Introducing a personal learning environment in higher education. An analysis of connectivity

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Abstract

Universities have a key role to play in the progress and development of the Knowledge Society. They should lead the way in the design of teaching strategies that promote knowledge building. Personal learning environments (PLE) represent a groundbreaking new development in educational practices through the incorporation of Information and Communications Technology (ICT), and an opportunity to promote the creation of universities without walls able to meet the demands of the knowledge society.

This study focuses on the relationships established by the participants (students and teachers) in two higher education instructional sequences using institutionally-powered PLE (iPLE). One of the sequences was carried out at the University of Barcelona and the other at the University of Andorra. Both used the same technological support, the *Elgg* platform, which allows users to build their own personal work and learning environment. The main hypothesis of the study is that the relationships formed depend on the techno-pedagogical design of the teaching and learning process.

The results show that in both cases the relationships that the participants establish with their peers and teachers are indeed related to the characteristics and requirements of the particular techno-pedagogical designs. Although the technological environment allowed all the participants to establish relationships with others, the main interactions were found in small working groups created to carry out learning and assessment activities. In conclusion, we stress the importance of planning teaching and learning activities and assessment processes that are able to exploit the full potential of PLE.

Keywords

connectivity indicators; *Elgg*; higher education; personal learning environment; techno-pedagogical design.

I. Introduction

Personal learning environments (PLE) have emerged as a promising new way to respond to the needs of the knowledge society and represent a substantive change in the understanding of the role of ICT in education (Adell & Castañeda, 2010). Many higher education institutions have introduced *institutionally-powered* PLE (iPLE) in their programs (Casquero, Portillo, Ovelar, Romo & Benito, 2010). iPLE are digital environments pre-formed by the institutions that allow students to create and organize their own networks of learning resources, applications and tools in line with their interests and objectives, and to communicate with people engaging in specific learning activities (Adell & Castañeda, 2010; Anderson, 2006; Attwell, 2007; Downes, 2007; Martindale & Dowdy , 2010; van Harmelen, 2008). These environments offer students the opportunity to integrate workspaces and individual and group learning which can be shared to a greater or lesser degree and to connect the learning acquired in formal or informal settings (Hall, 2009).

From a constructivist and sociocultural perspective, learning is conceived as a process of constructing knowledge which is social and shared (Vygotsky, 1979). One of the key concepts of this approach is the concept of educational influence. Systems of shared meanings are constructed thanks to the educational influence of others, that is, to the different kinds of support provided by the participants (the teacher and the other students) in the course of the joint activity (Author 3, Onrubia & Mauri, 2008). In online contexts, just as in classroom settings, the nature and the intensity of the support that students can receive from the teacher and their peers, as well as the possibilities of adjusting this support to the process of construction of knowledge, will depend on their involvement and participation in the joint activity throughout the teaching and learning process (Author 3, 2004).

So, when we analyse teaching and learning processes in iPLE, we are especially interested in the relationships that are created between the participants in these environments. Recent studies have found that the personal networks of students who use iPLE are more densely connected that those of students who use a traditional virtual learning environment (Casquero et al., 2010, 2013). According to these authors, this is because iPLE provide a unique window that allows students to see the activity of all the network participants (Casquero, 2013).

II. Objectives

The present study analyses the relationships between participants (students and teachers) in higher education courses that use iPLE. The assumption is that these relationships depend, to a large extent, on the techno-pedagogical design of the teaching and learning process in which their use is framed. By techno-pedagogical design we understand "a proposal of content, objectives and teaching-learning activities, as well as guidance and tips on how to carry them out; an offer of technological tools; and a number of suggestions and guidelines on how to use these tools in the development of teaching and learning activities" (Author 3, Mauri & Onrubia, 2008, p. 86).

Specifically, this paper has two objectives:

i. To identify, describe and analyse the interaction between participants (students and teachers) in two higher education instructional sequences using iPLE.

ii. To analyse the relationship between the specific techno-pedagogical design of the two instructional sequences using iPLE and the interaction between the participants in these environments.

III. Methodology

In order to achieve these objectives, an exploratory study of an essentially descriptive nature was conducted using a case analysis methodology in a natural context. One case study was carried out at the University of Barcelona and the other at the University of Andorra.

