation instrument intended to consider the time factor in e-learning will take into account some, or all, of the indicators in the matrix. The choice of which factors should be converted in indicators depends on the design, methodology and objectives of each particular investigation.

References

Anderson, T. & Elloumi, F. (2008). *Theory and Practice of Online Learning*. Athabasca University. Retrieved from http://cde.athabascau.ca/online_book/contents.html

Bates, T. (2010). Relevant voices around the world. *eLC. Research Paper Series*, *0*, 4-6.

Bautista, G. (2011). 'El acompañamiento del estudiante: profesorado para una nueva forma de aprender'. In Gros, B. (ed.). *Evolución y retos de la educación virtual. Construyendo el e-learning del siglo XXI*. Barcelona: UOCInnova.

Cuban, L. (1995). The myth of failed school reform. *Education Week*, 1 November. Available at http://larrycuban.wordpress.com/2011/02/02/the-myth-of-failed-school-reform-part-1/

De Laat, M., & Lally, V. (2003). Complexity, theory and praxis: Researching collaborative learning and tutoring processes in a networked learning community. *Instructional Science, 31*, 7-39.

Duart, J., Salomón, L., & Lara, P. (2006). La 'Universitat Oberta de Catalunya' (UOC). Innovación educativa y tecnológica en educación superior. *RIED, 9*(1-2), 315-344.

Garrison, D.R. & Anderson, T. (2005). *El e-learning del siglo XXI*. Barcelona: Octaedro.

Gros, B., Barberà, E. & Kirschner, P. (2010). Time Factor in e-learning: impact literature review. Some exploratory research. *eLC. Research Paper Series*, *0*, 16-31.

Gros, B. (ed.). (2011). *Evolución y retos de la educación virtual. Construyendo el e-learning del siglo XXI*. Barcelona: UOCInnova.

Guitert, M. (2011). Time Management in virtual collaborative learning: the case of the Universitat Oberta de Catalunya (UOC). *eLC. Research Paper Series*, *2*, 5-16.

Mas, X., Gros, B., & García, I. (2009). La evolución del modelo educativo de la UOC: un enfoque orientado a la adquisición de las competencias del s. XXI. Retrieved from www.virtualeduca.info/ponencias2009/522/Articulo_modelo_educ_competencias.pdf

McVay Lynch, M. (2002). *The Online Educator. A guide to creating the virtual classroom*. New York: RoutledgeFalmer.

Pérez-Mateo, M. & Guitert, M. (2011). How to promote effectiveness in terms of time in networking processes. *eLC. Research Paper Series*, *3*, 37-47.

Race & Brown. (2005). *500 tips for tutors*. 2nd Edition. London & New York: RoutledgeFalmer.

Sangrà, A. (2001). Enseñar y aprender en la virtualidad. *EDUCAR, 28*, 117-131

Salmon, G. (2003). *E-moderating: The Key to Teaching and Learning Online* (2nd ed.). London: Taylor & Francis Books Ltd.

Stoll, L., Fink, D. & Earn, L. (2003). *It's about learning (and it's about time)*. What's in it for schools? London & New York: RoutledgeFalmer.

Thrupp, M. & Willmott, R. (2003). *Education management in managerialist times*. Philadelphia: Open University Press.

UOC (2009). *The UOC's educational model. Evolution and future perspectives*. Barcelona: UOC.

UOC. (2012). *Compromiso social*. Retrieved from http://www.uoc.edu/portal/es/universitat/compromis-social/codi-etic/index.html

Willis, N. (2007). 'Time Management'. In Distefano, A., Rudestam, K. E. & Robert J. Silverman, R.J. *Encyclopedia of Distributed Learning*. London: SAGE Knowledge.

Wragg, E.C. (2004). *The RoutletgeFalmer Reading in Teaching and Learning*. London & New York: RoutledgeFalmer.

Esposito, A.; Sangrà, A. & Maina, M. (2013). Chronotopes in learner-generated contexts. A reflection about the interconnectedness of temporal and spatial dimensions to provide a framework for the exploration of hybrid learning ecologies of doctoral e-researchers. *eLC Research Paper Series, 6, 15-28.*

CHRONOTOPES IN LEARNER-GENERATED CONTEXTS A REFLECTION ABOUT THE INTERCONNECTEDNESS

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Chronotopes in learner-generated contexts. A reflection about the interconnectedness of temporal and spatial dimensions to provide a framework for the exploration of hybrid learning ecologies of doctoral e-researchers

ABSTRACT

This work is concerned with a reflection on the construct of "chronotope" (Bakhtin, 1981) as a conceptual tool suitable for illustrating the affordances of emerging Web 2.0 learning ecologies of doctoral researchers. For the purposes of this work, the chronotope is considered as an analytical lens suitable for illustrating the movements of PhD researchers across shifting space/time configurations (affordances) arising from scholarly environments increasingly permeated by digital mediation. The conceptual framework under construction looks at the intersection of time and space being produced by self-directed PhD students, engaged in sifting the learning opportunities provided both by institution-bounded and self-organized learning ecologies in the open Web. The focus is on the role that personal technologies – especially social Web tools and environments – play in the function of supporting academic identity building in the course of a doctorate and in affecting the boundary crossing activities undertaken by PhD e-researchers in their efforts to draw opportunities from hybrid (analog/digital; formal/informal) learning ecologies. The developmental phases of a doctoral journey (Gardner, 2009), along with the interweaving of past-present-future in the "identity-trajectory" of PhD students (McAlpine & Amundsen, 2011), are adopted to provide a preliminary frame for the object of study. It is argued that the notion of chronotope, understood as multiple and variously appearing institutional constraints and individual motivations, can help to make sense of the extent to which this new 'species' of doctoral e-researcher is able to co-evolve within the academic culture of the local research training environments.

KEYWORDS

learning ecologies, chronotopes, doctoral students, social Web

Esposito, A.; Sangrà, A. & Maina, M. (2013). Chronotopes in learner-generated contexts. A reflection about the interconnectedness of temporal and spatial dimensions to provide a framework for the exploration of hybrid learning ecologies of doctoral e-researchers. *eLC Research Paper Series, 6, 15-28.*

INTRODUCTION

This paper examines how the time factor, in its interconnectedness with space factor, affects the construction of the theoretical framework of a study exploring emerging learning ecologies of doctoral students. The inquiry investigates a sample of PhD researchers, mainly across Italian universities, focusing on the adoption of tools and services in the open Web as complementary "potential forms of assistance" (Luckin, 2010) in their doctoral journey.

Recent research analysing the doctoral experience (McAlpine & Amundsen, 2011; Gardner & Mendoza, 2010) provides accounts of a considerable diversity of activities being undertaken by individual PhD students, beyond the influence of the crucial relationship occurring between the apprentice researchers and their supervisor(s) (Shulman, 2004): from building networks outside their local academic environment to searching for different kinds of support and engaging in self-directed tasks (Jazvac-Martek, Chen & McAlpine, 2011). Such diversity can also be considered within an ecological approach to doctoral education (Cumming, 2010), which takes into account both the increasingly numerous academic and extra-academic factors and stakeholders currently dealt with by doctoral candidates. Furthermore, empirical studies show that Web 2.0 tools have started to affect the behaviours of apprentice researchers (British Library/ JISC, 2009-2011; James, Norman, De Baets et al., 2009; Zhu & Procter, 2012). They generally show a high degree of flexibility but more rarely demonstrate an active use in the adoption of social media. Moreover, tools and environments in the open Web are seen as providing useful ways of supporting needs associated with the different phases of a doctoral experience (Zaman, 2010) and enabling PhD students to find new "learning partners" (Flores-Scott & Narad, 2012). These applications are facilitating "emerging Web 2.0 learning ecologies" (Williams, Karousou & Mackness, 2011), defined as *loci,* in which new kinds of learners – "*silent experts* in how, where and by whom want to be educated" (ibid.) – strive to balance "emergent and prescriptive learning" by coping with "openness and constraint" provided by the open Web and by institution-led educational opportunities.

These self-organized learning ecologies are seen as providing particular "opportunities for learning" (Barron, 2006) and interactions enabling a "greater agency" (Luckin, Clark, Garnett et al., 2010, p. 74) by individual learners in the construction of "learner-generated contexts" (ibid.). Recent research on postgraduate students (Gourlay & Oliver, 2012) has given some empirical evidence of the sophisticated degrees of "adaptability, agility and resilience" (ibid.) required for students to be engaged with diverse technologies permeating the "conventional" higher education context. However, issues related to the creation of new spaces and time-frames by doctoral students are, to date, underesearched. The research project to which this paper is related sets out to explore the extent to which doctoral students in Italian universities are able to draw new learning opportunities from the adoption of emerging technologies available on the open Web. The study will first describe current and new uses of technologies and other kinds of resources by individual students in their doctoral activities. Secondly, it is designed to illustrate how a niche of PhD candidates – named as "doctoral e-researchers" – use and co-construct alternative or complementary learning spaces and temporal configurations, as they are absorbing conventional practices and tacit norms from a defined research training setting.

This paper aims to contribute to the construction of a conceptual framework useful for researching "hybrid" (physical/ virtual) (Kazmer, 2005) and "personal learning

ecologies" (Andrews & Haythonthwaithe, 2011) of individual doctoral students. These apprentice researchers are considered in their effort to reap the benefits of the social Web (Boulos & Wheeler, 2007) to complement the opportunities for learning being provided by the respective, conventional research training contexts.

The interplay of spatial and temporal affordances of "learning ecologies" is considered here as a crucial issue for highlighting the inherent features of learning ecologies as complex and evolving systems and revealing characteristics of agency on the part of individual learners. It is argued that the spatiotemporal matrix defined by the notion of "chronotope" (Bakhtin, 1981), along with an ecological approach to the topic being researched, can be functional for this purpose and can shed light on sense-making practices of self-directed learners striving to shape their "identity-trajectory" (McAlpine & Amundsen, 2011) as future researchers.

The article will firstly present the rationale, focusing on the construct of chronotope as a spatiotemporal matrix suitable for revealing the dynamics of individual's doctoral experience over time and diverse spaces. Secondly, it will discuss three theoretical strands in the background section: 1) the time factor in the doctoral journey; 2) learning ecologies as sources of learning opportunities featured by space and time markers; 3) key instances of application of the notion of chronotope to research on technology-mediated learning contexts. Thirdly, it will outline key elements for a theoretical framework, building on the theoretical strands previously discussed. Finally, some provisional conclusions will be drawn, prefiguring further research and discussing advantages and disadvantages of the use of metaphors in research.

RATIONALE

There are different options for analysing time factor in a digitally-mediated doctoral journey. It could be analysed as a resource, being interpolated between instructional time planned in learning design and time management learner's skills (Romero & Barberà, 2011). Studying time as a resource focuses on the organizational characteristics of doctoral journey and their effects on individual learning timeframes, considering the chronological value of time use for enabling self-efficacy in learners (Odaci, 2011). Otherwise, it would be possible to focus on the time affordances of specific ICT tools – so far an underesearched area (Bates, 2010) – as adopted for doctoral activities.

This study identifies individual, self-directed doctoral students as unit of analysis. Focus on the time factor is related to how PhD students "construct time to generate learning opportunities" (Bloome, Beierle, Grigorenko et al., 2009, p. 313) rather than to how much time is given to academic learning. So, attention is concentrated on time as process rather than on time as quantity. The work underlies the assumption that "space is made in time" (Lemke, 2004) and considers time as context of learning activity, "as produced and productive, rather than a container for action or a passive background for ongoing activity" (Brown & Renshaw, 2006, p. 249). A qualitative perspective of analysis of the time factor in emergent learning ecologies is endorsed in order to reveal the "goal orientation" (Riemann, 2009) of self-directed learners (doctoral researchers) making sense of the shifting places and shifting timescales which they are co-constructing and across which they are moving along their learning path (doctoral journey). In other words, the time factor in the doctoral experience is holistically examined as a meaning-making matrix, in which time and space markers help us to gain insights on qualitative

features of the experiences of doctoral students, grappling with multiple spaces and exposed to a range of resources. The construct of "chronotope" (Bakhtin, 1981) is considered as providing a holistic view of "how people conceptualize their collective and individual movement through time and space" (Bloome et al., 2009, p. 324). In essence a chronotope "characterizes the typical ways in which narrative genres move the scene from place to place" (Lemke, 2004). In fact, this notion was devised and developed by Bakhtin in his seminal construction of the problems of literary forms. In narratives the chronotope represents the particular interconnectedness of temporal and spatial indicators as key features of a literary genre in a text. At the same time, it accounts for authors' and characters' world views, for their capacity to act upon (e.g. in Goethe's novels the hero co-emerging "along with the world") or to be acted upon (e.g. in Greek romance, the unchanging character of the hero), and for their cognitive strategies and degree of freedom to change the historical situation in which they are contextualized. In a text, chronotopes are always multiple and changing, and often interwoven and competing, allowing its "knots" of meaning "to be tied and untied" (Bakhtin, 1981, p. 15).

The particular chronotope characterizing a specific learning environment has been formulated as an ongoing process, being shaped and re-discussed within a dialogical context being nurtured by a range of voices (Brown & Renshaw, 2006). Unlike novels, in which chronotopes indicate moves from one scene to another one, in a learning process participants negotiate their own identities as authors arising from symbolic moves across different time-space configurations. As in novels, in everyday life and in educational contexts, chronotopes are generally "messy, complicated, incomplete, multiple, and competing" (Bloome et al., 2009, p. 324). Moreover, new chronotopes are emerging, for instance in "our use of educational media" (Lemke, 2004), which it is worth understanding "for effective design of educational environments" (ibid.).

It is important to notice that the focus in this study is on understanding how doctoral students "construct time to generate learning opportunities" (Bloome et al., 2009) rather than on identifying learning patterns in the doctoral experience, as has been explored elsewhere (e.g. Boud, 2008; Flores-Scott & Narad, 2012). However, in the background this paper takes into account the Bakhtinian approach to learning (Koschmann, 1999) as a social, dialogical and historically situated process. In such a process, the exposure of the individual to multivoicedness and outsideness, as well as the personal struggle against diverse degrees of power relationships in the dialogue with others, help to increase learning and produce personal growth. This view is aligned with a socio-cultural approach to the notion of learning ecologies (Barron, 2006) and to a conceptualization of context as learner-centric (Luckin, 2010), in which a learner's intentions and motivations make sense of the multiple interactions occurring between the individual and other people and resources, through the enabling mediation of technology.

BACKGROUND

THE DOCTORAL EXPERIENCE AND THE TIME FACTOR

As a process of change, a doctorate has to do with the transition "from a good course taker to an independent researcher" (Lovitts, 2005) and typically involves a sense of becoming, well expressed in the metaphor of the "doctoral journey" (Baptista & Huet, 2012). In their learning path, individual PhD students develop academic dimensions such as "knowing", "acting" and "being" (Barnett &

Coate, 2005), where the dimension of "being" is intended as any embedded forms of knowing and acting in the world and is often neglected in research training design (Whiteman & Oliver, 2008). Such dimension is highlighted in the notion of "identity-trajectory" (McAlpine & Amundsen, 2011a) in which the integration of past-present-future is continuously evolving and interweaving across the three main strands of "intellectual" (the link with the tradition and the perspective of future contributions to knowledge), "networking" (the web of connections being intertwined beyond the academic boundaries) and "institutional" (the set of tasks and responsibilities in which a PhD student is located). Elsewhere, this process of becoming is described as featured by three fluid developmental phases (Gardner, 2009), in which the individual doctoral student gradually gains greater autonomy: from more structured and guided tasks (e.g. coursework, exams) toward more unstructured and self-directed activities (e.g. decisions on the dissertation, future employment choices). The idea of "identity-trajectory" can also be related to the Bakhtinian construct of "ideological becoming" (Bakhtin, 1981), which provides a powerful tool for making sense of the whole student experience and the pedagogical orientation in a doctoral journey. This construct refers to the development of one's own way of viewing the world (from the Russian meaning of the word 'ideologhìa'), rather than a mere political view (Freedman & Ball, 2006, p. 4). The individual is engaged in the progressive emotional and ideological transformation of the individual consciousness, through the mediation of the enabling (digital) environment, by interacting with different voices and struggling with "various kinds and degrees of authority" (Bakhtin, 1981, p. 345). Individual doctoral students have to cope with the diversity, multivoicedness and ever-evolving nature of the academic setting in which they are situated. This suggests a possible interpretative frame of emergent profiles of doctoral e-researchers, in which the capacity to create new spaces of academic socialization can lead to reshaping the fundamental relationship between the apprentice researcher and the supervisor and variously affect the intellectual, networking and institutional strands of activities, across the diverse developmental phases of a doctoral journey. The need to frame the enabling conditions of the Web 2.0, defined as "an artefact evolving according to shifting user engagement" (Brown, 2012, p. 50), leads to a consideration of the ecological metaphors and their capacity to describe learning environments and collective and individual agents shaping (and being shaped by) them.

LEARNING ECOLOGIES AND THE SPACE FACTOR

While, in general, ecological views draw attention to the "cyclical and emergent nature of human activity" (Andrews & Haythonthwaithe, 2011, p. 159), the proper notion of "learning ecology" is defined as a "new, self-catalytic system" (Seely-Brown, 2000), characterized by a dense fabric of intellectual interactions occurring everywhere and among diverse subjects, producing and expanding the core competences of a local context. An ecological approach to e-learning in higher education (Ellis & Goodyear, 2009) appears to meet the purpose of describing the entanglements of formal/ informal, analog/ digital spaces characterizing the doctoral experience of PhD researchers coping with a range of technologies and support services. The ecology metaphor has been inflected differently according to socio-technical approaches, focusing on the mutual influence of people and technologies (Nardi & O'Day, 1999; Andrews & Haythonthwaithe, 2011) or socio-cultural approaches, exploring the relationships between learners and the intricacies of the local environment (Barron, 2006; Luckin, 2010; Pachler, Cook & Bachmair, 2010). Diverse approaches produce

a different focus on spatial features and the role of populations or agents for individual change in local ecosystems. For instance, the seminal conceptualization of the "information ecologies", defined as the interconnected system of "tools, people, values and practices in a local environment" (Nardi & O'Day, 1999, p. 49) relates the concept of "locality" to participants in each setting who "construct the identities of their technologies through the rhythms and patterns of their use" (1999, p. 55). In such systems "keystone species" (librarians in their example) are organisms playing a crucial role in the functioning of the ecology, even if their work is invisible and peripheral. They preserve the key functions within the ecosystem (modes of knowledge distribution), assuring sustainability and "balance found in motion, not stillness" (p. 53), for instance introducing new technology-mediated practices. Building on these socio-technical stances, Andrews & Haythornthwaithe (2011) focus on "personal learning ecologies" to draw attention to the current "on-the-ground lived experiences of students and teachers", being affected by the spread of social media tools, the ownership of personal devices and the changing nature of user engagement, evolving along with the digital artefacts. In their view, higher education students can be thought as an emerging "keystone species", able to co-evolve with their environment and respond to the pressures of technological change. Along these lines, Williams, Karousou & Mackness (2011) point to "Web 2.0 learning ecologies" as *loci* in which self-directed learners strive to balance "emergent and prescriptive learning" by coping with "openness and constraint" being provided by the open Web and by institution-led educational opportunities. Highlighting the tensions occurring between the self-directed learner and the constraints of institution-bounded learning is a key issue in researching doctoral e-researchers. Likewise, it is important to think of the learning opportunities in the social Web as a product and process coupled with the development of individualized forms of mass communication (Pachler et al., 2010). Otherwise, Pata & Laanpere (2011) provide a vision of learning ecologies *as* biological systems rather than metaphors and discuss the construct of "hybrid learning ecosystems" to highlight the tensions between formal educational assets and "open learning ecosystems" where digitally literate learners are dwelling in the social Web. On the other hand, Barron describes 'learning ecology' as the "set of contexts found in physical or virtual spaces that provide opportunities for learning" (2006, p. 195), which may include formal, informal, and non-formal settings. In her view, a learning ecology encompasses a range of environments closely linked to physical or virtual spaces and characterized by a specific collection of elements founding specific conditions for learning. In fact, each context provides a "unique configuration of activities, material resources, relationships, and the interactions that emerge from them"(ibid.).

In this study we prefer to think of learning ecology of doctoral e-researchers as plural and hybrid (institutional/personal) (Pata & Laanpere, 2011), where the distinction between formal, institutionally organized learning ecologies and informal, "open learning ecosystems" (ibid.) provides a dialogue of tension and interdependence rather than polarization. Likewise, hybridity of spaces characterizing these emergent learning ecologies is also considered, the term "hybrid spaces" being based on Kazmer's (2005) view of the mutual influences between analog and digital spaces in blended learning instances. This tenet is aligned with discourses aiming to link the physical and the digital and acknowledging "the significance of the changes that technology can make to the potential of everyday spaces" (Luckin, 2010, p. 9). This approach helps to attribute an equal status to analog and digital spaces and, in particular, fits the features of a doctoral experience grounded in conventional university settings, in

which – apart from the mediation of technology through services such as e-mail and a digital library – the role played by the institutional e-learning platforms is quite scarce and the weight of the "personal learning ecologies" of PhD students can represent an element of discontinuity in research training practices.

