Tools linked to informal learning: opportunities to strengthen personal learning environments of university students during the times of pandemic

Herramientas asociadas al aprendizaje informal: oportunidades para potenciar los entornos personales de aprendizaje de estudiantes universitarios en tiempos de pandemia

与非正式学习相关的工具：疫情期间改进大学生个人学习环境的机会

Инструменты, связанные с неформальным обучением: возможности для улучшения личной среды обучения студентов университета во время пандемии

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Abstract

Informal learning is gaining relevance for the acquisition of professionally valuable skills. In this sense, ICT in general, and the construction of a personal learning environment (PLE) in particular, become allies to this end. Moreover, they have been key during the times of pandemic when formal education institutions all over the planet have been forced to close. The present study has the objective of describing the tools used by students for the purpose of searching for information, creating content, and sharing and interacting in informal environments. The methodology follows a quantitative approach under a non-experimental and transactional design. A questionnaire is applied to a probabilistic stratified sample (n=1187) comprising university students from different programs at the Universidad Nacional (Costa Rica). The main findings suggest that the search and management of information, in addition to the tools used for sharing and interacting, are the components related to a higher number of digital resources, while being less used in activities related to content creation. Between groups, differences regarding the usage of tools have been detected according to the variables of sex, age and field of study. It is recommended that universities introduce new methodologies, and promote more efficient strategies that enable raising awareness about the relevance of learning with technology, as well as to recognize the contributions of complementary informal learning to formal education. The combination of both aspects will facilitate continuous and permanent learning for the acquisition of professional skills, especially within the framework of the limitations and demands derived by the global pandemic situation caused by the COVID-19.

Keywords: ICT, PLE, Web 2.0, university students, informal learning, higher education.

Resumen

Los aprendizajes informales están cobrando relevancia para la adquisición de habilidades valiosas profesionalmente. En este sentido, las TIC, en general, y la construcción de un entorno personal de aprendizaje (PLE), en particular, se convierten en aliados favorables a tal fin. Sobre todo, han resultado claves en la situación de pandemia que ha obligado al cierre de las instituciones de educación formal en todo el planeta. El presente estudio tiene el objetivo de analizar qué herramientas utilizan los estudiantes para buscar información, crear contenido y compartir e interactuar en los ambientes informales. La metodología responde a un enfoque cuantitativo, bajo un diseño no experimental y transaccional. Se aplica un cuestionario a una muestra probabilística estratificada (n=1187) compuesta por estudiantes universitarios de las diferentes carreras de la Universidad Nacional (Costa Rica). Los principales hallazgos apuntan a que la búsqueda y gestión de información, junto con las herramientas para compartir e interactuar, son los componentes que emplean un mayor número de recursos digitales, siendo utilizadas las TIC en menor medida en las actividades relativas a la creación de contenido. Se han detectado diferencias entre grupos en cuanto al uso de herramientas en función de las variables sexo, edad y área de estudio. Se recomienda, por tanto, que las universidades implanten nuevas metodologías e impulsen estrategias más eficaces que permitan concienciar acerca de la relevancia del aprendizaje con tecnología, así como reconocer los aportes de los aprendizajes informales complementarios a la educación formal. La combinación de ambos aspectos facilitará el aprendizaje continuo y permanente para la adquisición de habilidades profesionales, sobre todo en el marco de las limitaciones y exigencias derivadas de la situación de pandemia mundial provocada por el COVID-19.

Palabras clave: TIC, PLE, Web 2.0, estudiantes universitarios, aprendizaje informal, educación superior.

概要

非正式学习与获得有价值的专业技能日益相关。从这个意义上说，信息通信技术，尤其是个人学习环境 (PLE) 的构建，成为了获得专业技能的有利手段。最重要的是，它们在全球由于疫情正式教育机构被迫关闭的情况下发挥了关键作用。本研究旨在分析学生在非正式环境中使用哪些工具来搜索信息、创建内容以及分享和互动。我们采用了非实验协议的定量方法，对由国立大学 (哥斯达黎加) 不同专业的大学生组成的分层概率样本 (n = 1187) 进行了问卷调查。主要调查结果表明，对信息搜索和管理以及网络共享和交互工具是最常用的数字资源，而在与内容创建相关的活动中使用 ICT 的程度较低。我们在性别、年龄和学习领域变量上发现了使用上述工具的差异。因此，研究建议大学实施新方法并推广更有效的战略，以提高人们对技术学习重要性的认识，并认可非正式学习对正规教育的补充作用。特别是在全球新冠疫情造成的限制和提出的需求下，这两个方面的结合将促进为获得专业技能的持续学习。