Elgg (www.elgg.com), an open source social network platform that allows users to select and organize resources or widgets in personal and group spaces according to the learners' interests and needs, was used in both cases. The platform, redesigned specifically for this study, offers a wide collection of widgets (files, blog, microblogging, bookmarks, RSS, calendar, photos, videos, news, activity on the platform, wikis, etc.) that can be configured at different public/privacy levels (public for any internet user, only visible to site users, or private, and so on). The platform also allowed students to create different groups with different public/privacy levels. The resulting environment is an iPLE in which participants can create their own PLE by configuring and using the widgets available. They can also connecting their PLE to others, and share resources and tools to create common spaces with other participants.

a. Characteristics of the instructional sequences

<table>
<tr><th colspan="2">Case 1: University of Barcelona</th><th colspan="2">Case 2: University of Andorra</th></tr>
<tr><td colspan="2">Optional course "Virtual learning environments, tools and practices", included in the Master's program in Educational Psychology (University of Barcelona).</td><td colspan="2">Compulsory course "Educational Psychology" included in the Degree program in Educational Sciences (University of Andorra).</td></tr>
<tr><td colspan="4">Date</td></tr>
<tr><td colspan="2">First semester 2011–2012.</td><td colspan="2">Second semester 2011–2012.</td></tr>
<tr><td colspan="4">Participants</td></tr>
<tr><td colspan="2">Fifteen students (12 females and three males) organized activities in four workgroups; three teachers (two males and one female)</td><td colspan="2">Fifteen students (15 females) organized activities in four workgroups; one teacher (female).</td></tr>
<tr><td colspan="4">Format</td></tr>
<tr><td colspan="2">Blended learning</td><td colspan="2">Face-to-face classroom learning</td></tr>
<tr><td colspan="4">Techno-pedagogical design</td></tr>
<tr><td>Spaces and activated widgets</td><td>Planning of instructional sequences</td><td>Planning of instructional sequences</td><td>Spaces and activated widgets</td></tr>
<tr><td>Individual spaces
17 widgets: activity, photo album, friends, files, blog, curriculum, profile description, favorites, groups, my location, RSS, about me, bulletin board, Twitter, videos, wiki
Small work group space
7 widgets: photo album, files, blog, calendar, favorites, photographs, wiki.
Common space (jointly managed by the three teachers)
4 widgets</td><td>In previous in-person session
Presentation by the teachers
• readings and themes for reflection of the main subject ideas (MSI).
• tools and readings on educational uses
Between the two in-person sessions
Individual work
• review readings and themes for reflection:
• review reading and tools
Small group work
• (one group per session) produce a presentation</td><td>Resolution of each problem in four stages:
First stage
Each student individually searches for information on the Internet about the problem posed and produces a summary of the required reading, linking the content to the problem, which they then post on the personal blog in their PLE.
Second stage
Students create a work group in their PLE where they share information about the problem and their personal reflections.</td><td>Individual spaces
24 widgets: activity, photo album, friends, files, blog, calendar, curriculum, profile description, forum, favorites, groups, tag cloud, profile in progress, audio playback, RSS, about me, bulletin board, talk in Messenger, Twitter, Twitscoop, latest photographs, online users, videos, wiki
Small work group spaces
8 widgets: photo album, files, blog, calendar, favorites, forums, videos, wiki</td></tr>
</table>

