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INCLUSIVE DIGITAL ONLINE ENVIRONMENTS AS A DEVICE FOR PEDAGOGIC DIFFERENTIATION: A TAXONOMY PROPOSAL

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The use of technology and, specifically, digital environments in training and education in both formal and non-formal contexts is becoming increasingly common. That type of technical-pedagogical solutions, however, may not always provide a sense of belonging to trainees, which may eventually lead to non-participation or even dropping out. Although some studies have identified possible reasons for this type of lack of association and abandonment, there are still areas that require further research, such as the configuration of these digital environments as pedagogical-differentiation devices or the assessment of their social-inclusion potential. This paper proposes a classification of the social-inclusion potential of digital environments, which was the validated result of data gathered from a query submitted to 30 e-learning experts and a literature review. Qualitative analysis of the data led to the identification of four potential levels of inclusion, from "exclusive digital learning environment" to "inclusive digital learning environment",

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and the determination of their separate pedagogical-didactical and technological characteristics. The importance of this paper lies in the possibility of using this classification to analyse how digital environments are being conceived and used today.

1 Introduction

Over the past 15 years, the European Union has been taking steps to achieve economic growth and to address unemployment and social inequality both by modernizing the means of communication and information and by searching for answers to the challenges brought about by the coming-of-age of the knowledge society.

The EU's intention of "becoming the most dynamic and competitive knowledge-based economy in the world, capable of assuring a sustainable economic growth, generating more and better jobs and greater social cohesion" (European Commission, 2000), as it is expressed in the Lisbon 2000 strategy, was reaffirmed in the Europe 2020 strategy (European Commission, 2010), which aims to base the European economy for the next decade on intelligent, sustainable and inclusive growth.

E-learning has been singled out as a means to promote lifelong learning (LL), thereby contributing to sustainable economic growth and social cohesion; however, it is impossible to guarantee that online learning environments will act as real social inclusion promoters. Furthermore, rather than contributing to social inclusion, technology often becomes another factor for social exclusion, increasing personal limitations and the gap between those who do and those who do not have the means and the right to understand, enjoy and have a say in digital cultural environments (Gorard & Selwin, 2005).

It is precisely this social inclusion potential of digital environments that is the focus of this paper, which seeks to answer the following questions:

- Which pedagogical-didactical options characterize an inclusive digital environment (IDE) as a pedagogical differentiation device?
- Which technical requirements must be present in an IDE?

The paper is structured as follows. We first provide a theoretical frame of reference for discussing digital learning environments as a pedagogical device for social inclusion, and then we examine the pedagogical practice normally performed in digital environments. Then, the methodological procedures used in this study are described, and the results are presented.

2 Theoretical framework

2.1 Digital learning environments as a pedagogical device

In this article, the phrase "digital learning environments" is understood to include all environments or digital tools developed and/or organized for the purpose of mediating training and educational communication in different types of e-learning. If training is to contribute to the participation of all of those for whom it is intended, it is important to promote communication, interactivity, and a strong sense of involvement of the learners in the learning process, all of which occurs primarily in open, flexible environments that propitiate autonomy.

Technology as an educational device can contribute directly or indirectly to facilitate the participation of individuals in learning activities, to lower access barriers, and to respect the specificities and the different learning paces of different students (Becker, Newton & Swang, 2013). The opportunity to learn in environments that recognize, respect and value cultural diversity and contexts is particularly relevant in adult learning, considering the various personal and professional constraints that may affect the learners, as well as the range of their expectations.

The view of technologies as educational devices requires us to acknowledge the differences among students and to be mindful of these differences. In this respect, Monteiro, Leite and Lima (2012) point out the importance of using digital technologies not just as a simple educational prop that triggers understanding and retention of taught content, but rather a tool to "create a means to foster the appropriate recontextualization and cultural relation of taught knowledge, further to the development of personal and social skills of those who use them" (*op. cit.*, 2012, p. 34). In this sense, culture allows students to "develop a cognitive anchor for new knowledge and allows them to relate and integrate new concepts within a coherent perspective that recognizes diversity" (McLoughlin & Oliver, 1999, p. 10).