关键词: ICT, PLE, Web 2.0, 大学生, 非正式学习, 高等教育。

Аннотация

Неформальное обучение становится все более важным для приобретения профессионально ценных навыков. В этом смысле ИКТ в целом и создание персональной среды обучения (ПСО) в частности становятся благоприятными союзниками в достижении этой цели. Прежде всего, они сыграли ключевую роль в ситуации пандемии, которая вынудила закрыть формальные учебные заведения по всему миру. Цель настоящего исследования - проанализировать, какие инструменты используют студенты для поиска информации, создания контента, обмена и взаимодействия в неформальной среде. Методология отвечает количественному подходу, в рамках неэкспериментального и транзакционного дизайна. Анкета была применена к стратифицированной вероятностной выборке (n=1187), состоящей из студентов различных специальностей Национального университета (Коста-Рика). Основные результаты показывают, что поиск и управление информацией, а также инструменты для обмена и взаимодействия являются компонентами, в которых используется большее количество цифровых ресурсов, при этом ИКТ в меньшей степени используются в деятельности, связанной с созданием контента. Были выявлены различия между группами по использованию инструментов в зависимости от пола, возраста и области исследования. Поэтому университетам рекомендуется внедрять новые методики и продвигать более эффективные стратегии для повышения осведомленности об актуальности обучения с помощью технологий, а также признать вклад неформального обучения в дополнение к формальному образованию. Сочетание обоих аспектов будет способствовать непрерывному обучению на протяжении всей жизни для приобретения профессиональных навыков, особенно в контексте ограничений и требований, возникающих в связи с глобальной пандемической ситуацией, вызванной COVID-19.

Ключевые слова: ИКТ, ПСО, Web 2.0, студенты университета, неформальное обучение, высшее образование.

Introduction

For the past few decades, the importance of Information and Communication Technologies (ICT) in facilitating the multiple activities of social life, and particularly the development of educational processes, has become evident. Due to the pandemic generated by COVID-19, ICT have gained more relevance in many contexts and espe-

cially in the field of teaching, by supplying new channels of interaction between the student body and the educational centers (Salinas, 2020), and enabling the migration of teaching and learning processes onto virtual stages.

Although universities are a part of the group of institutions that represent formal education, and they have been developing a silent technological transformation for some time (Casillas & Ramírez, 2019), they have not been exempted during this sanitary crisis, and they are suffering the devastation caused in each and every teaching system. Thousands of higher educational centers around the world have seen their doors closed, forcing students and teachers to face the adversity brought on by the pandemic in order to carry out the substantive action of education, research and transference that characterizes them. In this sense, multiple technological resources have offered a solution to the problem of space and time, following the closure of educational institutions and particularly universities (Sangrà, 2020).

In this situation, the importance of the students' digital competence becomes evident since they must be prepared to respond to the demands of an information society, as well as to take advantage of the multiple available resources – especially the web 2.0. On the other hand, the importance of informal education as a promoter of desirable abilities in the contemporary society needs to be recognized as well, especially during the COVID-19 era that has required a process of reorganization in the family, and more collaboration between cohabitating people in order to carry out the daily tasks and activities within the different spheres of action: personal, family, social, work, leisure, etc. The pandemic situation can lead to a paradigm shift or, at least, a profound reflection on the prevalence of formal learning that is more regulated and centered on an institution, facing the necessity to stimulate and recognize informal learning where the students are the protagonists and the directors of their own learning.

In this sense, the construction and development of the Personal Learning Environments (PLE) gains importance every time the possibilities offered by them for generating learning through the use of technological resources as well as to favor a decentralization that allows the learning axis to be shifted from a specific institution and a concrete time frame, to give the leading role to the student body itself, are recognized. Through the PLE development, taking advantage of the opportunities of informal learning is fostered, self-directed learning, and an awareness about the need for lifelong education are promoted (Aoki, 2020; González-Sanmamed et al., 2019).

Personal Learning Environments

For a few decades, the concept of PLE has been motive for reflection, debates and research (Castañeda et al., 2019) embodied in a large number of publications (Yen et al., 2020). The prominence of this concept has largely been propelled by the rapid proliferation of technology that not only facilitates information access and management, but also contributes to every user being able to take on an active role in the content creation in multiple formats, as well as its rapid and free dissemination in most cases.

After revising the literature, several perspectives of approaching the concept of PLE can be identified (Gallego-Arrufat & Chaves-Barboza, 2014; Ordaz & González-Martínez, 2020). On the one hand, an approach from a pedagogical aspect is proposed, assuming that learning is a social activity that is developed all throughout life. Despite the fact that educational institutions are the bastion of formal learning, PLE gain a larger importance as they incorporate informal learning and the social dynam-

ics that accompany them, and are being transformed in great measure by ICT usage (Ordaz & González-Martínez, 2020). On the other hand, there is also a more technological meaning of PLE (Sahin & Uluyol, 2016) that centers around the interest in the resources used for the construction and development of the same.

For the present article, the starting point is the concept of PLE proposed by Castañeda and Adell (2013), who define them as a set of tools, activities and interactions that are utilized to learn, as much from a pedagogical as from a technological point of view. In this sense, the construction and development of a PLE raise awareness of learning nourished by the available resources that each person adapts according to the context, and that they are able to use in formal as well as informal spaces. In addition, it is characterized by the possibility of situating the learning axis in the person who is learning (Yen et al., 2019), thereby promoting self-directed lifelong learning (González-Sanmamed et al., 2019).

