E-Learning Performance and Students' Results Case of a French Business School

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ABSTRACT

E-learning experiments in higher education are becoming more recurrent. However, these experiments are seldom tangibly applied to an entire academic year group. Integrating *e-learning* into a pedagogical program implies performance analysis in terms of both students and teachers, but also from the institute's point of view. Due to the lack of Information Systems based research into *e-learning* performance modeling, the article propose an analysis mixing this research area with some findings in Education Sciences.

The first part of this article presents an analysis of the main scientific publications on which we have built our research model. The second part presents the initial findings of our on-going research project at Montpellier Business School (France). A comparison between traditional teaching and face-to-face teaching was carried out using the student marks in five different courses of study. The results show that the teachers' predisposition to adopting these new teaching techniques is not directly related to an improvement in the students' results. In other words, the paper is consistent with the need to avoid any techno-centered approach to on-line education.

In the same way, the article concludes that a measure of the e-learning performance must not be limited to the students' results alone. Indeed, the case studied puts forward that the legitimacy of an *e-learning* project can lie more in the satisfaction of being able to meet new strategic challenges through its development, than in simply improving an existing teaching tool.

Key-words: *E-learning*, Performance, Learning, Higher studies, Business School

1. INTRODUCTION

Given the current economic context, in which the two driving forces are the globalization of trade and the development of information technologies, the sector of higher education is undergoing a genuine transformation. The e-learning phenomenon represents one of the most highly developed computer-assisted approaches in this educational evolution.

The gloomy economic climate, since 2002, in which this "new cognitive economy" is taking shape, proves (yet again) that the exhilaration expounded by an innovative concept does not automatically go hand in hand with the anticipated, or even expected, effectiveness. Consequently, introducing *e-learning* into the education sector reveals some obscurantism about its own performance.

Few scientific works have been published on the subject compared to other areas of application of information systems. This indicates the lack of theoretical corpus sufficiently consensual to come to terms with this issue. The contingency of the cases studied or even the newness of the concept could certainly be cited as causes. But, such observations do not legitimate research projects flouting theories which, despite being inherent, can nevertheless be associated with it.

In Management Sciences, it can be considered that research into information systems involves the contribution of organizational and technological mechanisms that bring media to knowledge and information exchange. Traditionally, an information system is assessed from different view points, depending on: its efficiency, its effectiveness and how players use it and are satisfied with it. But, specific *e-learning*-related criteria have not been clearly identified. This is why the assessment criteria can, to a large degree, be taken from those used in education sciences, a field in which a lot of research has gone into how to assess learners (using technology or not). Therefore, we have chosen to combine these two fields, information systems and education sciences, in order to propose an *e-learning* experimentation performance analysis grid.
The first part of this article presents an analysis of the main scientific publications on which we have built our research model. The second part presents the initial findings of our on-going research project at the Montpellier Business School (France). A comparison between traditional teaching and face-to-face teaching was carried out using the student marks in five different courses of study. The results show that the teachers' predisposition to adopting these new teaching techniques is not directly related to an improvement in the students' results.

For the moment, the initial data collected only allows us to conduct a comparative analysis of the marks obtained by students having attended these on-line lessons and the marks gained by those who previously attended traditional classes for the same courses. These results should be interpreted in the broader context of learning processes and overall performance measuring. The tests

presented hereafter, on the influence levels of various characteristics and factors, will be the subject of future publications.

2. LITTERATURE ANALYSIS

Even if *e-learning*-based scientific publications in the educational field are less verbose than in other new technology fields of application, their combination makes it possible to envisage what the basis of an analytical model - to gauge the performance of remote teaching approaches - could be like. Enhanced by the study of scientific works on information systems and education sciences, the following model offers an arrangement of the main influence factors as well as their relationships. It does not, of course, claim to be exhaustive but simply tries to lay the foundation for theoretical modeling, which can subsequently be improved by further research.