Assuming that learning ecologies are conceptualized as hybrid and embedding clusters of learning opportunities, it is necessary to clarify the extent to which the notion of context and learner's agency (capacity to act in the world) are related. Luckin (2010a) provides an extensive discussion on the different theoretical perspectives about contexts for learning. She holds a view on context in its close interplay with learning and technology and builds on the socio-cultural perspective from Cole (1996), who uses the metaphor of "weaving" to sustain an interpretation of context merging the activities and their surrounding circumstances (in a time-bounded manner), against a view of context as a container. In this perspective, Luckin (2008; 2010) develops the learner-centric framework of "ecology of resources", that "considers the resources with which an individual interacts as potential forms of assistance that can help that individual to learn" (Luckin, 2010, p. 159). Her goal is in the identification of the components (people, technologies, frames) supporting the educational experience of learners and in any related adjustment in order to provide learners with the appropriate scaffolding. The learner's intentions are the axis from which the context can be interpreted as unified lived experience, making sense of the multiple interactions between people, activities and resources. A context is always "local to a learner", as it consists of an individual's subjective experience of the world, which is always spatially and historically situated (2010, p. 18). In this view, technology plays a mediating role that can help "to make these connections in an operational sense" (ibid.). Emerging technologies have a peculiar role as mediation tools: they are seen as fostering the production of "learner-generated contexts" (Luckin, Clark, Garnett et al., 2010, p. 74), which provide students with the opportunity to achieve "greater agency" (ibid.) in defining goals and boundaries of their learning contexts. The model of "ecology of resources" was created with the wider aim of designing "technology-rich learning experiences". For the purpose of this study it provides an individual-based perspective for looking at learning ecologies as sources of opportunities. Moreover, it considers static and dynamic representations of the interactions occurring among learners and "potential forms of assistance" (alias "resources") drawn from such learning ecologies. The context, as represented in the "ecology of resources", is therefore understood as a unique configuration of potential forms of assistance, produced and developed by the individual learner. Learners are urged by hybrid learning ecologies and are engaged in sifting resources and enacting interactions with them on the basis of their own intentions and changing needs. In the effort of combining and merging learning opportunities, an individual learner creates and crosses shifting spaces and times that constitute particular characteristics of emerging "learner-generated contexts". Moreover, the configuration of these shifting spatial and temporal dimensions is likely to reveal the "image" of individual self-directed learners striving to orient themselves across learning ecologies. It is argued that both these aspects can be holistically examined using the analytical tool of the chronotope, which shares with ecological views the perspective of human activity as cyclical and emerging.

THE CHRONOTOPE AS APPLIED TO (DIGITALLY-MEDIATED) LEARNING CONTEXTS

The chronotope construct (Bakhtin, 1981) has been extensively applied to literary, art and

cinema criticism and, more recently, to fields such as organizational studies and educational research. Here, as a mere example, it is worth recalling the prototypical genre of "road chronotope" and its inherent motif of the "encounters" shaping the path of the primary characters in narratives, such as Greek romance adventures and "road movies". This kind of chronotope has apparent links with the ideas of doctoral journey, 'identity-trajectory' and 'ideological becoming'. However, the goal of this study is related to the exploration of shifting spatial and temporal dimensions of hybrid learning ecologies.

A range of empirical studies have variously applied the construct of chronotope to (technology-mediated) learning contexts (e.g. Lemke, 2004; Brown & Renshaw, 2006; Matusov, 2009; Bloome, Beierle, Grigorenko *et al.* (2009); Ligorio & Ritella, 2010; Compton-Lilly, 2010; Loperfido & Ligorio, 2011; Hakkarainen, Ritella & Seitamaa-Hakkarainen, 2011; Rajala, Hilppö, Lipponen et al., in press). In the following paragraphs, attention is drawn to a short selection of these studies, reviewing them as functional in the construction of the theoretical framework in mind. Brown and Renshaw (2006) refer to the particular chronotope characterizing a specific learning environment as an ongoing process, shaped and re-discussed within a dialogical context being nurtured by a range of voices. These researchers apply Bakhtin's construct to classroom activities and adopt the "chronotope" as a means to uncover how students' participation in the classroom is inflected through interaction among past experiences, ongoing involvement and still-to-be-accomplished objectives. They use the notion of chronotope to reveal the shifting identities of students as they emerge in the interplay of time and space in a collaborative learning approach. They discuss the co-presence of competing chronotopes in classroom activities: for instance, a cooperation-based approach suggested by the teacher versus the specific, individual interpretation of such approach on the part of students, with respect to past achievements, present problems and foreground perspectives. In some cases learners act as "local heroes" whose actions have an apparent influence on the spatial/temporal matrix. In fact, these researchers conceptualize the chronotope as "creative spaces in which identities, both personal and collective, may be imagined, enacted, or contested" (Brown & Renshaw, 2006, p. 249). What it is particularly relevant in this perspective is the connection highlighted between space-time configurations prescribed by the school environment and the capacity of the individual student to affect it and therefore to act upon the environment of the location. Bloome et al. (2009) expand such a pedagogical use of chronotope, focusing on the opportunities for learning that can be designed. They build on Lemke (2004), who stresses the role of chronotope in providing descriptions of the "typical patterns of organization of and across activities in space and time" and in highlighting features of cultures, subcultures and communities of practice. To this end, focus is drawn to "make a distinction between individually held chronotopes, shared chronotopes, and publicly held chronotopes" (Bloome et al., 2009, p. 325).

Such a key distinction can help to identify the "institutionally sanctioned chronotopes" (Lemke, 2004) and those chronotopes that are constructed by doctoral students through their self-directed practice in digital environments, for instance for purposes linked to leisure and professional activities and for research purposes. Moreover, it can be argued that some doctoral e-researchers are able to move across different chronotopes (as they move across different learning ecologies) with the goal orientation of moving digital practices from the private/professional sphere (individual and shared chronotope) towards new kinds of "publicly held chronotopes". In other words, some self-directed learners could demonstrate

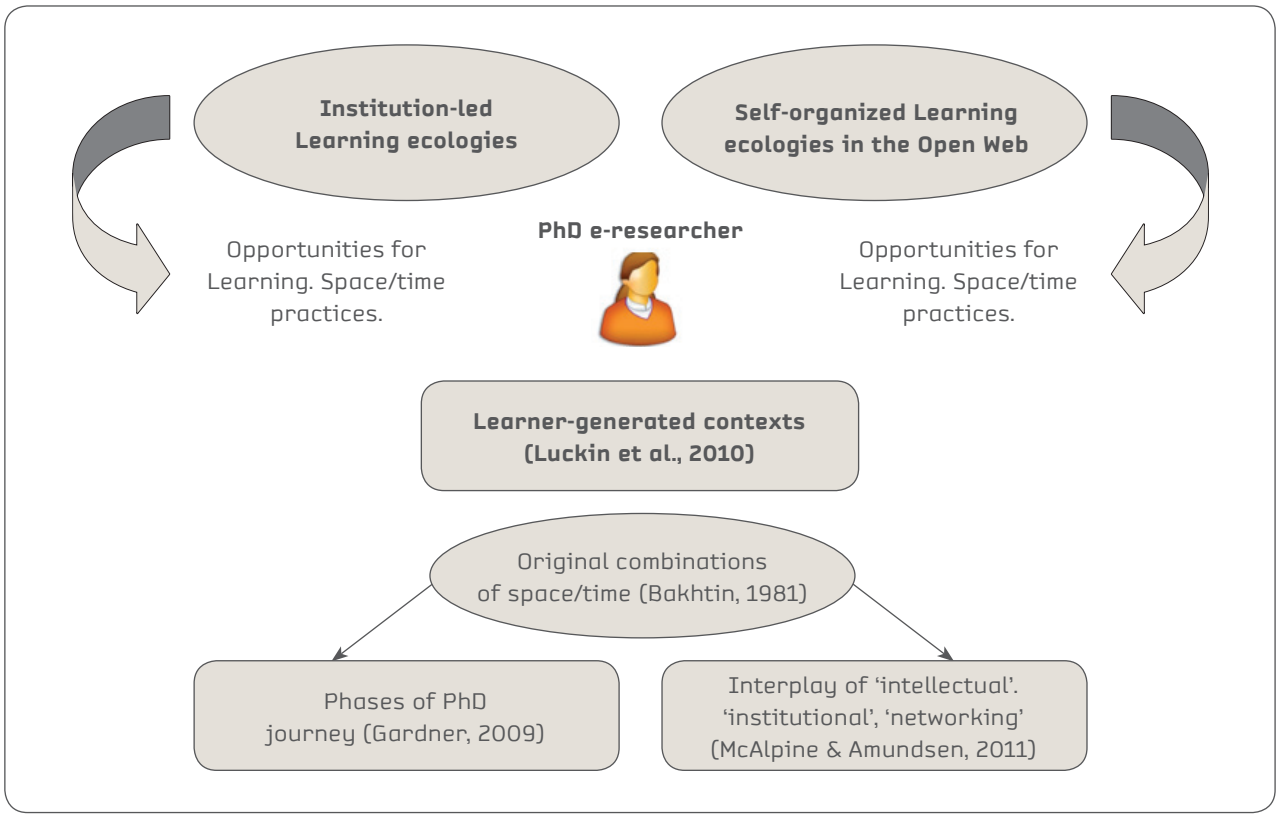
to create an "expansive chronotope" (Rajala et al. in press). Creating such a transformative chronotope, PhD students expand their agency and the related impact on the historical situation in which they are located, beyond the conventional space/time configuration defined by their formal research training environment. The relation between group work and the perception of space/time while using technology is specifically explored by Ligorio an& Ritella (2010), focusing on a case of collaborative teacher training being developed in a mixed physical/virtual learning environment. They highlight social and cultural factors at work in collaborative activities to gain an understanding of the coordination patterns of technology-mediated activities. The metaphor of diverse musical tempos is used to highlight the coordination patterns of the specific space/time configurations emerging from the analysis of the transitional moments in the collaborative work. The identification of the coordination patterns characterizing the boundary-crossing activities of doctoral e-researchers between institutional and self-organized learning ecologies is just at the heart of the undertaken investigation. Finally, focusing on quality of technology mediation, Hakkarainen, Ritella an& Seitamaa-Hakkarainen (2011) view the chronotope as "an approach that guides one to examine both temporal and spatial implications of technology-mediation". They discuss the original chronotope emerging from a collaborative technology-mediated context and providing learners with "amplified semiotic resources based on temporally integrated (bringing earlier crystallized cognitions to the present) and spatially merged virtual and social spaces of activity" (ibid.). This approach leads us to consider affordances of "learner-generated contexts" as dynamic and dialogical, being co-constructed by participants (Oliver, 2006) and as networked and evolving across space and time dimensions (Hoffmann & Roth, 2005). On the other hand, it is worth noting that the instances reported above refer to collaborative learning situations organized in formal settings. Otherwise, preliminary findings give evidence that the PhD researchers participating in the inquiry mostly show an isolated mode of study (Esposito, Sangrà & Maina, 2013). Thus, the focus is on the extent to which self-directed doctoral students are originally able to coordinate learning opportunities drawing from hybrid learning ecologies to create a kind of transformative chronotope.

ELEMENTS FOR A THEORETICAL FRAMEWORK

The theoretical strands briefly considered in the previous sections provide some key elements to develop a theoretical framework matching a research question aiming to explore the affordances of emerging learning ecologies of doctoral e-researchers. The provisional achievement is graphically summarized in the Fig.1 below.

The doctoral experience can be framed as a journey in which an "identity-trajectory" is to be unfolded, through the diachronic interweaving of the "intellectual", "networking" and "institutional" strands (McAlpine & Amundsen, 2011a) and across three developmental phases from the status of student towards a more defined autonomy as researcher (Gardner, 2009). The idea of "identity-trajectory" can be coupled to the notion of "individual becoming" (Bakhtin, 1981), in which individual PhD students orientate their intentionality through a dialogical and productive "struggle" with other subjects and multiple resources. Hybrid (physical/virtual; institutional/self-directed) learning ecologies are seen as the emergence of digitally permeated ecosystem, in which hybrid (physical/virtual) spaces (Kazmer, 2002) are closely interconnected, mutually influence one other and also open up to different

Figure 1. Elements for a theoretical framework.



temporal configurations. Institutional and self-directed learning ecologies are thought as complementary, but sometimes overlapping or contrasting sources of learning opportunities. Doctoral students are driven by their motivations and evolving learning needs and strive to filter and re-combine such learning opportunities, in order to produce unique learning contexts. Following Luckin (2010), the learning context being produced is understood as an "ecology of resources" – a matrix in which the prospective researcher shapes, manages and makes sense of the different "potential forms of assistance", be they human or material resources or tools – that are available in their formal and informal learning ecologies. The Bakhtinian chronotope provides an analytical tool that can be useful to gain insights on the extent to which doctoral e-researchers manage their moves across institution-led and self-organized learning ecologies to generate learning contexts. The distinction and relationship between private, informally and formally shared chronotopes – as outlined by Bloome et al. (2009) - are adopted to reveal shifting modes and spaces for scholarly activity and interaction in networked environments and can provide the lived experience of this niche of "silent experts" (Williams et al., 2011) coping with conventional and "scripted" or open and networked learning environments. The analysis of the ways in which doctoral students are actually interpreting space and time affordances of hybrid learning ecologies is likely to reveal the extent to which emerging digital mediation is affecting the intellectual, networking and institutional strands of activities, in different phases of the doctoral journey. Furthermore, it can shed light on the capacity of individual doctoral e-researchers to co-evolve along with (or, to a degree, in contrast to) their reference academic setting and discipline culture.

CONCLUSIONS

This paper has provided a reflection on the construct of the chronotope as an analytical lens suitable for illustrating the moves of PhD researchers across competing space/time configurations (affordances) emerging from formal and informal learning ecologies.

The time factor, in its close interdependence with space factor, was here discussed within a perspective considering the interplay of metaphors as a way to inform research (Sfard, 1998). This choice has its own potential and risks. On the one hand the use of metaphors enables "conceptual osmosis between everyday and scientific discourse" (Sfard, 1998, p. 4). On the other hand, this might expose the researcher to a danger of relying on her previous assumptions. As Sfard suggests, it is worth considering a dialogue approach to other kinds of metaphor. This article provides an early attempt to think of an interplay between the metaphors of learning ecologies and chronotope, taking into account a defined research question and with the aim of holistically considering space and time factors. Various issues remain or should be explored more in-depth. For instance, a more focused consideration of space and time dimensions developing in ecosystems (e.g. Cadenasso, Pickett & Grove, 2005) might provide additional hints for discussing digital ecosystems and related ecological metaphors. As regards the chronotope, although the variety of its applications to a range of research topics continues providing evidence of its analytical richness and flexibility, it is acknowledged that the conceptualization of chronotope is affected by weak analytical precision due to a current lack of systematic definition of the term (Leander, 2001; Bemong & Borghart, 2010). Furthermore, the application of this construct by educational researchers has been harshly criticized by philologists (Matusov, 2009). Such hurdles notwithstanding, it can be said that this notion fits the constructivist grounded theory approach underlying the ongoing study of doctoral researchers' Web 2.0 learning ecologies. In fact, the chronotope does not constitute a prescriptive framework from which to draw hypothesis before undertaking data gathering. On the contrary, it provides the researcher with a repertoire of "sensitizing concepts" (Charmaz, 2006) that can be used to orientate the collection and interpretation of empirical data.

References

Andrews, R. L. & Haythornthwaite, C. (2011). E-learning ecologies. In E-learning. Theory and Practice. London: SAGE, 143-160.

Baptista, A. V. & Huet, I. (2012). Making sense of metaphors about doctoral students' competences: Analysis of supervisors' voices. Procedia. Social and Behavioural Sciences, 47 (2012), 930-937.

Barnett, R. & Coate, K. (2005). Engaging the Curriculum in Higher Education. Maidenhead: SRHE/Open University Press.

Bakhtin, M. M. (1981). Form of Time and Chronotope in the Novel. In (Holquist, M. & Emerson, C. translators) The dialogic imagination. Four essays by Mikhail Bakhtin. Austin: University of Texas Press, 84-258.

Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecologies perspective. Human Development, 49, 193-224.

Bates, T. (2010). Relevant voices around the world. In Barberà, E. (ed.). Time factor in e-learning. eLC – Research papers Series - Issue 0, 2010, 4-6. Retrieved March 20, 2011 from: http://www.uoc.edu/ojs/index.php/elcrps/issue/view/issue-0

Bemong, N. & Borghart, P. (2010). State of the Art. In Bemong, N., Borghart, P., De Dobeleer, M. et al. (Eds). Bakhtin's Literary Chronotope: Reflections, Applications, Perspectives. Ginko, Academia Press, 3-16.

Bloome, D., Beierle, M., Grigorenko, M. & Goldman, S. (2009). Learning Over Time:

Uses of Intercontextuality, Collective Memories, and Classroom Chronotopes in the Construction

of Learning Opportunities in a Ninth-Grade Language Arts Classroom. Language and Education 23 (4), 313–34.

Boulos, M. & Wheeler, S. (2007). The emerging Web 2.0 social software: an enabling suite of sociable technologies in health and health care education. Health Information and Libraries Journal, 24(1), 2–23.

British Library/JISC (2011) Researchers of tomorrow. A three-year (BL/JISC) study tracking the research behaviour of 'Generation Y' doctoral students. Second annual report 2010-2011. Retrieved June 30, 2011 from: http://www.jisc.ac.uk/news/stories/2011/06/researchersoftomorrow.aspx

Brown, R. & Renshaw, P. (2006). Positioning Students as Actors and Authors: A Chronotopic Analysis of Collaborative Learning Activities. Mind, Culture, and Activity. Vol. 13, No. 3. (1 August 2006), 247-259.

Cadenasso, M.L., Pickett, S.T.A., Grove, J.M. Dimensions of ecosystem complexity: Heterogeneity, connectivity, and history, Ecological Complexity, Volume 3, Issue 1, March 2006, pp. 1-12.Cumming, J. (2010). Doctoral enterprise: a holistic conception of evolving practices and arrangements. Studies in Higher Education, 35 (1), (February 2010), 25–39.

Charmaz, K. (2006). Constructing Grounded Theory: A Practical Guide through Qualitative Analysis. London: SAGE.

Compton-Lilly, C. (2010). Making sense of time as context: Theoretical affordances of chronotopes in the study of schooling and school success (WCER Working Paper No. 2010-11). Retrieved from University of Wisconsin-Madison, Wisconsin Center for Education Research website: http://www.wcer.wisc.edu/publications/workingPapers/papers.php

Conole, G. & Dyke, M. (2004a). What are the Affordances of Information and Communication Technologies? ALT-J, 12(2), 113-124.

Conole, G. & Dyke, M. (2004b). Understanding and Using Technological Affordances: a response to Boyle & Cook, ALT-J, 12(3), 301-308.

Cresswell, J. & Hawn, A. (2012). Drawing on Bakhtin and Goffman: Toward an epistemology that makes lived experience visible. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 13(1).

Cumming, J. (2010). Doctoral enterprise: a holistic conception of evolving practices and arrangements. Studies in Higher Education, 35 (1), (February 2010), 25–39.

Ellis, R. A. & Goodyear, P. (2009). **Students' experiences of e-learning in higher education: the ecology of sustainable innovation. London: Routledge.**

Flores-Scott, E. & Nerad, M. (2012). Peers in Doctoral Education. New Directions in Higher Education, 157 (Spring 2012), 73-83.

Foucault, M. (1967). Of other spaces, heterotopias. Retrieved November 15, 2012 from: http://foucault.info/documents/heteroTopia/foucault.heteroTopia.en.html.

Freedman, S. W. & Ball, A. F. (2006). Ideological becoming. Bakhtinian concepts to guide the study of language, literacy and learning. In Ball, A. F. & Freedman, S. W. (Eds.). Bakhtinian perspectives on Language, Literacy and Learning. Cambridge University Press, 3-33.

Gardner, S. K. & Mendoza, P. (2010). On becoming a scholar: Socialization and Development in Doctoral Education. Stylus Publishing, LLC.

Gourlay, L. (in press) "Creating time: students, technologies and temporal practices in higher education", *E-learning & Digital Media* 11(1).

Gourlay, L. & Oliver, M. (2012) Curating, combat or coping? Student entanglements with technologies in HE. Paper presentation at SRHE 2012, Newport, UK.

Hakkarainen, K., Ritella, G., & Seitamaa-Hakkarainen, P. (2011). Epistemic mediation, chronotope, and expansive knowledge practices. 9th Conference of Computer-Supported Collaborative Learning (CSCL).

James, L., Norman, J., De Baets, A.-S., Burchell-Hughes, I., Burchmore, H., Philips, A., Sheppard, D., Wilks, L. & Wolffe, J. (2009). The lives and technologies of early career researchers, JISC report. Retrieved July 5, 2011 from: http://www.jisc.ac.uk/publications/reports/2009/earlycareerresearchersstudy.aspx#downloads

Jazvac-Martek, M., Chen, S. & McAlpine, L. (2011). Tracking the Doctoral Student Experience over Time: Cultivating Agency across Diverse Spaces. In McAlpine, L. & Amundsen, C. (Eds) (2011). Doctoral Education: Research-based Strategies for Doctoral Students, Supervisors and Administrators. Netherlands: Springer, 17-36.

Kazmer, M. M. (2005). Cats in the classroom: Online learning in hybrid space. First Monday, 10 (9) (September 2005). Retrieved December 20, 2012 from: http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1278/1198.

Koschmann, T. (1999). Toward a dialogic theory of learning: Bakhtin's contribution to learning in settings of collaboration. Paper presented at the Computer Supported Collaborative Learning (CSCL '99), Palo Alto, CA. Proceedings, 308-313. Retrieved March 20, 2012 from http://kn.cilt.org/cscl99/A38/A38.HTM.

Leander, K. M. (2001). 'This is our freedom bus going home right now': producing and hybridizing space-time contexts in pedagogical discourses. Journal of Literacy Research. 33(4), 637-679.

Lemke, J. L. (2004). Learning across multiple places and their chronotopes. Contribution at the symposium *Spaces and boundaries of learning.* Retrieved December 20, 2012 from: http://www-personal.umich.edu/~jaylemke/papers/aera_2004.htm.

Ligorio, M. B. & Ritella, (2009). The collaborative construction of chronotopes during computer-supported collaborative professional tasks. *International Journal of Computer-Supported Collaborative Learning*. Vol. 5, No. 4. (December 2010). Retrieved May 15, 2011 from: *http://www.springerlink.com/index/P37N1N7033552W31.pdf*

Loperfido, F. F. & Logorio, M. B. (2011). Chronotopes as tools for building identities in universities blended courses. Paper presented at the *III National Congress CKBG* (Collaborative Knowledge Building Group), Bari, 6-8 April 2011.

Lovitts (2005). Being a good course-taker is not enough: a theoretical perspective on the transition to independent research. *Studies in Higher Education*, 30(2), 137-154.

Luckin, R. (2008). The learner-centric ecology of resources: A framework for using technology to scaffold learning. *Computers in Education*, 50, 449-462.

Luckin, R. (2010). *Re-designing learning contexts: technology-rich, learner-centred ecologies*. London, UK: Routledge.

Luckin, R. (2010a). Contexts for learning. In Luckin, R. *Re-designing learning contexts: technology-rich, learner-centred ecologies*. London, UK: Routledge, pp. 3-18.

