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Performance Factors of a "Full Distance Learning": The Case of Undergraduate Students in Academic Exchange

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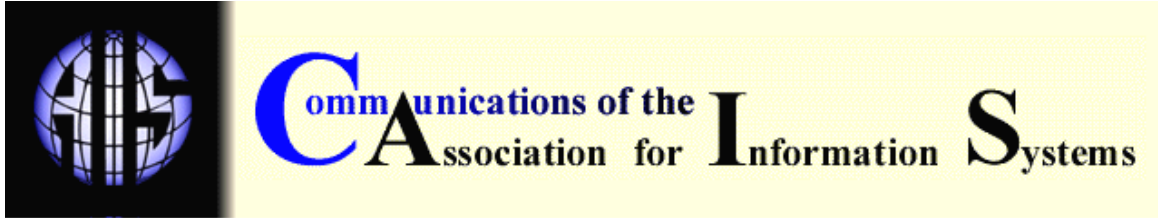*GSCM, Montpellier Business School*

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PERFORMANCE FACTORS OF A "FULL DISTANCE LEARNING": THE CASE OF UNDERGRADUATE STUDENTS IN ACADEMIC EXCHANGE

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ABSTRACT

Various e-learning systems have been developed and implemented in educational contexts. However, few studies try to go beyond the experimental level of identifying numerous factors that influence this technology and apply them to a real academic class of students. This article based on an in-depth analysis of a business school case—Montpellier Business School (France)—and survey data from 405 students assessed on their use of the e-learning platform, helps illuminate the patterns involved in e-learning performance. A literature review on e-learning performance factors is realized and a theoretical model focusing on three dimensions of e-learning performance—the learner side, the institutional environment and the e-learning system per se—is presented and tested empirically. The key findings of this paper identify motivation and self-discipline of students as main drivers of e-learning outcomes. Other results show that the integration of e-learning in a pedagogical program requires the analysis of its performance not only from learners and instructors point of view, but also from the underlying strategic perspective of the institution.

KEYWORDS: E-Learning, Performance, Motivation, Self-discipline

I. INTRODUCTION

E-learning[1] represents probably one of the most highly developed computer assisted approaches in education. By 2004, at least two million higher-education students in the US were engaged in

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[1] E-learning refers to learners gaining knowledge through the individual use of electronic or digital media, such as computers, tapes, CDS, the Internet, etc.. [Cheng, 2006]. This definition includes both *on-line learning,* also referred to as web-based learning, which means that learners achieve

some form of distance education. For example, 11% of students took an online course during 2002, 97% of public institutions offered at least one online or blended course, 49% offered an online degree program, and 67% consider e-learning a critical long-term strategy for their institution [Allen and Seaman, 2003]. It is even expected that over the next 20 years the global market for online learning is estimated to exceed $215 billion, with a rapid growth in cross-border delivery of higher education [Hezel and Mitchell, 2005]. Despite this growth potential, there is increasing evidence that existing e-learning systems demonstrate limited quality, and have a high likelihood of failure [Alexander, 2001].

Information systems (IS) research has investigated different aspects of technology-enabled learning, [e.g., Alavi, 1994; Alavi et al. 1995; Leidner and Jarvenpaa, 1995; and Piccoli et al. 2001]. Both the effectiveness and outcomes associated with e-learning have been studied. A review of extant literature suggests that the effectiveness of e-learning is largely equivocal. For instance, Piccoli et al. [2001] and, more recently, McFarland and Hamilton [2005] reported no significant differences in learning performance between students supported by technology-enabled learning and those using the conventional classroom. On the other hand, Andrewartha and Wilmot [2001]—study of the impact of interactive multimedia courses in education—and Ladyshewsky [2004]—analysis of the use of the IBM learning space platform by post-graduate students—,find considerable improvements in learning achievements and satisfaction resulting from the use of technology-enabled learning.

These contradictory findings suggest the necessity to further investigate these issues to devise a coherent explanation. The newness of the concept and lack of empirical research analyzing real implementations of e-learning systems may partially explain these results.

This study based on an in-depth analysis of a business school e-learning system implementation and survey data helps illuminate the factors involved in e-learning performance. It offers the originality to analyze e-learning outputs in a specific context:

- 405 undergraduate students engaged in a full year of academic exchange in a foreign university (two classes studied over two years).

- Students followed e-learning courses of their home country business school while being in their host university (double diploma exchange).

- On-line courses were "full e-learning" not "blended e-learning" (like it is the case in the majority of empirical research done on the subject).

Therefore, the aim of this research is not to compare e-learning to traditional learning, but to explore the influencing factors involved in e-learning performance. We examine a set of possible motives for e-learning performance rather than seek to confirm or disprove any single reason and examine empirically our suggestions. In particular, we focus on three dimensions of e-learning performance: The learner side, the institutional context and the e-learning system per se, and investigate how these dimensions affect e-learning performance.