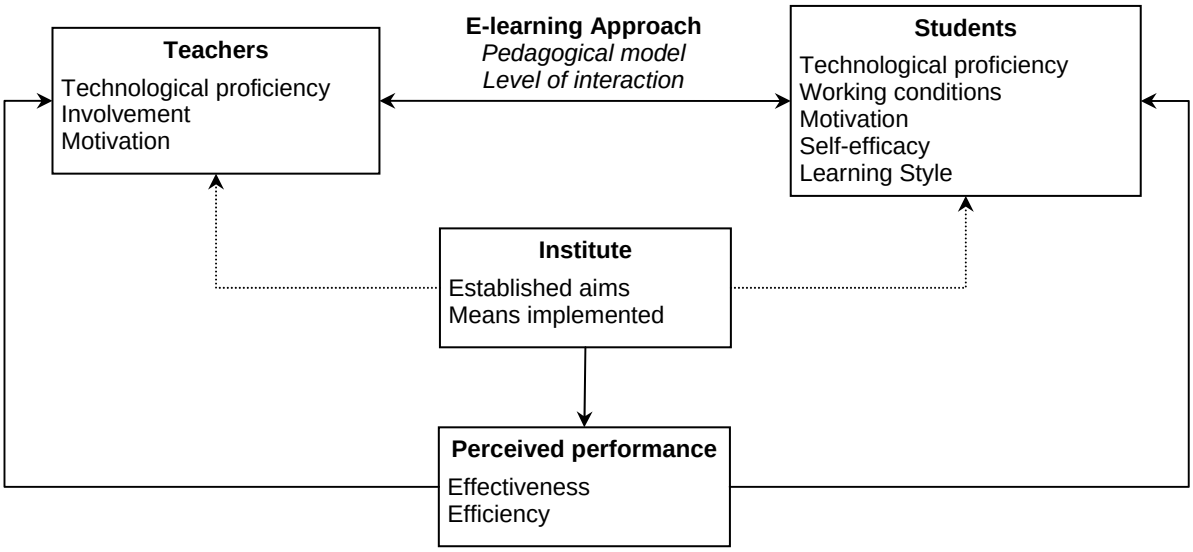


Figure 1: E-learning and performance flowchart

2.1. The *e-learning* approach

The first stage is of course to define the subject of our analysis and thus to determine the characteristics we retain from an *e-learning* approach. Indeed, rapid development of distance teaching, driven by spreading Internet technologies, has put a strain on neologisms inducing multiple variations on the same theme. *E-learning*, *virtual class*, or even *digital campus* seem, *at first sight*, to be concepts whose main differences remain limited to the scope of the technological system installed and to the related pedagogical mode. The table below summarizes some of the definitions.

Table 1: E-learning definitions and similar concepts

	Description	**Reference works**
E-learning	Teaching method via a technological tool such as Internet, etc., allowing teachers to make all or part of their lessons available to a public of learners, and without any spatiotemporal restrictions. To a greater or lesser extent, *e-learning* systems often include means with which to: maintain an interaction with and follow-up on learners, personalize programs, assess or self-assess learner progress, etc.	Piccoli & *al.* (2001) Webster & Hackley(1997) Minnion & *al.* (2002) Tu & Corry (2002) Northrup (2002) Hirumi (2002)
Virtual class	Specific type of *e-learning* allowing the simulation of a teaching space representing the classroom via new technologies (interactive audio and/or audiovisual conversations, white board, assessment systems, group work, etc.) in addition to the benefits offered by the new technologies (asynchronous communications, file sharing, automated performance indicators, etc.).	Leidner & Jarvenpaa (1993) Hiltz (1995) Copolla & *al.* (2002) Bieber & *al.*(2002)
Digital campus	Generalization of the *e-learning* approach in a training institute's range of programs. In this case, the technological tools must also be able to deal with the associated administrative procedures (enrolment, school fees, course payment, etc.).	Work from the UO-MLR open university (Université Ouverte – Languedoc Roussillon). Case of Catalogne Open University

Because the technological tool implemented is supposed to become the main interface in the learning process, it clearly plays a central role in an *e-learning* analytical model. As an extension of the media richness theory, some research projects reveal that the features this system makes available will render it more or less compatible with certain pedagogical models. (Webster & Hackley, 2001; Leidner & Jarvenpaa, 1995). In 2002,

research carried out by Minnion & *al.*, drew up various models related to psychological and philosophical trends:

- *Rationalism:* it is considered that knowledge can be transferred to the learner who, for this to happen, has to use his/her power of reasoning.
- *Objectivism:* knowledge comes from experience. The learning process is seen as an accumulation of knowledge.
- *Constructivism:* knowledge is the fruit born from interaction and exchange between learners. The teacher plays the role of organizer / group leader.
- *Imagination:* knowledge grows according to the learner's ability to create and scrutinize.

Depending on the subject taught, the teacher's preferences or the *student learning style*, one model is likely to be more suitable than another one. However, as yet, we do not have a scientific corpus enabling us to predetermine the efficiency of each one in different context. But the real danger reside probably more in not adopting any pedagogical model at all. In any event, this is what many case studies have highlighted in unsuccessful experiments noted (Piccoli & *al.*, 2002). Thus, strictly speaking, the content conveyed or the variety of matching technological features is not what guarantees the tool's effectiveness, but rather their appropriation in the context of one or several pedagogical models.

The features offered by new technologies (such as forums, chat rooms, team working tools, etc.) aim to afford learners a more active role in acquiring or developing their knowledge. Indeed, interaction is considered as one of the key factors in catching and holding the attention of a "virtual public" liberated from the classroom workplace (Webster & Hackley, 1997). However, the degree of interaction between students and teachers depends on how the two parties react.

In a conventional class lesson, the interactions affecting the students' attitude and performance take place spontaneously, in real time. Teachers interpret student behavior, answer questions, clarify concepts, give preference to discussion, structure the lesson according to the time frame, etc. This ability to initiate and facilitate such interactions, to encourage or steer *feed-back*, is what, among other things, characterizes the teaching profession. In an *e-learning* approach, communications are mainly asynchronous and, through technology, are media-based. Opportunities to interact in real time are generally confined to planned sessions which can be incorporated into the pedagogical approach at certain precise moments. It is therefore particularly useful to classify the possible types of interactions when using the *e-learning* solution (Hirumi, 2002)[1].