Luckin, R., Clark, W., Garnett, F., Whitworth, A., Akass, J., Cook, J., Day, P., Ecclesfield, N., Hamilton, T., & Robertson, J. (2010). Learner-Generated Contexts: A Framework to Support the Effective Use of Technology for Learning. In M. Lee, & C. McLoughlin (Eds.), Web 2.0-Based E-Learning: Applying Social Informatics for Tertiary Teaching (pp. 70-84). Hershey, PA: Information Science Reference. doi:10.4018/978-1-60566-294-7.ch004

Matusov, E. (2009). Journey into Dialogic Pedagogy. New York: Nova Science Publishers. McAlpine, L. & Amundsen, C. (Eds) (2011). Doctoral Education: Research-based Strategies for Doctoral Students, Supervisors and Administrators. Netherlands: Springer.

McAlpine, L. & Amundsen, C. (2011a). Making Meaning of Diverse Experiences: Constructing an Identity Through Time. In McAlpine, L. & Amundsen, C. (Eds) (2011). Doctoral Education: Research-based Strategies for Doctoral Students, Supervisors and Administrators. Netherlands: Springer, 173-183.

Nardi, B. & O'Day, V. (1999). Information ecologies: using technology with heart. Cambridge, MA: MIT Press.

Odaci, H. (2011). Academic self-efficacy and academic procrastination as predictors of problematic internet use in university students. Computers & Education, 57, 113-119.

Pata, K. & Laanpere, M. (2011). An Ecological Meta-Design framework for open learning ecosystems. Paper presented at the ECER 2011 Conference, "Urban Education", Berlin, Germany, 13-16 September 2011.

Rajala, A., Hilppö, J., Lipponen, L., & Kumpulainen, K. (in press). Expanding the Chronotopes of Schooling for Promotion of Students' Agency. In O. Erstad & J. Sefton-Green (Eds.), Learning lives: Transactions, technologies, and learner identity. Cambridge University Press. Draft retrieved June 20, 2012 from: http://chicago.academia.edu/Documents/in/21st_Century_Education_and_Learning

Reimann, P. (2009). Time is precious: Variable and event-centred approaches to process analysis in CSCL research. Computer-Supported Collaborative Learning. 4, 239-247.

Romero, M. & Barberà, E. (2011). Quality of e-learners' time and learning performance beyond quantitative time-on-task. IRRODL, 12 (5). Retrieved September 20, 2011 from: http://www.irrodl.org/index.php/irrodl/article/view/999

Shulman, L.S. (2004). The Doctoral Imperative: Examining the End of Erudition. In Shulman, L.S. & Hutchings (Eds) (2004).Teaching as Community Property: Essays in Higher Education. San Francisco: Jossey_Bass. 219-233.

Whiteman, N. & Oliver, M. (2008). *Engaging with the research methods curriculum.* Reflecting Education, 4 (1). 63-71. Retrieved May 24, 2011 from: http://eprints.ioe.ac.uk/3120/

Williams, R., Karousou, R. & Mackness, J. (2011). Emergent learning and learning ecologies in Web 2.0. IRRODL, 12 (3). Retrieved April 20, 2012 from: http://www.irrodl.org/index.php/irrodl/article/view/883

Zaman, M. (2010). Doctoral Programs in the Age of Research 2.0. In Anandarajan, M & Anadarajan, A. (2010). e-Research Collaboration. Springer Verlag, 233-246.

Zhu, Y. & Procter, R. (2012). Uses of blogs, Twitter and Facebook by PhD students for Scholarly Communication: A UK study. Paper presented at 2012 China New Media Communication Association Annual Conference Macao International Conference 6-8 December 2012. Retrieved February 16, 2013 from: https://www.escholar.manchester.ac.uk/item/?pid=uk-ac-man-scw:187789

#03

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EXPLORING LEARNERS' EMOTIONS OVER TIME IN VIRTUAL LEARNING

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Exploring learners' emotions over time in virtual learning

ABSTRACT

Time constitutes an important factor influencing every process related to e-learning. Along these lines, we need to study how students manage time in their learning processes. We need to know if they feel that they have enough time to carry out a learning activity or whether they feel stressed and frustrated by the lack of time. We are also interested in what kind of emotions they express and how these emotions evolve over this period of time. Our work focuses on studying the nature and role time plays in the affective states learners experience during a long-term e-learning process. Our methodological design shows the type of data we need to collect, which methods are more suitable for analysing this data in order to detect and interpret the learners' emotions across time.

KEYWORDS

Affective learning, emotions, time factor in affective learning, virtual affective agent/tutor, affective management.

INTRODUCTION AND RATIONALE

According to Demeure et al. (2010), time is an important variable in the analysis of teaching-learning processes that take place in e-learning and, more specifically, in CSCL contexts. Moreover, one of the main concerns in the educational field is that of making knowledge more meaningful and long-lasting. The e-learning process has to be an active process where technologies must serve as tools to support knowledge building and skill development in students by taking into account the students' specific, cognitive and emotional characteristics and skills that can facilitate and complement this process (Silva et al, 2006). In long-term virtual learning practices, it is important to investigate what kind of emotions students express and how these emotions evolve over this period of time. On one hand, we need to determine the factors that lead students to remain in the same negative affective state for a certain period of time, as this can lead to a significant reduction of the quality of learning and even withdrawal from studies. On the other hand, we need to study how students manage time in their learning processes. We need to know if they feel that they have enough time to carry out a learning activity or whether they feel stressed and frustrated by the lack of time. In this regard, we will establish a methodological design that shows the type of data we need to collect and which methods are more suitable for analysing the data in order to detect and interpret the learners' emotions across time.

An exhaustive analysis of all the data regarding the emotions students transmit is crucial for detecting and interpreting various types of emotions and anticipating the emotional states that students may experience at particular points in their learning process. Once we have completed our analysis, we need to develop a way of reacting to mediate and regulate students' e-learning processes. Affective pedagogical agents or tutors have been widely used in e-learning environments in a variety of ways (Beale & Creed, 2009; Frasson & Chalfoun, 2010). This study will lay the foundations for the design of an affective virtual agent/tutor able to intervene and mediate in students' e-learning processes, providing them with an appropriate affective feedback that will guide, advise and help them according to their needs and feelings. In order to achieve those challenges, this article will focus first on making a comprehensive and critical analysis of the state of the art of computer-based affective learning in relation to the time factor (i.e. evaluating important research work on the analysis of affective interactions, emotional feedback, affective tutor, etc.). Secondly, based on this analysis, we present our research questions. Thirdly, we describe our own proposal for explaining how we will address this issue in relation to the time factor and the advantages and innovations our proposal can offer regarding other proposals. Here we describe our approach at a conceptual design level.

BACKGROUND RESEARCH

During the past decade, emotion has emerged as a vital element of the learning process but many questions about emotional management in education remain unanswered. In his research, Pekrun (2005) recognises the lack of knowledge of the occurrence, frequency and phenomenology of emotions in different learning environments, and especially in e-learning. The emotional relationship with new tools and learning content are new research areas of particular interest to e-learning (Ekflides, 2006). The educational experiments being carried out in virtual learning environments require a redefinition of the agents involved (teachers and students), the spaces where educational activities are

conducted, time and learning sequences (Perez, 2002). The teaching process involves preparing the teacher to generate an effective dialogue with/and among participants, by encouraging active learning and knowledge building through collaboration, by knowing how to identify feelings and emotions and by controlling and providing appropriate models of expression (Ibarrola, 2000). Emotional aspects play a fundamental role in the user's interaction, because they affect cognitive processes. In other words, the user's affective states have an influence on how well that person solves rational problems. More specifically, emotions affect attention and memorization, as well as the user's performance and assessment (Brave & Nass, 2002). In this section, we study students' emotions from several perspectives, such as time management, the relationship between time and affectivity, and technology use, both at individual and group level.

- **As regards time management**, we need to study how students manage time in their learning processes and how this is related with their emotions. Zimbardo & Boyd (1999) propose the following paradoxes about how to manage time perception effectively: (1) Understanding relativity, (2) Consistent awareness and (3) Conscious effort. However, even if students are good at time management, this does not guarantee that they will achieve effective learning. For instance, Roy & Christenfeld (2007) suggest that people underestimate how long it will take them to complete future tasks. There are three facts that one should take into account: (1) the tendency to underestimate future duration, which disappears when the task is new, (2) the existence of similar bias in estimating both past and future durations, and (3) variables that affect memory of duration, such as level of experience of the task and the duration of the delay before estimation, affect prediction of duration in the same way. It appears that, at least in part, people underestimate future event duration because they underestimate past event duration.

- **As regards time and affectivity**, we want to identify what kind of emotions students express and how these emotions evolve over a period of time. It is necessary to know if the negative emotions that have been detected remain and turn into other negative (and possible more harmful) emotions through time and set time limits to make them change to more positive emotions. Both D'Mello et al. (2007) and Baker et al. (2007) have shown that students are most likely to remain in the same affective state over time in these environments and that certain emotional transitions are more likely than others. Likewise, McQuiggan et al. (2008) have shown that when transitions to alternate affective states did occur, they followed interesting patterns. Moreover, Feidakis et al. (2012) argue that time and emotions have to be taken into account in three stages when assessing a task: before the task, in real time and at deferred time.

- **At an individual level**, we will have to take into account the time perception of learners in relation to their time perspectives and their time management skills. It is necessary to know whether students feel that they have enough time to carry out a learning activity or whether they feel stressed and frustrated by the lack of time. In this sense, lack of time may be caused because the format of learning content or the development of learning activities cannot be adapted to each student's learning style (Alonso et al, 1994). Learning style constitutes an important precondition for the design of any learning process. In this sense, Bloom (1968) explored the Model of School Learning by concluding that, given sufficient time and quality teaching, nearly all students could learn. Johnston & Aldridge (1985) proposed

an exponential learning model, which included learner characteristics - specifically, aptitude and motive - as conditions related to learning achievement. Therefore, learning achievement can be predicted by a function of student characteristics and the time spent in learning. Demeure et al. (2010) argue that the major difficulty for individual learners is to balance all their professional, social, and academic activities.

- **At group level**, in Computer-Supported Collaborative Learning (CSCL) contexts, time is also an important factor in group work. Analysis of collaborative learning interactions requires a constant effort in trying to detect emotions through the application of a variety of methods, such as discourse and conversation analysis, analysis of feelings or opinion mining that allow non-intrusive automatic detection and extraction of emotions from student-created texts and dialogues. In this case, the teacher should apply an activity plan that takes time into account in terms of when it is suitable to proceed to emotion detection as well as when to provide dynamic recommendations and affective feedback, depending on the design and requirements of the collaborative activity concerned. Therefore, *with regard to group processing*, group formation needs time in order to establish the social norms to regulate member activities (Demeure et al. 2010). In this sense, the five stages of group development (orientation, conflict, cohesion, performance and dissolution) could be used to analyse temporal relationships in interaction, in terms of the succession of stages (Tuckman & Jensen, 1977). So, the teacher can influence or persuade learners by providing suitable affective feedback in order to regulate members' emotions in every planned stage. By doing so, group members can feel more confident through belonging to a community and they can even develop co-leadership skills.

- **As regards technology**, it is necessary to incorporate specific tools in the virtual classroom that will facilitate communication of both intentions and feelings at appropriate time intervals which can be easily recognized both by the teacher and the students. The latest research and development in the areas of artificial intelligence and robotics are reflected in the appearance of Intelligent Tutor Systems (ITS). As well as being educational programs, these simulate the behaviour patterns of a human tutor, aiming to improve learning in a field of knowledge. ITS are empowered with Affective Pedagogical Tutors (APT), which act as teachers and are able to interact with the student in human communication style (Beale & Creed, 2009). An APT's role is to solve problems, provide advice, guidance and emotional support in interaction with the student and to show contextuality, continuity and temporality. Learners experience a variety of emotions while interacting with a virtual tutor in the same way as in the context of traditional learning, when a human tutor can influence student emotions in order to improve efficiency in learning (Hargreaves, 2002). Similarly, a virtual tutor can be seen as a practitioner able to influence emotions in the learner. Moreover, these emotions will strongly influence their cognition (Isen, 2000). An APT can be invaluable when students do not recognize that their actions are inappropriate or simply not optimal. In such a case, a virtual tutor can intervene with the appropriate advice. In other circumstances, they may encounter situations that are unfamiliar due to insufficient knowledge, so they might benefit if they have someone to guide them, answer their questions and show them the right process. As such, several types of environments have been designed and evaluated (Table 1) and several types of effects have been detected (Table 2).

Table 1. Different types of virtual environment with APTs.

Types of virtual environments with APT (Affective Pedagogical Tutors)	
Embodied Agents	An embodied agent can be defined as a digital, visual representation of an interface, often taking a human form (Cassell, 2002). Affective issues such as empathy, self-efficacy and motivation have been implemented in various forms in a very broad range of different virtual environments. Because of their strong life-like presence, animated teaching agents can capture students' imaginations and play a critical motivational role in keeping them deeply engaged in a learning environment's activities (Lester et al. 1997). Indeed, one of the main goals of an ITS is to be able to recognize and address the emotional state of the learner and react accordingly through the presence of the pedagogical agent. Examples: Affective tutor (Kapoor, 2007), AutoTutor (D'Mello et al, 2005).
Narrative Learning Environments	Narrative has been an important way of transmitting knowledge across generations, and is innate in human nature. Narrative is also a valuable vehicle for structuring knowledge and helping us in the process of creating meaning. By applying a narrative approach, it is possible to achieve an application that may help learners by illustrating phenomena and procedures and by motivating them to stay engaged and immersed in learning tasks. In addition, narrative learning environments can facilitate activities associated with learning, such as role-playing and exploration, reflection and idea sharing that use different pedagogical strategies and affect the context of narration. Examples: Crystal Island (McQuiggan and Lester, 2008), FearNot! (Aylett et al. 2005).
Subliminal Learning	According to Chalfoun and Frasson (2008), emotions, especially motivation and engagement, are widely related in various cognitive tasks. A large body of work in neuroscience and other fields leads us to believe that simple to complex information can be learned without perception or complete awareness of the task at hand (Dijksterhuis and Nordgren 2006). In fact, the existence of perceptual learning without perception has been neurologically proven and accepted (Del Cul et al. 2007). In a recent work, Chalfoun and Frasson (2008) have suggested an increase in performance when using a subliminal teaching Intelligent Tutoring System.

Table 2. The most characteristic effects detected in virtual environment with APTs

The most characteristic effects detected in these environments
• ***Person Effect*** **(Lester et al, 1997):** The presence of an agent in an interactive environment, though not encouraged, can have a positive effect on the perception of the educational experience for the student. The time factor was not taken into account in these works. Examples: *Herman the Bug* (Lester et al, 1997); *Steve* (Johnson & Rickel, 2000); *AutoTutor* (Graesser et al, 2008).
• ***Proteo Effect*** **(Yee & Bailenson, 2007):** Students can learn because they are motivated by the characteristics of their avatars and they want to be like them. In this case, the role of the agent is not authoritarian, but fundamentally emotional/social support. Research on this effect is more focused on immersion in the 3D environments of educational games. This line of research does not take the time factor into account and it remains open without conclusive results in the literature. Examples: Troublemaker (Aimeur & Frasson, 1996); Jake & Jane (Arroyo et al, 2009).
• ***Protégé Effect*** **(Chase et al, 2009):** Students make a greater effort to learn how to teach their avatar than on their own learning. The focus of these agents is based on the "Learning by Teaching" paradigm; this means the student learns to teach the agent technical issues or concepts. The time factor was not taken into account in this work either. Examples: Betty (Biswas et al, 2009).

RESEARCH QUESTIONS

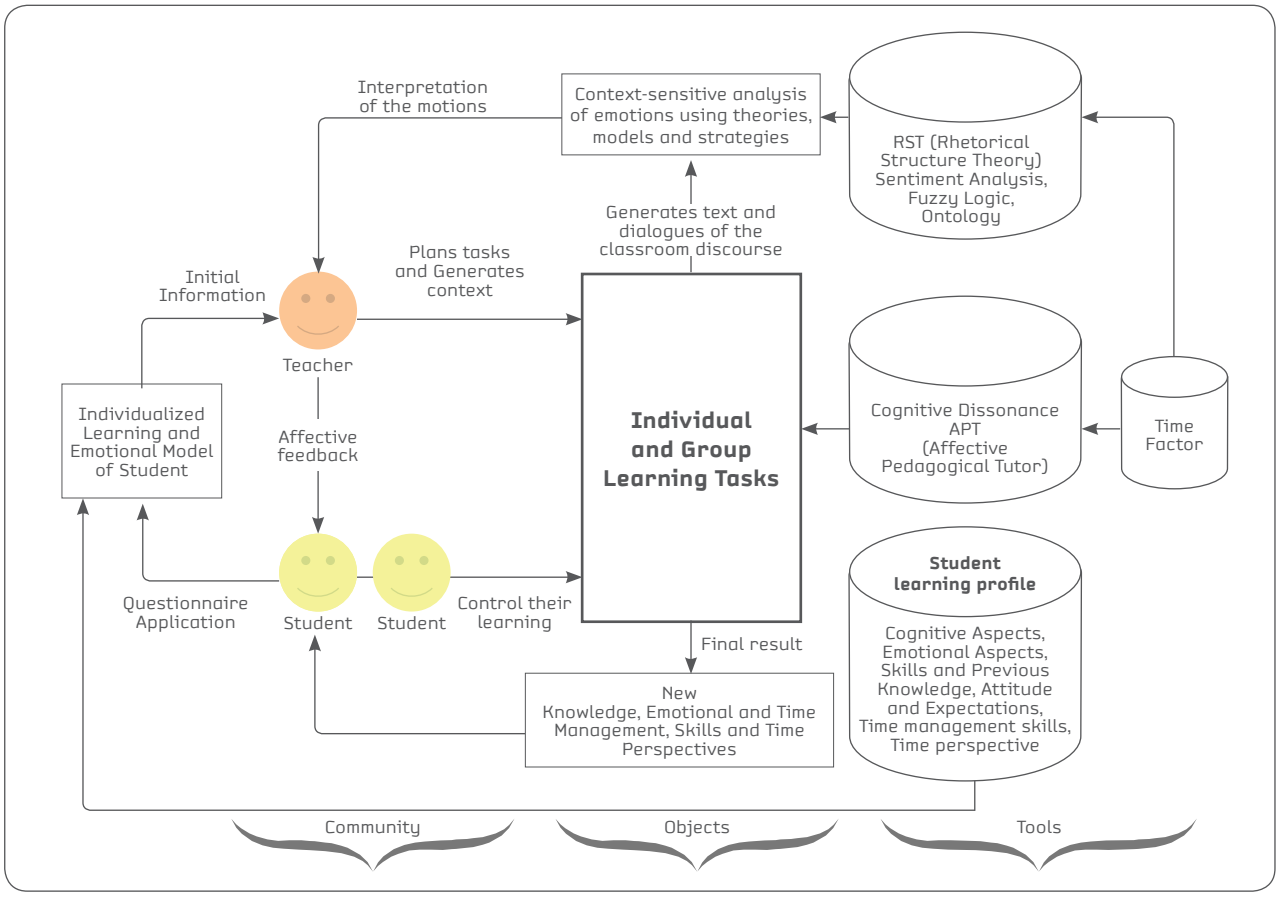
Based on the analysis made of the literature described in the previous section, we proceeded to identify the following research questions that still remain open and for which we will try to provide some effective answers in our current and future work:

- **(Q1)** How do students manage time in their learning processes? How can we know if they feel that they have enough time to carry out a learning activity or whether they feel stressed and frustrated by the lack of time?
- **(Q2)** What kind of emotions do students express and how do these emotions evolve over a certain period of time? How do negative emotions turn into other (and possible more harmful) negative emotions over time? What time limits should we set to make them change to more positive emotions?
- **(Q3)** What are the factors that lead students to remain in the same negative affective state that is considered detrimental and dangerous for a certain period of time, leading to a significant reduction in the quality of their learning, failure and even withdrawal from studies?
- **(Q4)** How can we detect and interpret various types of emotions and anticipate the emotional states students may experience at a particular moment of their learning process?
- **(Q5)** How can we make students react in time, guide them and help them in an appropriate way so they can come out of a negative affective state and move into a more positive one?
- **(Q6)** How should a virtual tutor manage time with the aim of providing feedback at the right time, intervening and mediating in the students' e-learning processes, providing them with appropriate affective feedback that will guide, advice and help them, depending on their needs and feelings?

A CONCEPTUAL EMOTION ANALYSIS MODEL

In today's student-centred constructivist learning environments, where students develop their learning processes over time, teachers' work is highly demanding. To provide an effective answer to the above questions, we are proposing an emotion analysis model at a conceptual level which integrates an extension of learning and linguistic theories with a variety of methods and tools. Our approach is based on the Activity Theory (AT) (Engeström et al., 1999), which provides a theoretical framework to understand and analyse a phenomenon, find patterns and make inferences through interactions that describe those phenomena. AT provides a conceptual framework (Barros et al, 2004) to situate social and technological elements of a system in the same unit of analysis, called activity. In our case, we apply an extended AT scenario which consists of making several participants (teacher and students) cooperate and interact with specific objects (such as text and dialogue) through the use of specific tools (APTs, emotion analysis tools) to carry out goal-oriented activities. According to Barberà (2010), the "temporal dimension in e-learning is considered as a real tool which is always present and which spreads out into the planning and implementation of online education". In this sense, we include the time factor as a tool within our definition of the AT for providing both teacher and students with more control and flexibility in the development of their respective tasks. That is, with regard to resources and tools, they decide how and when to use them. In this way, the time perspective and time management both become an issue and a fact in planning and carrying out learning tasks, while they play an important role in the establishment and evolution of the emotional state of the learning community. Adequate time management is a necessary factor in facilitating and

Figure 1. Graphic Representation of the Emotion Analysis Model based on an Extended Activity Theory Scenario.



enhancing the teaching-learning processes. Let us now briefly explain the components of the architecture of our conceptual Emotion Analysis model which is based on an extension of AT with emotional information and time factor (Figure 1).

In this context, emotion can be used to initiate actions that direct the student's attention to the cognitive goal that needs to be completed. At this point it is important that the teacher's feedback takes time into account. Without being obsessive or abusive, it will consider the duration of the student's learning process in three ways: the time needed to carry out an activity, the time the student has available, and the moment the tutor considers that he/she has to intervene with cognitive and emotional feedback. Concerning the tools used in our framework, first, the building of a robust student learning profile is an important component of our model. The resulting student profile enables the teacher to establish the content format, develop activities and choose the settings for using methods such as Project-based Learning, Problem-based Learning or Case-based Learning.

