E-learning and approaches to learning in higher education

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Abstract:
This paper addresses three specific areas in the relationship between e-learning and the approaches to learning used by higher education students. It starts by examining how these approaches find expression in learning situations which involve e-learning. It then goes on to assess the extent to which e-learning is a factor in the learning approaches adopted by students. Finally, it discusses ways in which active and in-depth learning skills can be directly developed via e-learning.

Key words:
Approaches to learning, E-learning, ICT, Higher education.

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INTRODUCTION

A growing body of research in the field of Educational Psychology is drawing attention to the fact that learning in higher education can occur on different levels — each of which results in a learning product of different quality.

From this perspective, an academic education of higher quality might be defined as "in-depth learning", in contrast to what we could call "superficial learning" (Biggs & Collis, 1982). "In-depth learning" involves the construction of a more comprehensive, personalized, lasting and transferable knowledge of the subject matter; "superficial learning", on the other hand, requires merely the temporary retention of the subject matter in snapshot form, which can be primarily put to use in situations of evaluation. As research increasingly demonstrates, each of these learning *results* is closely related to the type of learning *process* employed. The "learning approach" concept seeks to represent these processes in terms of the way students *relate* to their learning tasks (Marton & Ramsden, 1988). According to this concept, how students address learning is fundamentally determined by the interaction of two variables: motivation, and learning strategy.

Within this theoretical framework, two principal types of motivation (instrumental and intrinsic) and two principal types of learning strategy (superficial and in-depth) have been identified within the context of higher education (e.g. Biggs, 1987). A superficial approach combines instrumental motivation with superficial strategy (the aim being to meet the minimum requirements by memorizing and regurgitating information). As we might expect, this approach tends to be found in superficial learning, as defined above. An in-depth approach, on the other hand, combines intrinsic motivation with an in-depth strategy (deriving pleasure from learning by understanding its content). This approach tends to be found in a context of in-depth learning, as described above. Research has also revealed the existence of a third approach to academic learning, characterized by a combination of a motivation to achieve (i.e. get the best marks possible) and an organizational strategy (i.e. systematic organization of study) (e.g. Entwistle, 1987). The tendentially higher academic performance achieved is consistent with this approach.

In parallel with general research into learning in higher education, another area of research has focussed on how higher education students use ICT (Information and Communication Technology) in their learning: what we conventionally call e-learning (e.g. Laurillard, 2006). Depending on the opportunities offered by ICT we might at first glance expect approaches to e-learning to be characterized in terms of organization and the superficial/in-depth dichotomy. Perhaps, though, as with any other task, ICT admits of approaches of a completely different character. Might the nature of ICT in some way determine the probability that one approach is favoured over another? And might it be possible to use it to promote more active approaches to learning?

Whether or not we accept the notion that new technology significantly influences the type of learning which occurs in higher education, we cannot deny that ICT is used more and more by teachers and students in higher education, and this fact alone means it merits special attention.

PRACTICAL APPROACHES TO E-LEARNING

Although the literature on the approaches adopted to different learning tasks is extensive, research into how these approaches apply to ICT-assisted learning is limited. Evidence does however suggest that the learning approach concept can be generally applied to distance learning, which is one of the typical components of e-learning (Richardson *et al.*, 1999).

Given the "hypermedia" format of most learning environments based on ICT[1], we might entertain the hypothesis that a superficial approach to e-learning would manifest itself as a tendency to interact more passively with the learning environment, to involve oneself with less enthusiasm in the task at hand, to stick to linear or predefined learning itineraries when navigating through the learning environment, to avoid hyperlinks, and so on. Again hypothetically, an in-depth approach to e-learning may take the form of a more dynamic and idiosyncratic interaction with the learning environment, the will to learn something from each new task, more adventurous navigation, extensive use of hyperlinks, and so on. We might also expect the two approaches to be used consecutively (i.e. by starting to explore the learning environment and then following the itinerary it suggests, or vice versa). And in fact, in a survey of university students working in an online conferencing learning environment, Cuneo and Harnish (2002) found that the in-depth approach resulted in a more active use of the environment (i.e. more e-mails and files exchanged and read), greater valorization and less anxiety about revealing personal knowledge or ignorance of the technicalities and conventions of online communication. In the same learning context, the superficial approach resulted in a significantly reduced use of almost every aspect of the e-learning environment (i.e. fewer e-mails and files exchanged and read), greater anxiety about revealing personal knowledge / ignorance and a greater reluctance to express personal opinions. Similarly, Ford (1995, quoted in Entwistle, 2000) detected two opposing styles in the consultation of computer databases. The "global style" was characterized by the use of a wider range of terms per query, with more results returned as a consequence but less satisfaction with these results. The "analytical style", on the other hand, involved greater precision in the way queries were constructed. The same author also discovered the existence of a third approach, the "versatile style", which combined the characteristics of the two aforementioned styles and obtained the best levels of efficiency. We can reasonably draw a parallel between this "versatile style" and an in-depth approach to database consultation.