Figure 1 shows a possible relationship among the various elements present when considering digital environments as educational devices.

The three axes in Figure 1 illustrate the interaction among technology, culture and learning. Technology facilitates the selection, diversification, and optimization of the means for disseminating various types of knowledge to different groups. Using recontextualization rules, a specific educational discourse is produced according to the context applicable to the transmission-acquisition of culture. Assessment rules are found in teaching practice, which may combine the potential of technology with personal and shared learning processes (Monteiro, Leite & Lima, 2012; 2013).

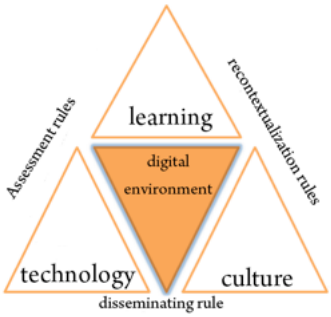

Fig. 1 - Virtual environments as an educational device (Monteiro, Leite & Lima, 2012, p. 34).

Technology is therefore a means through which we can facilitate the diversification of auditory and visual resources and their dissemination through an educational discourse that respects and values multiculturality, thus contributing to narrowing the digital divide across access and participation. According to Torres-Diaz (2015), differences in abilities and skills are the highest level of the digital divide.

In short, pedagogic differentiation devices may facilitate individuals' access to, use of, and participation in digital environments, which corresponds to the premises of digital inclusion.

Interactions are therefore seen as the basis of the learning practice in a digital environment and are substantiated by constructivist and socio-interactionist theories, as they require the negotiation of conflicts and shared meanings.

The pedagogical characteristics mentioned above, such as the focus on the learner, the encouragement of autonomy, the need to promote interactions and sharing are consistent with the concept of pedagogical differentiation and inclusive devices, as mentioned before. This concept, however, needs to be supplemented by theoretical research anchored in practical situations in real contexts. The study discussed below is based precisely on this idea.

3 Methodology

This paper proposes a classification of the inclusiveness potential of digital environments. Data was collected by a literature review and an online questionnaire.

The literature review was based on the Eric database. We selected and analysed articles written in English since 2012. Using the keywords "e-learning", "learning environment", and "inclusion", our initial search returned 1093

results, so we tried "adult education" and "adult learning" instead, and we've got 27 articles. From these, we selected 6 that directly referred to pedagogical and technical aspects of digital learning environments (Criu & Ceubanu, 2013; Murray & Mitchell, 2013; McDougall, 2015; Mavroudi & Hadzilacos, 2013; Vandenhouten *et al.*, 2014; Hassanein, 2015).

The questionnaire consisted of 12 questions, 9 of which addressed sociodemographic and professional issues. The remaining questions concerned e-learning, in particular the length of experience, the learning management system (LMS) used, the characteristics of an inclusive environment, and considerations regarding actual practice in an e-learning context (What are the characteristics of an inclusive online learning environment? In general, do you consider your practice and your online environment inclusive? Why?).

Regarding the respondents (n =30), 12 (41%) are female and 18 (59%) are male, with ages between 33 and 68 years old, with at least 2 years and a maximum of 20 years of experience with e-learning. They are from Brazil (2), Uruguay (1), Poland (1), Spain (3), Italy (6), Portugal (14), England (1), Ecuador (1) and EUA (1). The individuals are identified as Esp1, Esp2, …

Moodle is the most commonly used LMS (86%) in formal environments (84%), and for among the respondents are teachers, trainers, instructors and e-learning managers.

A qualitative analysis of the data (Bowen, 2009) led to the identification of four potential levels of inclusion, from "exclusive digital learning environments" to "inclusive digital learning environments", in addition to a description of their pedagogical-didactical and technological characteristics.

4 Presentation and discussion of results

This section presents the results of the literature review and questionnaire. The literature review led us to identify aspects to consider in online adult education environments (Table 1).