The remainder of this paper is structured as follows: section two is an analysis of previous studies on e-learning and constitutes our theoretical basis. Section three describes the case of the Montpellier Business School where the research has been conducted. The next section presents our conceptual framework, along with the study hypothesis and the methodology used to collect the data. Finally, the research results, discussion, and conclusion are presented.

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learning through the media of the Internet, or an Intranet, and *off-line learning*. This latter dimension refers to learning by way of an independent computer and the content of the learning material is stored on disks or CDS. While the subset we are studying in this article is on-line learning, we will refer to it as e-learning in the rest of the paper.

II. LITERATURE REVIEW

Information systems researchers' attention has gradually shifted from the influence of Information Technology (IT) on traditional classes to virtual classrooms. The literature review developed in this section reflects this evolution and its implications on teachers, students and Business Schools or universities. We further put the emphasis on how e-learning performance has been dealt with in previous research and suggest including the institutional context—business schools—as a dimension of e-learning performance. Indeed, e-learning projects are no more considered only as training systems simply implemented to improve teaching methods, but more and more as a way to create value or even sustain competitive advantage. The case studied in the second part illustrates this phenomenon.

THE TEACHERS

Introducing e-learning requires the teacher to make major changes and even transform his/her way of teaching [Coppola et al., 2002]. Exercises are no longer tied to the singular space and time frame in which they were confined, and content often provided orally has to be pre-formalized (in writing, audio, video, etc.). A separation of roles between lesson designers, tutors, and various experts means that the course design shifts both from handcrafting to mass-production, and from individual to group. "Stage plays" combining verbal and non-verbal communications are replaced by more impersonal contacts and interactions aimed at reducing uncertainty and equivocality. This can be explained by two assumptions of the media richness theory [Daft and Macintosh, 1981; Daft and Lengel, 1984, 1986]. The first is the teacher's need to process information in order to reduce uncertainty and equivocality [Daft and Lengel 1986]. We mean by uncertainty, the difference between the amount of information required to perform the task and the amount of information already possessed by the organization [Galbraith 1977]. Equivocality, is defined as the ambiguity of the task caused by conflicting interpretations about a group situation or environment. Therefore, as information increases, uncertainty and equivocality decrease. The second assumption of this theory is that the media commonly used in organizations works better for certain tasks than others. Specifically, Daft and Lengel [1984] concluded that written media was preferred for unequivocal messages while face-to-face media was preferred for messages containing equivocality. This implies that for teachers to accommodate the changes introduced by e-learning, they need to move from the position of knowledge holder or facilitator to a role of regulator for the learners. The aim of the learner-teacher interactions is to motivate and stimulate the learners, and help them clarify the concepts presented in the content [Moore, 1998]. Therefore, one of the teacher's roles consists of interacting with students to help them overcome the difficulties of learning alone with this platform. Tools such as forums or corrected exercises can be used to enable these interactions. Indeed, regular feedback often represents a factor in learner's satisfaction with the platform [Northrup, 2002]. However learner's satisfaction is also affected by the transactional distance because maintaining instructor effectiveness (i.e., lower transactional distance) results in a trade-off with efficiency [Lemak et al. 2005]. We refer to the transactional distance as the quality of teaching and learning interaction between instructors and students who are geographically separated [Lemak et al. 2005]. Transactional distance seems to be more important than the physical separation between the teacher and his/her students [Lemak et al. 2005].

Actually, this change from "Sage on the Stage" to the "Guide on the Side" [Coppola et al., 2002] does not eliminate the various roles that a teacher is supposed to play. Following twenty semi-structured interviews, Coppola et al., [2002] gathered data about faculty experiences creating and delivering courses using Asynchronous Learning Networks (ALN). Fourteen male and six female professors representing different departments were interviewed. The authors captured three role changes enacted by instructors in ALN settings: cognitive roles (which relates to mental processes of learning, information storage, and thinking), affective roles (which relates to influencing the relationships between students, the instructor, and the classroom atmosphere), and managerial roles (which deals with class and course management, requires greater attention to detail, more structure, and additional student monitoring). The authors conclude that "virtual teachers" continue to exercise their cognitive, affective, and even managerial roles. The

difference, however, is that they need to adapt their behavior to capitalize on the potential offered by e-learning and develop an "on-line student-centered learning community" [Brower, 2003]. Introducing e-learning in a business school can lead to a form of anxiety and can influence the level of motivation and satisfaction of students as they feel that they have to work harder, and they perceive that the professor isn't fulfilling his or her responsibility [McFarlan and Hamilton, 2005]. Some experimental studies revealed that the involvement level of the teacher in e-learning is a decisive factor of its success as teachers and learners are often perceived to hold asymmetrical positions [Piccoli et al., 2001; Webster and Hackley, 1997].