[1] Here we refer the reader to an education science literary review by Bannan-Ritland in 2002 regarding the concept of interaction in the e-learning field. We have only adopted the most accepted concepts.

The typology put forward by Moore (1989), widely used since then in education sciences, classifies interactions into three types, in relation to the sender and receiver: *learner-learner*, *learner-teacher* and *learner-content*. Let us look at each of these in more detail.

The *learner-content* interactions are defined as a process that consists of "*intellectually interacting with the content so as to bring about a change in understanding of the topic on the part of learners and to enhance their cognitive structures"* (Moore, 1989). Even when the students are alone, they have to commit themselves to this type of "internal" dialogue so as to encode and retain information (Berge, 2002). Content can only become knowledge for the student if this active cognition process occurs. In most cases, in a learning situation, content quickly becomes inert if there is a lack of immediate practical application ensuring this cognitive acquisition. It seems that making knowledge and skills available, just before an opportunity to use them, makes learning more effective (Gagné, Yekovich & Yekovich, 1993). This means it is vital to regularly alternate theoretical presentations with practical sessions in the courses offered (case studies, multiple-choice tests, etc.). This just-in-time requirement raises a certain number of questions concerning the simplification of the chosen cognitive approach and its long term effect on the student's skills.

The *learner-learner* interactions take place individually or in a group, with or without an instructor (Moore, 1989). As Northrup (2001) reminds us, *e-learning* is characterized by being able to learn anywhere and at any time via information technologies, but which may isolate the student. To overcome this feeling, group work or any other form of team work is often recommended. Forming social bonds and fulfilling part of the work as a team is not the only role of these learning activities. They also make it easier to reach the goal in terms of knowledge acquisition. The analysis of learning communities (Tu & Corry, 2002) shows us that besides individuals, the community learns even in a remote context. Vygossky's research (1978) demonstrates just how important the social context is, and in particular interactions between learners, in the learning process. The environment should therefore stimulate exchanges between learners enabling beginners to take their shortcomings on board and to change their views through communication.

The aim of the *Learner-Teacher* interactions is to motivate and stimulate learners by allowing them to clarify concepts introduced in the content (Moore, 1989). One of the teacher's roles is therefore to interact with students, so as to help them overcome any difficulties that could not be resolved through contact with the subject matter or with other students. In addition, the teacher has to check the program is running smoothly. To do this, he/she ensures the program is being followed correctly by examining the path taken by each learner (time spent on the lesson, etc…) and lends guidance if a problem is identified. Tools such as individual forums or exercise correction can back up these interactions.

Regular *feedback* often adds to student satisfaction with regard to this learning approach (Northrup, 2002). In this way, the teacher also strives to manage each student's progression.

A teacher, who consequently has to manage both teaching and learning, has to create an environment in which learners can be involved in projects, problem solving and other activities. The teacher is not a spectator but rather a co-discoverer who guides the learning process and encourages different types of interaction as well as reflection. Interactions are at the heart of learning, the success of which depends on the alignment between the aims, activities and feedback opportunities (Berge, 2002). In practice, the approaches aiming at improving these three types of interaction are those which are most likely to contribute to the success of e-learning[2]. These are the three explicit axes of success for our model, with the primary objectives being all those outlined by the school, the activities and the feedback which mainly takes place between the students and the teachers.

2.2. The Teachers

Introducing e-learning can require the teacher to make major changes and even transform his/her way of teaching (Jean, 2001; Copolla & *al.* 2002; Godinet & Caron, 2003). Exercises are no longer tied to the singular space and time frame in which they were confined. Content often provided orally has to be pre-formalized (in writing, audio, video, etc.). A separation of roles between lesson designer, tutors and various experts, means the course design shifts from *handcrafting to mass-production* and from *individual to group*. "Stage plays" combining verbal and non-verbal communications are replaced by more impersonal contact (if we refer to the richness of media theory in any case).

The pedagogical style also requires a transformation. The teacher moves from the position of holder of knowledge or facilitator in student development to a role of regulator. In fact this migration, *from "Sage on the Stage" to the "Guide on the Side"* introduced by Copolla & *al.*, 1997 does not eliminate the various roles that a teacher is expected to play. Following a series of around twenty interviews, the authors conclude, for example, that virtual teachers continue to exercise their cognitive, emotional and even domineering roles. To do so, they have to develop new behavior and to be able to use information technologies to communicate some of those signals (via forums, Email, etc.).

Therefore, if teachers wish to capitalize on the potential offered by *e-learning*, they need to be able to manage information technologies. Even if assistants can relieve them of technical tasks, they should be able to interact directly with learners and follow-up on their work via the platform, to make practical information available on-line, etc.