Three transversal components in PLE are proposed (Castañeda & Adell, 2013). The first one is related to information access, an aspect that becomes especially relevant taking the large quantity of available content into account. Linked to the previous, the possibility of formal and informal training available online is worth mentioning, i.e. MOOC that facilitate flexible and ubiquitous learning, and that not only impact the knowledge acquired by the learner but also their activities, aspirations and abilities (Jung & Lee, 2020).

The second component refers to the tools and strategies for content creation. The offer for this purpose is ample, diverse, and facilitates online dissemination. The use of resources becomes an ally in the development of analysis, creativity and synthesis, as well as feedback by the users, which is conducive to a dialog and continuous improvement (Castañeda & Adell, 2013). Among the more used resources for content creation are blogs and wikis (Ñáñez-Rodríguez et al., 2019). In regards to the blogs, studies like the one by Muñoz-Carril et al. (2020) should be noted, which shows the key variables that intervene in the use of this resource as a learning mechanism: the perceived self-efficacy, the expectations of personal results, the support to improve social bonds, the perception of its utility, the attitude and the perception of happiness and enjoyment.

The third component of PLE lies in those tools and strategies for communicating and disseminating information. The massive use of devices such as tablets and smartphones, as well as the proliferation of multiple resources and apps, among which social networks stand out, demonstrate that we are connected most of the time. These connections can determine the personal knowledge networks (PKN) that are nourished by learning forged in formal but also informal environments. Each person can represent a convergence node (Sangrà & Wheeler, 2013) where the connection networks meet the information and experiences that cross the barrier of space and time.

Informal learning

Learning is being carried out in new forms and taking an unwonted impulse by inserting itself into a dynamic and complex digital ecosystem (Siemens, 2004). In spite of formal education remaining the main focus to learn, there is more and more awareness about the fact that learning, as an inherent human function, is not limited to a concrete cycle, rather it is complemented by types of learning in non-formal and informal modalities (Dai et al., 2020). In other words, the new paradigms, beyond formalizing

the informal (Sangrà & Wheeler, 2013), point to the convenience of putting innovative strategies and methodologies that recognize the importance of these spheres for life-long learning, and the fundamental role ICT play, into practice (González-Sanmamed et al., 2019).

As a response to the current society's tendency to demand from the individuals that they update or even change professions due to the quick rate at which knowledge becomes obsolete (González-Sanmamed et al., 2020), and the subsequent necessity to reform professional training (Sangrà & Wheeler, 2013), international organizations and education policies (García-Martínez et al., 2020) put their faith on the developing abilities that enable the students to adapt to the change; for instance, by self-directing their learning, with elements of formal, non-formal and informal education as the cornerstone.

Informal learning is the one that lacks pedagogic planning and is neither linked to an official educational institution nor to a teacher, where each person decides what to learn according to their interests and their location in a specific context, thus becoming a resource for life (Andreatos, 2007). Informal learning can take place in a casual way but enables the acquisition of skills essential to the professional and personal development (González-Sanmamed et al., 2019). Studies on this topic (Andreatos, 2007) indicate that around 80% of knowledge, abilities and professional practices required for certain jobs come from informal learning.

In this sense, ICT are allies and promoters of informal learning and, beyond being a mere support tool, they are modifying socio-cultural dynamics and human behavior (Dabbagh & Castañeda, 2020). The use of digital open educational resources (OER) or MOOC generates opportunities for this, although the difficulty of detecting real learning due to the particularities of this modality should be noted (Sangrà & Wheeler, 2013). Moreover, the construction and development of a PLE will mean a step towards raising awareness around how and with whom we learn, and enable personal as well as professional growth.

Some studies suggest taking advantage of the potential of ICT to stimulate informal learning at work (Gerards et al., 2020). Additionally, several studies come to the conclusion that university students more often use the resources to access information (García-Martínez & González-Sanmamed, 2017; Tirado & Roque, 2019), search engines and video channels being the most used. The PLE component related to content creation is the least developed one (García-Martínez & González-Sanmamed, 2019; López et al., 2017). This finding is attributed, on the one hand, to the rapidity with which these resources emerge, and on the other hand, to the lack of time or the disinterest to discover them, joined by the still widespread usage of traditional resources that neither facilitate interaction nor help with content dissemination (García-Martínez & González-Sanmamed, 2019).

Other authors (Alves & Ferreira, 2016) create a positive link between social networks and the acquisition of informal learning, highlighting factors such as interaction and collaboration as particular stimulators, though also underlining the infrequent critical analysis of the information shared in them. Previous studies point out that the resources most used by university students to interact and share information are social networks and video channels (García-Martínez & González-Sanmamed, 2020), mobile apps being the most frequent medium (Leiva-Núñez et al., 2018).

Despite the polemic caused by Prensky's (2001) proposal related to the "digital natives", there is a consensus about younger people (below the age of 30) incorporating and accepting ICT more easily into their daily practices (Rocha et al., 2020; Vázquez-Cano et al., 2020) despite the fact that they are not necessarily linked to learning processes (García-Martínez et al., 2016), and on occasion, it is taken for granted that they possess digital competencies just for the mere fact of being young. Several studies demonstrate how young people between the ages of 15 and 24 are positioned more easily as digital experts, in comparison to groups between the ages of 25 and 54, and older than 55 (Sánchez et al., 2015; Sciumbata, 2020). It also becomes evident how age is a positive and significant variable in regards to the perception of utility, the ease of usage and the enjoyment of MOOC (Rocha et al., 2020).