Other research into learning approaches in ICT environments has yielded findings which seem to confirm the idea of different levels of learning as introduced by the "learning approaches" perspective. An exploratory survey of the variables involved in computer-based learning (van den Brink *et al.*, 2000) detected indications that primary and secondary school students can conceive this type of learning in terms which are: a) quantitative (i.e. the use of computers as a way of acquiring, and in some cases applying, further knowledge of school subjects); b) qualitative (i.e. the use of computers as a way of facilitating comprehension of subjects); and c) institutional (i.e. the use of computers to obtain grades). This suggests that computers may basically be viewed by students as a resource which they can use as a complement to a previously-structured conception of learning. In other words, a resource which may improve the efficiency of this type of learning (by "increasing motivation", "accelerating learning" and "reducing the information load"). Similar findings were obtained in a qualitative survey which sought to map conceptions of computer-based learning among university students (Rebelo & Duarte, n. d.). These findings emerged from an analysis of replies collated in semi-structured interviews and revealed a degree of correspondence between conceptions of e-learning and conceptions of learning in general, as phenomenographic research has previously observed (i.e. learning as accumulation of information, as comprehension or a means to obtaining grades). There additionally emerged a new

conception in which the efficiency and organization involved in e-learning are key points.

From an intervention perspective, research has shown that an in-depth, organization-intensive approach to e-learning can be promoted in two complementary ways. The first involves ensuring certain conditions for learning, basically via organization. The second consists in helping students develop a "meta-learning" capacity, i.e. "(...) students' consciousness of and control over their own learning processes (...)" (Biggs, 1987, p. 2).

So how can ICT be used to help promote an in-depth, organization-intensive approach to learning? The answer to this question can perhaps be expressed in terms of how e-learning can be used in the two ways mentioned above. In the first place, it can help empower these approaches as a tool for instruction in curricular content — in other words, by the use of learning situations based on ICT and designed according to certain criteria. In the second place, e-learning can serve the same purpose as a means of developing the "learning how to learn" capacity: in terms both of specialized applications for the teaching of learning strategies and of utilitarian applications that can be used for the same purpose.

We shall now examine in more detail how computer-based learning and meta-learning assisted by e-learning can be used to modify the learning approaches used by higher education students.

THE E-LEARNING FACTOR IN APPROACHES TO LEARNING

From the analysis of many of the learning tasks related with ICT we might expect them to constitute a supreme incentive to the adoption of an in-depth approach to learning. And in fact, many of today's e-learning environments organize learning experiences which seem to contain some of the ingredients associated with this type of approach (Biggs & Moore, 1993). In the first place, students are known to take to ICT with enthusiasm (Laurillard, 1993), a fact which may translate into high *intrinsic motivation* for the tasks in which such a resource is used. And then, given that e-learning environments tend to be "interactive", they seem to be an excellent way of promoting an *active posture* among students[2]. Considering, too, that such environments are typically organized according to a "hypermedia" format, they seem to be the ideal platform for the development of a *well structured knowledge base*[3]. Finally, given the uses to which communications networks are typically put (i.e. Internet and intranets), they represent an excellent platform for *social interaction* within the learning context, in a spirit of collaborative learning.

From another perspective, the possibilities offered by ICT in terms of simulations seem to constitute an excellent way of helping students address the consequences of their intuitive notions and to promote conceptual changes (Sparkes, 1993)[4].

