The learning management system: Variables that determine its use

Las plataformas de formación virtual: algunas variables que determinan su utilización

http://dx.doi.org/10.18381/Ap.v11n2.1521

Annachiara Del Prete*
Julio Cabero Almenara**

ABSTRACT

Teachers consider the Virtual Learning Environment a technological tool with strong didactic potential. This perception is validated by the frequency of its use both in technical and didactic spheres, which frequently interweave with each other. The main assumption of our research is that those technical and pedagogical competences of the digital tools have promoted the use of the Virtual Learning Environment (AVA) in class causing a change of the methodology used as a result. The study is a non-experimental one but an ex post facto with non-probabilistic sampling. The survey was carried out on a population of 640 teachers of a professional technical higher education institution in Chile. The results showed that, in order to incorporate digital tools into their educational practice, teachers should emphasize the didactic domain of those devices over the technical ones. In conclusion, it has been highlighted that the teaching staff uses AVA mainly to accomplish administrative tasks to the detriment of the didactic use.

Keywords
Higher education, LMS, digital competences, teaching competences

RESUMEN

Las plataformas de formación virtual son consideradas por el profesorado como herramientas tecnológicas con fuertes potencialidades didácticas. Esta percepción viene determinada, entre otras variables, por su frecuencia de utilización, su dominio técnico y didáctico, y por las correlaciones entre ambos dominios, así como la frecuencia de utilización. El supuesto principal de la investigación es que las competencias en el uso técnico y pedagógico de las herramientas digitales, que presenta el profesorado, promueven la utilización del ambiente virtual de aprendizaje (AVA) en el aula y el cambio en la metodología empleada. El estudio es de tipo no experimental, ex post facto con un muestreo no probabilístico. La encuesta se aplicó a una población de 640 docentes de una institución de educación superior técnico profesional de Chile. Los resultados hacen evidente la importancia del dominio didáctico de las herramientas digitales sobre el dominio técnico para que el docente las incorpore a su práctica educativa. Considerando que el profesorado reconoce que posee un mayor dominio técnico que didáctico de estas herramientas, es de comprender el mayor uso del AVA para la realización de tareas de gestión y administrativas.

Palabras clave
Educación superior, LMS, competencias digitales, competencias docentes

Received: October 25, 2018
Accepted: December 17, 2018
Online Published: September 30, 2019

* PhD on Educational Technology by Universidad Rovira i Virgili of Tarragona [University of Rovira i Virgili, Spain]. Researcher by Centro de Investigación en Educación Inclusiva [Inclusive Education Research Center] of the Pontificia Universidad Católica de Valparaíso [Catholic Pontifical University of Valparaíso], Chile.
** PhD on Educational Sciences by Universidad de Sevilla [University of Sevilla], Spain. Professor of the Universidad de Sevilla, Spain.

INTRODUCTION

From the studies and the in-class practices analyzed and carried out in recent years (Pettersson, 2018; Buabeng-Andoh, 2012), we can assert that information and communication technologies (ICTs), open educational resources (OERs) and virtual formation platforms (Learning Management System, LMSs) can have a positive effect on improving efficiency, accessibility and education equity, formation and learning. However, from the same reports, we learn that the introduction of technological tools in classrooms and in educational institutions does not suffice to change the paradigm that learning requires in line with an everchanging sociocultural context and permeated by increasingly complex technologies that modify our everyday life, our relationships and professional performance.

Delgado-García, García-Prieto and Gómez-Hurtado (2018) argue that the pedagogical change will be possible only if the perspective of technological innovation is crossed with the purpose of designing new integrative didactic, alternative and research teaching models (Siemens and Weller, 2011). These models aim at educating to innovate based on the premises of a collaborative, participative and dialogical learning.

Over the last decade, higher education institutions, in order to attend the opportunities and challenges of innovation on teaching learning and assessment processes (Adams *et al.,* 2017), have adopted and integrated LMS in their management and educational practices (Rienties *et al*., 2014; Solano and Abella, 2017; Chaljub, 2019). These systems maximize interaction and collaboration among participants (Vázquez and Burrial, 2017; Yanacón-Atía & Menini, 2018), and promote autonomous and collaborative learning (Alonso, 2018).