THE LEARNERS

All the teacher characteristics would not be enough to predict the motivation and the active behavior that the learners will develop. Indeed, in a first stage, learners can be engaged with e-learning because they are using a multimedia as a way to learn. Going beyond this e-learning feature, we should not neglect the feeling of frustration or isolation that e-learning can have on individuals [Piccoli et al. 2001; Hara and Kling, 2000]. The more virtual an organization becomes, the more face-to-face encounters are needed by users [Handy, 1995; Davenport and Pearlson, 1998]. Some theories such as the "social presence" [Short et al., 1976] have already focused on the socio-emotional and psychological perceptions of users relying on a media rather than face-to-face discussions. In addition to being motivated by the lesson, learners also have to be motivated to learn via the e-learning system. Alavi and Leidner [2001] recognized that most of the studies carried out on on-line learning focused on technology features and neglected the individual psychological processes through which learning occurs.

This form of teaching however, involves a cultural change for the learners. Even if some studies found no differences between student's performance in e-learning *versus* traditional classroom [McFarland and Hamilton, 2005; Lu et al., 2003; Piccoli et al. 2001], the advantages inherent to online learning alone can not be sufficient to satisfy most students [Zhang et al., 2004]. Students need to develop a more active behavior, and explore knowledge in a more open information space than they are used to receiving in the classroom. They have to interact with the content, and integrate it to modify their cognitive structures [Moore, 1998]. Even when students are alone, they have to commit themselves to this type of "internal" dialogue so as to encode and retain information [Berge, 2002]. Learners therefore, have to become highly autonomous and this is supposed to be facilitated by the e-learning mechanism. This approach is likely to provide more freedom to learners, but at the same time requires from them more discipline. Moreover, coaching by teachers seems also to be necessary for learning [Piccoli, 2001], as it allows them to check how students organize their work and manage their "virtual timetable" [Arnaud, 2003].

Nevertheless, even if the scientific and professional literature has suggested several worthy pedagogical models that can be used to develop an e-learning activity, we can observe that this has often been without consideration of learning styles. Leidner and Jarvenpaa [1995], put forward this importance by distinguishing between five learning styles: objectivist, constructivist, cooperative, cognitive and socio-cultural [2]. This implies that for increasing the performance of an e-learning system, the courses in the platform need to be available in different versions covering the spectrum of students learning styles [Lu et al., 2003]. The complexity of the content creation process however, would be much higher as the students' learning style can't be known beforehand.

THE INSTITUTE

The organizations—Business Schools or universities—where the e-learning activity is developed are rarely considered and often excluded from previous proposed models. The few studies that

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[2] We also recommend research carried out by Honey and Munford [1992] who distinguish four different learning styles: thinkers, activists, theorists, and pragmatists.

considered this dimension have largely focused on organizational problems induced by e-learning implementations, as well as the subsequent and compulsory input from the institute. As previously highlighted earlier, the majority of field studies in e-learning rely on experiments between teachers and learners using a specific technological tool (*all things being equal otherwise*). In an era in which IT adoption represents a strategic challenge for schools, in our opinion, it is the right time to focus more on "school-related" variables that will play a key role in the success of an on-line teaching activity.

Theories focusing on the use of new technologies consider their diffusion level as a key factor of their acceptance. Diffusion is the process by which the technology is extended to other parts of the organization [Goodman and Sproull, 1990]. This diffusion is required in order to create a prescriptive general opinion of the new technology. Adopting a technology depends on individuals' determination, but also on how the managers "promote" the idea [Salancik, 1977]. Moreover, there's a sort of "value paradox"—the more the technology is emphasized, the more harshly it will be judged if the pre-stated aims are not achieved—[Sproull and Hofmeister, 1986]. Adopting a new technology depends also on the symbolism associated with it [Prasad, 1993]. The way in which an e-learning project is introduced to the players involved will therefore also be an influential variable in its perceived level of success.

On-line learning brings major changes to the teaching profession and requires from the school several investments. In particular:

- Understanding the state of the art,

- Defining an incentive system for teachers (reducing teaching load, bonus, etc.),

- Training teachers and helping them in designing on-line lessons, multimedia resources, quizzes, student coaching, etc.,

- Forming an editorial committee to assess teachers' work: meeting pre-determined quality criteria, abiding by copyright laws, etc.,

- Defining a media team responsible for transforming the resources developed by the teacher (formats: web, flash, audio, video, etc.),

- Defining a technical team responsible for putting the e-learning platform on-line and updating it.

All of these factors, along with those mentioned earlier, determine the success of an e-learning system and by no means represent an exhaustive list. The organizational complexity of educational schools makes it difficult to forecast the success or failure of any given project.

E-LEARNING PERFORMANCE

Studies on e-learning performance have each focused selectively on the effects induced on learners and teachers in the followings ways:

- learner-teacher interactions,

- group exchange between learners themselves,

- cognitive processes and pedagogical models,

- cultural changes,

- experience(s) gained by the teacher and the learner.