Secondly, we endow the Affective Pedagogical Tutor (APT) with several roles. Firstly, there is the capacity to design and apply *cognitive dissonance strategy* in both the planning and implementation of learning activities which are carried out cooperatively. In particular, in the design of learning activities, both at individual and group level, our APT plans evaluation tasks with dissonance questions based on the "Learning by Teaching" paradigm (Biswas

et al, 2009). In addition, another role for the APT will be as a troublemaker classmate, i.e. a difficult student who sometimes gives incorrect answers in order to provoke cognitive dissonance, similar to the agent used by Aimeur & Frasson (1996). Here, it is important to study how the APT should manage time and know the moment when it should appear to play this role. As cognitive dissonance provokes "constructive conflicts" for students, it is more likely that several emotions will also appear and be openly expressed by students. For this reason, it is important that learning activities should be controlled by the APT with an appropriate time management strategy so that the "conflicts" can be resolved within a desired time interval and not leave space for unwanted negative emotions and situations among students. In particular, cognitive dissonance allows us to identify possible activating or inhibiting emotional causes and consequences, as well as its influence on students' emotional situations, behaviours, habits and behaviour modification, including their time management skills and their perception of time perspectives. Moreover, it allows us to know how students manage time in their learning processes. In this case, we need to know if they feel that they have enough time to carry out a learning activity or whether they feel stressed and frustrated by the lack of time. We are also interested in what kind of emotions they express and how these emotions evolve over this period of time. It is necessary to know if the negative emotions that have been detected remain and turn into other negative (and possible more harmful) emotions over time, and to set time limits for changing them to more positive emotions.

Thirdly, we need to find the best way to automatically detect and present the affective behaviours that participants show in their interactions in virtual spaces in order to label and display their emotions in an unobtrusive, relevant and non-intrusive way. To achieve this, we will apply an extension of Rhetorical Structure Theory (RST) and Sentiment Analysis (Liu, 2012), also taking the Time Factor into account. We are using these discourse analysis tools to analyse collaborative learning activities (such as the creation of a wiki and debates in forums or chats) in order to extract the emotional relationships between discourse units and provide a graphic representation of the emotional structure of discourse. Based on the time factor, we can determine how long students remain in the same negative affective state in their discourse and then we can search for the factors that have led to the situation. In this case, we need to specify a time limit after which continuation of this situation can be considered detrimental and dangerous, as it can lead to a significant reduction of the quality of learning, failure and even withdrawal from studies. An analysis of the emotional state will also take the context in which learning occurs into account. We understand as *learning context* all relevant information related to a student/group that participates in the learning activity. We will use ontologies as a computational approach to represent this context. Moreover, based on these context data and given that the emotional state is not a precise thing, the analysis will include machine learning techniques (such as fuzzy logic) to derive the emotional state as well as its relationship to the context and the learning outcome.

The application of the above tools provides important knowledge about when specific emotions arise and what causes them. Consequently, in response to the detection of students' affective states their occurrence over time, the tutor is able to provide appropriate feedback to make students react in time, guide them and help them in an appropriate way. This method helps students enhance their time perception, emotional safety and more effective and fruitful engagement in the learning experience. This is more evident when students

become capable of coming out of a negative affective state and moving into a more positive one at a particular moment in their learning process.

FUTURE WORK

In order to evaluate and analyse the effects of this model in the collaborative learning process, our future work will first focus on developing a full computational model and then designing and carrying out three experimental scenarios which will assess the validity of our model and provide us with appropriate answers to the research questions set above. In all three scenarios we will conduct a controlled experiment for which two groups are needed: an experimental group and a control group. This will be an important part of our research, as a controlled experiment is a highly focused way of collecting data and will be especially useful for us in order to determine emotional and behavioural patterns of cause and effect.

CONCLUSION

At each step of the learning process it is important that both emotion detection and emotional feedback take time into account. At a conceptual level, this study proposes a methodological framework for managing students' emotions, especially when carrying out cooperative tasks and where time management plays an important role in students' participation, behaviour and performance and is directly related to students' emotional states during the learning process. In this context, emotions can be used to initiate actions that direct the student's attention to the cognitive goal that needs to be completed. The ultimate aim is to provide an environment where students feel safe, comfortable, valued and confident that they will receive the help they need to achieve their goals. All in all, we consider time as an important factor to be taken into account and this is clearly reflected in the design of our integrated approach and Emotion Analysis Model which includes the provision of timely affective feedback.

References

Aimeur, E. & Frasson (1996). Analyzing a new learning strategy according to different knowledge levels. *Computers & Education, 27*(2), 115-127.

Alonso, C., Gallego, D. & Honey, P. (1994). *Los Estilos de Aprendizaje. Procedimientos de diagnóstico y mejora.* Bilbao: Ediciones Mensajero. Universidad de Deusto.

Arroyo, I., Cooper, D.G., Burleson, W., Woolf, B.P., Muldner, K. & Christopherson, R. (2009). Emotion Sensors Go to School. In V. Dimitrova, R. Mizoguchi, B. du Boulay, & A. Grasser (Eds.), *Artificial Intelligence in Education. Building Learning Systems that Care*: *From Knowledge representation to affective modelling,* Vol.200. Frontiers in Artificial Intelligence and Applications (pp. 17-24). Amsterdam: IOS Press.

Aylett, R., Louchart, S., Dias, J. & Paiva, A. (2005). FearNot! an Experiment in Emergent Narrative. In: Panayiotopoulos, T., Gratch, J., Aylett, R.S., Ballin, D., Olivier, P., Rist, T. (eds.) IVA 2005. LNCS (LNAI), vol. 3661, pp. 305-316. Springer, Heidelberg.

Baker, R., Rodrigo, M., & Xolocotzin, U. (2007). The dynamics of affective transitions in simulation problem-solving environments. *Proceedings the 2nd International Conference on Affective Computing and Intelligent Interactions*, (pp. 666-677). Lisbon, Portugal, 2007.

Barberà, E. (2010). Time factor in e-learning: ELC research programme 2009-2012. *ELearnCenter Research Paper Series*, 0, 12-15.

Barros, B., Vélez, J. & Verdejo, F. (2004). Aplicaciones de la Teoría de la Actividad en el desarrollo de Sistemas Colaborativos de Enseñanza y Aprendizaje. Experiencias y Resultados. *Revista Iberoamericana de Inteligencia Artificial, 24, pp.67-76.*

Beale, R. & Creed, C. (2009). Affective interaction: How emotional agents affect users. *International Journal of Human-Computer Studies, 67*(9), pp.755-776.

Biswas, G., Roscoe, R., Jeong H. & Sulcer, B. (2009). Promoting Self-Regulated Learning Skills in Agent-based Learning Environments. In *Proceedings of the 1 7th International Conference on Computers in Education.*

Bloom, B.S. (1968) Mastery learning. U.C.L.A.-C.S.E.I.P. Evaluation Comment, 1-2.

Brave, S. & Nass, C. (2002). Emotion in human-computer interaction. In Jacko, J. & Sears, A. (Eds.), *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications (chap. 4).* Hillsdale, NJ: Lawrence Erlbaum Associates.

Cassell, J. (2002). Nudge nudge wink wink: elements of face-to-face conversation for embodied conversational agents. In: Embodied Conversational Agents. MIT Press, Cambridge

Chase, C., Chin, D., Oppezzo, M. & Schwartz, D. (2009). Teachable agents and the protégé effect: Increasing the effort towards learning. *Journal of Science Education and Technology,* 18, 334-352.

Chalfoun, P.& Frasson, C. (2008). Subliminal priming enhances learning in a distant virtual 3D Intelligent Tutoring System. IEEE Multidisciplinary Engineering Education Magazine: Special Issue on Intelligent Tutoring Systems 3(4), 125-130.

Del Cul, A., Baillet, S. & Dehaene, S. (2007). Brain Dynamics Underlying the Nonlinear Threshold for Access to Consciousness. PLoS Biology 5(10), 16.

Demeure, V., Romero, M. & Lambropoulos, N. (2010). Assessment of e-learners' temporal patterns in an online collaborative writing task. *eLC Research Paper Series*, 1, 5-16.

D'Mello, S.K., Craig, S.D., Gholson, B., Franklin, S., Picard, R.W. & Graesser, A.C. (2005). Integrating Affect Sensors in an Intelligent Tutoring System. In: Affective Interactions: The Computer in the Affective Loop Workshop at 2005 International Conference on Intelligent User Interfaces, New York, USA.

D'Mello, S., Taylor, R.S. & Graesser, A. (2007). Monitoring affective trajectories during complex learning. *Proceedings of the 29th Annual Meeting of the Cognitive Science Society*, Austin, TX, 203-208.

Dijksterhuis, A. & Nordgren, L.F. (2006). A Theory of Unconscious Thought. Perspectives On Psychological Science 1(2), 14

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? Educational Research Review, 1(1), 3-14

Engeström, Y., Miettinen, R. & Punamäki, R.L. (1999). *Perspectives on Activity Theory.* Cambridge University Press.

Feidakis, M., Daradoumis, T. & Caballe, S. (2012). A Multi-fold Time Approach to Address Emotions in Live and Virtualized Collaborative Learning, *Complex, Intelligent and Software Intensive Systems (CISIS), 2012 Sixth International Conference on*, vol., no., pp.881- 886, 4-6 July 2012.

Frasson, C. & Chalfoun, P. (2010). Managing Learner's Affective States in Intelligent Tutoring Systems. In Nkambou, R., Mizoguchi, R. & Bourdeau, J. (Eds.) *Advances in Intelligent Tutoring Systems* (pp. 339-358). Springer-Verlag, Berlin-Heidelberg.

Graesser, A., D'Mello, S., Craig, S., Witherspoon, A., Sullins, J., McDaniel, B. & Gholson, B. (2008). The relationship between affective states and dialog patterns during interactions with autotutor. *Journal of Interactive Learning Research,* 19(2), 293.

Hargreaves, A. (2002). Mixed emotions: teacher's perceptions of their interactions with students.

Ibarrola, B. (2000). L'educació emocional. Infància, 116, 5-8.

Isen, A.M. (2000). Positive Affect and Decision Making (ed) Handbook of Emotions. Guilford, New York Handbook of Emotions (2nd ed., pp. 417-435). New York: Guilford.

Johnson, W.L. & Rickel, J.W. (2000). Animated Pedagogical Agents: Face to Face Interaction in Interactive Learning Environments. *International Journal of Artificial Intelligence in Education*, 2000.

Johnston, K. & Aldridge, B. (1985). Examining a mathematical model of mastery learning in a classroom setting. *Journal of Research in Science Teaching,* 22, 543-554.

Kapoor, A., Burleson, W. & Picard, R.W. (2007). Automatic prediction of frustration. International Journal of Human-Computer Studies, 65(8) pp.724-736.

Lester, J., Converse, S., Kahler, S., Barlow, S., Stone, B. & Bhogal, R. (1997). The persona effect: affective impact of animated pedagogical agents. *In Proceedings of the SIGCHI conference on Human factors in computing systems*, pp. 366.

Liu, B. (2012). Sentiment Analysis & Opinion Mining. Synthesis Lectures on Human Language Technologies. *Morgan & Claypool Publishers,* May 2012, 167 pages.

McQuiggan, S., Robison, J., & Lester, J. (2008). Affective transitions in narrative centred learning environments. *Proceedings of the 9th International Conference on Intelligent Tutoring Systems*, 490-499.

Pekrun, R (2005). Progress and open problems in educational emotion research. Learning and Instruction, 15(5), 497-506.

Pérez, A. (2002). Elementos para el análisis de la interacción educativa en los nuevos entornos de aprendizaje. Pixel-bit revista de medios y educación, 19(1), 49-61

Roy, M.M., & Christenfeld, N.J.S. (2007). El sesgo en la memoria predice el sesgo en la estimación de duración de la tarea en el futuro. *Memoria y Cognición*, 35, 557-564.

Silva, B., Cruz, E. & Laureano-Cruces, A. (2006). Análisis para identificar los Estilos de Aprendizaje para el modelado del Dominio del Conocimiento. *XIX Congreso Nacional y V Congreso Internacional de Informática y Computación de la ANIEI*. Tuxtla Gutiérrez, Chiapas, 25-27 de octubre del 2006.

Tuckman, B.W., & Jensen, M.A.C. (1977). Etapas de pequeños grupos revisited desarrollo. *Grupo y Estudios Organizacionales*, 2, 419-427.

Yee, N. & Bailenson, J. (2007). The Proteus effect: The effect of transformed self-representation on behavior. *Human Communication Research,* 33(3), 271.

Zimbardo, P.G. & Boyd, N. (1999). Putting time in perspective: a valid, reliable, individual-differences metric. *Journal of Personality and Social.*

Usart, M.; Romero, M. & Barberà, E. (2013). Measuring students' Time Perspective and Time on Task in GBL activities. *eLC Research Paper Series, 6, 40-51.*

MEASURING STUDENTS' TIME PERSPECTIVE AND TIME ON TASK IN GBL ACTIVITIES

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Measuring students' Time Perspective and Time on Task in GBL activities

ABSTRACT

Computer-based learning in general and Game Based Learning (GBL) in particular are becoming widely used in lifelong learning institutions and business schools. However, instructional and research design of these environments is still in a process of adaptation, due to the novelty of the GBL methodology and the initial stage of research studies in the field. One of the key factors in understanding these learning contexts is the time factor, defined both as an objective dimension (Time-on-Task; ToT) and as a subjective, psychological variable (Time Perspective; TP). The purpose of this paper is to discuss how to measure these two temporal variables in computer-based learning activities. In particular, we will raise the question of which techniques and methodologies are being used to measure these temporal variables in computer-based learning and GBL, and we will further discuss these methodologies in order to propose an suitable methodology that could be useful for researchers. For this purpose, an exhaustive literature review on time measurement in the learning sciences was conducted. The outcomes of the study aim to draw a usable methodology for measuring both TP and ToT in computer-based educational contexts. Results of this study could be of interest for researchers and practitioners in the field of computer-based learning when designing and implementing time measures in the learning process.

KEYWORDS

Time Perspective, Time-on-Task, Computer-based Learning, Game Based Learning, Serious Games.

INTRODUCTION AND RATIONALE

Continuing professional development and lifelong learning are vital to both individual and organizational success (Wall & Ahmed, 2008). Games for education, also known as Serious Games (SG) have long been used for management training in order to safely practice skills and competences that could play a central role in learners' improvement (Mawdesley et al., 2010). There is a broad corpus of research on factors involved in students' learning performance for computer-based learning approaches; in particular, digital Game Based Learning (GBL) activities have been studied the last years with initiatives such as the network of excellence in Serious Games (GaLA project, 2010). Nevertheless, studies focusing on the temporal aspects of SG are still lacking. Time has been highlighted as important in these scenarios (Barberà, Gros & Kirschner, 2012). In particular, we can distinguish two different approaches; the psychological time of learners, in particular, Time Perspective (TP; Zimbardo & Boyd, 1999), which is related to learning performance and investment in learning; and the objective measure of learning time, also defined as Time-on-Task (ToT; Romero, 2010), defined as the time students spend on a learning activity. That can vary depending on the learning task measured.

An original contribution of this exhaustive literature review is to contribute to filling the blank existing in the field of Game Based Learning (GBL) and time, thus helping achieve an understanding of the role of TP and ToT in computer-based learning environments, in particular, in SG activities. In this paper, we focus on the existing ways of measuring these two temporal variables in order to build a solid methodological base for further studies, such as exploring how students' TP and ToT could relate to learning performance when adult learners play SGs in the context of b-learning courses.

BACKGROUND RESEARCH

In computer-based learning, time plays an important role during the learning process. From the literature review by Barberà, Gros & Kirschner (2012), we can say that, though the time factor in ICT-based learning methodologies is important, in particular for the teaching and learning processes, it has mostly been neglected by researchers. As the authors claim: "The time factor (...) management and conscious adaptation is decisive for the well-functioning of online learning". (p. 17). Time can be tackled using different approaches; however, in learning, time invested in learning and Time Perspective (TP) can be considered as key variables (Adelabu, 2007); TP, in particular, is a student attribute that, if correctly measured, can be very useful in explaining dropping out. With the results of our study, institutions could help students by giving them some guidance on the average scheduled time devoted to learning activities. More, if studied as the time devoted to a learning activity or task, we can define Time-on-Task (ToT; Romero, 2010) as another variable involved in students' learning performance in computer-based learning.

We will therefore focus this review on these two temporal aspects: from a more psychological perspective, the temporal orientation or Time Perspective (TP; Zimbardo, & Boyd, 1999), defined as the way individuals and cultures divide their experience into three different temporal categories: past, present and future. In the next section, TP is introduced as one of the main factors in the human relationship with time from a psychological perspective according to Zimbardo & Boyd (1999). ToT is then introduced as an objective measure of time in a learning task, defined as time-on-task (Romero, 2010). Finally, we will study these

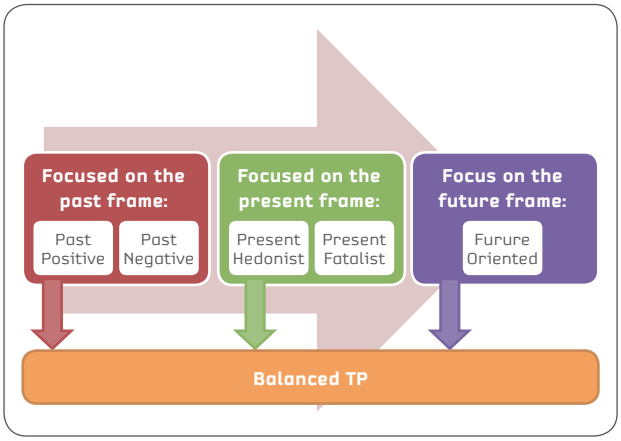
temporal variables in the particular field of computer-based GBL.

TIME PERSPECTIVE

TP is a psychological construct that has been related to learning performance, motivation and self-regulation processes. It is composed of five factors as seen in figure (1):

As education has historically been defined as a future-oriented process (Leonardi, 2007; Schmidt & Werner, 2007) researchers have focused on the concept of Future Time Perspective (FTP) as a factor of students' psychological time. FTP in general, and Time Perspective (TP) in particular, have been approached in lecture based, face-to-face learning environments, where TP is understood as important in relation to learning performance and investment in study. The lack of a theoretical base on TP has hampered somehow the use of a uniform measuring process and instrument for studying students' TP (Thiébaut, 1998). In this presentation, we will discuss the Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999) as a reliable and valid instrument for measuring TP, together with other proposed, qualitative methods.

Figure 1. Factors of the Time Perspective (Zimbardo & Boyd, 1999)

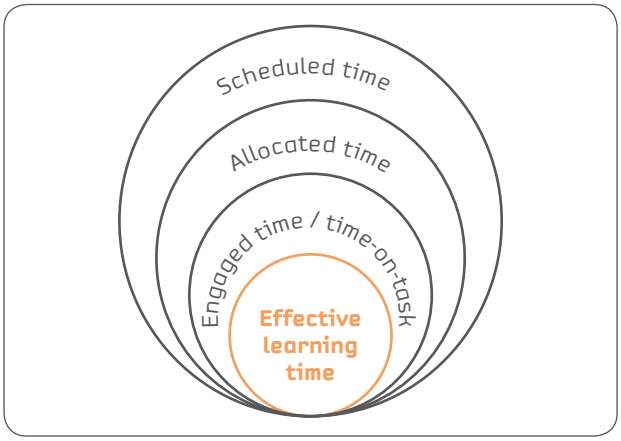


TIME-ON-TASK (TOT)

Concerning ToT, we focus on the Allocated Learning Time (ALT) model (Harnischfeger & Wiley, 1985; Fischer et al. 1980), this model is a theoretical framework historically used in face-to-face contexts, and adapted for computer-based contexts (Romero, 2012).

Scheduled time is defined as the time an educational institution schedules for learning activities. Allocated time, constrained by teachers in class, differs from the real engaged time (also called ToT), as students may not be working on academic matters all the time, they socialize, are distracted and so on. Following Caldwell, Huitt & Graeber (1982), the amount of time spent on learning is a factor determining students' achievement. This engaged time or ToT can be defined as the amount of time students devote to a learning task within the bounds of allocated time (Fischer, 1979, ALT model). Within this time, they have a certain amount of effective learning time, which is hard to see in learning situations where learners are not directly observed by the teacher. For this reason, most of the research developed in relation to academic times and learning has been focused on the relationship between ToT and learning performance (Romero & Usart, 2012).

Figure 2. The ALT model for e-learning contexts (from Romero, 2010)



COMPUTER-BASED LEARNING AND SERIOUS GAMES

Continuing professional development and lifelong learning are vital to both individual and organizational success (Wall & Ahmed, 2008). Previously studies assumed that face-to-face learning contexts are future-oriented; as Leonardi (2007) affirms, educational processes are oriented towards future learning goals and delayed gratification. This is particularly the case in adult education, where students are supposed to be more mature and to have a better understanding of the links between studying and their own success in the future (McInerney, 2004). Romano & colleagues (2005) admit that the growth in distance education increases the need to study students' learning strategies in distance and computer-learning environments, including time management and self-regulation. Games for education, also called Serious Games (SG), have also long been used for management training in order to safely practice skills and competences that play a central role in student workers' improvement (Mawdesley et al. 2010).

Furthermore, it is reasonable to focus on time, both, objective (ToT) and psychological (TP), when trying to understand student's achievement in these educational settings. When focusing on GBL methodologies, as games focus on instant rewards, these activities are supposed to help present-oriented individuals improve their learning behaviours (Zimbardo & Boyd, 1999) because it has been observed that present-focused individuals engage and can perform better in instant feedback situations such as games and social activities. Present-hedonist individuals are supposed to have less time management skills and to be easily distracted by external factors (Wassarman, 2002). In SGs, it is also expected that differences will be observed between playing times (ToT): under time pressure, future oriented students are supposed to manage time better in order to achieve their short-term goals (winning the game) and long-term goals (success in the course) while present and past-oriented individuals just play for fun and instant rewards. There is also the possibility that present-hedonists just "click". In this case, lower time played would lead to low performance outcomes.

GOALS

As has been seen, there is a gap in the study of time in relation to learning performance and time on task (ToT) for formal education, in particular, for those participating in computer-based and GBL learning tasks.