Table 1

IDE FOR ADULT EDUCATION AND TRAINING

Aspect	Characteristics	Authors' perspective
Design	Planned Student centred Flexible	Need to be planned based on the understanding of how students learn (Criu & Ceobanu, 2013) The design must take prior knowledge into account (Criu & Ceobanu, 2013) and consider how learner is socially and historically situated (McDougall, 2015) There must be a flexibility in terms of course pathways and timetables (Murray & Mitchell, 2013) Take into account student learning style and cultural differences (Hassanein, 2015)

Aspect	Characteristics	Authors' perspective
Activities Interactions	Promote interactions between people, resources and contents Stimulate freedom and autonomy Self-paced Collaborative Ethical concerned	Students must have some freedom and autonomy (Murray & Mitchell, 2013) Respect different learning rhythms (Criu & Ceobanu, 2013) Need of guidance and scaffolding from teacher/tutor (Criu & Ceobanu, 2013) Interactions should be afforded to information in different contexts (Criu & Ceobanu, 2013) Learning situation is created through the co-participation, communication and sharing (Criu & Ceobanu, 2013; McDougall, 2015; Mavroudi & Hadzilacos, 2013; Vandenhouten et al., 2014) Consider social political influences; geographic; learner and cultural diversity; the digital divide; and legal issues (Vandenhouten *et al.*, 2014)
Content Resources	Meaningful Diversified Culturally relevant	Learning needs to be meaningful, have real-world connections (Criu & Ceobanu, 2013; McDougall, 2015)
Evaluation Assessment	Include people, processes and products Formative	The evaluation includes items related to evaluation of people (e.g., E-Learning team members and students), processes (e.g., the design and evaluation of online courses), and products (e.g., course materials) (Vandenhouten *et al.*, 2014) Ongoing formative assessment must be valued (Criu & Ceobanu, 2013)
Technical	Reliable and adaptable hardware and software Competent technical staff	Reliable and adaptable infrastructure is required of the institution including hardware and software as well as competent technical staff (Vandenhouten *et al.*, 2014)

As Table 1 shows, there are several aspects to consider regarding online environment for adult education and training. According to the authors, teachers/tutors have to pay special attention to the environment design, promote interactive and collaborative activities, check the ethical aspects, share meaningful content, diversify resources, provide formative assessment and evaluate people, processes and product. It is also important not to neglect technical workings of the hardware, the software and the user support.

In addition, the analysis of questionnaire responses enabled us to organize the characteristics of an inclusive environment according to pedagogical-didactic and technical issues, some of which lie at the intersection of these two domains, as shown in Figure 2.

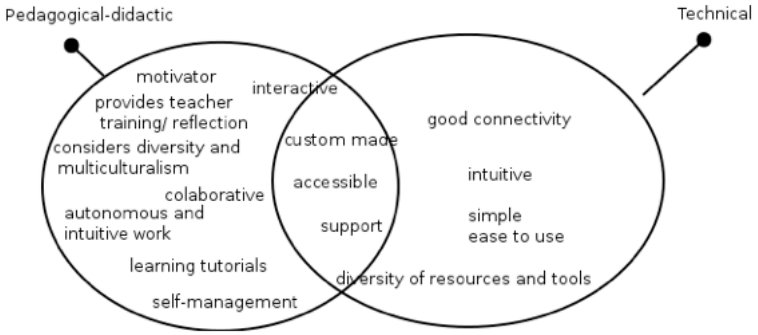

Fig. 2 - Characteristics of an inclusive online environment

As Figure 2 shows, an online inclusive environment combines technical assumptions with pedagogical-didactic choices, which are consistent with the pedagogical differentiation devices.

When asked about their own experience, 16 specialists considered the environment to be inclusive, 4 didn't consider it inclusive, 7 didn't replied and the remaining 3 considered it partially inclusive. The reasons mentioned for considering it inclusive were: the accessibility, the communication (share, dialog, negotiation), the care for everyone, the transparency, the feedback, the multiple pathway to success, the use of different resources, the application of universal design principles and the ability of reaching the students wherever they were (inside or outside the classroom).

To clarify these concepts and the identified characteristics, the literature review, supplemented by the answers to the questionnaire, was performed to insights into the research questions, as described below.