These experiments-based studies, often conducted on a test group of learners, point to the strengths and weaknesses of these tools with regard to teaching and learning processes [Lemak et al. 2005; Mills et al., 2006; McFarland and Hamilton, 2005; Bernardin, 2005; Sharda et al.,

2004; Zhang et al., 2004; Brower, 2003; Bieber et al., 2002; Minnion et al., 2002; Coppola et al., 2002; Piccoli et al., 2001; Webster and Hackley, 1997; Hiltz, 1995; Alavi, 1994]. They suggest that several influencing factors may give a particularly subjective character to the idea learners and teachers may have on e-learning. In particular, if the arguments in favour of e-learning put forward the possibility of improving the students' training process, others are interested in the underlying economic and strategic potential of an institute undertaking such initiative. This latter perspective considers e-learning as a meaningful way to reduce operating costs [Minnion et al., 2002]. If we consider that the knowledge to be transferred to the learners and the interactions associated with their understanding can be formalized via a computer-communication process, then the hypothesis of reducing the operating costs of a teaching activity is a legitimate one. The following elements: an automated didactic system, self-assessment functions, teachers called on essential pedagogical coaching, less classroom space needed due to face-to-face lessons, etc. should at first sight, contribute to reducing the cost of teaching per student and generating savings likely to secure a return on the technological investment. Some researchers even associate e-learning implementations with development and competitive advantage achievement [Webster and Hackley, 1997; Dufner et al., 1999]. The use of technology in education has nowadays, however, outpaced systematic efforts to evaluate its effectiveness [Lemak et al., 2005, p. 150]. Therefore, caution needs to be taken, in terms of how ambitious research can be done on the degree of success of such e-learning tools.

Instead of trying to test the hypothetical impact of e-learning on the reduction of operating costs or the creation of a competitive advantage, we believe it is necessary to take into account the idea of performance from an institute's standpoint. It is still coherent, in fact, to consider that an organization's investments in IT—whatever they are—are suitable only if they are part of a growth strategy [Powell and Dent-Micaleff, 1997]. On the one hand, the return on investment is not always assessed on objective grounds:

- Some costs cannot be accurately measured (for example: the hourly production cost of creating or transforming a course),

- Contextual changes that can happen, between when the decision is made to invest and when the system actually bears fruit,

- In some countries, labour laws are not well adapted to e-learning teaching specificities (as is the case of the French university system).

On the other hand, the decision to invest may also be motivated by less analytical financial ambitions. For several years, training centers have been subject to a certain pressure for experimenting or adopting e-learning systems [Lemak et al., 2005; Webster and Hackley, 1997; Alavi et al., 1995]. Implementing e-learning systems can therefore aim at promoting a modern image, or even avoiding being marginalized for future developments in the field. Measuring effectiveness and efficiency as perceived by the institute's management team may also contribute to its overall success. The case of Montpellier Business School analyzed in the next section follows this strategic perspective.

III. RESEARCH FIELD

Montpellier Business School e-learning project started in early 2001 with the decision to make it compulsory for students following the year abroad program. Consequently, at the start of both 2002 and 2003 academic years, 800 students were dispatched to 130 different foreign partner universities. In addition to the courses they attended in their host universities, these students had to follow specific Montpellier Business School courses[3] via the e-learning platform developed for

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[3] Lessons considered, aside from those taken at the host university, as decisive for the students to be able to follow the curriculum in their school: Finance, Auditing, Information Systems, E-business and Process Management.

this purpose. The challenge was to offer students the opportunity to obtain two diplomas the same year. They have to validate both their academic year at the host university, and the one from their Business school that allow them to be accepted to the final year of specialization.

THE INSTITUTION

The interviews we conducted with the group's management team revealed that the e-learning was developed in order to fulfill the need of providing the training program to students going abroad. In this way, the primary aim was not to improve the learning process, but to take full advantage of the distance learning opportunity. The following means were employed to achieve this goal: recruiting a teacher as a person in charge of the e-learning project; using the services of a computer engineering consultancy firm; training the teachers involved; and implementing an editorial committee (made up of teachers representing the education and research departments) responsible for validating each teacher's work. As an incentive to teacher's participation, a reduction in the teaching load and other duties was implemented.

THE E-LEARNING TOOL

Emphasis has been put on an e-learning system that provides the greatest flexibility possible and does not require determined specifications in advance. Instead of buying an existing ready-made platform, the decision was taken to build a "homemade" one using open-source technologies. Developed by the Business School webmaster, this platform, which is now in its fourth version, offers the same features as a professional product available on the market (content chunking, discussion forum, schedule for work to be done, glossary, quizzes, etc.). This choice is justified by the fact that total control over the source code allows changes to be made at any time and specific needs can be met.

The e-learning platform includes, in particular, a system allowing the teachers to create on-line course content with the same ergonomics and the same functionalities as a conventional word-processor (copy, paste, text layout, inserting pictures or animated objects, etc.). As a result, the teacher theoretically does not need any specific IT skills.

THE LEARNERS

The 800 students for the two academic years studied (2002-2003 and 2003-2004) were hosted in 130 partner universities in which they had computer rooms at their disposal, allowing them to make full use of the e-learning platform functionalities. The only equipment needed, is a computer (PC or Mac) connected to the Web via an Internet browser (and perhaps a printer if the student needs to keep a hard copy of the lessons rather than viewing them in their electronic format). All the information related to our sample is discussed later on.