Methodology

After extensively revising the literature, the study was conducted from an empirical-analytic focus, and through an ex post facto design characterized by not manipulating variables, and of a transactional nature due to the fact that the data is obtained in one single moment. The study is of a descriptive nature (Hernández et al., 2014).

Taking the former into account, the general objective of this study is to analyze the use of technological tools that the university students use in their PLE for the development of informal learning. The following research hypotheses were posited:

1. The variable sex causes significant differences in the frequency of ICT usage in informal environments in the PLE components.

2. The variable age generates significant differences in the students' PLE development in regards to the usage in informal environments.

3. There are no significant differences in the resources used in informal environments when it comes to the field of study.

Population and sample

The reference population (N=3165) corresponds to university students in the last year of their program at the Universidad Nacional (UNA) in Costa Rica. A sample (n=1187) of the stratified probabilistic kind was used (Hernández et al., 2014). More precisely, seven strata representing the seven faculties at the UNA were defined, covering 51 different programs. The calculation of the sample was carried out with the formula for finite populations (Arnal et al., 1992): error 3%, reliability level 95% and expected proportion (p=5%).

The average age of the sample is 24 years (SD=4.18) with a range that varies between 20 and 57 years of age. In Table 1, some sample characteristics are presented.

Table 1

Absolute and relative frequencies of the sample

	Man				Woman		
	427 (35.9%)				760 (64.1%)		
	CIDEA	CIDE	Philosophy and Letters	Earth and Ocean studies	Social Sciences	Health Sciences	Natural Sciences
Field of study	60 (5.1%)	235 (19.8%)	186 (15.7%)	69 (5.8%)	316 (26.6%)	118 (9.9%)	203 (17.1%)
Used device	Laptop		PC		Tablet		Smartphone
	982 (82.7%)		78 (6.6%)		15 (1.3%)		112 (9.4%)
Internet connection	Less than 1 hour		1 to less than 3		3 to less than 5		Over 5 hours
	63 (5.3%)		353 (29.7%)		401 (33.8%)		370 (31.2%)
ICT training	Informal face to face		Informal virtual		Secondary school course		University course
	259 (21.8%)		159 (13.4%)		414 (34.9%)		451 (38.0%)

Note. CIDEA: Research Center: Teaching and the Arts; CIDE: Research Center in Teaching and Education.

Data collection techniques and tools

After revising the literature, the one referring specifically to the topic of the study as well as the methodological, the survey technique was decided upon. More specifically, a questionnaire structured in different sections was prepared *ad hoc*. In this paper, the data relating to the section about ICT tools in informal environments is presented. This part included 30 statements in a Likert type scale classified according to the three PLE components: information access, creation and sharing (Table 2). The answer categories vary within a range of 5 points (from 1=never, to 5=always).

Procedure and analysis

The questionnaire was judged by experts to fulfill the validity of the content. Once the first draft was prepared, it was revised by 20 professionals in the field of higher education, research methodology, and education technology. According to the obtained observations and assessments, the first version of the scale was built, which was applied to 45 students of characteristics similar to the final sample during a pilot test. The results of this test corroborated that the scale functioned correctly, as well as allowed an assessment of the items through the first psychometric analyses.

The definitive questionnaire was applied in the classrooms and self-managed. To this end, the students were given the necessary time to answer. When it was handed out, the study was briefly presented by the researcher, and the surveyed were encouraged to read the first page minutely, where they were informed about the different aspects of the study's objective, and the procedure for handling the data. Furthermore, the

voluntary, anonymous and confidential nature of the study was especially emphasized, informing of the possibility to cease participation at any time without the need for a previous explanation. As they were students of age, the informed consent was done orally, and turning in the complete questionnaire implied consent to use the data for the purpose of research.

Once all the questionnaires were collected, a data base with the statistical package SPSS v.21 was generated. Descriptive tests (central tendency measures, variability and distribution) and Cronach's Alpha and Omega internal consistency analyses were conducted, the latter with the program JASP. Subsequently, the Pearson correlation test was conducted with the scale's components. Lastly, analyses to compare the groups were conducted through the MANOCA, ANOVA and Student t test respectively, once the normality (with the Kolmogorov-Smirnov contrast test for different groups) and the homogeneity of variance (with the Levene test) had been proven.

Results

In the following, the main results are presented according the structure posited with respect to the objectives and the hypotheses.

Descriptive analysis of ICT usage frequency in informal learning

In Table 2, a few statistics of the items the scale consists of can be observed. The items have been grouped according to the three components that, according to Castañeda and Adell (2013), have been identified to articulate the proceedings and objectives in which the tools and technological resources subjected to assessment were employed.

In the component relating to information access to foment informal learning, the most used resources are generic search engines with an average of 4.10 (SD=1.24); video tutorial viewing (M=3.96, SD=1.15) and video channels to search for information (M=3.96, SD=1.15). The least used for this purpose are the massive open online courses (M=1.49, SD=1.04), the information management apps (M=1.64, SD=1.12) and the university's own repositories, in this case at the Universidad Nacional in Costa Rica (M=1.93, SD=1.23).