• file: readings • favorites: links to websites • class group forum • news 2 common widgets for all participants, even if they do not activate them • messaging • microblogging Guidelines • Identify themselves by posting a photo and personal information in their user profile; • configure work and individual learning spaces through a wiki in personal and private spaces; • bridge communication between participants through internal messaging; • share and spread information they have prepared (presentations, summaries, etc.) using other sources, files and favorites; • prepare presentations on the in person sessions in their small work group spaces, forum and/or wiki; • include additions and contributions from unrelated people — such as other students — inviting them to participate in the environment; and • actively participate in class group forums throughout the instructional sequence.	on MSI content and publish it in their PLE; • (one group per session, different from the previous one): produce a presentation of a critical analysis of the uses referred to in the readings and publish it in their PLE. During the in-person session 1. Presentation (40 minutes) of the MSI content by a small work group. 2. Small work group project (30 minutes): contrast between the reflections of the different groups with the previous presentation. 3. General discussion (50 minutes) of the MSI content, moderated by the group who made the presentation. 4. Presentation (40 minutes) of the critical analysis, prepared by the other small work group 5. General discussion (40 minutes) of the critical analysis, moderated by the group who made the presentation. Between one in-person session and the next one (the groups responsible for the presentations) • make a summary of the session and publish it on the PLE public blog; • make a MSI synthesis, incorporating the summary of the session, and moderate a forum in their PLE (participation not mandatory) • make a final synthesis including contributions made to the forum; In the next in-person session • presentations of the final synthesis by the small work group; • MSI closure by teachers	In this group space they discuss the problem, pose possible solutions and create a multimedia product about the proposed solutions agreed on by all group members. Each work group can decide what widgets should be included in its shared space. Third stage During the in-person class, each small work group presented their solutions to the problem to the rest of the class group supported by their multimedia presentation. Fourth stage Each student contributes individually to the class group forum detailing the knowledge acquired in the module and their assessment of the solutions to the problem and the content they work on.	Common space 4 widgets • files: readings, problems proposed, notes, etc. • favourites: links to websites • news • group forum 2 common widgets for all participants, even if they do not activate them • messaging • microblogging Guidelines • Identify themselves by posting a photo and personal information in their user profile; • customize their own profile by selecting and organizing a wide range of widgets, obligatory: activity, blog and those needed to add resources and materials related to the topics of the course; • customize group spaces by selecting and organizing a wide range of widgets that allow students to add resources and materials related to the topics of the course; • discuss the problem posed and possible solutions using the space group forum; • jointly assess the solutions to the problem and the knowledge acquired together with the whole class group.
Final student assessments (percentage of evidence)			
30% participation in the overall dynamics of the class and in forums 30% individual final project 40% presentations in small work group and forum		80% resolution of four problems: • 40% quantity and quality of resources in individual profile • 20% quantity and quality of resources in group space	

moderation	• 20% quality of forum discussions 20% participation in the final assessment session of the project

Source: Adapted from Author 3, Author 2, Author1 & Bustos (2014)
Table 1. Subjects and techno-pedagogical designs

b. Data collection and analysis

Data collection and analysis was performed using a multi-method perspective that combines quantitative and qualitative methodologies.

Activity logs provided by the technology platform were collected in order to perform a structural analysis. Following the lead of other researchers (de Laat, Lally, Lipponen & Simons, 2007; Reffay & Martínez-Monés, 2013; Rienties, Tempelaar, Van den Bossche, Gijselaers & Segers, 2009; Stefanone & Gay, 2008), we used Social Network Analysis (SNA) as a tool to identify and understand the communicative and interactive dynamics established between the participants via the use of their PLEs. On the basis of relatively standardized algorithms, SNA provides a powerful set of concepts, procedures and measures to describe and explain the structures of interaction and participation. Despite the diversity of perspectives on teaching and learning and the diversity of researchers' areas of interest, most of these studies coincide in analysing the *direction* (the patterns of sending and receiving resources or information) and the *strength* (the frequency or volume of the exchanges) of the relationships between participants. The predominant measurements in these studies are the ones concerning the study of the whole network, that is, *density* (the description of the set of connections between the participants) *centrality* (identification of participants occupying central or peripheral positions) and *cohesion* (dyads, cliques or subgroups that have comparatively more intense relations with each other than with the other participants).

In this framework, our analysis of the communicative and interactive dynamics established between participants is based on two decisions (Bustos, 2011). The first relates to the public nature of the communication, i.e., the fact that participants can read all the contributions published. We define the communicative relationships in terms of comments or direct responses made by participants to previous contributions made by other participants. The second is to do with the direction of the communication, which leads us to distinguish between senders and receivers of comments or answers. For example, some widgets, such as files, pages or photos, allow them to provide input and feedback, while others, such as forums or microblogging, also allow participants to respond to contributions made by others. In this way, a set of group and individual indicators is established to capture the frequency of communication exchanges between the participants, in terms of the number of responses received and the number of responses given, and also the extent of their relationships, in terms of the number of different participants with whom they establish contact. More specifically, we use two types of indicators of connectivity: i) group indicators (for the whole class group and for the small groups) and ii) individual indicators (see Table 2).