Similarly for information technologies in an organization (Sproull & *al.*, 1987), all these reasons mean that introducing *e-learning* in an establishment can induce a form of anxiety and influence the level of motivation. For all that, some empirical research reveals that the teacher's level of involvement in *e-learning* is a decisive factor in its success (Piccoli & *al.*, 2001; Webster & Hackley, 1997). These conclusions confirm the theory of social influence related to the use of technologies (Fulk & *al.*, 1990) according to which behavioral models developed by some are based on behavior observed by others. The case of *e-learning* appears to make this issue even more striking as teachers and students hold asymmetrical positions and the former are supposed to act as role models for the latter.

In addition to being sufficiently familiar with information technologies, *e-learning* also necessitates a positive attitude towards them. Training teachers how to use them may simply not be enough to develop this type of culture.

2.3. The Learners

Teacher characteristics, for all that, would not be enough to predict the motivation and the active behavior that the students will develop. Going beyond the vigor attached to *e-learning*, we should not neglect the feeling of frustration or isolation that distance learning can exert on individuals (Hara & Kling 2000). The more virtual an organization becomes, the more users tend to need face-to-face encounters (Handy, 1995). In addition to being motivated for the lesson, students also have to be motivated to learn via the *e-learning* mechanism in relation to their own command of information technologies and how to use them.

This form of teaching therefore also involves a cultural change for the learners. They are required to develop a more active behavior, to access knowledge in a more open information space, whereas up until then they had been used to receiving it in the confines of a classroom. Therefore, learners have to acquire a high degree of autonomy, which is more supposed than facilitated by the e-learning mechanism. The e-learning approach is supposed to provide learners with greater freedom, but at the same time they have to be able to envisage their own self-efficacy. Even if follow-up monitoring by teachers appears as a prerequisite to learning (Piccoli, 2001, p. 8) it seldom include the control of the way students organize their work and manage their "virtual timetable".
Scientific and professional literature has, at length, dealt with pedagogical models that should be adopted in an e-learning activity. However it has often be done to the detriment of learning styles**.** This is probably due to the fact that this student characteristic cannot be known

[2] Report for the Canadian government in 2002: "Methods and strategies for promoting on-line interaction for students undergoing distance learning."

beforehand and that there can potentially be as many different learning styles as there are learners. On the other hand, some Education Science research (Honey & Munford, 1992) identifies 4 main styles which seem pertinent to us to take into consideration when setting up an e-learning system and its performance model.

Table 2: characterization of learning styles

	Characteristics	**Preferences in terms of *e-learning***
Thinkers	They base their learning on data collection, observation, and listening to others. They analyze before drawing any conclusions. In group work, they mainly play a support and advisory role. Thinkers like to have sufficient time to observe and prepare.	Communication and group work tools Documentary sources and links to other references Self assessment tools
Activists	They appreciate new experiences, tending to apply concepts directly to them and subsequently inferring consequences and points of interest from them.	Group work communication tools Project based on content offering room for creativity rather than instructions to be followed. Short-term work Exercises, simulations, project fulfillment
Theorists	They use a rational approach in their cognitive process. Their approach is procedural and analytical leaving little room for an emotional intelligence.	Preference for individual work rather than problem solving. Clear pedagogical objectives and learning methodology.
Pragmatists	They need to see in advance what empirical use and implication a piece of knowledge or technique will have in their professional activity. As down-to-earth people they need to tie theory and practice together.	Aims and lesson plans clearly identified. Practical guides Feedback from experience gained in the field, from expert opinion.

Besides the pedagogical models advocating active participation by students, from now on we can consider that the e-learning lesson can also be given in any number of ways thus covering the full spectrum of mentioned learning styles. However, this is not sufficient to deduce that it would be a good idea to allow a student to enroll solely for pedagogical models supporting his/her own learning style or personal preferences. For example, it could be necessary to initiate and train a *theorist* student in working group methods. Consequently, it is better to think in terms of management of the different learning styles than, simply, in terms of their applicability.

2.4. The Institute

In scientific literature, the institute in which the e-learning activity is set up has a low profile or is totally eclipsed with respect to the proposed models.

However, the little research done emphasizes the organizational upheavals induced by e-learning as well as the subsequent and compulsory input from the institute (Jean, 2001). As previously highlighted, recorded field studies have mainly been proven experimentally between teachers and learners using a specific technological tool (*all things being equal otherwise*). In an era in which adopting information technologies represents a strategic challenge for schools, in our opinion, it is time to analyze the 'school-related' variables likely to play a role in the success of an on-line teaching activity.

Theories concerning the use of new technologies evoke the fact that their spread is a factor in their own acceptance. Spread is the process by which the technology is extended to other parts of the organization (Goodman & Sproull, 1990). Opportunity is created for others to use this technology and to be aware that others use it. This spread is required in order to create a prescriptive general opinion of the new technology. Upheavals in the teaching activity brought about by *e-learning*, mean that its implementation depends on how determined a school is and resources available.