In regards to the component relating to content creation in order to incentivize informal learning, the student body mostly uses text processors (M=3.99, SD=1.25) and the resources for collaborative work (M=3.06, SD=1.55). The least used tools are digital project managers (M=1.43, SD= .87); task managers (M=1.82, SD=1.21) and programs for data analysis (M=1.54, SD= .99).

Finally, for information sharing within the framework of informal learning, the students mostly use mobile messaging apps (M=4.37, SD=1.11); electronic mail managers (M=4.17, SD=1.15) and social networks in general (M=3.98, SD=1.27). The least used apps are social markers (M=1.27, SD= .71) and professional networks (M=1.88, SD=1.22).

Table 2

Descriptive statistics organized by PLE components

	1	2	3	4	5	Total	M	SD	As	Cu
Accessing information										
Blogs, wikis, websites... for reading	96	134	312	325	292	1159	3.50	1.21	-.47	-.65
Video tutorials (Youtube, Vimeo, etc.)	60	70	209	329	485	1153	3.96	1.15	-1.0	.23
Institutional archives	618	198	174	76	70	1136	1.93	1.23	1.14	.20
Video Channels (YouTube, etc.) searching for information	77	68	219	278	520	1162	3.94	1.21	-.99	.05
Advanced search engines (Google scholar, etc.)	250	167	277	198	267	1159	3.06	1.45	-.06	-1.3
"Read later" applications (Pocket, Instapaper, etc.)	794	153	110	48	58	1163	1.64	1.12	1.74	2.04
Massive Open Online Courses (MOOC)	893	110	72	42	47	1164	1.49	1.04	2.21	3.91
Specialist databases in your area of study	286	201	268	204	188	1147	2.83	1.41	.11	-1.2
General search engines (Google, Bing, Yahoo, etc.)	74	75	153	192	640	1134	4.10	1.24	-1.2	.33
Podcast listening tools (SoundCloud, iVoox, Spotify, etc.)	437	103	160	137	326	1163	2.84	1.67	.13	-1.6
Content creation										
Image editors (Photoshop, Gimp, iMovie, etc.)	364	216	281	158	139	1158	2.56	1.37	.37	-1.0
Audio editing tools (Audacity, Adobe Audition, SoundForge, etc.)	621	254	143	81	56	1155	1.87	1.17	1.24	.56
Multimedia creation resources (Prezi, Glogster, Powtoon, etc.)	433	261	218	125	129	1166	2.36	1.36	.64	-.82
Text processors (Word, Write, Wordpad, etc.)	67	101	210	188	596	1162	3.99	1.25	-.95	-.26
SpreaSDheets (Excel, etc.)	307	218	227	159	238	1149	2.83	1.48	.18	-1.3
Digital task managers (Evernote, Trello, WunderList, Google Tasks, etc.)	707	166	141	86	63	1163	1.82	1.21	1.30	.51
Digital project management (MS Project, Basecamp, Gantt PV, etc.)	867	155	89	29	20	1160	1.43	.87	2.23	4.70
Information creation tools (blog, wiki, YouTube)	399	194	230	142	174	1139	2.56	1.45	.41	-1.2

	1	2	3	4	5	Total	M	SD	As	Cu
Data analysis programs (SPSS, Atlas ti, etc.)	818	159	103	43	32	1155	1.54	.99	1.94	3.04
Collaborative document creation (Google Docs, etc.)	277	176	224	139	330	1146	3.06	1.55	-0.2	-1.4
Presentations (Powerpoint, Keynote, etc.).	243	161	217	176	362	1159	3.22	1.52	-.20	-1.4
Sharing information										
Microblogging networks (Twitter, etc.)	427	198	191	155	165	1136	2.50	1.47	.46	-1.2
Networks for gathering and commenting on content (Tumblr, Pinterest, ScoopIt)	404	199	211	150	202	1166	2.61	1.49	.37	-1.2
Professional networks (LinkedIn, etc.)	648	198	162	74	68	1150	1.88	1.22	.07	-.13
General social networks (Facebook, Instagram, Google+)	81	96	172	226	580	1155	3.98	1.27	-1.0	-.13
Mobile messaging (Whatsapp, etc.)	52	50	104	157	781	1144	4.37	1.11	-1.7	2.13
Email, calendar, task, and contact managers, etc. (Outlook, Gmail, etc.)	54	64	167	226	654	1165	4.17	1.15	-1.3	.74
Videoconferencing (Skype, etc.)	483	237	227	112	102	1161	2.24	1.32	.74	-.63
Social bookmarking (Delicious, Diigo, etc.)	962	114	44	16	14	1150	1.27	.71	3.21	5.56
Storing and exchanging files in the cloud (Dropbox, Drive, Box, Onedrive)	166	126	214	215	448	1169	3.56	1.44	-.55	-1.0

Note. n= 1187; response options 1 = "never"; 2 = "almost never"; 3 = "occasionally"; 4 = "almost always"; 5 = "always"; M = mean; SD = standard deviation; As= Asymmetry; Cu= Kurtosis.