Indicators of network connectivity
Group indicators (calculated for all class group activities and small work group activities separately)
Network density: defined as the ratio of the relationships established by participants with other participants on the basis of comments or direct answers to the total of possible relationships that could potentially provide responses [n (n-1)]. Network density aims to capture the breadth of relationships or connections created between participants from their direct replies to others. The maximum density (1) is reached when all participants are directly interconnected.
Centrality: the extent to which the network dynamics depends on the activity of certain participants. The degree of centrality is complementary to the network density; network density describes the environment's general level of cohesion, while centrality defines the extent to which cohesion is organized around certain participants (Scott, 1991). If we consider the orientation of communication between participants, we obtain two complementary indicators: network centrality in a) the emission and in b) the reception of relationships. A high value of network centrality in the emission (nearly 100%) indicates that the network depends on the activity of one or a few participants, and a low value indicates that the network is close to behaving like a full mesh network in which all participants are directly interconnected (grade 1%). A high value of network centrality in the reception (close to 100%) indicates that the network depends on the visibility and prominence of one or a few participants, and a low value indicates that the network is close to behaving like a full mesh network in which all participants are directly interconnected (grade 1%).
Individual indicators (calculated separately for common space activities and small work group activities)
Degree of centrality in emission or output (out-degree): this is a measure of the position occupied by a participant in the network according to the relationships s/he establishes with other participants through the messages or comments addressed to him/her. A participant will be more central in emission the larger the number of different participants who direct their messages and comments to him/her, independently of the number of messages or comments that s/he emits. A high value of centrality in emission (nearly 100%) indicates that the participant shows a high degree of involvement in the communication process.
Degree of centrality in reception or input (in-degree): this is a measure of the position occupied by a participant in the network according to the relationships s/he establishes with other participants through the messages or comments received from him/her. A participant will be more central in reception the larger the number of different participants who address messages and comments to him/her, regardless of the number of messages or comments s/he receives. This indicator reflects the prominence and visibility of a participant in the network. A high value of centrality at reception (close to 100%) indicates that the participant is very visible or prominent in the network.

Source: Adapted from Author 3, Author 1 and Bustos (2009) and Bustos (2011 Table 2. Indicators of network connectivity).

Indicators of centrality were calculated following the measures suggested by Freeman (1979), through the standard output level (out-degree) – ties that start from participants – and degree standard input (in-degree) – ties received by participants. In order to calculate all the connectivity indicators, we used UCINET, a software program for analysing data from social networks (Borgatti, Everett & Freeman, 2002). The relationships with subjects external to the community (guests) and the actions undertaken with and by them were also recorded. At the end of the two instructional sequences, a collective assessment session was held with all participating students to complement the quantitative data. These sessions were recorded and transcribed for interpretative analysis.

IV. Results

a. Quantitative results

i. Group indicators

Table 3 shows the values of network density in the two case studies for both the class group and small work group activities. The network density was noticeably higher in case 1 (0.48% vs. 0.27%). In both cases, density ratios were higher in the small work group than in the class group.
Σ

	Network	Group 1	Group 2	Group 3	Group 4
Case 1: UB	0.48%	0.50%	0.83%	0.50%	0.58%
Case 2: UdA	0.27%	0.75%	0.75%	0.33%	0.50%

- The maximum density (1) is reached when all participants are directly interconnected.

- Table 2. Indicators of network connectivity

Next, we calculated the degree of centrality. Remember that this is an additional indicator to the network density: density describes the general level of cohesion in a network, while centrality shows the extent to which cohesion is organized around certain participants (Scott, 1991). Considering the orientation of communication between participants, we calculated two complementary indices of the degree of centrality: network centrality in the emission (out-degree) and network centrality in the reception (in-degree). Table 4 shows the values of these indicators for the two case studies.

	Out-degree	In-degree
Case 1: UB	58.83%	52.21%
Case 2: UdA	83.81%	83.81%

Table 4. Indicators of centrality

In case 1, the network is halfway to behaving as a full mesh network in which all participants are interconnected. By contrast, in case 2 we observe high values for network centrality, both in the emission and the reception, suggesting that network relationships depend on the activity of one or a few participants and that the network is a long way from behaving as a mesh network.

ii. Individual indicators

Table 5 shows the degree of centrality in emission (out-degree) and the degree of centrality in reception (in-degree) of participants in case 1 in the common space activities, based on the messages and comments they have exchanged.