4.1 Which pedagogical-didactical options characterize an IDE as a pedagogical differentiation device?

The literature review and the answers to the questionnaires helped us identify the following pedagogical-didactic characteristics of an IDE: based on a student-centred paradigm and skill development; interactive and collaborative; stimulates self-confidence, motivation, and learning autonomy and self-management processes; promotes reflection and formative assessment.

Regarding the educational paradigm underlying IDEs, the results indicate a preponderance of models focused on learners and on the development of skills, as is made clear in the following statement: "We need to adopt cognitive models and learning theories that foster learning inclusion, to recognize the diversity of

culture and of learning contexts, and design learning and assessment activities consistent with the pedagogical objectives" (Esp8).

In terms of the IDE mediation and interaction processes, several authors (Criu & Ceubanu, 2013; Mavroudi & Hadzilacos, 2013; Vandenhoute *et al.*, 2014) in addition to the interviewees highlight the relevance of different interactions that promote motivation, sharing, collaboration, and a sense of belonging (Esp8, Esp10, and Esp13). Clarke (2008, p.13) points out that motivation is probably the most important factor in learning, especially regarding the "groups who have had poor experiences of education and have considerable doubts about their abilities". In respect of sharing, Esp11 note that IDE: "Fosters inclusion, interaction and dialog among participants with creative results". The interaction between the teacher/instructor and learners/trainees, which is often referred to as support, mentoring, or mediation, appears in issues related to both the content and the use of the digital environment.

Similarly, personalization of digital environments through pedagogical-didactic choices is crucial. Examples of such personalization include the abilities to give individual feedback to learners (Esp26), create specific content for different learning needs and styles (Hassanein, 2015; Criu & Ceubanu, 2013), make room for and value individual participation, know learners and address them by their names, and know, encourage and value the personal and cultural characteristics of each learner (Germain-Rutherford & Kerr, 2014). These references may also include technical issues such as the 'responsiveness' of the environment (meaning the ability to adapt to different devices, for example, smartphones or personal computers), language choices, visual aspects, and the activation or deactivation of sound and animation.

Regarding the promotion of reflection and instruction of both teachers/instructors and learners/trainees, as Cortesão (2012) asserted, it is important to improve teaching practices by questioning and assessing. Esp26 proposed three levels of analysis of online inclusion: "technical (accessibility); social (meaningful and appropriate content for different cultures); pedagogical (flexibility, customization and feedback)".

In line with the above, the pedagogical characteristics also impact and are influenced by technical choices and limitations. This is precisely the focus of the next section.

4.2 Which technical affordances must be present in an IDE?

Both the authors and the experts consulted note the following as the technical affordances necessary for an inclusive environment: connectivity, intuition, diverse multimedia resources in proper working conditions, meeting accessibility requirements and responsive design.

Connectivity may first and foremost mean inclusion or exclusion in digital environments (Eynon & Helsper, 2011). The experts consulted commented on the need for suitable connectivity (Esp 2); and meeting accessibility and usability requirements (Esp1, Esp2, Esp11, Esp7, Esp12, Esp17, Esp21, Esp23, Esp27).

According to Vandenhouten *et al.* (2014), it is also important that institutions have a reliable and adaptable infrastructure and support staff.

4.3 Proposal of a classification for Digital Environments

We propose a Digital Environment classification based on pedagogical and technical factors that is intended to promote reflection regarding the potential of inclusion of digital environments; the taxonomy is summarized in Table 2.