Adhering to a certain technology depends on individuals' determination, but also on how the management team "promotes" the idea (Salanick, 1977). And yet, there is a "values paradox" here (Sproull & Hofmeister, 1986): the more the technology is emphasized, the more severely it will be judged, if the pre-stated aims are not achieved. Adopting a new technology also depends on the symbolism associated with it (Prasad, 1993). This symbolism can be at the root of resistance or over zealous use. It also influences the system set up, thus becoming one of the primary reasons for adoption. For instance, as a symbol, modernity is a driving force in the spread of information technologies. This symbolism is the result of the combined effect of management and socio-cultural variables related to the field of application (higher education in our case). The way in which an *e-learning* project is introduced to the players involved will therefore also be an influential variable in terms of the perceived level of success related to the measured efficiency.

On-line learning brings about major changes in the teaching profession requiring just as much investment from the school. We should in particular mention:

- The incentive system for teachers: provisions regulating terms and conditions of employment for teachers is still out of phase with the rapid development of distance learning. For instance in the French university system, an hour's teaching is likened to a

service that has to be carried out, in due course, in a classroom and in front of students. This raises the problem of payment for e-learning type lessons and incentive measures taken to encourage teachers to put in an effort.

- Training for teachers and help in designing on-line lessons, multimedia resources, quizzes, student follow-up, etc.
- Forming an editorial committee entrusted with assessing teachers' work: meeting pre-determined quality criteria, abiding by copyright laws, etc.
- Media team responsible for transforming the resources developed by the teacher (web, flash, audio, video formats, etc.).
- Technical team responsible for putting the e-learning platform on-line and up-dating it.
- Etc.

Of course, all these factors determining the success of an e-learning tool, as well as those already presented in this article, are by no means an exhaustive list. The organizational complexity of educational establishments makes it difficult to predetermine the success or failure of any given project. This being said, we have the advantage of being able to analysis the success of a student in a learning situation using a relatively clear performance indicator, that of exam results.

2.5. Success of an E-Learning System

The main scientific research into experimenting with such systems (Bieber & *al.*, 2002; Minnion & *al.*, 2002; Coppola & *al.*, 2002; Piccoli & *al*, 2001; Webster & Hackley, 1997; Hiltz, 1995; Alavi, 1995 & 1994) have analyzed the effects induced on learners and teachers in the following ways:

- learner-teacher interactions
- group exchange between learners themselves
- cognitive processes and pedagogical models
- cultural changes
- experience gained by the teacher and learner
- etc.

This experimental methodology-based research, often conducted on a test group of learners, has thus allowed the strengths and weaknesses of these tools to be brought to light - with regard to teaching and learning processes. It reveals that a multiplicity of influence factors confers a particularly subjective character to the idea learners and teachers may have of it. This can be explained through the differences in appraisal that each one makes of the: (1) pertinence of the set aims (purpose or acceptability concept), (2) relationship between the aims and the results achieved (effectiveness or usefulness concept) and (3) relationship between these results and the means (or effort) employed (efficiency or usability concept)[3].

If the arguments in favor of trying *e-learning* are, initially, with a view to improving the training process, others are interested in the underlying economic and strategic potential for an institute in taking up such a project. In this connection, another perspective is to consider *e-learning* as a way to rationalize the organization's operating costs (Minnion & *al.*, 2002). If we deem that the knowledge to be transferred to 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. All of the following should, at first sight, contribute to reducing the cost of teaching per student and generate savings likely to secure a return on the technological investment: an automated didactic system, self-assessment functions, teachers called on essentially for pedagogical follow-up, less classroom space needed due to face-to-face lessons, etc. Some research even associates this reasoning with an emphasis on development or even as a competitive edge acquisition (Webster & Hackley, 2001; Dufner & *al.*, 1999).

The e-learning market nevertheless entered troubled times two years ago. Caution needs to be taken therefore, in terms of the amount of ambition it is suitable to attach to research into the degree of success of such distance teaching tools. The fact that some "e-training" centers have recently gone bankrupt warns us that viability of an economics model based on information technologies should surely first transit by the appropriation and use of the latter.

So without trying to test the hypothetical impact of e-learning on the reduction in operating costs or the creation of a competitive edge, we believe it is nevertheless also necessary to take the idea of performance from an institute's standpoint into account. Is it still coherent, in fact, to consider that an organization's investments in information technologies (regardless of the organization) are pertinent only if they form part of a growth strategy (Powell & Dent-Micaleff, 1997)? On the one hand, the return on investments is not always assessable on objective grounds:

- certain costs cannot be measured accurately (for example: the hourly production cost of creating or transforming a lesson)
- the context, between when the decision is made to invest and when the system actually bears fruit, can radically change
- labor regulations as yet do not cater for distance learning (case of the French university system)
- etc.

On the other hand, the decision to invest may also be motivated by less analytical ambitions in financial terms. For several years now, training centers have been

[3] The *purpose*, *effectiveness* and *efficiency* definitions, frequently used in Economic Sciences, are reiterated here (see the Caby & *al.*, 1999 article to this effect). We have also drawn a parallel with the Education Sciences research on the *acceptability*, *usefulness* and *usability* idea (see the Tricot & *al.*, 2003 article to this effect).

subjected to a certain pressure concerning experimenting with or adopting distance learning systems (Webster & Hackley, 1997; Alavi & *al.*, 1995). Implementing them can therefore aim at promoting a modern image or even avoiding being marginalized in relation to developments in the field. Measuring effectiveness and efficiency as perceived by the institute's management team may also bear fruit in terms of overall success.