The broader aim of this study is to examine TP and ToT measurement processes in computer-based learning environments. These contexts are widely used (Kirriemuir & McFarlane, 2004), especially for adult education and training (Usart, Romero & Almirall, 2011). In particular, our objective is to define a reliable procedure for measuring students' TP (defined as a subjective, psychological construct) and ToT (defined as the objective time spent on the learning activity) in the context of formal, computer-learning programs for adult management students where SGs are implemented.

RESEARCH QUESTIONS

Two research questions will guide our study, in particular, our literature review:

- How has students' TP been measured in previous studies for distance and computer-based learning environments?
- How has ToT been defined and measured in previous research, in particular, in learning (SG) activities and computer-based courses?

PROCEDURE

Our search for relevant literature on the measurement of students' TP and ToT was carried out with a selective literature review, based on a three-step model: first, a search was carried out on two different research engines; Summon (the UOC engine that is focused in online education and psychology; and also Science Direct, where most of the journals on education and time perspective are listed; the keywords for the search were "time on task and learning" and "time perspective and learning". Secondly, all the references cited in the articles found in the first step were searched in order to spot different articles not retrieved in the first step; and therefore try to maximise the location of published references for this field. Thirdly, journals in the references selected in the final list on TP or ToT were identified as the main journals publishing on TP and ToT in the context of education. All these journals were searched, directly from their homepages. This last step was conducted in order to complete the number of references and to make sure that no articles were left out of the literature review. A total number of 46 articles were retrieved in the first step for ToT and learning, and 12 more were added from the second step. Finally, 21 references were selected for ToT based on the following criteria: an article was chosen if it gave both an explicit definition and a measurement process for ToT. For the TP variable, the process was equivalent, and 51 out of 194 papers were finally listed (38 of them were specifically focused on FTP). All the references were focused on the fields of learning or education.

RESULTS

TP MEASURES

Research on TP has historically been focused on face-to-face environments; in particular, 38 articles out of 51 focus on the future factor of TP (FTP). There are different instruments for measuring students' TP; not only self reported tests or questionnaires (Peetsma, 2000; Shell & Husman, 2001), but also task-reported measures such Teahan (1958). Nevertheless, since the Zimbardo & Boyd's (1999) TP foundational work on TP, more authors admit that, as a psychological construct, a self-reported test such as the ZTPI is a valid and reliable way of measuring this variable (Adelabu, 2007; Horstmanshof & Zimitat, 2007; de Bilde, Vansteenkiste & Lens, 2011). Closer in time, some researchers are studying how to adapt the ZTPI to formal learning scenarios. Along these lines, Janeiro (2012) presented the Time Perspective Inventory (IPT) as a new instrument for assessing the time perspective in school context, with 32 items organized in four scales, three related with the temporal zones (future,

Table 1. TP literature research results

Learning environment	Number of studies	Instruments
Face to face	2 46	• Task-reported measures (Teahan, 1958) • Self-reported tests: ZTPI, FTPQ, FTPS, IPT (Zimbardo & Boyd, 1999; Peetsma, 2000; Shell & Husman, 2001; Janeiro 2012)
Online learning	2	• Self-reported tests: ZTPI (Zimbardo & Boyd, 1999)
Game Based Learning	1	• Self-reported tests: ZTPI (Zimbardo & Boyd, 1999)

present and past), and one with an anxious or negative perception of the future. In parallel, the researcher measured positive relationships between future time orientation and school achievement in grade 12 students.

Despite the scientific production since 1942 on the study of TP and learning, little research has focused on computer-based learning or GBL tasks. Only one study distributed questionnaires online (Horstmanshof & Zimitat, 2007), and as a theoretical approach, Schmidt & Werner (2007) pointed to the importance of FTP in online learning environments. However, the study does not conduct any measurements of this variable. For GBL tasks, up to the authors' knowledge, three studies measure TP in games or social learning activities, all of them base their research on Zimbardo & Boyd's (1999) TP definition. Brown & Jones (2004) showed how present-oriented individuals have greater engagement in social activities. The authors used a self-reported questionnaire, the Temporal Orientation Scale (TOS) to measure TP. Results for African-American high school students indicate that past and present-oriented students tended to engage in social activities more than academic activities. In the same vein, Wassarman's (2002) thesis on TP and gambling behaviour points to present-oriented adults engaging more in gambling activities than past and future-oriented individuals. He used the ZTPI. Finally, Romero & Usart (2012) measured TP in a GBL activity. A total of 24 adult students in a master's course formed the sample (9 women and 15 men, age M = 31.90, SD = 4.09). A classification game, MetaVals, was implemented in an introductory finance course. The research scenario was set by an online pre-test of financial literacy, together with face-to-face SG activity, (where students played a web-based SG to classify assets and liabilities) and an online post-test. Students were rated, according to the ZTPI, as future or present-oriented. Results show that an active learning approach such SG involves competition and social interaction and demands students think about the future, but also focuses on instant rewards.

From this review, there are still different aspects of the role of student TPs in SG that need to be approached. One of the factors to be studied is the social aspect of collaborative GBL tasks. TP studies have focused only on individual learning activities; and little is known about how differently oriented individuals behave when cooperating or competing with other students. As SGs feature increasingly in current learning trends in adult formal education, research on TP should now study how to implement TP measurement in SG tasks.

TOT MEASURES

This variable has been studied in formal educational contexts since the beginning of the 20th century; and reappeared in the late 1950s. Carroll's (1963) model of school learning attended to instructional time variables. Studies in the sixties and seventies (Lahaderne, 1968; Hinrichsen, 1972) found positive correlations between time-on-task and achievement. However, research on ToT had its peak in the 1980s and nineties, with the definition of finally, a theoretical framework: the ALT model (Fisher, 1979). In this widely used approach, ToT can be understood as part of a superordinate concept: instructional time, which includes scheduled time, allocated time, engaged time (or ToT) and effective time (as seen in the ALT model in figure 2). Most of the references reviewed base their work on Fisher (1979) definition of academic engaged time or ToT: "the time which a student spends engaged in academically relevant material which is of a moderate level of difficulty" (p. 52). Following Caldwell, Huitt & Graeber (1982), there is an engagement rate to measure ToT, defined as the percentage of the class actively working, or engaged, in a learning task, and they related to achievement.

Table 2. ToT literature research results

Learning Environment	ToT Definition	ToT Measure
Face to face	ToT is the time a student spends engaged in academically relevant material of a moderate difficulty level. (Fisher, 1979). A conjunctive concept, not as simple as time engaged in learning, measured while people are working on a task or thereafter (Berliner, 1990).	• Number of self-determined trials children spend in learning an alternate, equivalent form of an experimental task. (Gettinger, 1985) • The integration of instantaneous workload for the time interval spent on the task (Berliner, 1990).
Online learning	Engaged time or ToT can be defined as the amount of time students devote to a learning task within the bounds of allocated time (ALT model).	• Time students spend in a computer-based task (Metcalfe, 2002) • Time logs of students engaged in individual or collaborative activities (Levinsen, 2006; Romero, 2010) • Time spent online by learners (Wellman & Marcinkiewicz, 2004)
Game Based Learning	ToT is the manner time is used in learning (Stallings, 1980).	• Time working with puzzles and games, both individually and in small groups (Stallings, 1980). • Time students' are engaged (logged) in the gameplay (Gee, 2003; Lewis, 2007).

Gettinger (1985) measured the time spent in learning (ToT) in 4th and 5th grade students, as the number of self-determined trials children spent in learning an alternate, equivalent form of an experimental task. Furthermore, Berliner (1990) highlights that ToT is a conjunctive concept, not as simple as time engaged in learning. He defines it in terms of learner's achievements, and measures it while people are working on a task or thereafter. Berliner admits that measurement issues for instructional time could be vastly complex, and advises that even if measured adequately, instructional time variables are not particularly powerful. He gives even a mathematical definition; the integration of instantaneous workload for the time interval that was spent on the task (i.e., the area below the instantaneous load curve), where average load represents the mean intensity of load during the performance of a task. From our review, we can therefore accept that ToT is a behavioural and quantifiable instructional time measure, aimed for monitoring the time-on-the-right-tasks (Berliner, 1990), the percentage of time students are engaged in tasks or materials that are related to the outcome measures used is a means to bring important concerns about curriculum and curriculum assessment into the teaching time model. Finally, when measuring ToT in face-to-face activities, the inclusion of self-reporting measures students' cognition, assessing moment-to-moment attention during lessons, may provide stronger relationships when relating ToT to learning variables (Peterson, Swing, Braverman & Buss, 1982).

From the extensive search carried out in the Summon and Science Direct databases, we can observe that not so many authors have studied ToT in computer-based contexts or GBL tasks. As a start, Metcalfe (2002) measured in a computer-based task (word counting and Spanish-English learning) that students with a fixed ToT for the computer tend to spend more time on medium difficulty items. In the other two studies found focused on online learning,

this variable followed the ToT definition given by the ALT model, and is measured as time logs of students' engaged in individual or collaborative activities (Levinsen, 2006; Romero, 2010). Observing a group of 120 college students in an online pharmacy program, Wellman & Marcinkiewicz (2004) found that time spent online by learners (ToT) was weakly correlated with learning.

Finally, as seen in table 2, four studies have been identified as focused on GBL and ToT; Stallings (1980) defined ToT as the way time is used in learning, and relates it to achievement in maths and language tasks. In particular, he contrasted time working with textbooks to time with puzzles and games among primary school pupils. He highlights that SG tasks were related to non-verbal skills, problem solving and lower student absence rates, and time spent in small groups was also positively related to achievement when compared to one-to-one classes. From the Romero & Usart (2012) research on GBL and ToT, two studies explicitly defined and measured ToT in SGs: Gee (2003) and Lewis (2007). These authors measured ToT as the time students' were engaged in the gameplay (logged in). In particular, Lewis (2007, p.918) observed that "time-on-task" is one of the great general truisms of educational interventions: the longer one spends learning, generally, the more one learns. However, he claims that the influence of time-on-task is subject to the relevance of the learning objectives addressed by a game. He considered a student's ToT in relation to an increase in learning performance. Games could facilitate an increase in ToT because of their engagement and improve some learning performances, but increasing ToT would not necessarily efficiently increase learning performance. Furthermore, Gee (2003) also argued that a well-designed SG could increase the students' ToT by creating an environment that encouraged practice, although this time does not directly relate to a better learning performance.

CONCLUSIONS AND IMPLICATIONS

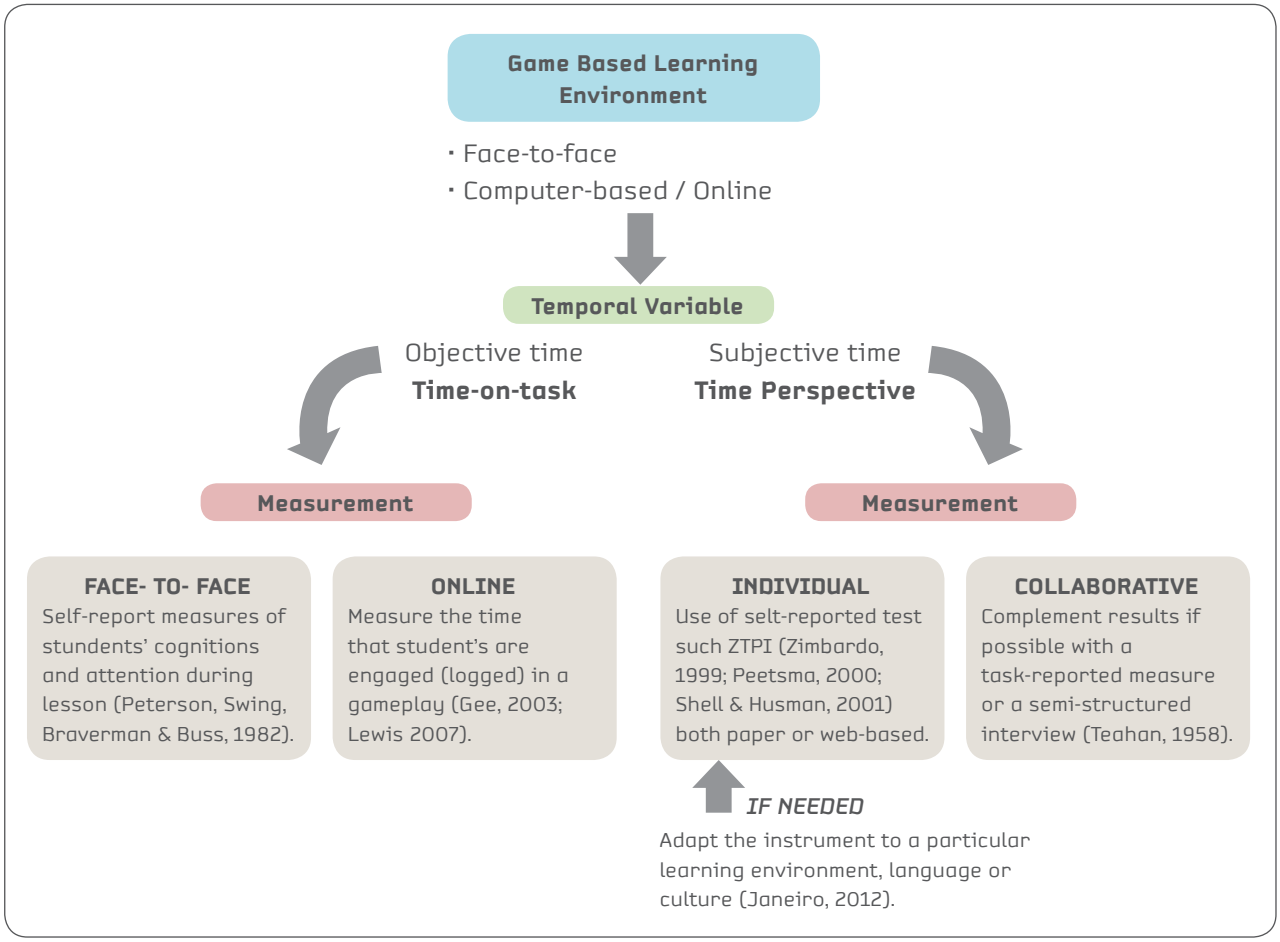
Measuring time in computer-based learning and SG tasks is an aspect that has been under-studied. From a subjective, psychological standpoint, we can affirm that self-reporting of TP from the ZTPI can be considered as a standard methodology in face-to-face environments and therefore be transposed to computer-learning and GBL. Moreover, as these new educational environments are no longer solely focused on the future (Zimbardo & Boyd, 1999; Schmidt & Werner, 2007), but also include present centred activities and rewards (Wassarman, 2002), TP with all its factors is the variable to study. On the other hand, a triangulation of students' TP results with an objective measure of actions of students is needed and could lead to more precise and reliable results in this field.

From our literature research, we have to admit that TP has been widely studied in face-to-face, instructional contexts, and little work has focused on the study of these temporal variables in computer-based learning or in SG tasks. Firstly, as Zimbardo & Boyd (1999) highlighted, there is an existing number of instruments and measures for TP. There is therefore a need for a reliable technique that can measure TP factors. ZTPI has been translated into different languages (Díaz-Morales, 2006) and can easily be administered online with tools such *Limesurvey* or *Moodle* (Romero & Usart, 2012). This instrument, combined with other measures such as students' time management and persistence, could give greater validity to the measurement of FTP. The fact that self-reported questionnaires are widely used in the field of learning, could therefore be limiting the validity of the measures on FTP.

According to the small number of references retrieved, ToT has also been under-studied

in the field of computer-based environments and GBL. It is important to mention that the existing measures of ToT from different perspectives could have a great impact on results, especially when related to achievement. Following Caldwell Huitt & Graeber (1982), small changes in each measure of time could lead to large differences in its effects. We should therefore focus on one definition and how we measure this variable when beginning a study. In computer-based environments, ToT is defined in the context of the ALT model (Romero, 2010), and is measured as the time students spend on a learning task. With the spreading of these learning methodologies, students' time logs are easier to monitor and study; particularly in specifically designed GBL tasks with accessible databases. However, it is important to highlight that, in SG tasks, ToT can differ from effective learning time because there are distracting activities like time spent on understanding poorly designed instructional scenarios or computer-based games and interfaces, processing incoherences, understanding game mechanics, and social interaction (Admiraal, Huizenga, Akkerman & Ten Dam, 2012) which does not directly relate to learning. Measuring methodologies should therefore be based in quantitative and qualitative data (see figure 3). Since Berliner 1990, the importance of measuring ToT correctly has been heavily stressed, not only because of relating it to achievement, but because of the difficulty, which online contexts could overcome, of monitoring real students' ToT (which may not be effective learning time, as there are technical

Figure 3. Scheme for measuring temporal variables in GBL environments



issues, understanding the game mechanics, collaboration and group interaction other than learning construction).

In conclusion, we propose that more experimental and case studies should be conducted in the field of time and computer-based learning, in particular, focusing on students' ToT in active-learning tasks, such as SG, which are being widely implemented, but nonetheless need experimental support to show their overall effectiveness, through the use of a consistent measurement process. TP should also be measured using self-reported online tests such ZTPI, which could allow researchers to better understand students' engagement and attitudes in computer-based and SG tasks. Future studies could support the theoretical conclusions highlighted in this review and make it possible to establish a consistent framework for measuring temporal variables in computer-based environments in general and for SG activities in particular.

References

Adelabu, D. H. (2007). Time perspective and school membership as correlates to academic achievement among African American adolescents. *Adolescence, 42* (167), 525–538.

Admiraal, W., Huizenga, J., Akkerman, S. & ten Dama, G. (2011). The concept of flow in collaborative game-based learning. *Computers in Human Behavior, 27*, 1185–1194

Barbera, E., Gros, B. & Kirschner, P. (2012). Temporal issues in e-learning research: A literature review. *British Journal of Educational Technology*, *43* (2), 53–55

Berliner, D. (1990). What's all the fuss about instructional time? In *The nature of time in schools. Theoretical concepts, practitioner perceptions.* Time to learn.

Brewer, J. & Hunter, A. (2006). Foundations of multimethod research: Synthesizing styles. Thousand Oaks, CA: Sage

Brown,W. T., & Jones, J. M. (2004). The substance of things hoped for: A study of the future orientation, minority status perceptions, academic engagement, and academic performance of black high school students. *Journal of Black Psychology, 30* (2), 248–273.

Caldwell, J. H., Huitt, W. G. & Graeber, A. O. (1982) Time Spent in Learning: Implications from Research. *Elementary School Journal, 82*, 471-480.

de Bilde, J., Vansteenkiste, M. & Lens, W. (2011). Understanding the association between future time perspective and self-regulated learning through the lens of self-determination theory. *Learning and Instruction, 21* (3), 332-344.

Díaz-Morales, J. F. (2006). Estructura factorial y fiabilidad del Inventario de Perspectiva Temporal de Zimbardo. *Psicothema, 18* (3), 565-71.

Fisher, C. (1979). Improving Teaching by Increasing "Academic Learning Time. *Educational Leadership, 37*(1), 52 - 54.

Fisher, C., Berliner, D., Filby, N., Marliave, R., Cahen, L. & Dishaw, M. (1980) "Teaching behaviors, academic learning time, and student achievement: An overview", In C. Denham and A. Lieberman (Eds.), *Time to learn,* National Institute of Education, Washington, DC.

GALA project (2010). *Games and Learning Alliance. Network of Excellence for Serious Games*. Retrieved 01/10/2012. From http://www.galanoe.eu/.

Gettinger, M (1985). Time Allocated and Time Spent Relative to Time Needed for Learning as Determinants of Achievement. *Journal of Educational Psychology, 77*(1), 3-11

Harnischfeger, A., & Wiley, D. E. (1985). Origins of active learning time. In C. W. Fisher & D. C. Berliner (Eds.), *Perspectives on instructional time* (pp. 133-56). New York and London: Longman

Horstmanshof, L. & Zimitat, C.(2007). Future time orientation predicts academic engagement among first-year university students. *British Journal of Educational Psychology, 77* (3), 703-718

Janeiro (2012). Time Perspective Inventory (IPT): a new instrument for the assessment of time perspective in school context. *Proceedings of the1st conference on Time Perspective*. Porto. Portugal

Kirriemuir, J. & McFarlane, A. (2004). Literature review in games and learning: A Report for NESTA Futurelab. Retrieved 17/07/2011. From http://www.futurelab.org.uk/resources/documents/lit_reviews/ Games_Review.pdf

Leonardi, A. (2007). Future time perspective, possible selves, and academic achievement. *New Directions for Adult and Continuing Education*, 114, 17-26.

Levinsen, H. (2006). Collaborative on-line teaching: The inevitable path to deep learning and knowledge sharing? *Electronic Journal of E-learning, 4* (1), 41–48.

Lewis, M.W. (2007) "Analysis of the roles of serious games in helping teach health-related knowledge, skills, and in changing behavior". *Journal of Diabetes Science and Technology, 1,* 6.

McGrath, J., & Kelly, J. (1986). *Time and Human Interaction: Toward a Social Psychology of Time*. New York, USA: Sage Publications.

McInerney, D. M. (2004). A discussion of future time perspective. *Educational Psychology Review, 16,* 141–151.

Metcalfe, J, (2002). A region of proximal learning model of study time allocation. *Journal of memory and language, 52*, 465-477

Mawdesley, M., Long, G., Al-jibouri, S. & Scott, D. (2011). The enhancement of simulation based learning exercises through formalised reflection, focus groups and group presentation. *Computers & Education, 56*, 44–52

Peetsma, T. (2000). Future Time Perspective as a Predictor of School Investment. Scandinavian *Journal of Educational Research, 44* (2), 177-192.

Peterson, P. L., Swing, S. R., Braverman, M. T., & Buss, R. (1982). Students' aptitudes and their reports of cognitive processes during direct instruction. *Journal of Educational Psychology, 74,* 535-47.

Romano, J., Wallace, T., Helmick, I., Carey, L. & Adkins, L. (2005). Study procrastination, achievement, and academic motivation in web-based and blended distance learning. *Internet and Higher Education, 8*, 299–305.

Romero, M. (2010). *Gestion du temps dans les Activités Projet Médiatisées à Distance.* Editions Européenes Universitaires. ISBN 978-613-1-52102-7.

Romero, M., & Barberà, E. (2012). Creative Collaboration Continuum enhanced by Online Education: Time Pressure, Time Quality and Social interaction. *34th IATUR Conference on Time Use Research.* 22-24 Aug 2012, Matsue, Japan.