While LMSs continue to develope and increase the didactic functionalities of the learning environment with tools that foster collaborative learning (Sinclair & Aho, 2018) and promote changes in the methods and modes of delivery and communication of the curriculum (Park, 2014), the development of its didactic use is being extremely limited even after decades (Rienties *et al*., 2014; Parsons, 2017), and there is no evidence that its use produces changes in the pedagogical practice (Kinchin, 2012).

As confirmed by different studies, the didactic potential of virtual learning environments (AVAs, [Spanish acronym]) in higher education is underutilized which, in many cases, limits their use to simple digital repository of learning objects (López, López and Prieto, 2018). Most teachers use platforms to transmit contents and information and, to a lesser extent, to develop, invent and create innovative educational practices (Del Prete, Cabero and Halal, 2018); a proof of this is provided in the ECAR Study of Undergraduate Students and Information Technology 2017 report (Brooks & Pomerantz, 2017), that points out that 75% of the teachers resort to institutional learning management mainly for tasks such as uploading the course program, publishing material,

delivering grades, requesting and collecting assignments. This leads to the need for teachers to acquire specific competences in virtual learning and gain student-centered training action (Guri-Rosenblit, 2018; Gracias Matosas-López, Aguado-Franco & Gómez-Galán, 2019).

One of the causes of the scarce pedagogical use of ICTs in the classroom lies in the insufficient teacher training, both in technological and pedagogical skills, aspects that must be combined to achieve an effective use of learning technologies (Del Prete and Zamorano, 2015). We can point out that the lack of digital skills creates insecurities and discourages teachers from using them in their practice (Umoru, 2012; Rodríguez, Raso y Ruiz-Palmero, 2019). Our finding is supported by the results of other research studies (Buabeng-Andoh, 2012; Del Prete *et al.*, 2018) that have found a positive correlation between the teachers' technological competences and their self-confidence in managing technologies; hence, these factors are acknowledged as predictors of the use of ICTs in teaching.

This positive correlation is also found in the proposal formulated by Mishra and Koehler (2006) and Koehler and Mishra (2008) in their TPACK (technological pedagogical content knowledge framework), that points out that the training of teachers must have to incorporate their ICTs in their teaching should not be limited to the technological domain but rather also knowing how to use them in methodological and disciplinary terms. In recent years, the TPACK model has raised more interest in educational research (Cabero & Barroso, 2016; Leiva, Ugalde and Llorente, 2018). This model is being applied by teachers in using virtual training platforms (Poitras *et al.*, 2017). It should be mentioned that even though the TPACK model has been validated by applying a structural equation model as a robust and potentially significant model (Ay, Karada & Bahaddin, 2015; Cabero and Pérez, 2018), it has also been criticized on several aspects such as its lack of consideration of the context and microcontext and the difficulty teachers encounter in discriminating interactions established in the model (González, 2017).

Lastly, we agree with Badia, García and Meneses (2017), when they point out that most of the studies about virtual learning environments focus mainly on aspects related to technology, and that little attention has been given to online teachers and their learning approaches; to which we could add the knowledge they have regarding the technological domain and the didactic use they make of technology.

USE OF VIRTUAL ENVIRONMENTS AND TEACHER TRAINING

Among the LMSs, Moodle has been consolidated as one of the learning management tools mostly used at international level (Kerimbayev *et al.*, 2017) and shows high levels of satisfaction among students (Inzunza *et al.*, 2014; Horvat *et al.*, 2015). In addition, the perceptions of the teachers are high in that its use improve their educational practice (Kerimbayev *et al.*,

2017; Jenaro *et al.*, 2018). Likewise, some authors point out that this LMS facilitates the development of a constructivist pedagogy by promoting the action and collaboration among students (Ramos-Pardo, Sánchez y Sánchez, 2012).

It should be kept in mind that to achieve the efficient transfer of knowledge with AVAs, it is necessary that their integration is accompanied by an innovative pedagogical proposal (Pozuelo, 2014). Hence, teachers become key elements since they are responsible of creating contents, planning didactic activities and adopting different tools in developing said activities.

As we have already mentioned, we have found different factors that influence the acceptance of AVAs among which, the degree of management of the tools (Deniz & Algan, 2007), their mastery for educational use and their contextualized application to the different curricular contents. These factors also have a decisive influence on the perception of the usefulness of these technologies and the facility in using them (Celik & Yesilyurt, 2013).