However, if we take the stance that the primary purpose of e-learning is to offer learners a working platform allowing them to improve their results (Maki & *al.*, 2000; Schutte, 1997; Hiltz, 1995; Webster & Hacley, 1997), it is appropriate to analyze the efficiency of the said potential in a real situation and context that goes beyond a mere simulation or experiment. The empirical part of the research in progress, for the moment, will concentrate on analyzing the results of an entire year group of students (400 learners) having taken five on-line courses as part of their syllabus and throughout the academic year.

3. RESEARCH FIELD

For the moment, the data collected only allows us to make a comparative analysis of the results of the students having taken these on-line courses with the results of those who had previously taken the same courses by traditional methods. Tests of influence levels of the depicted characteristics and factors (student satisfaction level, teacher involvement, pedagogical model, etc.) will be the subject of subsequent publications.

3.1. The Institute

Montpellier Business School's *e-learning* project was given impetus in early 2001 with the decision to make it compulsory for students following the Business School program to do a year's study abroad. Consequently, at the start of the 2002 academic year, 400 students were dispatched to 130 different foreign partner universities. In addition to the lessons they attended in their host universities, these students had to follow some Montpellier Business School courses via the e-learning platform developed for this purpose. The challenge for the students was to obtain two diplomas in the same year. In any case, these courses had to be followed and validated for a student to be able to move on to the next year of studies. This is why group work was encouraged to complete assignments which required coaching by tutors as part of internal assessment.

For all that, e-learning was developed here in a bid to open the training program to the rest of the world. In this way, the primary aim was not as much to develop the pedagogical tool as to take full advantage of the distance learning opportunity. The following means were employed to achieve this goal:

- recruiting a researcher-teacher as person in charge of the e-learning project,
- enrolling the services of a computer engineering consultancy firm,
- training the teachers involved,
- implementing an editorial committee (made up of teachers representing the education and research departments) responsible for validating each teacher's work..

As an incentive and to give value to the teachers' work, a reduction in their teaching load was implemented:

Table 3: incentives for creating *e-learning* lessons in the case studied

The year the e-learning lessons were created	*Presenting and up-dating lessons in subsequent years*
Reduction in the teaching load equivalent to the number of face-to-face teaching hours as per the course syllabus (disregarding the different year groups involved). *Example: reduction of 30 hours for a 30-hour e-learning course to be taught the following year.* Reduction of 100 hours in non-face-to-face teaching time. This reduction concerns tasks of the following type: taking part in student selection panels, managing cross-referenced projects, etc.	The e-learning teaching time that students have to fulfill is counted in the same way as the time spent attending face-to-face teaching periods. *Example: if in a 30-hour course, a student year group has to spend 10 hours e-learning, these 10 hours will be counted in the annual teaching load that a university teacher has to provide.* This time is, in particular, to be spent keeping the course up-to-date. A reduction in non-face-to-face teaching time (attributed as stipulated above) that the teacher should assign to giving the e-learning lesson (particularly for: answering the questions on the forum, posting practical information about the work expected, etc.). This reduction, on an annual basis, is equal to: • 100 hours. • If fewer than 400 students, the reduction is calculated according to the following weighting: 0.25 hour x number of students enrolled for the on-line course. In order to offer favorable teaching conditions (to organize certain modules, to up-date certain data, etc.), the teacher benefits from a teleworking scheme: • One day a week (a set day each year) he/she is exempt from having to be at Montpellier Business School. • A high-speed Internet connection is made available at the teacher's home (DSL, cable or Numéris line). • A mobile phone with a subscription for one hour's communication per month designed to cover his/her professional calls.

This system of lightening the workload and related obligations has been formalized in the employment contract of all the teachers involved.

3.2. The E-Learning System

Emphasis has been put on an approach and a system affording the greatest possible flexibility to an innovative project whose specific needs had not been predetermined. Instead of buying an existing ready-made platform, the decision was taken to build a "homemade" one using open-source technologies. Developed by the group's 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 handed in, glossary, quiz, 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 met.

The e-learning platform includes, in particular, a system allowing the teacher to create lesson content on-line him/herself 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 does not need any special IT skills.

3.3. The Learners

The 400 students on a year's study abroad were hosted in a variety of universities in which they had computer rooms at their disposal allowing them to make full use of the e-learning platform functionalities. Incidentally, the only material needed was a computer (PC or Mac) connected to the Web with an Internet browser (and perhaps a printer if the student wanted to keep a hard copy of the lessons rather than viewing them in their electronic format). The questions or complaints made by the students (often by Email) were more oriented towards the conditions and difficulties of reconciling two courses at the same time, as opposed to problems with using Web technologies.