Romero, M. & Usart, M. (2012). Game Based Learning Time-on-Task and Learning Performance According to the Students' Temporal Perspective. *Proceedings of the 6th European Conference on Games Based Learning,* 4-5 October 2012 Edited by Dr Patrick Felicia, Waterford Institute of Technology: Ireland. ISBN: 978-1-908272-70-6

Schmidt J. T. & Werner C. H. (2007). Designing Online Instruction for Success: Future Oriented Motivation and Self-Regulation. *The Electronic Journal of e-learning*, *5* (1), 69 -78L

Shell, D. F. & Husman, J. (2001). The multivariate dimensionality of personal control and future time perspective beliefs in achievement and self-regulation. *Contemporary Educational Psychology, 26*, 481-506.

Teahan, J. E. (1958). Future time perspective, optimism, and academic achievement. *The Journal of Abnormal and Social Psychology, 57* (3), 379-380.

Thiébaut, E. (1998). La perspective temporelle, un concept à la recherche d'une définition opérationnelle. *L'année psychologique. 98* (1), 101-125.

Trautwein, U. (2007) "The homework-achievement relation reconsidered: Differentiating homework time, homework frequency, and homework effort", *Learning and Instruction, 17* (3), 372–388.

Usart, M., Romero, M. & Almirall, E. (2011). "Impact of the Feeling of Knowledge Explicitness in the Learners' Participation and Performance in a Collaborative Game Based Learning Activity". *Lecture Notes in Computer Science, 6944*, 23-35.

Wagner, P., Schober, B. & Spiel, C. (2008), "Time students spend working at home for school", *Learning and Instruction, 18*, 309–320.

Wall, J. & Ahmed, V. (2008). Use of a simulation game in delivering blended lifelong learning in the construction industry - Opportunities and Challenges. *Computers and Education, 50* (4), 1383-1393.

Wassarman, H. S. (2001). The *role of expectancies and time perspectives in gambling behavior*. ProQuest Dissertations and Theses. ProQuest Dissertations & Theses (PQDT), n/a

Zabel (1995). *Correspondence course completion rates*. PhD dissertation. Retrieved 01/10/2012. From http://etd.lib.ttu.edu/theses/available/etd-01072009-31295009342592/unrestricted/31295009342592.pdf

Zimbardo, P. G., Keough, K. A. & Boyd, J. N. (1997). Present time perspective as a predictor of risky driving. *Personality and Individual Differences, 23*, 1007-1023. Zimbardo, P. G. & Boyd, J. N. (1999). Putting time into perspective: A valid, reliable individual differences metric. *Journal of Personality and Social Psychology, 77*, 1271-1288.

Franco-Casamitjana, M.; Barberà, E. & Romero, M. (2013).
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and Learning Efficiency in Collaborative Learning Contexts.
eLC Research Paper Series, 6, 52-62.

A METHODOLOGICAL DEFINITION FOR TIME REGULATION PATTERNS AND LEARNING EFFICIENCY IN COLLABORATIVE LEARNING CONTEXTS

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A Methodological Definition for Time Regulation Patterns and Learning Efficiency in Collaborative Learning Contexts

ABSTRACT:

This article defines a methodological design for analysing time regulation patterns and learning efficiency in collaborative learning contexts in online education. The methodological design explained here is based on a thorough literature review of time regulation in learning contexts and its adaptation to the scenario of the appropriate research framework.

KEYWORDS:

methodological design; time regulation; learning regulation; learning efficiency; collaborative learning; online education.

INTRODUCTION

Human beings' lives unfold over time, learning and technology; Reimann (2009) considers that learning develops over time. According to the current scenario, which tends to make claims for social and economic paradigm change and constant time factor cost, it is useful to find out about time regulation strategies for obtaining learning efficiency in order to improve individuals' lifelong learning goals.

This article explains a methodological definition for analysing time regulation patterns that generate learning efficiency, specifically in collaborative learning, within an online education environment. This methodological design is part of a research framework that would explain the time regulation shown by online students and some effects this could have on the collaborative learning efficiency they obtain.

BACKGROUND RESEARCH

The theoretical background is based mainly on paradigms of cognitivism and social constructivism. Learning self-regulation and collaborative learning are particularly studied from social constructivism paradigm. Learning self-regulation is contextualized by self-regulation strategies, metacognition, co-regulation and socially shared regulation (Hadwin, Järvela & Miller, 2011; Zimmerman & Schunk, 2011; Alexander & Schwanenflugel, 1994). This article analyses time regulation considering both the collaborative learning level, task coordination in terms of time regulation and team and individual regulation of learning times (Fransen, Kirschner, & Erkens, 2010). The main research, on which the article is based, uses an approach to "Temporal Self-Regulation Theory" in order to follow a theoretical framework for human behaviour concerning temporal aspects and a specific guideline on "self-regulatory capacity" (Hall & Fong, 2010), which is explained in the following sections. Moreover, time regulation and learning efficiency are mostly based on a cognitivism paradigm. Time regulation is considered as a part of learning regulation and determined by productivity (Reimann, 2009; Vohs & Schmeichel, 2003; Macan, 1994).

LEARNING REGULATION

Learning regulation has been defined as the capacity to intentionally plan, control and affect with our actions in such a way that learners have active control of their own learning and outcomes (Hadwin, Järvelä & Miller, 2011). Learning regulation is therefore focused on the processes by which learners are able to set goals, plan, execute, affect and adapt their own learning. Regulation in learning is metacognitive and social, and learners are able to regulate behaviour, cognition and motivation. Findings have described learning regulation as intentional and goal directed, and goals can guide strategies and give some information about the standards used for monitoring, evaluating and regulating. Considering these authors, researchers can obtain some information about learners' direction, motivation and intent if they know what their goals are.

The role of metacognitive planning, monitoring and control processes is one of the main points of the learning regulation theories, especially concerning self-regulation. A strategic change in thinking, feeling and action occurs when learners perceive a difference between where they are, as individuals or as a group, and where they would like to be. Metacognitive processes must be measured, observed and systematically analysed when doing research about learning regulation (Hadwin, Järvelä & Miller, 2011).

Regulated learning is, for some authors, a social activity, so the social context and its interaction are basic elements for understanding it (Volet, Summers & Thurman, 2009). Motivational, cognitive or behavioural challenges, and control over them (Perry & VandeKamp, 2000) foment active learning regulation in individual and collaborative learning environments (Hadwin, Järvelä & Miller, 2011). Learners can regulate motivation, cognition and behaviour. In addition, learners are able to change their context, their groups and themselves.

According to the literature, there are three kinds of regulated learning: Self-Regulated Learning (SRL), Co-Regulated Learning (CoRL) and Socially Shared Regulated Learning (SSRL). "Self-Regulated Learning (SRL)" is the goal-directed action or process when individuals regulate their own learning process cognitively, behaviourally, contextually and motivationally (Pintrich, 2000). SRL therefore appears when students consciously and intentionally plan, monitor and regulate cognition, behaviour, motivation and emotion in order to complete an academic task and goal. Social cognitive theory considers that SRL is conducted in environmental conditions that promote adopting, developing and refining strategies, plus monitoring, evaluating, setting goals, planning and embracing and changing processes. SRL takes place in individual, cooperative and collaborative learning activities and tasks in new contexts, as well as changing structures and environment conditions. Hadwin, Järvela and Miller (2011) cite the fact that the self-regulation principal goal is the independence or personal adaptation in regulatory activity.

Co-Regulated Learning (CoRL) is the regulatory ability between oneself and others and the activity system, while carrying out tasks alone, cooperatively or collaboratively. The goal of CoRL is a transition towards self-regulation or mediation of individual adaptation and the regulatory competence among group members. CoRL are emergent interactions that temporarily mediate regulatory work, such as strategies, monitoring, evaluation, goal setting and motivation (Hadwin, Järvelä & Miller, 2011).

Socially Shared Regulation of Learning (SSRL) goal is collective adaptation and regulation of collaborative processes. Several individuals therefore regulate themselves individually in order to co-construct and synthesize strategies, monitoring, evaluation, goal setting, planning and beliefs, leading to shared outcomes. SSRL takes place in cooperative and collaborative tasks, when interdependent or collectively shared regulatory processes, beliefs and knowledge produce a co-constructed or shared outcome (Hadwin, Järvelä & Miller, 2011).

TIME REGULATION

This article considers time regulation as actions or behaviour processes linked to time, which are planned and executed to achieve greater efficiency in learning tasks, at the self-, co-, and socially shared regulation level. However objectives and motivation, economic and human resources should be taken into account along with quality time, quantity time, time flexibility and cognitive capacity, as individuals' resources and changeable elements for obtaining productivity. Time regulation is a dimension consisting of four perspectives, global and subjective time, and quantity and quality time. Global time is characterized by cultural, social and institutional agreement about time, in contrast to subjective time as a self-regulation through the perception of time (Vohs & Schmeichel 2003). Quantity time, or time-on-task, is the number of minutes spent learning, whereas quality time alters learning performance (Romero & Barberà, 2011).

The categories used to study the time factor will be based on Macan, Shahani, Dipboye and Phillips (1990), when they designed a survey for measuring the Time Management Behaviour Scale (TMBS). Even though there are not many studies relating learning regulation and the time factor, those available offer significant results to be used as a theoretical and empirical framework.

Macan (1994) mentions the interest of doing research about other contexts and individual characteristics which appear for individuals who have the perception of time control. According to Winne and Hadwin (2008), regulation means an adaption or a change over time. Therefore, as some authors suggest the importance of researching how students regulate particular study activities or tasks, or activities during periods of time. Hadwin, Järvelä and Miller (2011) state that research mixing self-regulated learning, co-regulated learning and socially shared regulated learning could shift the granularity from a particular study and series of episodes. The same authors say that the way individuals and groups build on regulatory processes, strategies and knowledge over time, and over tasks, should be studied.

Alexander and Schwanenflugel (1994), after studying metacognitive attributions and the knowledge base, conclude that strategy regulation is composed of a complex interaction of different factors. This research will seek to explain how learning regulation is composed by different elements, and to highlight time regulation as being one of the main ones. This research will follow the way that online students have less time to study but have developed significant learning regulation strategies during their studies in order to be better time managers, whether or not they had this ability before their online studies.

Self-Regulated Time (SRT) is those temporal actions or processes that individuals use to regulate their own time so as to achieve a goal. According to Vohs and Schmeichel (2003, p. 217), SRT is related to temporal processes and implicit or explicit judgements, which "underlie people's attempts at self-regulation, such as time duration, time orientation and intertemporal choice".

Macan, Shahani, Dipboye and Phillips (1990) list three time management factors from Lakein's ideas: to set goals and priorities, time management mechanics, and a preference for organization. As control over those three time management factors grows, perception of control over time increases. Macan (1994) proposes that time management behaviours are connected through a perception of control over time. Individuals who recognise themselves to be in control of their time avoid experiencing frustration and tension, compared to those who do not perceive themselves as having such control. Students in the Macan, Shahani, Dipboye and Phillips (1990) study who considered themselves to have control over their time reported more satisfaction at school.

Co-Regulated Time (CoRT) is those actions or processes that a group of people use to regulate their time in common so as to achieve a collective goal. However, a group of cognitions operates very differently to the sum of individual cognitions (Stahl & Hesse, 2006), and Reimann (2009, p. 240) cites that "learning unfolds over time". The time factor is related to quantity and sequence, as individuals learn by accumulation of experiences (Ritter et al. 2007). This is therefore heightened when people are learning in groups, because communication and interaction processes are added (Reimann, 2009). Hadwin, Järvelä and Miller (2011) study outcomes, giving several clues for continuing research about which strategies are effective for individual and collective regulation of those challenges.

External Regulated Time (ERT) includes the temporal actions or processes that groups use to regulate their common time in accordance with global time, in order to achieve a collective goal. In this sense, global time is understood by cultural, social and institutional agreement about the value given to time (Vohs & Schmeichel, 2003), as the concept of time diversifies among individuals, organizations, or societies (Collinson & Cook, 2001).

Individuals who have the capacity to use an effective self-regulation in everyday life are able to improve self-regulatory abilities and practice compensatory strategies. "Temporal Self-Regulation Theory (TST)" is described by Hall and Fong (2007, p.6) as a theoretical framework for understanding human behaviour in general, including temporal aspects "to make sense of human behavioural patterns that seem to represent, on the surface, significant deviations from rationality". TST is based on the construct of "Self-regulatory capacity" (SRC), defined by the authors as the capacity "to exert top-down control over one's actions" (Hall & Fong, 2010, p. 86). They suggest that it is almost synonymous with executive function. Executive function can therefore be studied by reaction time task tests.

This study uses TST to approximate temporal self-regulation and efficiency in order to identify human behaviour patterns in education and whether there are some individuals who have the capacity to use effective self-regulation in everyday life. Accordingly, the research framework is intended to look at how such individuals improve self-regulatory abilities and practice compensatory strategies in their learning activity.

METHODOLOGICAL DESIGN

In order to construct a methodological design for time factor strategies and time regulation typologies, some customized instruments for obtaining reliable and appropriate data must be created.

LEARNING EFFICIENCY

Paas and Van Merriënboer (1993) designed the Deviation model (Hoffman & Schraw, 2010) to measure the efficiency of the mental processing with two variables: learning performance, such as examination scores, and cognitive effort, which is the students' estimate of the mental effort expended. In addition, other authors (Stanovich & West, 1998; Streiner, 2003; Streiner & Norman 2003, & Warnick et al. 2008) have defined the Conditional likelihood model (Hoffman & Schraw, 2010). This article is based on the Conditional likelihood model, considering learning efficiency as the conditional rate of change or relative gain of performance, time, effort and other individual differences.

Taking into account the Conditional likelihood model (Stanovich & West, 1998; Streiner, 2003; Streiner & Norman 2003, & Warnick et al. 2008), this article measures learning efficiency with four variables: learning performance, cognitive effort, individual learning regulation patterns, and individual time regulation patterns. Learning performance is understood as academic results and acquired learning objectives. Cognitive effort, as with the Paas and Van Merriënboer (1993) method, is measured with a scale scored by students' perception (Tuovinen & Paas, 2004). In this case, a 10-point scale is used instead of a 9-point scale in the original method. The individual learning regulation patterns are the typology of students depending on the learning strategies they use in order to obtain quality and good results in their learning, taking into account the time they invest, shared with personal and work time. Finally, individual time regulation patterns are the typology of students depending on the time strategies they use in order to obtain quality and good results in their learning.

In addition, collaborative learning efficiency is measured with four variables: team learning performance, cognitive effort, co-regulated learning patterns, and co-regulated time patterns. The team learning performance is the academic results and the common acquired learning objectives as a group. Cognitive effort is measured with a 10-point scale by the members of the working team, based on Paas and Van Merriënboer (1993) method.

In this section, firstly the independent and dependent variables are introduced, followed by the description of the instruments designed for the purposes of this study. In table 1, the variables and instruments that will later be introduced in this section can be seen.

INDEPENDENT VARIABLES

The independent variables that the methodological design takes into account are individual learning regulation patterns and individual time regulation patterns.

The individual learning regulation patterns are mainly obtained from a questionnaire designed for the study to collect learning regulation pattern data, such as learning strategies concerning the steps students' follow during the learning process. The sources of this independent variable are the self-reported declarations of the students in this questionnaire. The research indicators of these variables are: clear ideas about how to study and number of credits studied at the same time. Meanwhile, the variables of interest are the specific time regulation patterns, which have some effect on the collaborative learning process.

The independent variables - individual time regulation patterns - are collected from personal experience of the sample through the analysis of a questionnaire. Data is needed on their personal strategies, actions and attitudes related to their individual and collaborative learning activities. Data is also needed about their timetable, including family, work, learning and spare time. The source of this information is the students' responses from the questionnaire. The information is presented on a 10-point scale, or transformed into a 10-point scale during its analysis in order to be able to work with different data. Results are also compared with direct observation. The research indicators of individual time regulation patters are: clear ideas about how to plan the study; the number of working hours per week, and the number of family constraints.

Table 1. Synthesis of the variables and instruments.

Variables	Concept	Instruments
Independent Variable	Individual learning regulation patterns	Questionnaire (Q) Interview & Personal Diary (IPD)
Independent Variable	Individual time regulation patterns	Questionnaire (Q) Interview & Personal Diary (IPD)
Dependent Variable	Learning Efficiency	Interview & Personal Diary (IPD) Learning Activity Register (LAR)
Dependent Variable	Collaborative Learning Efficiency	Interview & Personal Diary (IPD) Observatory Category Table (OCT)

DEPENDENT VARIABLES

The dependent variables that are included in the methodological design are learning efficiency and collaborative learning efficiency.

Learning efficiency as a dependent variable is obtained from an interview and personal diary, and from a learning activity register. The sources are the students and professors. This variable is included in questions in the interview and the personal diary, such as learning strategies used to study, and learning strategies used to study related to time. Meanwhile, it is also considered in a 10-point scale within the interview and the personal diary, such as cognitive effort and time invested in learning (Time-on-Task). Effective learning within a learning activity record is collected in some items: time of connections and communications in the classroom, learning strategy used in the classroom, and individual steps showed in the classroom. The research indicators of this dependent variable are the learning objectives acquired; academic results; cognitive effort; time invested in learning, and clear ideas about how to study and how to obtain learning efficiency.

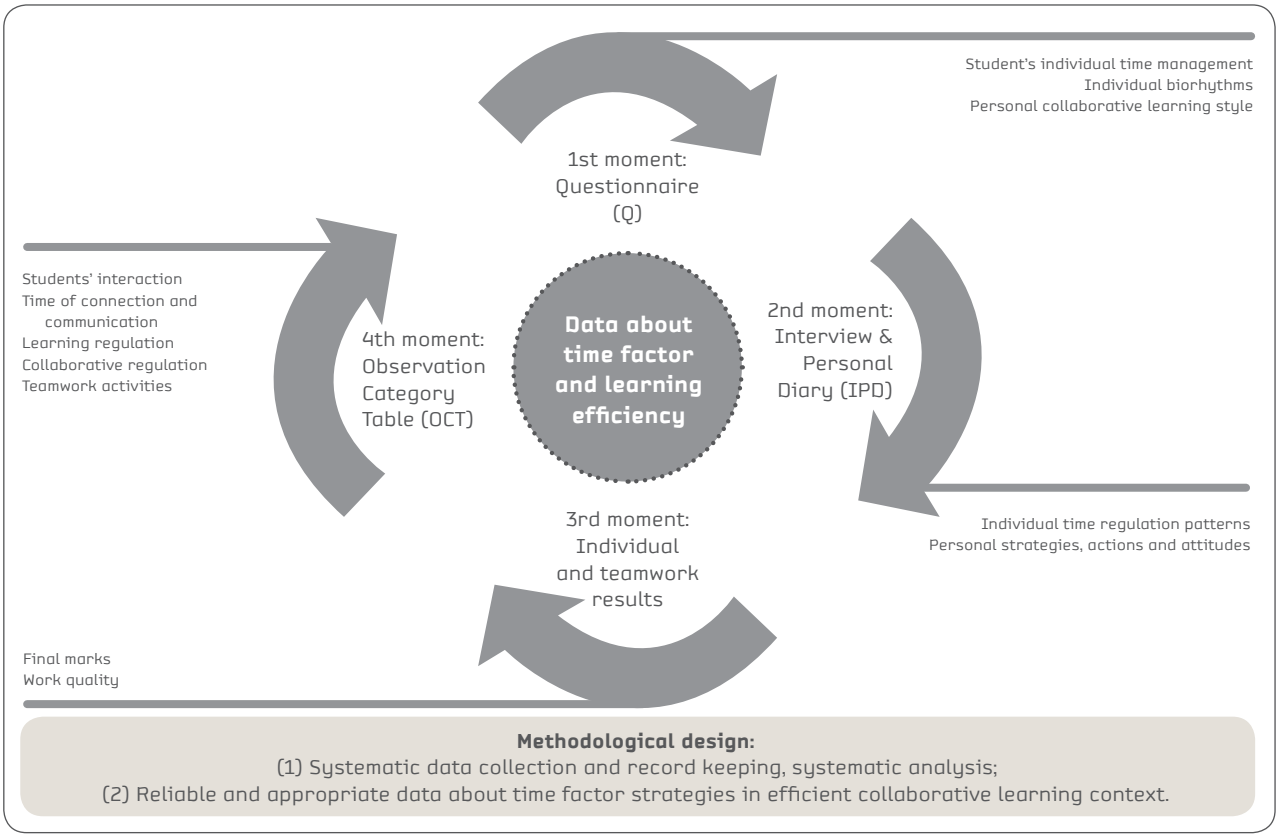
Finally, collaborative learning efficiency is also included in the interview and personal diary and in the learning activity register. The source is the students and professors. This dependent variable is extracted from same items of learning efficiency, though adding the collaborative point of view. However, the research indicators of collaborative learning efficiency are acquired learning objectives; academic results; cognitive effort; time invested to do the collaborative work; level of participation of the rest of the group, and clear ideas about how to work in a team in online environments.

All variables measure the activity during the same period of time; according to Reimann (2009) the temporal unit should be the same for all variables, as he called "minimal unit of time". This period lasts two semesters, divided in four variables collecting moments. The first moment is focused on obtaining individual time regulation patterns. The second moment obtains the cognitive effort and time quantity during the individual and collaborative activity. The third moment is when the quality of the final collaborative piece of work and the final individual marks are displayed. Finally, the fourth moment is the observation of the activity into the classroom, to check the reliability of the data survey and compare the results with the individual and team learning objectives.

RESEARCH INSTRUMENTS

The methodological design uses three different research instruments: a questionnaire, an interview which includes a personal diary, and an observation register. The first research instrument is a Questionnaire (Q), which is needed to record time regulation patterns in order to obtain collaborative learning efficiency. Q should collect time regulation strategies from students enrolled on the courses already mentioned about their personal and studying situations. In order to guarantee maximum possible participation, an agreement with the lecturer is planned. A sample of at least two hundred students is required, with a view to obtain significant conclusions. Q consists of thirty-nine questions; the first part has fifteen questions about the student profile, such as family, work and study, in order to identify the students' individual time management. The second part, about time regulation personal style, has six questions, such as the possible use of individual biorhythms in order to achieve more efficiency, time management, learning strategies and planning skills. Finally, there are eighteen questions about personal collaborative learning style. Q has five open questions, asking the

Figure 1. Methodological Design Workflow



respondents to write down five strategies they follow when they are studying and another five strategies that they use when they are working in a collaborative activity. The rest of the questionnaire has pull-down questions.