And in fact these positive expectations with regard to ICT-based learning are partly confirmed by research.

A study of an initiative in a polytechnic college which involved, among other things, the use of a management tool in the form of a computer game (designed to increase motivation and organize learning) revealed that the initiative seemed to mitigate the negative effects of the educational context on approaches to learning (i.e. the superficial approach increases and in-depth and organization-intensive approaches decrease, but not as much as in a control group) (Davies *et al.*, 1994). Another study, which also involved the use of a computer game but was set in a context of International Politics (involving cooperative learning and the application and testing of learned content), also revealed beneficial effects for motivation and comprehension (Ramsden, 1992). A study on the use of interactive video demonstrated that this medium can stimulate discussion and promote a "problematizing approach" to content (Laurillard, 1993). Comparative studies on education with and without a conferencing system (CSILE) revealed that the use of this system is associated with significantly better results in reading comprehension and reflection by students on their own and others' work (Lamon *et al.*, 1993). One study which compared seminar-based teaching with teaching which also incorporated a conferencing system (which requires critical thinking, comprehension and the ability to articulate knowledge) revealed that such a system is more efficient in encouraging students to explore, integrate and apply their ideas[5] (Newman *et al.*, 1998). Finally, a comparative study of the teaching of mathematics

in which the conventional method was compared against an interactive method using the hypermedia format (involving computing science students) revealed the second method to be more closely associated with the in-depth approach (Hambleton *et al.*, 1998).

Then again, some research has revealed that ICT does not automatically guarantee an in-depth approach to learning, and may even work in the opposite direction, as a factor in the adoption of a superficial approach.

A study into the effects of computer simulation of laboratory work revealed that when under pressure to complete a task on time there is a tendency, similar to that observed in the "natural" environment, to use an "unreflective approach" (Laurillard, 1993). A descriptive study of the reactions of students to a computer-based learning task (and which can be used in an active, idiosyncratic manner) revealed that even students who normally used an in-depth approach and had a highly-developed conception of learning were prone to approaching the task superficially (i.e. consulting information in linear fashion, as automatically controlled by the program, and avoiding parts where their opinion is solicited) — as if their habitual approach did not extend to the new context in a self-regulated manner (DeJong, 1994).

A comparative study involving one group of students confronted with a computer simulation of a problem and another group faced with the same problem in pencil-and-paper format revealed that the former group tended to adopt a trial-and-error approach to solving the problem, while the latter preferred to test hypotheses (Laurillard, 1993). Another comparative study of mathematics teaching by conventional methods versus teaching in a "hypermedia" environment revealed an association between the latter method and a reduction in the use of the in-depth approach — perhaps because students may have approached the task with preconceptions as to their responsibility in learning (Hambleton *et al.*, 1998).

One possible interpretation of these findings is that the level of involvement and intentionality of students in many e-learning environments does not necessarily require significant processing of content. Until very recently, most educational use of ICT consisted of systems designed to facilitate the acquisition of a greater amount of knowledge in a lesser amount of time and, in many cases, to test how well this knowledge had been memorized (Ramsden, 1992). In other words, systems which did not provide "(…) the type of challenge which in-depth learning requires" (Sparkes, 1993, p. 147), encouraging instead a superficial approach which lessened the quality of learning (Ramsden, 1992). More specifically, this has been attributed to the fact that much of the software produced for ICT learning purposes is based on the ingenuous notions held by programmers with regard to the learning process (Newman *et al.*, 1998), or on the failure to articulate design principles (Ramsden, 1992).

The identification of such problems has formed the basis for the enunciation of proposals for the evaluation and design of e-learning environments which incorporate the need to contribute to in-depth learning (e.g. Duarte, 2000; Laurillard, 2002).

Similarly, the fact that ICT does not automatically encourage an in-depth approach can be interpreted in the light of the thesis of Laurillard (1993), who argues that it is not the educational resource which determines the type of learning but rather the context in which it is used. In fact, as Ramsden (1992) points out: "No educational resource, no matter how useful, can solve the fundamental problems of education (…)" (p. 161). In the light of this, various contextual conditions have been proposed for the use of ICT in a manner conducive to an in-depth approach to learning (*see* DeJong, 1994 and Laurillard, 1993, 2002).