Figure 1 shows how 23.8% indicate they never or almost never use resources in informal environments in order to access information; a great percentage (55.7%) occasionally, and the remaining 20.5% indicate they almost always or always use them. For content creation, the percentage of students who never or almost never use them increases (35%); 43.7% do so occasionally and 23.3% almost always or always. In regards to the resources that facilitate content sharing in the context of informal learning, the data reflects that 22.7% always or almost always use them; 56.3% occasionally and 21% never or almost never.

Subsequently, the Pearson correlation test was conducted with the different components. Positive and elevated data is observed in a range between .58 and .62 (Table 3). In regards to the internal consistency analysis, the Cronbach's Alpha as well as Omega coefficient was obtained due to the fact that it was an ordinal scale. In both cases, optimal results were obtained. The moderate scoring with respect to the statistics by

component is worth mentioning. The one relating to information sharing stands out with a higher score (M=2.95, SD= .67), followed by the component information access (M=2.93, SD= .65) and lastly, generating content (M=2.80, SD= .84).

Figure 1

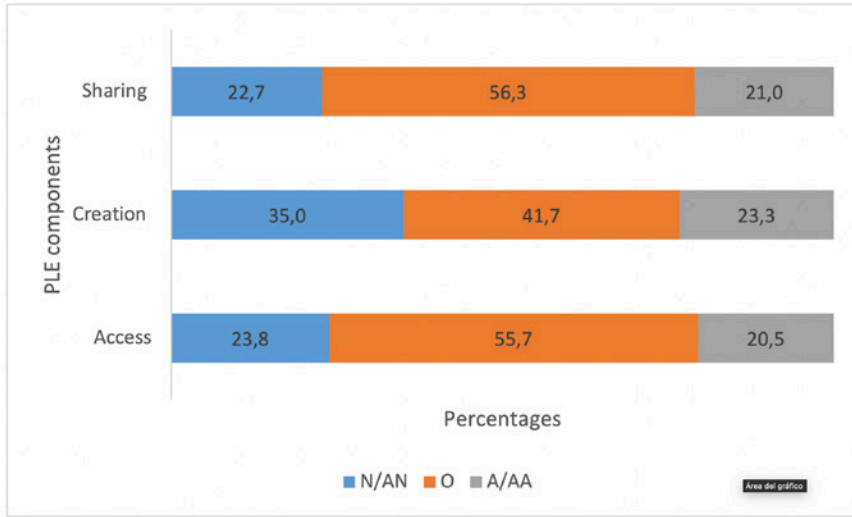*Percentage data of used resources organized by PLE components*

Table 3

Correlation matrix and descriptive statistics for components

	Access	Creation	Sharing	Alfa	Omega	M	SD	As	Cu
Access	1	.614**	.577**	.76	.77	2.93	.65	.06	.24
Creation	.614**	1	.571**	.79	.80	2.80	.84	.06	-.55
Sharing	.577**	.571**	1	.74	.75	2.95	.67	-.27	.22

Note. **The correlation is significant at the level of .01 (bilateral).

Analysis of differences in ICT usage with respect to the variable sex

The Student t test was conducted to identify differences in ICT use in informal environments according to the variable sex. In the first place, the normality was proven with the Kolmogorov-Smirnov contrast test (p> .05) for both groups (men and women), and the homogeneity of variance with the Levene test (p-value> .05). In Table 4, significant differences in the component information sharing are observed, women obtaining higher mean scores than men. On the contrary, significant differences are found in the component information access where men have higher scores. Finally, there are not any differences found in the component content creation.

Table 4

Results of the Student t test with respect to sex

Variable "sex"	Group statistics			T test for equivalence of means		
	Sexo	Mean	SD	t	df	Sig. (bilateral)
Access	M	2.99	.66	1.998	1169	.049
	F	2.90	.65			
Creation	M	2.83	.81	.873	1169	.383
	F	2.79	.85			
Sharing	M	2.81	.70	5.337	1169	.000
	F	3.03	.64			

Note. M= male; F= female

Analysis of differences with respect to the variable age

In order to identify differences in ICT usage in informal environments according to the variable age, two groups were generated following the theory proposed by Prensky (2001) about digital natives. One group is composed by students of less than 30 years of age, and the other one by students of 30 years of age or more. First, Kolmogorov-Smirnov contrast tests were conducted to prove normality, obtaining an insignificant "p" level (p> .05) for both groups ("natives and immigrants"). Moreover, the Levene test (p-value>.05) was conducted to prove the assumption of homogeneity of variances. The data resulting from the Student t test (Table 5) for the comparison of means between groups, shows that the students of less than 30 years of age obtain higher scores in each component. Thus, it can be stated that differences with respect to the variable age in regards to ICT use in each PLE component in informal learning environments exist.