Table 2
DIGITAL ENVIRONMENT TAXONOMY

Level	Focus	Impact
0 – exclusive digital environment	Digital environments that do not take into account the background and learning levels of individuals. Focused on contents and unilateral transmission of knowledge. Suitable for some individuals in specific situations, but excludes a vast majority lacking the "pre-requirements" (specific knowledge, abilities, self-motivation, autonomy) to attend training.	These environments often contribute to digital and social exclusion, as the contents may not be comprehensible and the individual may not feel that he/she is wholly part of the system. Failure and drop-out rates in e-learning are usually high.
1- starting IDE	Digital environments favour the acquisition of technological skills. They are focused on the interaction between the individual and technological resources. They usually have a variety of multimedia resources (image, sound and video) and are supported by tutorials and simulations. They are based on repetition and skills training; the system usually provides automatic feedback.	These environments are important for providing a common base for exercising citizenship in the future, but are not in themselves enough to promote change and social inclusion.
2- on-going IDE	Digital environments that combine work with technologies and with the development of cross-cutting and specific skills in various fields of knowledge. They are carefully planned and structured in advance and are based on constructivist pedagogical models. They also promote systematic interactions with a view to the expected learning outcomes.	These environments are important for creating conditions for the construction of knowledge and may encourage participation in digital cultural contexts.

Level	Focus	Impact
3- IDE	Digital environments that are carefully planned, with a flexible design that combine technological, pedagogical and social components; they provide conditions for access, usage and participation in various contexts through digital means. The information is presented in multiple ways and compatible with different devices. They stimulate freedom and autonomy, motivate, promote different interactions (between people, resources and contents) and co-participation, communication and sharing. These environments are based on the completion of tasks related to real contexts, take individuals into consideration (characteristics, learning style and rhythm). They are customizable, and value the different pathways to learning and solving problems. The ongoing formative assessment is valued.	These environments are fundamental to achieving the millennium goals of promoting overall development with respect of making available the benefits of new technologies, especially information and communication.

As shown in Table 2, the Digital Environments are classified on a scale of 0 = exclusive digital environment to 3 = IDE, with the focus of this article being the characteristics of this fourth level.

As previously mentioned, IDE generally have the following pedagogical characteristics:

- Learning paces:
  IDEs include individual moments and moments in which learning occurs collectively. They respect different learning paces and also give learners the chance to choose the best way to complete a task or to overcome a challenge, individually or with other students.
- Teaching-learning model:
  Teaching strategies are based on the discussion, problematization, organization of ideas and sharing of results. The contents are culturally relevant and stem from different interests and learning needs.

The purpose of assessment is to self-regulate learning, gain awareness of whether the paths chosen are relevant and feasible, and define strategies and new challenges for work in the future.

From a technological standpoint, there is always a "meeting point" shared by teachers/instructors and learners/trainees. Resources are available through social networks, media, LMS, CMS, and cloud computing, among other sources. At times, however, there must be face-to-face contact or an interactive platform (via e.g., an LMS, Facebook, or Google groups) to mediate bilateral communication and constant sharing. The platforms used are responsive and

meet the requirements of usability and accessibility.

Various communication channels are available, all of which are simultaneously producers and consumers. Resources are open, reusable, customized, and adapted to the different sociocultural contexts and are then produced and disseminated by everyone involved. More than being a teaching tool, the media are used as a means of expressing, communicating, constructing, and sharing knowledge.

Conclusions

The intention to base the coming decade of the European Union on intelligent, sustainable and inclusive growth (European Commission, 2010) requires a greater effort in the training of each citizen and an investment in lifelong learning that respects and accounts for the different paths taken in life, collaborating with the development of personal, social, and technological skills.

In view of this challenge, digital environments may contribute to digital inclusion by enabling participation, flexible training, the use of alternative and innovative pedagogies, diversification of communication media, increased individual empowerment and an increased sense of belonging to digital environments. Together, all of these factors should provide appropriate conditions for access, usage and participation in different social contexts through the use of digital resources. They can motivate and promote different interactions taking into consideration individual needs; IDEs also value the different pathways used in learning and solving problems related to the real world.

In short, IDEs may be regarded as pedagogical differentiation devices in that they:

- Ensure the technical conditions to access, and pedagogical conditions for using and participating in digital environments;
- Recognize diversity and multiculturality;
- Require that the teacher/instructor produce resources designed to be used in a specific sociocultural context, for and with a particular category of students;
- Promote a space for interaction, action, and reflection conducive to the construction of learning.

This taxonomy is expected to serve as an instrument that can be used to analyse how digital environments are being designed and used.

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