We should also remember that just as different approaches to learning were detected in different study tasks, e-learning tasks also admit of different approaches. This might lead us to consider the need, in parallel with intervention in the environment in which ICT is used, to act on the level of the personal characteristics of the users.

Summing up, everything indicates that ICT-assisted learning does not automatically lead to the adoption of an in-depth approach (DeJong, 1994). If we are to make the in-depth approach automatic, a number of variables would seem to be decisive, such as the specific design of the learning environments based on ICT, and the context in which it is used (i.e. the skills of the user and the surrounding environment).

From the authors' perspective, it is therefore necessary to clarify the degree to which e-learning can really contribute to the development of an in-depth and more organized approach to learning, and which components of this type of learning are responsible for the adoption of the desired approach. More specifically, it seems on the one hand that the evaluation of e-learning should incorporate criteria capable of measuring the degree to which it encourages the adoption of an organized, in-depth approach to learning by users; and on the other that the design of e-learning environments should be based on the findings of such an evaluation and on the principles which govern such approaches to learning.

META-LEARNING ASSISTED BY E-LEARNING AND APPROACHES TO LEARNING

As in other areas of Educational Psychology, ICT features strongly in intervention in the learning skills of students. At the turn of the last century Entwistle *et al.* (1998) argued that "technology based on computers can be used not only to produce efficient learning materials and teaching, but also to support efficient learning by students" (p. 1). Studies such as Entwistle's heralded a new wave in intervention and research in ICT-assisted meta-learning (Duarte, 1999). More specifically, this research focuses on the use of specialized e-learning environments in the development of learning skills (e.g. applications which teach and enable the use of the strategy for the realization of conceptual maps). Meanwhile, the use of ICT for this purpose may also take the form of non-specialized applications. Jonassen (1996) for example proposes the use of programs for the construction of databases as a way of developing strategies for organizing information. Finally, even applications designed for teaching curricular content can constitute a form of intervention in this area, as noted by Marincovich (1995, p. 2): "(...) because students are actively involved in the construction of knowledge rather than passively taking in information, they become conscious of how to improve their learning skills while they navigate through new problems".

At first glance, meta-learning via e-learning would seem to possess some significant advantages. Firstly, students are known to be motivated by new technology (Laurillard, 1993). ICT can therefore constitute one way of encouraging students to enter the arena of global intervention in learning skills, as well as an incentive for them to ask for help in this regard (Solomonides & Swanell, 1995). Secondly, ICT can help to compensate for the impracticality of providing, for everyone at all times, training in learning skills (Tait & Entwistle, 1996). Thirdly, the media typically involved in an ICT environment enable easier evaluation of personal learning patterns — which in turn enables intervention to be geared to the characteristics of each learner (e.g. Entwistle *et al.*, 1998). Fourthly, the possibility of using information technology to construct excellent simulations provides students with a foretaste of new learning experiences (*see* Entwistle *et al.*, 1987). Fifthly, since programming is no longer confined to a specialist few, educational actors and students are now able to take the initiative to produce their own applications for meta-learning and e-learning (e.g. Goldberg & Salari, 1997). Finally, since in certain circumstances ICT can facilitate an in-depth approach to learning, it also constitutes a good way of promoting an in-depth approach to learning new learning skills.

However, despite this wealth of potential, the real effectiveness of most specialized e-learning environments as a platform for meta-learning remains to be proved. The fact is that most environments are based on the intuitive notions of programmers on how students "ought to" learn (Newman *et al.*, 1998). Here too, then, we need an evaluation and a congruent design of these environments.

Various types of e-learning environments have been suggested in research into approaches to learning. We will now examine some of the environments which currently exist.

Entwistle *et al.* (1987) devised an "interactive simulator" for secondary school and university students[6]. This application comprises two modules: "theatre" and "blackboard". The theatre module works by simulating situations typical of the 1st year of higher education (e.g. tutorials), which are presented in the form of an adventure game. In other words, users are invited to make choices which, in conjunction with a variety of possible events, determine how the "play" evolves. Students can ask at any time the reason for the appearance of the scenes

they are confronted with, and can also ask for advice on the right learning strategy. The blackboard module records the profile, actions and comments of the user, and the level which s/he managed to reach.