The second research instrument is an interview, which includes a personal diary (IPD). This instrument is carried out like an interview and aimed at twenty of the respondents to the Q, who agree to participate as volunteers after being asked to cooperate. IPD collects the individual time regulation patterns, personal strategies, actions and attitudes about individual and collaborative learning activities, while they are learning in collaborative context. IPD has three grids corresponding to three different days, where there are vertical lines, with time distribution from 00:00 to 23:00 and horizontal lines with some daily activities. Moreover, the IPD has some open questions about time factor strategies and attitudes concerning individual and collaborative learning activities in order to clarify possible misinformation from the Q. The interviewer fills in the grid and the details about the studying activities by asking the students.

Finally, an observation register is used to compare what individuals say and what they actually do, by using the observation method in virtual classrooms. The Observation Category Table (OCT) has some labels connected with the theoretical background and the items considered in the two previous instruments. The first part of the OCT collects the data interaction of all the students, the day and time of their connection and communication into the classroom spaces. However, the second part compares the answers given in the Q and IPD learning regulation, collaborative learning regulations and teamwork activity items, with

the class activity. These labels make it possible to engage the three research techniques, in order to analyse the same aspects during the three studies.

The research follows a mixed methodology in order to work with quantity data to obtain students' profiles according to their time regulation and learning, and quality data to complete the different dimensions of the study. The methodological dimension of the Questionnaire (Q) is based mainly on a quantitative data analysis; however, the Interview and Personal Diary (IPD) and the direct observation of the classroom are based on a qualitative data analysis to corroborate the answers.

NEXT STEPS IN THE DEVELOPMENT OF THE RESEARCH FRAMEWORK

A first release of the research framework for studying time regulation study is being made. The objective of the research framework is to characterize time regulation and its effects on learning efficiency through online education, in which the mentioned methodological design is being used. This research analyses time and learning regulation and learning efficiency in collaborative online education. This research is proposed to answer the following main research question: "What are students' time regulation patterns for achieving learning efficiency in collaborative learning contexts?".

Moreover, the specific objectives of this research are to create a usable methodological design guaranteeing systematic data collection and record keeping, systematic analysis, and providing reliable, appropriate data about time regulation patterns, in order to obtain collaborative learning efficiency.

The study sample is taken from students who are studying different courses in an online university, and after passed at least 15 credits (375 hours of studying into the European Credit Transfer and Accumulation System) of their unfinished grade, so as to guarantee a minimum of expertise as an online learner. The dimension of the sample should be not smaller than two hundred respondents. The selected courses to be analysed should have at least four aspects in common: courses must follow complete online methodology; courses should have at least one collaborative activity; the collaborative activity must follow teams' similarities, and its syllabus must include a competency for developing the capacity for teamwork and collaborative learning. Moreover, in order to be able to generalize from the answers, the courses should be selected from degrees of very different branches of knowledge, from social sciences to science & technology, and from different languages.

In order to analyse the qualitative data, it is created a results matrix by using ATLAS. TI programme to acquire data reduction, disposition and transformation. However, taking into account the qualitative data obtained after the application of the three instruments, the Homals analysis will also be used to find out the time regulation typologies. This technique performs a homogeneity analysis and it makes possible to group the variables into sets, which allows the examination of the different kinds of students' profiles and the time factor strategies that they use, and their learning efficiency. Despite of the issues related to time require qualitative methodology in nature (Barberà, Gros & Kirschner, 2012), there are some specific quantitative data, which is analysed by SPSS programme.

Considering the value of time factor, the increase in e-learning solutions and the global and collaborative contexts, a methodological definition of time factor strategies is needed within a social and economic paradigm-changing scenario.

References

Alexander, J. M. & Schwanenflugel, P. J. (1994). Strategy Regulation: The Role of Intelligence, Metacognitive Attributions and Knowledge Base. *Developmental Psychology, Vol. 30, N. 5*, 709-723.

Barberà, E. & Clara, M. (2012). Time in e-Learning Research: A Qualitative Review of the Empirical Consideration of Time in Research into e-learning. ISRN, vol. 2012, 1-11 http://www.isrn.com/journals/education/2012/640802/

Barbera, E., Gros, B. and Kirshner, P. (2012). Temporal Issues in E-learning Research: A Literature Review. British Journal of Educational Technology, 43(2), 53-55. http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8535.2011.01255.x/abstract

Collinson, V. & Cook, T. F. (2001). "I don't have enough time": Teachers' interpretations of time as a key to learning and school change. *Journal of Educational Administration 39, 3,* 266-281.

Fransen, J; Kirschner, P. A. & Erkens, G. (2010). Mediating team effectiveness in the context of collaborative learning: The importance of team and task awareness. *Computers in Human Behavior*, doi: 10.1016/j.chb.2010.05.017.

Grau, V., & Whitebread, D. (2012). Self and social regulation of learning during collaborative activities in the classroom: The interplay of individual and group cognition. Learning and Instruction.

Hadwin, A. F.; Järvela, S. & Miller, M. Self-Regulated, Co-Regulated, and Socially Share Regulation of Learning. Chapter 5. In Zimmerman, B. J. & Schunk, D. H. (2011). Handbook of Self-Regulation of Learning and Performance. New York: Routledge.

Hall, P. A. & Fong, G. T. (2010). Temporal self-regulation theory: looking forward. *Health Psychology Review, 4*:2, 83-92.

Hall, P. A. & Fong, G. T. (2007). Temporal self-regulation theory: A model for individual health behavior. *Health Psychology Review, 1*:1, 6-52.

Hoffman, B. & Schraw, G. (2010). Conceptions of Efficiency: Applications in Learning and Problem Solving. *Educational Psychologist, 45(1)*, 1-14.

Janssen, J., Erkens, G., Kirschner, P. A., & Kanselaar, G. (2012). Task-related and social regulation during online collaborative learning. Metacognition and Learning, 7(1), 25-43.

Kirschner, F.; Paas, F. & Kirschner, P. A. (2009). Individual and group-based learning from complex cognitive tasks: Effects on retention and transfer efficiency. *Computers in Human* Behaviour, 25, 306-314.

Lakein, A. (1973). *How to get control of your time and your life*. New York: New American Library.

Macan, T. H. (1994). Time Management: Test of a Process Model. *Journal of Educational Psychology, Vol. 79, N. 3*, 381-391.

Macan, T. H., Shahani, C., Dipboye, R. L. & Phillips, A. P. (1990). College Students' Time Management: Correlations With Academic Performance and Stress. *Journal of Educational Psychology, Vol. 82, N. 4*, 760-768.

Perry, N. E. & VandeKamp, K. J. O. (2000). Creating classroom contexts that support young children's development of self-regulated learning. *International Journal of Educational Research, 33*(7-8), 81-843.

Pintrich, P. (2000). Role of goal orientation in self regulated learning. In M. Boekarts, P. R. Pintrich & M. Zeidner (Eds.). *Handbook of self-regulation*, pp. 452-494. San Diego: Academic Press.

Reimann, P. (2009). Time is precious: Variable - and event- centred approaches to process analysis in CSCL research. *Computer-Supported Collaborative Learning, 4*: 239-257.

Romero, M., Hyvönen, P. & Barbera, E. (2012). Creativity in collaborative learning across the life span, Creative Education. 3(4), 422-429.

Romero, M. & Barberà, E. (2011). Quality of Learners' Time and Learning Performance Beyond Quantitative Time-on-Task. *The International Review of Research in Open and Distance Learning, Vol. 12*, N. 5, 125-137.

Saab, N. (2012). Team regulation, regulation of social activities or co-regulation: Different labels for effective regulation of learning in CSCL. Metacognition and Learning, 7(1), 1-6.

Stahl, G. & Hesse, F. (2006). Focusing on participation in group meaning making. *Computer-Supported Collaborative Learning, 1,* 311–313. DOI 10.1007/s11412-006-9960-2.

Stanovich, K. E., & West, R. F. (1998). Who uses base rates and P(D/H)? An analysis of individual differences. *Memory & Cognition, 26(1),* 161-179.

Streiner, D. L. (2003). Diagnosing tests: Using and misusing diagnostic and screening tests. *Journal of Personality Assessment, 81*, 209-219.

Streiner, D. L., & Norman, G. R. (2003). *Health measurement scales: A practical guide to their development and use* (3rd ed.). Oxford, UK: Oxford University Press.

Tuovinen, J. E. & Paas, F. (2004). Exploring Multidimensional Approaches to the Efficiency of Instructional Conditions. *Instructional Science 32*, 133-152.

Volet, S.; Summers, M. & Thurman, J. (2009). High-level co-regulation in collaborative learning: How does it emerge and how is it sustained? *Learning and Instruction, 19*, 128-143.

Vohs, K. D. & Schmeichel, B. J. (2003). Self-Regulation and the Extended Now: Controlling the Self Alters the Subjective Experience of Time. *Journal of Personality and Social Psychology, Vol. 85, No. 2*, 217-230.

Warnick, E. M., Bracken, M. B., & Kasl, S. V. (2007). Efficiency of the child behavior checklist and strengths and difficulties questionnaire: A systematic review. *Child and Adolescent Mental Health, 17*, 1-6.

Zimmerman, B. J. (2000). Attaining self-regulation: a social cognitive perspective. In P. Pintrich, M. Boekaerts, & M. Zeidner (Eds.), Handbook of self-regulation (pp.13e99). Orlando, FL: Academic Press.

Grau, J. & Minguillon, J. (2013). When procrastination leads to dropping out: analysing students at risk. *eLC Research Paper Series, 6, 63-74.*

WHEN PROCRASTINATION LEADS TO DROPPING OUT: ANALYSING STUDENTS AT RISK

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When procrastination leads to dropping out: analysing students at risk

ABSTRACT:

Higher education is a very expensive process which creates highly qualified citizens, a key asset in our information society. Nevertheless, in some cases, the educational system fails to provide the appropriate support to all learners. Dropout rates are very high, resulting in frustration for both the learner and for institutional managers. This problem is even worse at distance/online universities, as students can take breaks for one or more semesters, procrastinating in what it is supposed to be their main goal for ensuring success: maintaining an adequate enrolment pace, which puts them in a risk situation. In this paper we analyse the relationship between taking a break and dropping out for several undergraduate degrees at an online university. Results show that the risk of extending a break too long and finally dropping out is very high during the first few semesters, where most dropouts occur. By using the appropriate policies and strategies, higher education institutions can detect students at risk and try to improve retention through a better understanding of the dropping out drama.

KEYWORDS:

procrastination, dropping out, breaks, enrolment, retention, time management, e-learning, higher education

INTRODUCTION

From an institutional perspective, dropping out of university is very important, as it needs to be seen as a failure of the university system to generate an outcome (graduates) with the considerable quantity of public resources invested. However, financial costs of dropping out[1] are only part of the total costs: non-pecuniary (or affective) costs – which can only be guessed – are also important for non-graduates (Johnes, 1990).

After a first approach, it can be noticed that university dropout is a multidimensional phenomenon that needs to be correctly defined before a deep analysis and correction of its causes is tackled. One of the authors who puts most emphasis on the creation of a doctrine of university dropout is Vincent Tinto (Tinto, 1975). Tinto mentions the importance of reaching a good definition of university dropout, placing the importance of such a definition on a level with the importance of detecting the causes of dropping out:

> *"Despite the very extensive literature on dropout from higher education, much remains unknown about the nature of the dropout process. In large measure, the failure of past research to delineate more clearly the multiple characteristics of dropout can be traced to two major shortcomings; namely, inadequate attention given to questions of definition and to the development of theoretical models that seek to explain, not simply to describe, the processes that bring individuals to leave institutions of higher education."*

Nowadays, high levels of university dropout are a concern for the majority of governments with developed higher education systems. For example, in Spain, the Conference of Spanish University Rectors (CRUE)[2] has defined the dropout rate in an arbitrary way as the percentage of students, with respect to the total of students enrolled for these degrees in their first semester, who have not enrolled for the academic year when they should theoretically have finished the degrees or the following year. This definition applies indistinctly to "brick-and-mortar" and online universities. This definition assumes that students advance smoothly each semester, taking all predetermined subjects, which, is, by no means, the reality at distance universities.

Although the definition of the CRUE may be valid for "brick-and-mortar" universities, where the main priority of most students, above other professional or family duties, is studying, it does not seem that it can be valid in the same way for online and/or distance universities, where the majority of students have more work and family commitments, and where the existence of breaks (semesters without enrolment) therefore seems much more likely[3]. The main difficulty lies in the fact that, faced with several successive semesters of non-enrolment by a given student, it cannot be said with certainty that the student has definitively dropped out of the degree, as it may be that a longer or shorter break is being taken. It should therefore be concluded that the official definition of dropping out in Spain does not reflect the particular features of online higher education.

1. We use the term "dropout" and "dropping out" interchangeably.
2. Conferencia de Rectores de las Universidades Españolas (CRUE). (2010). Universidad Española en Cifras. Madrid.http://www.crue.org/export/sites/Crue/Publicaciones/UEC2010VOLI.pdf
3. In the case of the UOC, a 100% virtual university, in the majority of cases the real duration of the degrees is double the theoretical duration. The academic requirements for remaining on the degree do not stand in the way of this (contrary to the situation at some brick-and-mortar universities), nor do they prevent students taking a break between two academic semesters.

In addition, it is interesting to note that some definitions of dropout in e-learning appear in the bibliography (for example Castles (2004) defined dropout students "as those who had formally withdrawn, had left without notifying the university, or did not complete a course during a semester", or Levy (2007), as the students who "voluntarily withdraw from e-learning while acquiring financial penalties", but neither of them takes into account the actual enrolment behaviour of students.

Academic procrastination is defined "as intentionally deferring or delaying work that must be completed" (Schraw, Wadkins, & Olafson, 2007). Understanding procrastination in the sense of taking a break of one or more semesters, it can be observed that this is not uncommon at distance universities (due to their relaxed enrolment requirements), as students have more opportunities to decide how many subjects they take each semester and their pace. In Grau-Valldosera and Minguillón, (2011), a new definition of dropping out is introduced for online higher education (using UOC as a case study), taking into account the aforementioned issues; that is, the particular features of students and also the possibility of taking breaks procrastinating at semester level. This definition falls into the category "Time personalization (rhythms, adaptive time, acceleration, etc.)" defined by Gros et al. (2010), where time factor in e-learning is analysed. Using this definition we can clearly establish a line between those students just taking a break and those starting a long break that leads them into dropping out. According to Michinov et al. (2011), it is interesting to pair the concept of "taking a break" with that of procrastination, translating the temporal dimension from the subjects to that of the degree.

As time (of inactivity) is the leitmotiv behind the ad-hoc definition for dropout that has been arrived at, some of the variables that can eventually be related to dropout as descriptors or even as causes would also be related to the time-factor "macro-variable". For example, time management skills were detected as predictors of persistence studies in a questionnaire of 60 items (Holder, 2007), while the tendency towards procrastination/disengagement "is often associated with deficiencies in the processes of self-regulation", and would also be a factor that can affect the learning and performance and that can potentially cause dropout (Michinov,Brunot, Le Bohec, Juhel & Delaval, 2011). Other variables like time availability or time constraints (Romero, 2011) would be more external, that is, more imposed by the environment (Lee & Choi, 2011).

This paper is structured as follows: Section 2 describes the methodology we have followed for analysing the relationship between taking a break and dropping out. In Section 3 we describe the data sets used in the experiments, as well as the discussion of the analysis performed on such data sets. Finally, in Section 4, we summarize the conclusions that may be drawn from the results obtained in the analysis and the current and future research lines related to this topic are outlined.

METHODOLOGY

EMPIRICAL DEFINITION OF DROPPING OUT

To analyse dropping out, we only need to know whether or not a student is enrolled on a specific degree during a specific semester. Therefore, only the "IDP" (student ID), "semester of enrolment" and "degree" fields are needed to generate an "enrolment record" for each student. Once arranged, these records have the following coding (as an example, a random record is selected):

IDP;1;1;1;0;1;0;0;0;0;0;0;0;0

Where the first field is the student's IDP and then a binary string for the semester record ("1" = student enrolled at least in one subject during that semester, "0" = student not enrolled in any subject). In this case, this student was enrolled during her three first semesters, then she took a break for one semester, she enrolled again for one semester and then never enrolled again during the next 8 semesters. The trail of zeros shows that this student has been inactive for several semesters, but she is still a potential student if she decides to enrol again.

The specific nature of this string is that, for analysis purposes, all enrolment sequences have been aligned in the "same starting position", that is, the first semester when each IDP is enrolled for each degree is considered to be the same for all students for this degree. In other words, we analyse student data as if all students were a single cohort. Obviously, the first element after IDP is always "1" (the first enrolment of each student). Notice that the sequences "IDP;1;0;0;0;0;0;0" and "IDP;1;0;0" are different in the sense of the quantity of information they contain, as more enrolment history about the first student is available for analysis (specifically, 7 semesters as opposed to 3). Our goal is precisely to determine the minimum length of the trailing zeros that best captures dropping out.

Once the enrolment sequences file of each degree is generated, the frequency of break sequences (that is, of sequences of one or more "0") can then be analysed. This is performed using a pattern information analysis process that detects the longest break sequence (with "1;0;...;0;1" format) within each enrolment sequence of each individual, with the particular feature that if, for example, a student has taken a break once for 5 semesters and for another 2 a semester later, she will only be calculated as having taken a break over 5 semesters (that is, the longest break). Notice that this process does not take graduates into consideration, as they could be considered as taking a break or abandoning their studies, when they have in fact obtained their degree. Similarly, as has been stated before, from a degree performance perspective, students are considered to have dropped out of a particular degree even if they move to another one.

In order to define dropping out, we are interested in establishing a threshold for what we consider a reasonable break period, which may be shorter or longer from degree to degree, depending on the enrolment-break behaviour of its students. This threshold is established based on the accumulated proportion (i.e. estimated probability) of students returning to their degree after taking a break of "N" consecutive semesters. We establish an upper boundary for this value of 5% which can be seen as a maximum error rate in classifying students as dropouts once they have taken a break of N or more semesters in a specific degree. Then, we compute N according to this boundary as the smallest number of consecutive breaks we have to wait until we can say that a student will drop out with an error of less than 5%. The details of this procedure can be found in (Grau-Valldosera and Minguillón, 2011).

TAKING A BREAK VS DROPPING OUT

Procrastination is defined as "intentionally deferring or delaying work that must be completed" (Schraw, Wadkins & Olafson, 2007). Additionally, they note the fact that "although research in this domain has yielded mixed results, most studies report negative correlations between procrastination, grades, learning, and completion of course work" (Howell et al., 2006). In this paper, the temporal dimension of the semester, which is the usual time frame in which procrastination is analysed, is widened to that of the degree. That is, we analyse "inter-semester" procrastination

rather than "intra-semester" one, although both timeframe levels are probably related. Then, for a given N and a specific semester (namely S), we can analyse the sequence of semester enrolments for each student, starting from such semester S, as follows:

IDP	1st sem	...	(S-1)th sem	Sth sem
idp	1	...	1	X

...	(S+N-1)th sem	...	Last sem
...	Y	...	Z

In the S^{th} semester, students may be enrolled (X=1) or taking a break (X=0). If X=1 we deduce that students are not dropping out in the semester S (maybe they will drop out later but not in that semester). If X=0 we analyze the sequence of N consecutive semesters starting (and including) semester S. As previously defined, if we find N consecutive breaks (that is, Y=0 for all the N semesters starting in semester S), we can conclude that the student drops out.

Nevertheless, we will use all available information, in order to not count students taking a break of length N or greater but continuing later as dropouts (there is at least one Z=1 from the S+N semester until the last semester we have information from such student).

Suppose N=5 and S=2 (the simplest case: dropping out after the first semester or, equivalently, in the second semester). Table 1 describes the different situations we can find when analysing data according to the enrolment pattern. Then, for a given semester S we can classify students according to Table 1 and generate a 2x2 contingency table, as follows:

Break vs dropping out	Does not drop out in Sth semester	Drops out in Sth semester
Does not take a break during the S^{th} semester	N_{00}	O^1
Takes a break during the S^{th} semester	N_{10}	N_{11}

Finally, we can estimate the following probabilities:

$$P_{11} = P(\text{dropping out}) = N_{11} / (N_{00} + N_{10} + N_{11})$$
$$P_{10} = P(\text{taking a true break}) = N_{10} / (N_{10} + N_{11})$$
$$P_{1|1} = P(\text{dropping out}|\text{taking a break}) = N_{11} / (N_{10} + N_{11})$$

Here, P_{11} is the estimated probability of dropping out in a given semester. According to preliminary dropping out analysis, we expect this figure to decrease across the number of semesters and achieving a "basal" level. On the other hand, P_{10} is the probability of taking a true break (that is, not dropping out after such break). We want to analyse whether this probability varies with time. Finally, $P_{1|1}$ is the conditional probability of dropping out as the

Table 1. Possible situations according to enrolment data.

IDP	Sequence	Situation
IDP2	1;1;X;...;X	This student does not take a break during the 2nd semester. She therefore does not drop out in the 2nd semester.
IDP2	1;0;0;0;0;0;0;...;0	This student has 5 consecutive zeros starting from the 2nd semester and she never enrols again. We therefore determine that she drops out in the 2nd semester.
IDP3	1;0;0;0;0;0;X;...;1;...;X	This student has 5 consecutive zeros starting from the 2nd semester but she later enrols again. We do not know whether she will be dropping out or not, but we determine that she does not drop out in the 2nd semester.

result of taking a break. Once again, we assume this probability to be very high in the first semesters and to decrease with P_{11}.

In the following Section we will compute these probabilities for different degrees, varying the semester S from 2 to the maximum available data (that is, until one of the N_{xx} is zero and we cannot compute the conditional probabilities). We will also analyse whether there are statistically significant differences between degrees.

EXPERIMENTS

DATA SETS

We have used all the available data from the five most popular degrees at the Universitat Oberta de Catalunya, namely Business Science, Humanities, Law, Psychology and Technical Engineering (both branches, Computer Management and Computer Science, altogether). This data has been gathered since 1996 up to 2010, prior to the radical change in higher education introduced by the Bologna Process. Table 2 shows, for each degree, its duration in semesters, the number of students enrolled on the degree and the computed N as described in (Grau-Valldosera and Minguillón, 2011). Taking all this data into consideration, we can extend our analysis, varying S from semester 2 to semester 15. However, as the number of students with available enrolment data decreases with the number of semesters, probabilities computed for large Ss (12 or more) need to be considered as indecisive for analysis purposes.