Students had no work to do in groups. They were required to individually learn on-line lessons, and train themselves with exercises created by the professors. They were advised to collaborate and exchange information on the electronic forum of the platform, but were free to use it or not. In terms of IT skills, the students could all be considered as having a satisfactory level for using the e-learning tool set up because in their first year of study on the Montpellier campus, they all had about 30 hours of compulsory computer science lessons. However, we did not think it was pertinent in this case study to analyze whether the teachers and/or students mastered IT skills. Moreover, recent studies show that these factors have a limited influence on both students' satisfaction and their resulting marks [Hayashi et al., 2004].

In line with previous empirical research on e-learning such as the ones by (Baldwin et al., 1997; Leidner and Fuller, 1997; Lim et al., 1997; Hiltz and Turoff, 1993; Hiltz, 1995), we are not analyzing the influence of collaboration behaviour on student learning process, but on the learners' perceptions on system effectiveness.

THE TEACHERS

The five teachers involved in the school's project taught specific subjects (finance, business process management, auditing, information systems, and e-business) that enabled the students to undertake a year of specialization upon their return. These courses were considered by the Business School as specific to management coursework in France, and unlikely to have any equivalent in the 130 partner universities. Furthermore, the teachers for this project were chosen according to their degree of involvement in the group's pedagogical activity. They were entirely responsible for drafting the content of the lessons to be converted to e-learning material. To do so, they had to follow this pedagogical model:

- Preparing course content into sessions equivalent to two-hour-long face-to-face lessons.

- Dividing each of the sessions into "chapters" or units of learning of no more than three screen pages. The standard writing reference to be used in terms of volume was 20 A4 pages per session.

- Assigning to students a case study covering all the sessions developed.

- Compiling a glossary, reference bibliography, as well as links to other recommended websites.

- Assessment of the work submitted by each teacher by the "editorial board" before being authorized to go on-line in September 2002.

- The teachers were held by institutional accountability to ensure student coaching.

Given the number of students to monitor—400 for each academic year scattered worldwide in different time zones—asynchronous communication is the most appropriate vehicle for this interaction. The chosen system needed to be as user-friendly as possible and not requiring any specific software on the 130 host university computers.

IV. METHODOLOGY

RESEARCH MODEL AND HYPOTHESES

In addition to how the project has been developed by the institute and the teachers, its implementation since 2002 has represented the opportunity to analyze its performance "on the spot" and collect data from students about their own perception of this system effectiveness.

The underlying conceptual model that guides our study is shown in Figure 1. In line with the literature reviewed and the characteristics of the case studied, we suggest that e-learning performance—measured as the degree of student's satisfaction and degree of success in the exams—(1) is positively related to the work context, (2) is positively related to student's self-discipline and motivation and 3) is positively related to the e-learning tool.
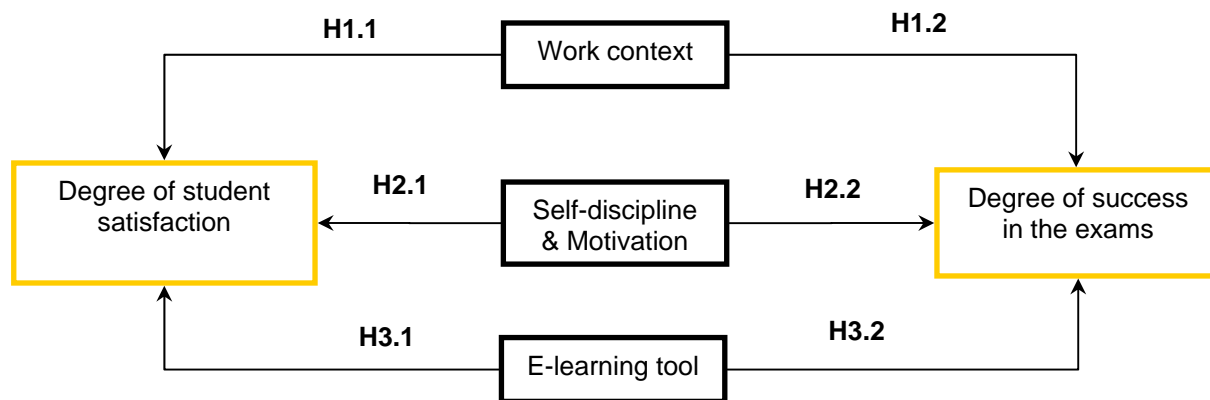
Figure 1. Research Model

As mentioned earlier, e-learning performance is measured using two dependant variables. The first one refers to the grades of the student for each of the five e-learning courses. In the education sector, exam results remain probably the most objective way used to evaluate the learning process achieved by the students. The measurement of this first variable simply implied the collection of grades from the business school administration.