The PASS ("Personalised Advice on Study Skills") application, also devised by Entwistle *et al.*, is designed for higher education students (especially freshers) and teachers, and is one of the most complex and advanced applications of its kind (Entwistle *et al.*, 1996, 1998; Tait & Entwistle, 1996; Tait *et al.*, 1995; TLTP, 1998). Its objective is to point up danger signs (i.e. inadequate study skills) and consequently improve these skills, in this way contributing to a reduction in failure rates. More specifically, PASS is designed to cultivate the acquisition of "study techniques" and develop organized, in-depth approaches to learning. The program comprises three inter-related modules: "Questionnaire", "Student View" and "Study Advisor". "Questionnaire" is an evaluation module whose primary purpose is to identify the learning difficulties of the user. It evaluates: a) the student's degree of preparation for higher education (e.g. entrance qualifications, autonomous study skills, study techniques, basic knowledge); b) the student's approach to learning; c) his/her study techniques in different areas (e.g. lecture hall, reading, uncertainties, writing, problem solving, organization and revision); d) other factors which hamper effective study (e.g. travel, health and stress, finance etc.). Evaluation is based on a series of interactive multiple-choice questions (i.e. questions displayed on the monitor one by one, with the user required to click on the "correct" answer). The "Student View" module is a visualization tool designed to help understand the nature and extent of the learning difficulties detected. Visualization takes the form of an "interactive graphic presentation" (i.e. the presentation of the results of the questionnaire in the form of a bi— or tri-dimensional graph which takes the two or three learning approaches as axes). Finally, the "Study Advisor" module offers advice on learning approaches, health, stress and study techniques (for lectures, use of resources, tutorials, problem solving, oral presentations, group work, organizing time, reading, writing, revision, exams, projects). This module uses a didactic method, but not in a prescriptive way: users are encouraged to consider the advantages and drawbacks of the different approaches to learning and to reflect on which approach is the best suited to their own case and context. Advice is available on two levels of complexity: a "summary" level which provides tips and tricks for better learning, and a "detailed" level which provides detailed suggestions and excerpts from replies from other students in research interviews on the learning process. A print function allows users to create a personalized guide to study techniques (i.e. the set of cues selected by the user, complemented by comments). Users also have the option of allowing their questionnaire results to determine which content they can access via the "Study Advisor", or of opting instead for "free" navigation. An online version of PASS was later developed, which had the advantage of making it accessible to a higher number of students (McCune, 1999)[7]. The creators of PASS then turned their attention to developing versions of the program for specific educational contexts (McCune, 1999).

The IECM ("Integrated Engineering Course Map") is an application designed by Solomonides (1993) which has been used in an initiative with higher education students (Solomonides & Swanell, 1995). The objective of the program was to prepare the students in the department of Mechanical Engineering at Nottingham Trent University for the learning they were to pursue[8]. This application comprised two modules: one on the curricular content of the course, the other on the type of learning expected of them. The second module addresses the different types of motivation to study, different conceptions of learning (with valorization of a qualitative conception) and different approaches to learning. With an in-depth approach presented as the preferred solution, the program provides instruction on the skills necessary for the application of this approach — for learning in general and for reading and answering tests in particular.

CLASS ("Couseware for Learning And Study Skills") is an application developed by Kibby *et al.* (1995), specially designed for first-year students with the objectives of promoting successful learning and the development of the ability to think critically. The program provides users with the opportunity to conduct a self-assessment of their style of learning and functions as a tutor, demonstrating and requiring the use of different learning strategies (e.g.

for management of time, reading, writing, group work). CLASS also features tools for the implementation of strategies for writing, conceptual mapping, reading, and creating hypermedia applications. In an informal evaluation of CLASS, Gunn (1995) noted that the application succeeds in helping students attain their objectives and promotes the transfer of acquired skills to different contexts.

"Skills Shop" is an application developed by Bailey *et al.* (1997), and is also directed at university students[9]. Users are first presented with the different approaches to learning, while being encouraged at the same time to develop an organized, in-depth approach and dissuaded from adopting a superficial approach. To allow users to reach the objectives it proposes, the application offers the development of different learning strategies. Over the series of modules it comprises, it acts as a strategic tutor for the management of time, learning in the lecture theatre context, reading, writing, revision and projects. "Skills Shop" also contains bibliographic references and a list of services in the area of learning strategies, as well as hyperlinks to websites on the same topic.