Participants	Out-degree (%)	In-degree (%)
T3	100.00	94.11
T2	100.00	76.48
S13	100.00	64.71
T1	64.71	58.83
S14	58.83	58.83
S07	58.83	47.06
S02	52.94	47.06
S09	47.06	47.06
S08	47.06	41.18
S11	47.06	58.83

S06	29.41	41.18
S04	29.41	29.41
S12	29.41	41.18
S10	23.53	35.30
S01	17.65	23.53
S03	17.65	35.30
S05	17.65	29.41
S15	17.65	29.41

Table 5. Individual indicators in-degree & out-degree, common space, case 1

The two teachers (T2 and T3) and one student (S13) occupied the top positions in both degree of centrality in emission or output (out-degree) and in degree of centrality in reception or input (in-degree). These three participants showed a greater degree of involvement in the communication process, and were also among the most visible or prominent participants in the network. Furthermore, six students (S14, S07, S02, S09, S08 and S11) showed average values both in degree of centrality in emission or output (out-degree) and in degree of centrality in reception or input (in-degree).

As table 6 shows, the results for case 2 coincide to an extent with those for case 1. The teacher (T1) occupied a higher position both in degree of centrality in emission and in degree of centrality in reception, thus showing a high degree of involvement in the communication process, and was also the most visible or prominent participant in the network. As for the students, a high degree of centrality in emission did not always coincide with a high degree of centrality in reception; in general, they showed relatively low levels on both indicators.

Participants	Out-degree (%)	In-degree (%)
T1	100.00	100.00
S07	40.00	26.67
S11	33.33	40.00
S06	26.67	6.67
S08	26.67	40.00
S13	26.67	6.67
S15	26.67	33.33
S02	20.00	6.67
S04	20.00	6.67
S01	20.00	33.33
S09	20.00	33.33
S03	20.00	26.67
S14	13.33	6.67
S12	13.33	6.67
S05	13.33	33.33
S10	6.67	20.00

Table 6. Individual indicators *in-degree* & *out-degree,* common space, case 2

With regard to the individual indicators of connectivity in the small work group activities, table 7 shows the degree of centrality in emission and the degree of centrality in reception of participants in case 1 in the small group activities, based on the messages and comments they exchanged.

Groups	Participants	Out-degree (%)	In-degree (%)
Group 1	S07	100.00	33.33
	S14	66.67	66.67
	S12	33.33	66.67
	S06	0	33.33
Group 2	S08	100.00	50.00
	S011	100.00	100.00
	S03	50.00	100.00
Group 3	S13	100.00	100.00
	S10	33.33	33.33
	S01	33.33	33.33
	S15	33.33	33.33
Group 4	S04	100.00	66.67
	S02	66.67	66.67
	S09	66.67	66.67
	S05	0	33.33

Table 7. Individual indicators *in-degree* & *out-degree,* small work group activities, case 1

In groups 2 and 3, students with a greater degree of involvement in the communication (higher values for the degree of centrality in emission) were usually the most prominent as well (with higher values for the degree of centrality in reception). In groups 1 and 4 this trend is not seen so clearly. There were also two groups with one student who did not issue any comment or message to another member of their small work group (G1: S06 and G2: S05).

Table 8 shows that in the small work group activities in case 2 there was no coincidence between the students with a higher degree of involvement in communication (higher values of the degree of centrality in emission) and the more visible or prominent students (higher values of the degree of centrality in reception).

Groups	Participants	Out-degree (%)	In-degree (%)
Group 1	S06	100.00	0
	S01	66.67	100.00
	S08	66.67	100.00
	S11	66.67	100.00
Group 2	S13	100	0
	S03	66.67	100.00

	S09	66.67	100.00
	S07	66.67	100.00
Group 3	S12	50.00	0
	S14	50.00	0
	S10	0	100.00
Group 4	S02	66.67	0
	S04	66.67	0
	S05	33.34	100.00
	S15	33.34	100.00

Table 8. Individual indicators *in-degree* & *out-degree*, small work group activities, case 2

iii. Relationships with external subjects to the community

Although in both instructional sequences the design of the digital environment allows participants to establish relations with subjects external to the respective class groups, only one subject in case 1 did so. This subject sent a message to two colleagues inviting them to enter the common space; one of them accepted the invitation and became a "friend" of one of the teachers, but from that point onwards did not perform any other action or re-establish communication with the participants.

b. Quanlitative results

In the collective assessment session held at the end of the instructional sequence, case 1 students highlighted the importance given to work in small groups and the low weight assigned to whole class group work and individual work in the design and development of the teaching and learning activities. They proposed that subsequent editions of the course should include activities involving all class members of the group.