Table 5

Group statistics and results of Student t test with respect to the variable age

Variable "Age"	Group statistics			T test for equivalence of means		
	Edad	Mean	SD	t	df	Sig. (bilateral)
Access	Less than 30	2.94	.65	2.053	1170	.030
	30 or more	2.80	.64			
Creation	Less than 30	2.89	.59	2.121	1170	.029
	30 or more	2.75	.56			
Sharing	Less than 30	2.99	.68	3.762	1170	.000
	30 or more	2.83	.59			

Analysis of differences in ICT usage in informal environments with respect to the variable field of study

In order to analyze the possible differences by field of study (independent variable) in the scale relating to ICT in informal environments, using the latter´s components as dependent variables, a one-way multivariate analysis of variance was conducted between groups. Before the MANOVA analysis for the variable field of study, the homogeneity of covariance was examined using the Box M test. The result (Box M=54.07, F=1.48, p= .003) revealed a violation of the assumption. Therefore, the use of Pillai's Tarce for the analysis of multivariate significance of main effects was decided upon, following the recommendation of Tabachnick and Fidell (2001). The MANOVA revealed a significant main effect for the variable field of study, Pillai's Trace= .061, F (3, 1162), p= .000, $\eta 2$= .020. The posterior univariate ANOVA showed that there are no differences in the components information search [F 6,1166) = 1.371, p=.223] and content creation [F (6,1166) = 2.122, p=.048]. However, there are differences found in the component information sharing [F (6,1166) = 4.957, p=.000], wherein students from the fields of Arts, Education, and Philosophy and Letters obtained higher scores that those in the field of Health Sciences (Table 6).

Table 6

Descriptive statistics (mean and standard deviation) of ICT tools usage with respect to the field of study

	CIDEA		CIDE		Philosophy and Letters		Earth and Ocean studies		Social Sciences		Health Sciences		Natural Sciences	
	M	DT	M	DT	M	DT	M	DT	M	DT	M	DT	M	DT
Access	2.98	.65	2.97	.67	2.99	.64	3.05	.71	2.90	.65	2.87	.62	2.95	.63
Creation	3.01	.89	2.84	.86	2.89	.84	2.73	.99	2.75	.81	2.71	.78	2.90	.79
Sharing	3.13	.77	3.09	.67	3.01	.62	2.84	.68	2.91	.62	2.75	.69	2.91	.71

Note. CIDEA: Research Center in Teaching and the Arts; CIDE: Research Center in Teaching and Education.

Discussion and conclusions

Knowing the tools that the university students in their last year of the program currently use to acquire informal learning becomes relevant for several reasons. The first one is the boom of ICT in education in general, and higher education in particular, where actions can be articulated to shift the paradigm and incorporate innovative methodologies from within the classrooms that not only augment established learning but also the ability to learn to learn, taking advantage of the opportunities offered by the digital society. On the other hand, the PLE development of students in the different fields of university education becomes relevant, especially for those who are soon to finish their studies and integrate into the work force, not only because of the help it will mean for the acquisition of skills for their work (Andreatos, 2007) but also because of the contribution it represents to continuous training and lifelong learning (Aoki, 2020; Dabbagh & Castañeda, 2020).

The data obtained shows how the university students know and use multiple resources within the framework of their PLE for the acquisition of informal learning. This as-

pect becomes relevant facing the exceptional current situation provoked by COVID-19 that has brought the vulnerability of formal education to light (Ali, 2020). In this regard, informal learning, flexible higher education systems, and those that implement methodologies that incorporate ICT are presupposed to be allies in the improvement of learning (Sangrà, 2020). Generally speaking, it is observed (Figure 1), albeit with moderate percentages, that the students use the tools located in each of the PLE components substantially. More specifically, the most developed components are those that enable information access and management (M=2.80, SD= .84), and information sharing (M=2.95, SD= .67). Contrary to that, the least developed component is the one related to content creation (M=2.80, SD= .84). The elevated percentage of students who indicate that they never or almost never use these resources is remarkable (between 22.7% and 35.0%). The results are similar to those obtained in previous studies (Jerez-Naranjo & Barroso-Osuna, 2020; Tirado & Roque, 2019), and the explanation for it probably stems from the fact that certain students maintain their PLE moderately developed. There could be multiple causes for this weakness but the effect caused by the lack of awareness about learning using ICT (Castañeda & Adell, 2013; Sciumbata, 2020) can be mentioned among others, some being accustomed to traditional strategies in the classrooms (Sangrà & Wheeler, 2013) where the use of different web 2.0 resources is not contemplated intensively. This eminently academic cause as well as the remaining digital divide in different levels of society have a negative effect on the acquisition of skills in informal environments, particularly those that could be accessed through the use of technology (Dai et al., 2020). Even though studies like Ali's (2020) indicate that tertiary education is shifting towards e-learning, the students' digital competencies being key to learning with integrated ICT, the obtained data with respect to the multiple resources could mean a detriment to these competencies, which could cast doubt on the higher students' capacity to accompany such dynamics.

The tools the student body uses the most to access and manage information are generic search engines, video tutorial viewing and video channels. Among the least used are MOOC, information management apps, and institutional repositories, similar results to those obtained in other studies about formal environments (Jerez-Naranjo & Barroso-Osuna, 2020). In this regard, it is observed that most students do not efficiently take advantage of ICT to search for information, and more especially to filter and manage it, a highly recommendable aspect considering the amount of available content (Yen et al., 2019). In this sense, it should be underlined how the new paradigms mention that it is just as important to know where we learn (Siemens, 2004) as to know from who and how. MOOC are an example for this, as they are barely used by students, and represent a complement that can effect their knowledge as well as their skills (Jung & Lee, 2020). In these times of pandemic, it becomes more important to develop the component of information access, for it facilitates remote learning, tearing down the barrier of space and time that the closure of the universities has provoked (Sangrà, 2020).