The second variable is student satisfaction with the e-learning system in relation to his/her specific context for the double diploma. Here, the aim was to evaluate how consistent with his/her academic exchange the e-learning system was for the student. By this way, e-learning performance is not simply reduced to the perceived quality of on-line courses or function of the platform. It takes into account the efficiency of the strategic objective of the institute with regard to the e-learning project that offers students the opportunity to get a double diploma, abroad, during an academic exchange, without any extension of their study duration. The measurement of this latter dimension assessed student's satisfaction with the strategic objective associated with e-learning. To do that, we asked students to state whether they prefer their actual situation or the one, which would have occurred if e-learning, had not been set up. Concerning the independent variables, the case studied put forward the interest to analyze the influence of the academic exchange context. First of all, the student's work context is, to a certain extent, beyond the control of the institution that initiated the project. Even if the international department of Montpellier Business School was careful to take this parameter into consideration when establishing partnerships, many different work environments are likely to affect how these learners perceive working on-line. Moreover, the students had to combine the on-line lessons from their French business school with those from their host university (taught in the local language, in a different cultural context, and according to its own pedagogical methods). Therefore, we hypothesize that:

H1: The effectiveness of e-learning is influenced by the work context of the students in their host university.

H1.1: The degree of satisfaction with e-learning is influenced by the work context of the students in their host university.

H1.2: Exam success through e-learning is influenced by the work context of the students in their host university.

Because it's interesting to examine the importance of variables tied to motivation on the one hand, and self-discipline on the other hand—measured in our research by (1) the frequency of use of the platform and (2) their own time management—, we suggest that:

H2: The effectiveness of e-learning is influenced by the students' self-discipline and motivation.

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H2.1: The degree of satisfaction with e-learning is influenced by the students' self-discipline and motivation.

H2.2: Exam success through e-learning is influenced by the students' self-discipline and motivation.

We could not carry out research on a subject like this without evaluating the students' perception of the e-learning system per se. To do this, we measured the students' perception of the pedagogical quality of the course and interactions created and presented by the teachers via the platform (quality of the content, work requested and exchange with the teacher and with other students via the platform).

H3: The effectiveness of e-learning is influenced by the e-learning tool.

H3.1: The degree of satisfaction with e-learning is influenced by the e-learning tool.

H3.2: Exam success through e-learning is influenced by the e-learning tool.

SURVEY

Given the large number of individuals targeted (800 students), we relied on an on-line questionnaire directly administered from the e-learning platform to collect the data. In June 2004, the 400 students enrolled in the 2002-2003 academic year, as well as the 400 students of the 2003-2004 academic year, were asked to fill the questionnaire. A reminder sent at the beginning of July of each academic year by Montpellier Business School management team enabled us to obtain a response rate over 50% less than a month after the questionnaire was launched (181 students from 2002-2003, and 224 from the 2003-2004 class). From the responses gathered, we have analyzed 405 usable questionnaires. Concerning the academic years 2004-2005, and 2005-2006, the questionnaires collected have not been analyzed for this study, as they will be part of a future longitudinal study.

V. RESULTS

The first step was to establish a factor analysis[4] (see table 1 and 2) in order to validate our research model measured by the questionnaire. The values in bold in the component matrix below highlight the factors on which each of our variables is most closely represented. Thus:

- Axis 1 basically represents the variables related to the student's self-discipline and motivation.

- Axis 2 is more associated with the student's work environment.

- Axis 3 refers to the e-learning tool per se and to how useful the students perceive it.

Our factor analysis confirms that our measures truly describe what they are intended to and, therefore, enable us to test our suggested hypothesis.

Table 1: Factor analysis correlation matrix

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[4] Method: Main component analysis; Barlett sphericity test: Chi-two; approx: 286,613; Significance: 0,000; Factorial analysis method: Regression; Rotation method: Varimax; maximum turn around number: 25; Condition for extracting actors: Eigenvalue > 1; Number of retained axes: 3; Total variance explained: 64%

	E-learning frequency of use	Period at the beginning of e-learning monitoring	Motivation towards e-learning	Free time in the host university	Work conditions in the host university	Perceived quality of the on-line course	Perceived interest in the on-line course
E-learning frequency of use	1	0.341244248	0.300313718	0.115324015	0.132027001	0.091269672	0.027104519
Period at the beginning of e-learning monitoring	0.341244248	1	0.395817104	0.13455274	0.155327309	0.106327102	0.058385862
Motivation towards e-learning	0.300313718	0.395817104	1	0.165524579	0.17706875	0.280470472	0.235241705
Free time in the host university	0.115324015	0.13455274	0.165524579	1	0.426141551	0.152719876	0.076551546
Work conditions in the host university	0.132027001	0.155327309	0.17706875	0.426141551	1	0.204794569	0.096746558
Perceived quality of the on-line course	0.091269672	0.106327102	0.280470472	0.152719876	0.204794569	1	0.256704694
Perceived interest in the on-line course	0.027104519	0.058385862	0.235241705	0.076551546	0.096746558	0.256704694	1

Table 2: Component Matrix of the factorial analysis

COMPONENTS MATRIX[4]	Factors		
	1	2	3
E-learning frequency of use	**0.759**	0.075	-0.063
Period at the beginning of e-learning monitoring	**0.792**	0.083	0.032
Motivation towards e-learning	**0.646**	0.083	0.445
Free time in the host university	0.079	**0.839**	0.049
Work conditions in the host university	0.101	**0.823**	0.117
Perceived quality of the on-line course	0.088	0.203	**0.710**
Perceived interest in the on-line course	-0.009	-0.029	**0.814**

Our model explains 20% of the variance in student's satisfaction and 7% of their success in the exam (Figure 2). The results put forward some interesting findings and we can especially observe that some causal relations are not confirmed. The main research results are summarized in Table 3.