The 2013 European Commission report on innovative teaching states that only 20%-25% of the students are taught by teachers that possess appropriate digital competences. This report underlines that the lack of teaching digital competences for a true "digital pedagogy" translates into the inability of the educational system to give the students the digital competences they need in the 21st century society. Therefore, given the increasing development and change in technology, a permanent process of teacher ICT training is necessary to enable teachers to include ICTs in their teaching-learning process, whether formally or informally (Avello, López y Vázquez, 2016).

Teacher training must not be limited to workshops and training only; permanent accompaniment is also necessary to help teachers identify the tools consistent with their teaching methods, as well as create spaces for the construction of collaborative networks that allow the exchange of knowledge and support for the pedagogical use of ICTs.

For students to present and develop the digital skills necessary to operate efficiently in our current society, teachers must possess the adequate digital competences; hence, teachers must receive good technological training on technological tool management as well as didactic training that provides them with the pedagogical ICTs know-how (Del Prete *et al.*, 2018; Rodríguez *et al.*, 2019) that enables new learning experiences mediated by technological resources (Pozuelo, 2014).

METHODOLOGY

DESIGN AND OBJECTIVE OF THE RESEARCH

Our study is non-experimental, *ex post facto* (Mateo, 2012), with a non-probabilistic convenience or casual sampling (Sabariego, 2012) that is determined by the facility the researcher has to access the subject sampling. The main assumption of this study is that the competences in the technological and pedagogical use of digital tools presented by teachers foster the use of AVAs in the classroom and the change in the methodology being used.

The research sample consisted of 640 professors of the different campuses of the Universidad Tecnológica de Chile INACAP [The Technological University of Chile] who represent 12.23% of the population among which 231 (36.09%) were male and 409 (63.91%) female. The vast majority (f=565, 82.12%) work in the in-class modality, followed at a considerable distance of 16 (2.52%), working in the online mode.

The instrument for the collection of information consisted of 16 items referring to different tools incorporated in the Moodle platform which teachers had to assess from 1 (very little) to 10 (very much), its frequency of use, the perception they had in regard to their degree of technological mastery and their didactic management.

This instrument showed a reliability index of 0.932 obtained through the Cronbach Alpha, as well as a total item correlation in case the elimination of an item would raise the reliability of the instrument. The analyses conducted have allowed us to infer that the reliability index of the instrument is high (O´Dwyer & Bernauer, 2014) and that it was not necessary to discard any item to raise the global reliability of the instrument.

RESULTS OF THE RESEARCH

One of the questions in our questionnaire analyzed in this article related to knowing whether teachers had used the AVA of the institution (Moodle) in the previous year, showed that 585 professors indicated that they had resorted to AVAs in the their didactic practice, in comparison to 56 who had not.

Based on this data, we inquired whether using or not the platform and its different tools could be related to the technical and didactic mastery teachers reported possessing as self-perception of the skill; and similarly, if the frequency at which they used the platform was marked by the technical and didactic mastery they had indicated having.

First, we showed the mean values and the typical deviations reached (See Table 1) for the three factors analyzed (technical proficiency, didactic proficiency and frequency of use). We considered the entirety of the tools presented. The correct interpretation must take into consideration that the scale offered was from 0 (none) to 10 (a lot).

Table 1. Mean values and typical deviation

		M	Typical deviation
Technical proficiency	Yes	6,3876	2,5827
	No	5,3310	2,7423
Didactic proficiency	Yes	5,8587	2,5318
	No	4,5554	2,5093
Utilization frequency	Yes	5,2317	2,4796
	No	4,3690	2,7411

Source: Self development.

The analysis of the results presented point out to two main aspects: first, that the mean values are higher in all cases in which the teachers indicated having used AVAs in their last year of teaching practice and, second, that the typical deviations are high, which suggests a dispersion of the self-assessment made.

In order to know if these differences would be significant from a statistical standpoint, we applied the Student t in independent samples and, at the same time, the Levene statistic to determine the value we would select according to the equality of variances. Table 2 shows the values obtained. The hypotheses we formulated in all the cases were:

- Null hypothesis (H0); there is no significant differences between the teachers who indicated they had used AVA in the last year and the technical, didactic proficiency and frequency of use of said tools, with alpha risk of error of 0.05.