In their collective assessment session, students in case 2 highlighted the impact of the assessment process on their activity in the PLE. In their view, actions valued positively in the evaluation process were clearly favored, while others not valued positively or not included in the evaluation – for example, discussing the contributions of other members of the class group who were not part of the same small work group – were carried out less frequently. Likewise, students said that the environment had been designed strictly for studying the particular course subject, and not as a social or leisure environment.

V. Discussion and conclusions

Taken together, these results suggest that the techno-pedagogical design of instructional sequences strongly affects the respective communicative and interactive dynamics and determines, to a great extent, the use that students make of the widgets available in the iPLE to configure their own PLE. In this regard, the components of the design that center on the characteristics and demands of teaching and learning activities and assessment merit special mention.
For example, the higher network density in case 1 (0.48%) can be attributed to the instructional sequence's blended learning format incorporating twice-monthly face-to-face sessions, and also to the fact that the environment allows, and in some activities obliges, the participants to connect with one another. In contrast, the lower network density in case 2 (0.27%) can be attributed to the face-to-face format; students attended two weekly sessions, and had less need of the digital environment to carry out the activities. The existence in case 1 of more activities involving all class group members is also likely to have raised the network density, as is the fact that there were three teachers continuously facilitating and promoting interaction between the participants in the environment, compared with only one teacher in case 2.

In both cases the density indicators were higher in the small groups than in the common spaces, indicating that most interactions in the digital environment occurred between the members of small workgroups. This is probably due to the fact that in both cases the techno-pedagogical design prioritized work in small groups. However, despite this similarity, the two cases show differences in terms of individual indicators of centrality. In two groups in case 1 (G2 and G3) students with a higher degree of involvement in the communication were also the most prominent, but this coincidence was not found in any of the groups in case 2. Once again, the reason for the difference is probably the use of the blended learning format in case 1, which required a higher level of communication and interaction between the participants in the digital environment to carry out group activities; the format in case 2 encouraged members of the small groups to interact with each other through face-to-face activities.

With regard to the indicators of centrality, a greater interconnection was observed between all participants in case 1 than in case 2. The individual results for students' centrality in the common spaces sheds more light on this aspect: while in case 1 one student (S13) had a high degree of visibility and prominence and six other students (S14, S07, S02, S09, S08 and S11) had average rates, in case 2 most students had low levels of centrality both in emission and reception. Once again, this may have been due to the learning format: to carry out the activities planned in the techno-pedagogical design, the blended learning format in case 1 required students to interact more with each other in the digital environment than in the face-to-face format of case 2. Moreover, case 1 includes a common space managed by three teachers who facilitated interactions between the students; in case 2 this common space did not exist, and so students interacted more with their teacher.

The individual results for participants' centrality in the network showed that in both cases the teachers had the highest degree of involvement in the communication process and were the most visible or prominent participants in the network. This finding reflected the thinking behind the respective techno-pedagogical designs, in which teachers' educational influence is regarded as a crucial aspect in the planning and development of the teaching and learning activities.

The results obtained from the activity records and the final assessment sessions show that relations with persons external to the instructional sequences were infrequent (case 1) or non-existent (case 2). Only in case 1 were two people from outside the instructional sequence invited to participate – probably as a result of a recommendation by the teachers, which was included in the syllabus. In fact, in the final assessment session students in case 2 attributed this to the fact that the environment was conceived strictly for course study and not for socializing or for leisure activities.

In summary, although the technological environment allowed communication and interaction between all participants in the instructional sequences and with people outside it, the interactions occurred mainly within the small groups, because the teaching, learning and assessment activities had been designed primarily to be carried out inside this framework. The introduction of iPLE in Higher Education programs allows students to create their own network of resources, tools, and contacts for learning (Casquero, Portillo, Ovelar, Romo & Benedict, 2010), aids the integration of spaces for individual and group work and learning, and promotes the establishment of connections between the learning acquired in formal or informal settings (Hall, 2009). However, the results suggest that, if the full potential of iPLE is to be realized and put to effective use by students, it is not enough to incorporate them in training programs; it is also necessary to design teaching and learning activities and assessment processes that encourage the establishment of relations and interaction between all participants, not just inside small workgroups, as well as between participants and other external sources of learning. Finally, we emphasize the role of the teachers; the more support and guidance teachers offer for implementing the iPLE and for realizing its potential, the greater will be the interconnection between the participants and the easier it will be to access external resources and other sources of learning and use them for the benefit of the training process itself.

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