Table 4: main features of the *e-learning* tool implemented in the case studied

Teacher environment	*Student environment*
Zone for direct content design (put on-line according to an advanced WYSWYG[4]-type) allowing the teacher to create lesson content on-line him/herself. System for creating a Quiz on-line with feed-back allowing the student to be directed in particular to parts of the lesson that need to be reworked. System giving the right to a student year group to access all or part of the lesson to be selected. Access, in his/her capacity as moderator, to his/her lesson forum: answering students' questions on-line and managing messages	Access to lesson content in the form of Web chunks and downloadable versions Access to practical information (timetable, standard procedure instructions, etc.), Access to "subject + correction" type exercises or self-assessment Access to a forum allowing the students to ask the teacher questions and share information and experiences among themselves. Practical tools: search engine, glossary, links, etc.

In terms of IT skills, these students could all be considered as having a satisfactory level for using the e-learning tool set up:

- in their first year of study on the Montpellier campus, they all had about 30 hours of compulsory computer science lessons,
- by the way, the platform requires no other skill than knowing how to use a Web browser.

3.4. The Teachers

The 5 teachers involved in the school's project covered the following subject areas: Finance, Process Management, Auditing, Information Systems, and E-business. Each teacher was responsible for drafting the content of the lessons to be converted to *e-learning* material. To do so, they had to adhere to the following pedagogical model:

- Cut course content up into sessions equivalent to 2-hour-long face-to-face lessons
- Divide each of the sessions into "chapters" or units of learning of no more than 3 screen pages. The basis writing reference to be adhered to, in terms of volume, is 20 A4 pages per session.
- Set the students a case study type assignment (in groups of 5) covering all the sessions developed and as part of their internal assessment.
- Compile the glossary, reference bibliography as well as the links to other recommended websites.

The work submitted by each teacher was assessed by an "editorial board" before being authorized to go on-line in September 2002.

[4] "What You See Is What You Get"

The teachers were held by institutional accountability to ensure student follow-up. Given the number of students to monitor (400) scattered worldwide in different time zones, asynchronous communication proved to be the most appropriate vehicle for their interaction. It was also important for the school that the chosen system be as user-friendly as possible and not require any specific software to be installed on the 120 host university computers. This is why, the use of electronic forums relayed to Email (for any confidential communication) was given preference.

3.5. Analysis of the Results

The diagrams below compare the final examination results[5] of two year groups:
(1) the 2002-2003 promotion, having followed all 5 courses on line
(2) the previous year's promotion having attended class and followed these courses in the traditional way on campus at Montpellier Business School.

These 5 examinations were held on the same day, at Montpellier Business School Co., upon the students' return from abroad. They were in the form of multiple-choice tests containing the same number of questions / answers for each course and drawn from a database having been used by the teachers for several years. The level of difficulty was therefore similar to that of the previous year. Marking was not done by the teachers, but by the group's management team, with a scanner and software enabling the papers to be processed automatically.
As for the diagrams, they reveal a drop in the level in 4 out of 5 courses. Future research will concentrate precisely on collecting and analyzing data (both qualitative and quantitative) allowing these results to be explained. However, there is already an interesting fact that is worth our attention...

In terms of skills, none of the teachers had any special prior expertise in *e-learning*. And in fact the auditing teacher (the only subject to show an improvement in results compared to the previous year) showed a appreciably inferior command of information technologies than her 4 colleagues. The latter, for example, were used to: creating PowerPoint presentations, having their students search through reference sites on the Web or even giving exercises using specific software (Excel, MsProjects, Software Engineering Environment, etc.). The teacher in question declared not having used information technologies in her lessons up until then, and feeling more at home in the oral teaching mode (traditional lesson) than one that requires everything to be formalized in writing (*e-learning* lesson). In other words, the only subject recording a higher level of student success is linked to the teacher with the least proficiency in new information and communication technologies.