- Alternative hypothesis (H1): there are significant differences between the teachers who indicated having used AVA in the last year and the technical, didactic proficiency and frequency of use of said tools, with alpha risk of error of 0.05.

	Levene equality of variances test	**t test for equality of means**

		F	Sig.	t	GL	Sig. (bilateral)
Technical proficiency	Assumption of equal variances	.651	.420	2.512	568	.012**
	No assumption of equal variances			2.386	45.672	.021
Didactic proficiency	Assumption of equal variances	.000	.984	3.237	567	.001**
	No assumption of equal variances			3.213	47.648	.002
Utilization Frequency	Assumption of equal variances	.893	.345	2.292	599	.022*
	No assumption of equal variances			2.107	53.890	.040

Table 2. Levene test and Student t test

Notes:
Sig = level of significance
gl = degree of freedom
* significant at p≤0.01
** significant at p≤0.05

As results of the analysis of the data shown in Table 2, we found that for the three factors examined, the Levene test showed the assumption of the equality of variances. On the other hand, in the three cases, the H0 formulated with an alpha risk of error of 0.01 was rejected while the H1 in technical and didactic proficiency and the 0.05 frequency of use were accepted. Based on these results, we concluded that the use of AVA in the last year is related to the technical and didactic proficiency the teachers claimed having of the tool, at the same time as having used AVA in the last year is related to the higher frequency of its use.

With this overview, we will now analyze if there are statistically significant differences in the proficiency and frequency of use regarding the tools

incorporated in the virtual platform. Table 3 shows the means and typical deviations obtained.

Table 3. Calculation of the mean and typical deviations

		Technical proficiency		Didactic proficiency		Utilization frequency	
		M	DT	M	DT	M	DT
e-mail	No	8.82	1.805	7.82	2.629	7.96	2.898
	Yes	9.30	1.432	8.31	2.339	9.02	1.920
Forums	No	5.24	3.925	4.23	3.213	3.65	3.228
	Yes	6.48	3.410	5.78	3.334	4.29	3.233
Blog	No	4.41	3.794	3.14	2.850	2.50	2.700
	Yes	4.67	3.524	4.13	3.326	2.56	2.502
Wiki	No	3.71	3.398	2.97	2.726	2.29	2.420
	Yes	4.69	3.501	4.20	3.346	2.66	2.606
Tasks (remittance of files for grading or feedback)	No	5.77	3.679	5.43	3.610	4.76	3.574
	Yes	7.78	2.962	7.50	3.025	6.88	3.262
Glossary	No	4.22	3.077	3.47	2.688	3.03	2.723
	Yes	5.37	3.615	4.64	3.476	3.40	3.137
Videos (YouTube, Vimeo, etc.)	No	5.58	3.469	5.11	3.241	4.33	3.310
	Yes	7.01	3.381	6.50	3.393	5.57	3.411
	No	4.13	3.508	3.09	2.493	2.24	2.443

Videoconference/ audioconference	Yes	4.47	3.584	3.96	3.382	2.59	2.670
Online questionnaires	No	4.37	3.911	3.75	3.333	2.93	3.282
	Yes	5.19	3.733	4.84	3.658	3.32	3.173
Co-evaluations (you assess your peers and they assess you)	No	3.97	3.647	3.27	3.253	2.34	2.689
	Yes	4.63	3.578	4.36	3.504	2.87	2.879
Consultations or surveys	No	3.71	3.398	3.16	2.919	2.83	2.971
	Yes	5.38	3.651	4.94	3.566	3.67	3.236

Notes:
M= mean
DT= typical deviation
Source: Self development.

Different aspects can be highlighted from the previous table, e.g., the mean scores of the means of teachers who indicated they had used AVA in the year in course are higher in the technical proficiency than in the didactic one, in the totality of the tools. The data show that means of teachers that have resorted to AVA in the last year are higher to the means of teachers that did not.

In order to analyze if significant differences had been established at a statistical standpoint between the use of the different tools and the technical, didactic proficiency and the frequency of use of AVAs, we applied once more the Student t for independent samples. The hypothesis formulated swung in the same direction as the one presented previously.

As for the technical proficiency, the statistics obtained are included in Table 4.