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[4] Components matrix after rotation using the Varimax method
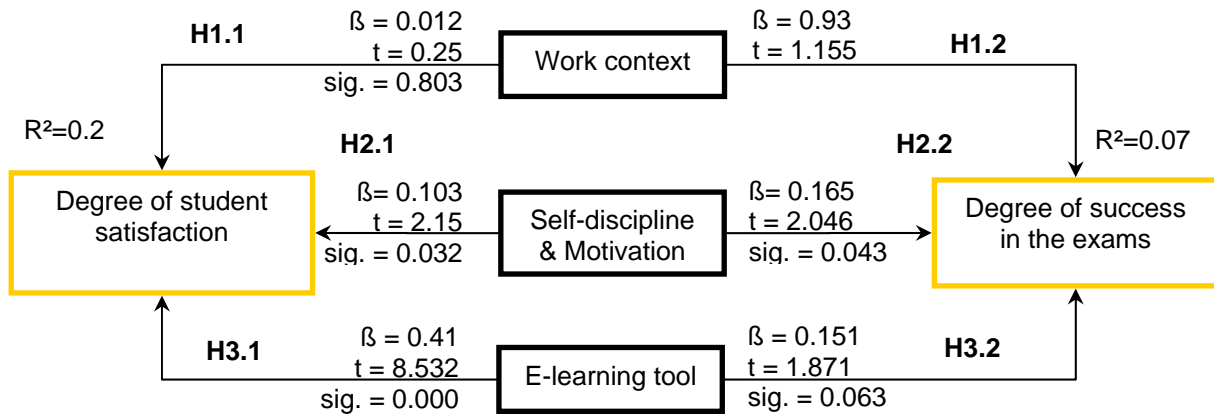
Figure 2: Results of the linear regression analysis

Table 3: Results of the hypothesis

Hypothesis	Result
H1.1: The degree of satisfaction with e-learning is influenced by the work context of the students in their host university.	Rejected
H1.2: Exam success through e-learning is influenced by the work context of the students in their host university.	Rejected
H2.1: The degree of satisfaction with e-learning is influenced by the students' self-discipline and motivation.	Confirmed
H2.2: Exam success through e-learning is influenced by the students' self-discipline and motivation.	Confirmed
H3.1: The degree of satisfaction with e-learning is influenced by the e-learning tool set up for that purpose.	Confirmed
H3.2: Exam success through e-learning is influenced by the e-learning tool set up for that purpose.	Rejected

In terms of the degree of satisfaction perceived by the students towards e-learning, the most statistically significant variables (significance threshold less than 0.05) are mainly those related to the e-learning tool[5] (coefficient 0.41), they are followed by the variables related to student self-discipline and motivation (coefficient around 0.1). Work context was not found to be very significant. We can conclude that our hypothesis, H1.1 is rejected whereas H2.1 and H3.1 are accepted.

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[5] Interest and quality of the on-line course as perceived by the student.

Concerning the degree of success in the exams, *self-discipline and motivation* seem to have the greatest influence and have been supported. While the work context and the e-learning system have a significance level higher than 0.05 and could not be supported. Consequently, H1.2 and H3.2 are rejected whereas H2.2 is confirmed.

VI. DISCUSSION

Our results present a deeper insight on why the learning context influence on e-learning performance remains marginal compared to student's learning abilities. The results reinforce the idea that, like traditional learning, individual variables (motivation and self-discipline) remain decisive factors in student's success [McFarland and Hamilton, 2005]. Even if environmental variables (conditions of work, available computing resources, etc.) are often put forward as important dimensions in e-learning performance, the case studied shows that their influence is not significant. In a more general way, this result leads us to question the importance of the variables related to the students' work environment. Even if they facilitate or hinder students' work, their influence seems diminished by other more decisive factors, mainly those tied to students' motivation and self-discipline. Thus, our results are in line with previous studies that advance the idea that e-learning outcomes depend, first and foremost, on students' motivation as well as a change in behavior related to self-discipline [Arnaud, 2003].

We also find that while e-learning implementations may have an important impact on students' satisfaction; their effect on students' success is not significant. Functionalities of the e-learning system can facilitate the learning process and be appreciated by the learners; however, their potential value does not predict any concrete improvement in the learning process. If the e-learning system can modify learners' behaviour [Webster and Hackley, 1997], it does not change the fact that the driving force in students' success is their own determination. These results are in line with previous research emphasizing factors such as students' motivation [Alavi et al. 2002; Hayashi et al., 2004; Hiltz, 1995].