Table 3 shows the number of students advancing through the second and third semester. Notice that we do not use data for all students, but only for those with enough enrolment data (i.e. with at least N+1 semesters) in order to determine whether they drop out or not according to the definition in (Grau-Valldosera and Minguillón, 2011). This means students with partial records are not included in the analysis.

Notice that after the first semester, there are 13,601 students who drop out (27.3%), which is a respectable figure. Furthermore, after the second semester, accumulated dropping out rises to 18,413 students (37.0%), which means that one out of three students does not continue after the first year[5]. This figure is

Table 2. Duration, number of students and number of consecutive breaks in order to determine a dropout for each degree.

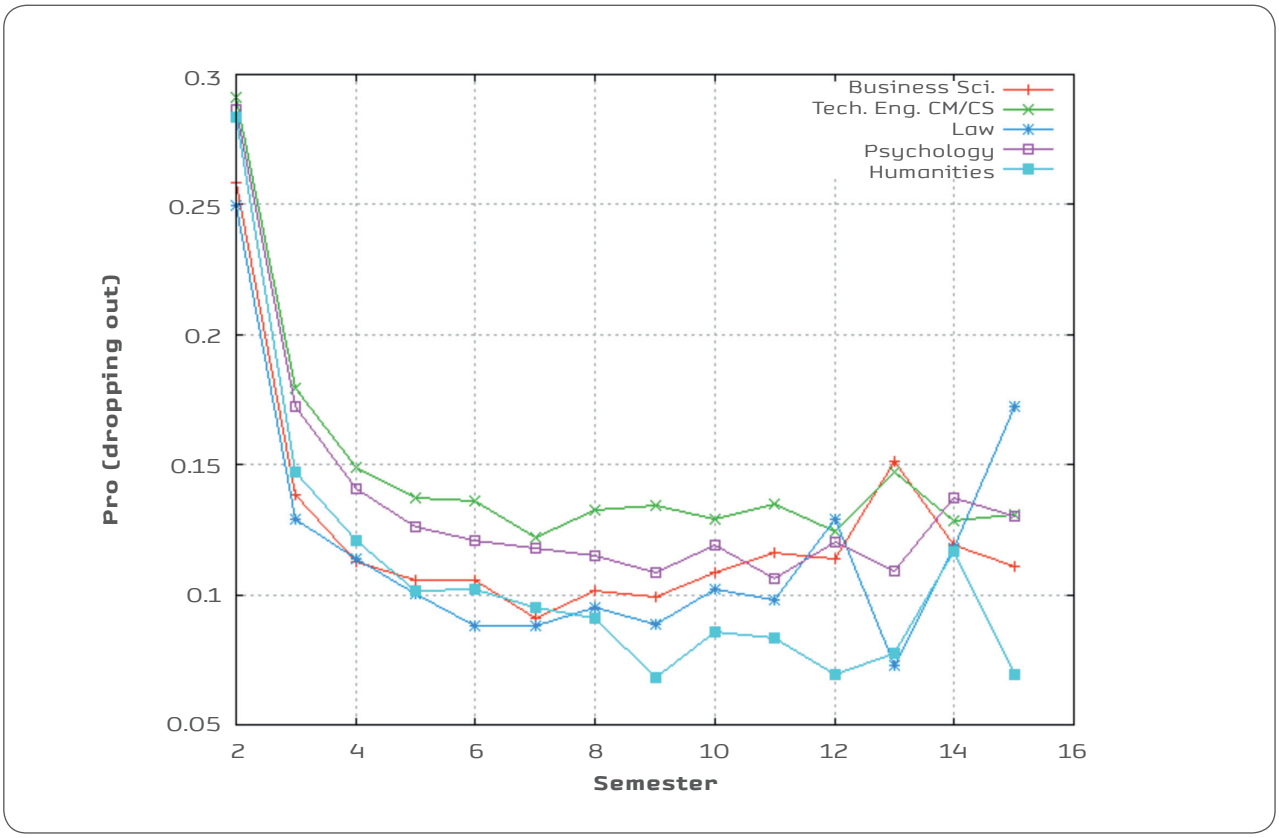
Degree	Duration (semesters)	Number of students	N
Business Science	6	18,608	5
Humanities	8	6,582	5
Law	8	5,535	5
Psychology	8	8,407	3
Technical Eng. CM/CS	6	12,604	5
Total	---	51,736	---

4. Students not taking a break are, by definition, not dropping out.
5. A 2010 report from the UNESCO Chair in Higher Education Management and Policy at the Universitat Politécnica de Madrid shows that dropping out (according to the official definition) states that the dropout rate for Catalan universities ranges from 21% up to 33% approximately. Available at http://catedraunesco.es/escuela/Inicio_files/dossier.pdf

Table 3. Number of students (and percentages) taking a break or dropping out for the second and third semesters..

Degree	N_s 2nd sem	True breaks	Drop-outs	$P_{1|1}$	N_s 3rd sem	True breaks	Drop-outs	$P_{1|1}$
Business Science	18,240	1,188 (6.5%)	4,713 (25.8%)	79.9%	11,261	899 (8.0%)	1,560 (13.9%)	63.4%
Humanities	5,396	330 (6.1%)	1,529 (28.3%)	82.2%	3,321	278 (8.4%)	488 (14.7%)	63.7%
Law	5,301	372 (7.0%)	1,324 (25.0%)	78.1%	3,444	227 (6.6%)	445 (12.9%)	66.2%
Psychology	8,401	494 (5.9%)	2,407 (28.7%)	83.0%	5,496	354 (6.4%)	947 (17.2%)	72.8%
Technical Eng. CM/CS	12,459	1088 (8.7%)	3,628 (29.1%)	76.9%	7,649	705 (9.2%)	1,372 (17.9%)	66.1%
Total	49,797	3,472 (7.0%)	13,601 (27.3%)	79.8%	31,171	2,463 (7.9%)	4,812 (15.4%)	66.1%

Figure 1. Probability of dropping out.



comparable to those for other distance learning providers. For instance, the UK Open University reported a dropout of 45% approximately after the first semester (Ashby, 2004). However, it must be taken into account that, as stated in Lee & Choi (2011), "although online learning has gained immense popularity and attention, recent studies indicate online courses have significantly higher student dropout rates than conventional courses (Levy, 2007)".

Figure 1 shows the probability of dropping out for a given semester. Notice that we compute this probability assuming that the student was enrolled during the previous semester, so we start with S=2 (i.e. the 2nd semester). In other words, S means "student was enrolled in

semester S-1 but decided not to take semester S and dropped out". These are "true" dropouts, that is, the student has no further enrolments.

Notice that all degrees, even though they have particular features and differences, show similar behaviour. The probability of dropping out is very high the 2nd semester, then rapidly decreases until it reaches a relative plateau in approximately the 6th semester. It is not surprising that figures stabilize after the 6th semester, as this number coincides with the expected duration of the degree. In fact, preliminary experiments show students at UOC usually enrol in half the number of subjects each semester, so, on average, they double the expected degree duration. It is reasonable to think that students reaching the 6th semester with half the degree "in the bag" have a different mindset to students in their first few semesters. This fact may be used to explain dropping out using two different approaches: during the first four or five semesters, dropping out may be caused by the clash between the student (becoming a student again for adult learners with different expectations and personal situation) and the institution (methodology, support, etc.); on the other hand, after the 6th semester, dropping out may be caused by attrition: that is, students that foresee that they will take too long to finish their degree and become disappointed.

On the other hand, Figure 2 shows the probability of taking a true break, that is, a student taking one or more subjects during semester S-1, not taking any during semester S but then enrolling again in semester S+1 or later.

In this case, it can be seen that the probability of taking a true break increases with time, but

Figure 2. Probability of taking a true break (i.e. not dropping out).

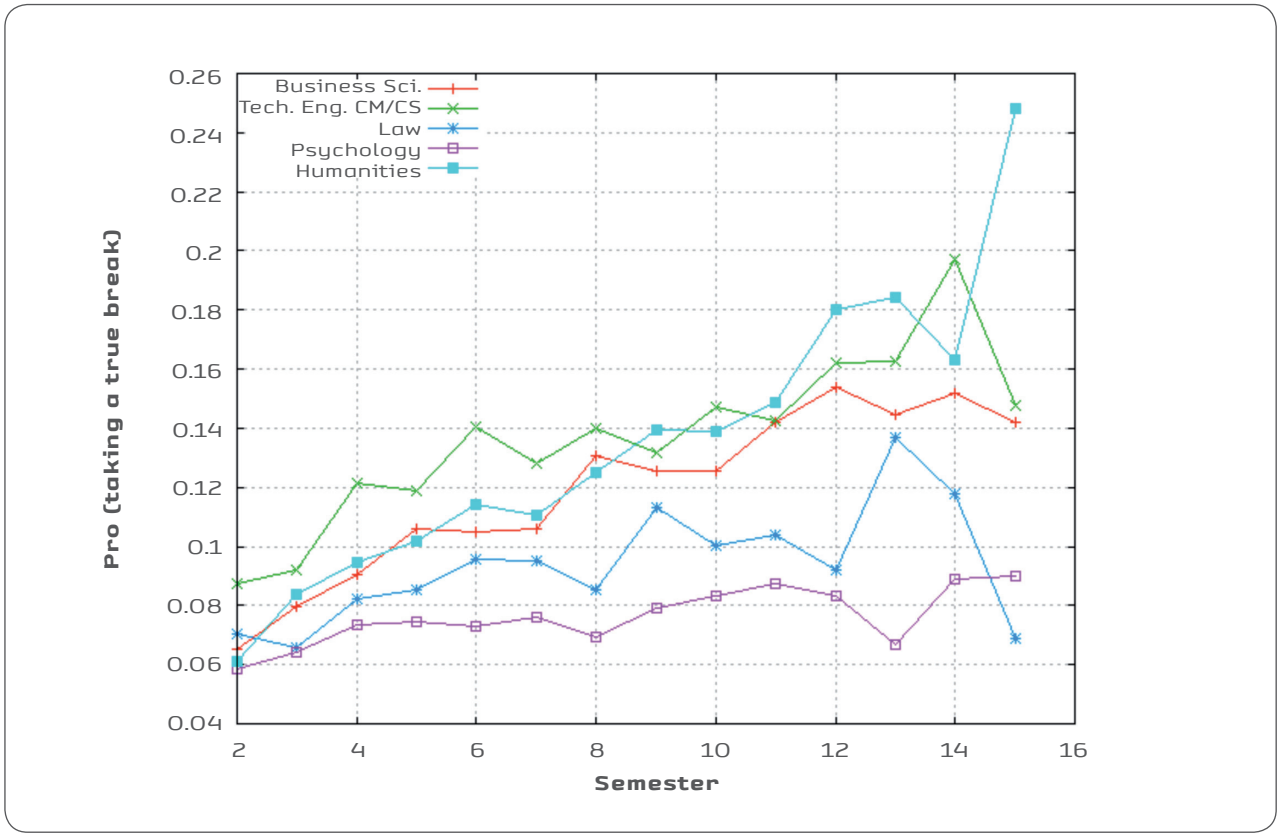
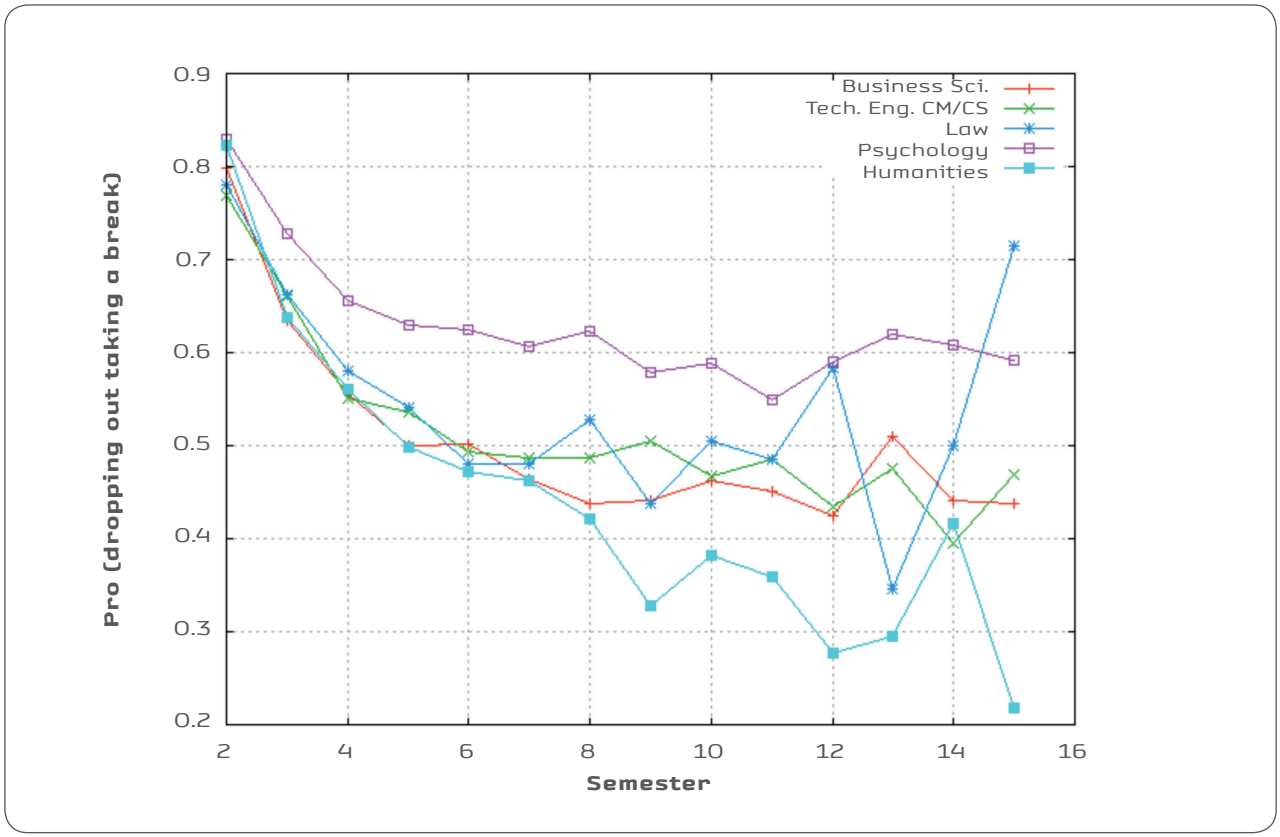


Figure 3. Probability of turning a break into a dropout situation.



at a different pace for each degree. However, from a wider perspective, Figure 2 shows that dropout behaviour seems to have a similar pattern among the various degrees.

Finally, Figure 3 shows the conditional probability of dropping out in semester S provided there is a break in that semester (in other words, this would be the probability that this break it is not a "true" break, triggering a dropout situation).

Notice that, once again, that all degrees seem to follow a common pattern for dropping out when starting a break, which is very high in the first six semesters and then stabilizes. It is also remarkable that for the Psychology degree, the probability of dropping out when starting a break is higher that the probability of it being a true break (as it is always higher than 0.5). On the other hand, the other degrees follow almost exactly the same behaviour, except the Humanities degree, where the probability of dropping out continues to reduce with time.

DIFFERENCES BETWEEN DEGREES

In order to explain differences between degrees, we build a Generalized Linear Model using the following approach. We generate a dummy variable for each one of the available degrees, which will be 1 for students taking such degrees and 0 for the rest; that is, we convert a categorical variable (degree) with 5 different values into 5 different binary variables. In fact we only need 4 dummy variables as what we do is compare the differences between one degre and the others. We code these dummy variables as BS, HU, LA, PS and TA, following the same order than in Table 2.

According to Table 3, the Law degree is the one with the lowest dropout rate during the 2nd semester. If we build a generalized linear model using dropout as the dependant variable and BS, TE, PS and HU as the independent variables (that is, removing LA), we obtain the following results:

```
Deviance Residuals:
 Min 1Q Median 3Q Max
-0.8297 -0.8217 -0.7732 1.5708 1.6657

Coefficients:
 Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.09987 0.03173 -34.664 < 2e-16
***
BS 0.04551 0.03596 1.266 0.206
HU 0.17201 0.04381 3.926 8.63e-05 ***
PS 0.18749 0.03986 4.703 2.56e-06 ***
CS 0.21028 0.03736 5.629 1.81e-08 ***
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*'
0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family
taken to be 1)

 Null deviance: 58397 on 49796 degrees of
freedom
Residual deviance: 58331 on 49792 degrees of
freedom
AIC: 58341

Number of Fisher Scoring iterations: 4
```

Notice that HU, PS and CS show strong differences with respect to LA, while BS does not (at a 0.05 significance level). We can repeat this analysis taking one of the degrees at a time, and the results obtained are equivalent: LA and BS degrees have a dropping out behaviour during the 2nd semester which is different to HU, PS and CS degrees.

If we repeat the same procedure for the probability of taking a true break during the 2nd semester, using PS as the baseline for building the model, we obtain the following results:

```
Deviance Residuals:
 Min 1Q Median 3Q Max
-0.4275 -0.3815 -0.3670 -0.3553 2.3806

Coefficients:
 Estimate Std. Error z value Pr(>|z|)
(Intercept) -2.77297 0.04638 -59.794 < 2e-16
***
BS 0.10897 0.05524 1.973 0.04852 *
HU 0.04175 0.07334 0.569 0.56912
LA 0.18897 0.07101 2.661 0.00778 **
CS 0.42624 0.05619 7.585 3.32e-14 ***
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*'
0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family
taken to be 1)

 Null deviance: 25,190 on 49,796 degrees of
freedom
Residual deviance: 25,105 on 49,792 degrees
of freedom
AIC: 25,115

Number of Fisher Scoring iterations: 5
```

In this case it can be seen that the BS, LA and CS degrees show differences (at a 0.05 level), while HU does not (with respect to PS). Therefore, taking into account both behaviours at the same time (dropping out or taking a true break), we obtain three different groups: 1) LA and BS; 2) HU and PS; 3) CS. Notice that this analysis does not say anything about the degrees or the causes that may lead to dropout, it is merely an indication that there is strong evidence that degrees should be analysed separately.

CONCLUSIONS

Dropping out is a serious problem that higher education institutions need to understand better so they can combat it. In a distance learning scenario, dropout figures are even worse, as students do not have the pressure to enrol every semester because the enrolment requirements are usually more relaxed. *A priori*, this "inter-semester" procrastination could be seen as something positive to help students self-regulate their learning pace

within a degree. In this paper we have analysed the relationship between taking a break in a given semester and the probability of never enrolling again; that is, dropping out the same semester.

In the light of the results from Section 3, we can state that there is a strong relationship between taking a break and dropping out, especially for the first four semesters, where the probability of dropping out knowing that the student is taking a break is bigger than the probability of not doing so. Therefore, even though taking a break is a natural and reasonable decision at a distance university, it is a very strong warning sign about the possibility of such a break being "extended", finally leading to dropping out. Higher education institutions such as UOC should establish policies for promoting the retention of students taking a break in the second semester, as four out of five students (see Table 3) not enrolling after the first semester are true dropouts. Had the institution been able to "rescue" just one out of these four drop-outs over all these years, it wouldthave saved more than 3,000 studentsdfrom dropping out after the first semestes.

On the other hand, we have also shown that there are significant differences betweensdegrees. Educational institutions need to tackle dropping out as an overall concern, but "one-size-fits-all" solutions cannot be applied, astdro-out rates differ from one degree to another, probably because of different underlying causes.

Current and future research in this topic should include the characterization of students according to the situations described by Table in order to see whether there is a "typical" profile for dro-outs or not. The evolution of such profile with respect to semester is also an interesting topic, as the reasons for dropping out will probably be different (clash vs attrition plus other unexpected causes). Obviously, building a complex model for dropping out, including information about the student and her academic performance during the previous semester, is also a very interesting topic. Among the reasons that can explain thetdro-out phenomenon, time-factor related variables like time-management abilities, time flexibility or time availability will presumably have an important role. Finally, further analysing the differences between degrees is also necessarydto achieve a better understanding of the true nature of dropping out.

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References

Ashby, A. (2004). Monitoring student retention in the Open University: definition, measurement, interpretation and action. *Open Learning*, 19 (1), 65-77.

Castles, J. (2004). Persistence and the adult learner: Factors affecting persistence in Open University students. *Active Learning in Higher Education*, 5(2), 166-179.

Grau-Valldosera, J., Minguillón, J. (2011). Redefining dropping out in online higher education: a case study from the UOC. *LAK '11 Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, ACM New York, 75-80.

Gros, B., Barberà, E. & Kirshner, P. (2010). Time factor in e-learning: impact literature review. eLC Research Paper Series, 0, 16-31.

Holder, B. (2007). An investigation of hope, academics, environment, and motivation as

predictors of persistence in higher education online programs. *The Internet and Higher Education*, 10(4), 245-260.

Howell, A. J., Watson, D. C., Powell, R. A., & Buro, K. (2006). Academic procrastination: the pattern and correlates of behavioural postponement. *Personality and Individual Differences*, 40, 1519–1530.

Johnes, J. (1990). Determinants of student wastage in higher education. *Studies in Higher Education*, 15 (1), 87.

Lay, C. (1986). At last, my article on procrastination. *Journal of Research in Personality,* 20, 474–495.

Lee, Y., & Choi, J. (2011). A review of online course dropout research: implications for practice and future research. Educational Technology Research and Development, 59 (5), 593-618.

Levy, Y. (2007). Comparingsdropouts and persistence in e-learning courses. Computers and Education, 48(2), 185–204.

Michinov, N., Brunot, S., Le Bohec, O., Juhel, J., & Delaval, M. (2011). Procrastination, participation, and performance in online learning environments. *Computers & Education*, 56(1), 243-252

Romero, M. (2011). Quality of e-learners' time and learning performance beyond quantitative

time-on-task. *International Review of Research in Open and Distance Learning*, 12(5), 125.

Schraw, G., Wadkins, T., & Olafson, L. (2007). Doing the things we do: a grounded theory of academic procrastination. *Journal of Educational Psychology*, 99(1), 12–25.

Tinto, V. (1975). Dropout from higher education: a theoretical synthesis of recent research. Review of Educational Research, 45 (1), 89-125.

Tinto, V. (1999). Taking retention seriously: Rethinking the first year of college. *NACADA Journal*, 19(2), 5-9.

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