For content creation, the most used resources are text processors, and resources for collaborative work. However, the least used ones are digital project managers, task managers, and data analysis programs, in accordance with other studies (López et al., 2017; Vicent et al., 2017). These limitations can not only lead to a considerable decrease of PLE but also a diminishment of certain desirable skills for the work and personal life, such as the capacity for reflection, synthesis, creativity, planning and organization, among others (Castañeda & Adell, 2013), and that can be developed thanks to the effective use of ICT (Gerard et al., 2020). As has been established, the use of online tools, where the student has an active role, is low. Such is the case with the

moderate use of blogs, even though previous studies (Ñáñez-Rodríguez et al., 2019) emphasize the goodness of these tools as a learning vehicle in formal as well as informal education (Muñoz-Carril et al., 2020).

In order to interact and share information, the participating group mostly use mobile messaging apps, electronic mail managers and social networks, as reported by other similar research (Leiva-Núñez et al., 2018; Vázquez-Cano et al., 2020). However, they do not use, or rarely do so, social markers and professional networks. As previously commented on, this is the most important social component of the PLE (Castañeda & Adell, 2013), without which PKN that promote learning in informal environments, with the possibility of nourishing them with flexible and ubiquitous content and connections (Sangrà & Wheeler, 2013), are not generated. In this regard, several studies alert to the positive effects of social networks where interaction and collaboration predominate (Alves & Ferreira, 2016), as catalysts for informal learning. In the same way, in these times of confinement and distancing, interactions through ICT become indispensable in order to guarantee the presence of the social component in learning (Salinas, 2020), and mitigate possible divides in regards to information access and the connections with different sources of information.

The results from proving the posited hypotheses demonstrate the complete or partial acceptance of the same. The variable sex has generated significant differences in relation to ICT usage in some of the PLE components. More specifically, women obtain higher scores when it comes to sharing and interaction, and men when it comes to information search and management, there being no difference found in content creation. There is no consensus in previous studies with respect to this point, it being common to see diverse and contradictory findings in the literature (Anzano-Oto et al., 2020; Martínez-López et al., 2020).

With respect to the variable age, the data points to significant differences between students below the age of 30 who obtain higher scores in ICT use in each PLE component in comparison to the group of 30 years of age or more. This finding is in accordance with those obtained in other studies (Rocha et al., 2020; Sánchez et al., 2015; Vázquez-Cano et al., 2020), and is in accordance, at least in terms of incorporating ICT into their practices, with the theory proposed by Prensky (2001). Although the literature notes that ICT use by younger students is not necessarily linked to learning processes, at least formal ones (García-Martínez et al., 2016), due to the lack of critical thinking and reflection on the shared content (Alves & Ferreira, 2016), and the little effective use of technology cause by them overestimating their technological abilities, and possessing no knowledge of the same (Sciumbata, 2020).

The data analysis confirms that the variable field of study partially generates significant differences in ICT use for PLE development. There were no differences detected in the components information search and content creation; however, there are some found in the component information sharing. More specifically, students in the fields of Arts, Education, and Philosophy and Letters use tools more frequently than those in the field of Health Sciences. It should be noted that there were no previous studies found with the same population, and that approach these variables. However, we should not lose sight of the fact that ICT competencies are desirable in any discipline, and that they are dynamic and change according to different factors such as the emergence of new resources (Ordaz & González-Martínez, 2020), the fragile stability of certain professions (González-Sanmamed et al., 2019) or the prevailing need to reform professional training (Sangrà & Wheeler, 2013). In this regard, education institutions

are advised to adopt innovative methodologies that incorporate ICT into their curriculum (Yen et al., 2019) from a techno-pedagogical perspective.

The pandemic due to COVID-19 has generated quick and, in some cases, effective responses from the universities (Salinas, 2020). Many of the actions have been carried out thanks to the integration of ICT into the teaching and learning processes, pointing to the barriers and challenges with respect to their application and use.

Building and developing a PLE can help each and every student on a general level. It will particularly be fundamental for those who will imminently incorporate into the work force, for an enriched PLE will represent a necessary support in adapting to the new, complex and changing contexts characterized by the technological proliferation (Dabbagh & Castañeda, 2020). In this sense, raising awareness about personal learning, and simultaneously knowing the contributions of informal learning complementary to formal education, means a big step towards developing continuous and permanent learning that will benefit their skills in the work place and in life.

Taking into account that the collected data refers to the students of one university, it would be interesting to broaden the sample with students from other universities, on a national as well as an international level, making comparisons between contexts possible. Furthermore, it should be underlined that the data was collected previous to the situation provoked by COVID-19. Therefore, it is suggested to conduct the study again, and from a longitudinal perspective contrast the results that could be modified by the migration of the courses into the virtual sphere during 2020.

Acknowledgements

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