Concerning the e-learning context, students have to balance e-learning courses with those of their host university (taught in a foreign language). Thus, in terms of e-learning performance, besides variables inherent to the tool itself, this research suggests as a moderating variable, the possible "coexistence" of e-learning courses with traditional courses. Experimenting e-learning in isolation can give insignificant results about its own effectiveness. E-learning research needs to overcome simple analysis that establishes direct cause effects between technology and outcomes [Alavi and Leidner, 2001]. Analysis should be conducted in the framework of the overall pedagogical system.

VII. CONCLUSION

E-learning performance has been documented in a number of studies and our knowledge about it is growing, but many questions and issues remain to be explored. In this paper, we investigate issues pertaining to three dimensions of e-learning performance: the learner side (motivation and self-discipline), the institutional environment (work context) and the e-learning system itself. We find that students' motivation and self-discipline are the main drivers of e-learning outcomes, that the e-learning system influences student's degree of satisfaction, and that the work context does not affect e-learning outcomes.

Like with any research, this paper presents limitations that, at the same time open new research perspectives. It may be interesting to use other methodologies than questionnaire survey to investigate e-learning outcomes. For instance, longitudinal and observation methods could be used in order to interpret the effectiveness of e-learning systems with a more systemic approach. In the same way, the "newness" of the e-learning concept and its experiments also incites us to perform longitudinal research in order to better analyze over time the learning process related to an innovative pedagogical tool. Other research could also be done on "blended learning" in order to compare the influence of factors put forward in this article.

Compared to most studies in this field, this empirical research presents several original aspects that can be summarized as follows:

- a real implementation (not experimentation) of e-learning in a higher education program,
- a "full e-learning" system.

Main results here tend to confirm the complexity of the learning process and incite us to recall, for example, the central role played by the students' intellectual and cognitive process. Until now, the e-learning market has tended to influence educational institutes to consider e-learning platforms. The main question that remains however is not "how effective or attractive our e-learning platform must be", but rather "how we could motivate our students to use it durably?" This can not be achieved by simply offering students sophisticated and modern learning systems which have most of the time only short-term effects [Piccoli et al., 2001]. E-learning projects should be designed to enable the institutions to explore and create underlying strategic advantages allowed by distance learning rather than simply improve the training processes.

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APPENDICES : VARIABLES MEASUREMENT

Variables measured		Measurement
E-learning effectiveness	Student success at the exam	*Counting of grades ranked from 0 to 20*
	Student satisfaction level with e-learning	*Measured with the question:* Between situations A and B, state below your preference level. (A): Existing method: following the 5 e-learning courses during your academic year of study abroad (B): Doing your academic year of study abroad without any other courses than the host university ones. When you are back in Montpellier Business school, following e-learning courses during an extension period of 6 months (without additional registration fees). I prefer A O O O O O O O I prefer B
E-learning frequency of use		*Measured with the question:* During your academic year of study abroad, on average, you connected yourself to the e-learning platform : ☐ several times daily (value = 2) ☐ every day (value = 1) ☐ every 2 – 3 days (value = -1) ☐ every week(value = -2) ☐ no opinion (value = 0)
Period at the beginning of e-learning monitoring		*Measured with the question:* Since when did you begin to follow on-line courses of Montpellier Business School? ☐ September - October 2002 (value = 5) ☐ November – December 2002 (value = 4) ☐ January – February 2003 (value = 3) ☐ March – April 2003 (value = 2) ☐ After April 2003 (value = 1) ☐ No opinion (value = 0)
Motivation towards e-learning		*Measured with the question:* With reference to Montpellier Business School e-learning courses, how do you evaluate your motivation level? (rank from 0 to 20)

Free time in the host university	*Measured with the question:* State below if the free time in your host university was, for you, rather advantageous or disadvantageous to follow Montpellier Business School e-learning courses: Disadvantageous O O O O O O O Advantageous
Work conditions in the host university	*Measured with the question:* State below if the work conditions in your host university was, for you, rather advantageous or disadvantageous to follow Montpellier Business School e-learning courses: Disadvantageous O O O O O O O Advantageous
Perceived quality of the on-line courses	*Aggregated variable calculated with the following questions asked for any of 5 e-learning courses:* Content quality: □ Very satisfying □ Satisfying □ Not very satisfying □ Not satisfying □ No opinion Quality of the work to do: □ Very satisfying □ Satisfying □ Not very satisfying □ Not satisfying □ No opinion Quality of communications with the professor (on the forum) □ Very satisfying □ Satisfying □ Not very satisfying □ Not satisfying □ No opinion Quality of communications with other students (on the forum) □ Very satisfying □ Satisfying □ Not very satisfying □ Not satisfying □ No opinion
Perceived interest in the on-line courses	*Aggregated variable calculated with the following question asked for any of 5 e-learning courses:* Interest of learning on-line this course: □ Very satisfying □ Satisfying □ Not very satisfying □ Not satisfying □ No opinion

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