Finally, we have to mention our own *Aprender Melhor — Programa de apoio ao estudo (v.1.2),* an e-learning environment developed by the authors and whose objective is to help students self-regulate their learning approaches (Duarte & Ramos do Ó, n. d.). More specifically, this application is designed to make users more aware of their learning processes and help them control them, and comprises five modules. Module one introduces users to the learning strategy concept, alerting them to the fact that the same strategy can be used at different information processing levels. Module two consists of a self-assessment questionnaire on the degree of use of the different strategies, accompanied by descriptions and illustrations of the strategies. The third module invites users to participate in activities whose objective is to demonstrate the different impacts of different learning strategies on the final result of learning. Module four offers personalized advice based on the user profile previously compiled, and offers a platform for the construction of personal strategies for changes in learning approaches. The fifth and last module allows users to systematically practise self-regulation in the different learning strategies. As they work in each module, users have continuous access to a profile which summarizes the results they are obtaining. This application is currently at the development and testing stage.

CONCLUSIONS

This paper began by pointing that as in other learning tasks (i.e. classroom/lecture theatre, reading, writing, problem solving), students mobilize a range of different learning approaches when confronted with learning situations based on ICT. According to the perspective by which we orient ourselves, these approaches reflect the interaction between different types of motivation and learning strategies. To a certain extent these approaches can be seen as personal characteristics which students bring to the learning situations they encounter and which inform the way they organize themselves with regard to these situations. In higher education, students and teachers — and the psychologists who give guidance in this milieu — have everything to gain from discovering the variety of approaches involved in e-learning, for this allows them to diagnose and in some cases to alter the way learners address situations in which ICT is used as a learning resource.

However, the personal approaches used in e-learning are not immune to the influence of the context in which it occurs. Considering one of the most decisive aspects in this context is the environment in which learning takes place, we examined the need for criteria of evaluation and design for learning environments based on ICT — criteria which will allow the learning environment to effectively contribute to the quality of learning. In the view of the authors these criteria can be based on the knowledge of the general learning conditions which discourage a superficial approach and encourage an organized, in-depth approach to learning. Much work remains to be done with regard to empirically establishing the degree to which the criteria followed are really conducive to improvements in learning. The authors also point out that this outcome depends not only on the e-learning environment but also on other factors inherent to this environment. Even a "good" e-learning environment can have neutral — or even negative —

effects on learning if it is not coherent with other vital components of the context: such as the conduct of the teacher or psychologist (who should therefore be aware of the risks) and the skills of the students.

With regard to the latter aspect, we examined in more detail how ICT can be used as a resource for the development of learning skills in higher education students. More specifically, we analysed the case of meta-learning via e-learning, highlighting how the latter can contribute both to the direct promotion of an organized, in-depth approach to learning and to self-regulation in the different approaches. ICT can in fact be a particularly effective way of attaining these goals, given the potential of e-learning as an active learning tool.

Endnotes

1. "Hypermedia" combines "hypertext" (i.e. a non-linear way of structuring text) with "multimedia" (i.e. "multisensorial" stimulation), involving navigation through a medium in which content is viewed and/or tasks accomplished.

2. "Interactivity" requires that the user chooses from alternative procedures, with each choice eliciting a different reaction from the system.

3. As noted, "hypermedia" is a conflation of "hypertext" and "multimedia", thereby obtaining "(...) a better articulation with the way humans store and retrieve information than traditional linear and uni-modal formats (...)" (Pollin, 1990 quoted in Gunn, 1995, p. 174).

4. Computer simulations work by testing different solutions to a given problem and generating an anlysis of each alternative.

5. Although tutorial learning seems to be more efficient in terms of motivation and the generation of ideas.

6. Of the various applications mentioned, this was the only one not directly tested as we were unable to gain access to a copy.

7. We thank the developer for allowing us online access to this e-learning environment.

8. We thank the developers for providing us with a free evaluation copy of this application.

9. We thank the developers for providing us with a free evaluation copy of this application.

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