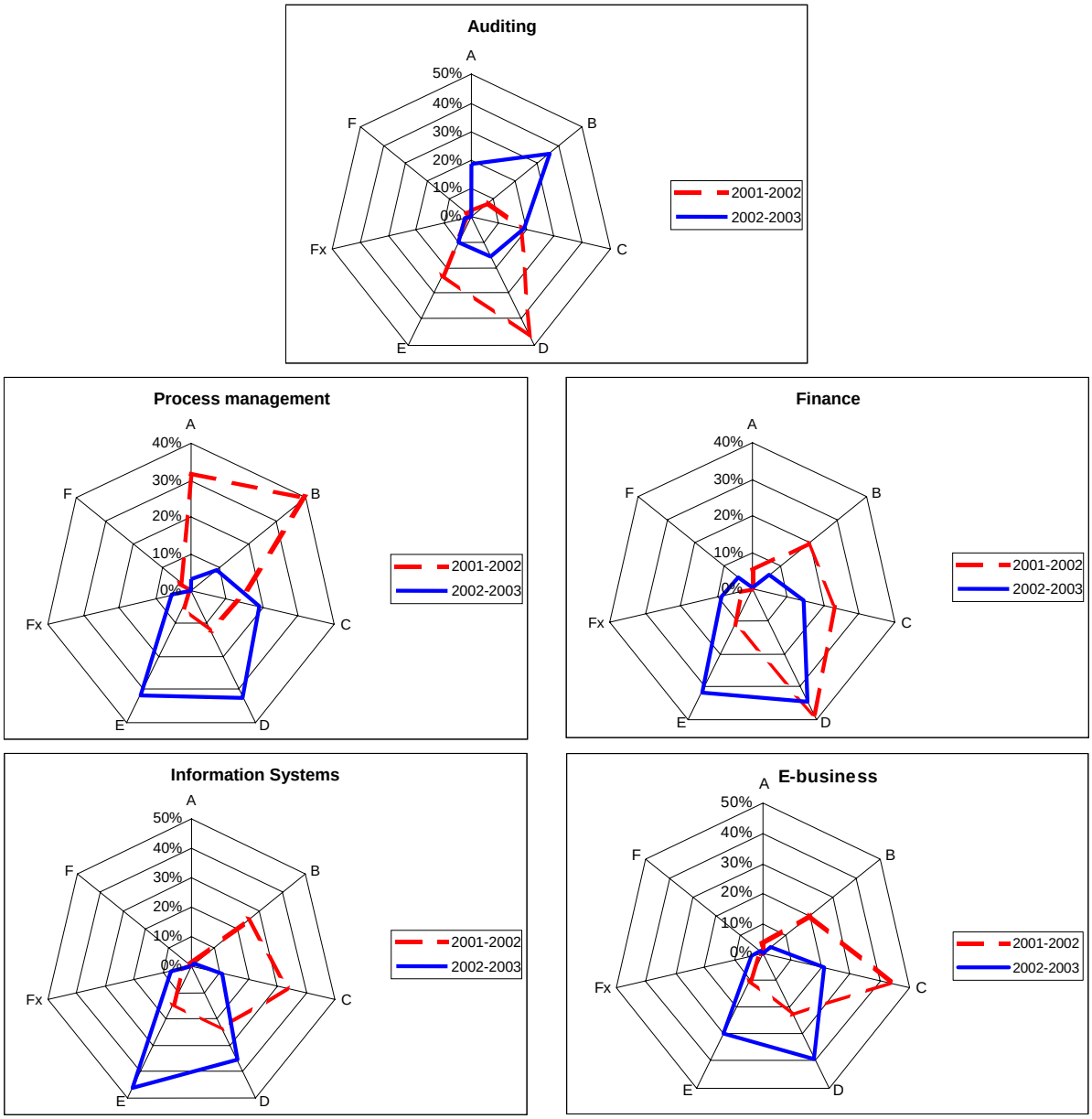
Consequently, this case, while unique, is it not enough to show that even if being conversant with information technologies is necessary for the "virtual teacher", it is not a determining factor in the success of an e-learning course? Is this not a perfect illustration of the need to dismiss professional reasoning as scientific in a techno-centered approach to on-line education?

On the one hand, given the diagrams, we could assert that the primary aim of such a tool has not been achieved. For all that, is this observation not worth putting into perspective so as not to adopt a simplistic approach to the legitimacy of this type of project? Indeed, this is the very first *in vivo* experiment for an institute, its teachers and students. These results can be interpreted as the formalization of the appropriation issues and cultural changes inferred by *e-learning* such as those we depicted in the literary analysis. For this reason, we believe that a methodology applied to the subject would be beneficial on a temporally longer system of reference, allowing the influence of this type of variable to be diluted.

For all that, over and above this decline in performance, the management team of Montpellier Business School considers the *e-learning* project as a success in as much as its implementation enabled the group to achieve the pre-determined globalization objective and to enroll an entire year group of students in a year's study abroad culminating in a double diploma. For this reason, the success of the tool must not be limited to examination results alone, but should include other indirect indicators. In this field example we see that the success of *e-learning* is closely linked to the success of the upstream project requiring its implementation.

[5] The results here are detailed according to the marking schedule applied in the target universities: A = Excellent; B = Very Good; C = Good; D = Fair; E = Unsatisfactory; Fx = Fail (with the right to re-sit); F = Fail (Student excluded)

Figure 2: Traditional class *versus* e-learning – comparison of exam results



4. CONCLUSION

Cross-referencing two fields, information systems and education sciences, provides the opportunity to offer an explanatory model of the effectiveness of an e-learning tool. This model incorporates the teachers' and students' characteristics, but also the institutes' aims and means as well as the fundamental relationships between these three categories of player. The research carried out at the Montpellier business school initially only allows the results students obtained in traditional training to be compared with those gained in on-line training, which represents only the beginning of research intended to delve more deeply into the proposed model. However, these initial results support our reasoning: a view overly centered around technological determinism should logically be dismissed, in the same way as limiting the measure of success to the students results alone. The aims of the school studied in this article show that the legitimacy of an *e-learning* project can lie more in the satisfaction of being able to meet new strategic challenges through its development than in simply improving an existing teaching tool.

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