Table 4. Independent sample test, technical mastery

		F	Sig	t	GL	Sig. (bilateral)
e-mail	Assumption of equal variances	7.392	.007	-1.963	553	.050
	No assumption of equal variances			-1.609	41.695	.115
Forums	Assumption of equal variances	2.738	.099	-1.871	475	.062
	No assumption of equal variances			-1.653	30.799	.108
Blog	Assumption of equal variances	.930	.335	-.370	419	.712
	No assumption of equal variances			-.347	31.679	.731
Wiki	Assumption of equal variances	.148	.701	-1.507	422	.132
	No assumption of equal variances			-1.546	35.214	.131
Tasks (remittance of files for grading or feedback)	Assumption of equal variances	8.048	.005	-3.806	524	.000
	No assumption of equal variances			-3.155	37.209	.003**
Glossary	Assumption of equal variances	4.985	.026	-1.756	435	.080
	No assumption of equal variances			-2.015	38.098	.051*
Videos (YouTube, Vimeo, etc.)	Assumption of equal variances	.590	.443	-2.508	495	.012**
	No assumption of equal variances			-2.454	43.027	.018
Videoconference / audioconference	Assumption of equal variances	.302	.583	-.520	411	.604
	No assumption of equal variances			-.529	36.650	.600
Online questionnaires	Assumption of equal variances	.300	.584	-1.235	441	.218
	No assumption of equal variances			-1.187	39.501	.242

Co-evaluations (you assess your peers and they assess you)	Assumption of equal variances	.002	.969	-.983	416	.326
	No assumption of equal variances			-.967	34.788	.340
Consultations or surveys	Assumption of equal variances	1.274	.260	-2.464	437	.014**
	No assumption of equal variances			-2.620	35.472	.013

Notes:
Sig = level of significance
gl = degree of freedom
* significant at p≤0.01
** significant at p≤0.05 –
Source: Self development.

Hos are rejected only in the following cases: tasks (remittance of files for grading or feedback), glossary, videos (YouTube, Vimeo, etc.) and consultations or surveys, at different levels of rejection (at p≤0.05 and at p≤0.01). These differences can be explained for different reasons: the tools complexity (glossary and surveys), the unreliability of the teachers in collecting works and activities carried out by the students through AVAs (tasks), as well as the non-utilization of these didactic resources in their teaching practice (YouTube).

Ho has not been rejected in the following cases: e-mail or forums which are of common use among teachers, regardless of whether they resort or not to AVAs. In all cases and not only in those we have observed statistically significant differences, these were significant in favor of those that did use AVAs.

After presenting the data of the technical proficiency, we will address those of the didactic mastery. Table 5 shows the Levene statistics and the Student t for independent samples regarding the didactic proficiency perceived by teachers. Once again, Ho will be formulated in the same previous terms.

Table 5. Independent sample test, didactic mastery

		Levene equality of variances test		t test for equality of means		
		F	Sig	t	GL	Sig. (bilateral)
e-mail	Assumption of equal variances	1.352	.245	- 1.237	548	.216
	No assumption of equal variances			- 1.119	41.464	.270
Forums	Assumption of equal variances	.286	.593	-2.464	465	.014*
	No assumption of equal variances			-2.545	33.434	.016
Blog	Assumption of equal variances	2.134	.145	-1.556	34.064	.121
	No assumption of equal variances			-1.777	31.679	.085
Wiki	Assumption of equal variances	4.061	.045	-1.990	412	.047
	No assumption of equal variances			-2.368	37.717	.023*
Tasks (remittance of	Assumption of equal variances	5.481	.020	-3.958	521	.000

files for grading or feedback)	No assumption of equal variances			-3.401	39.945	.002**
Glossary	Assumption of equal variances	6.431	.012	-1.866	420	.063
	No assumption of equal variances			-2.319	40.030	.026*
Videos (YouTube, Vimeo, etc.)	Assumption of equal variances	.988	.321	-2.379	492	.018**
	No assumption of equal variances			-2.475	41.270	.018
Videoconference / audioconference	Assumption of equal variances	9.451	.002	-1.423	400	.155
	No assumption of equal variances			-1.836	41.562	.074
Online questionnaires	Assumption of equal variances	3.069	.081	-1.721	430	.086
	No assumption of equal variances			-1.714	412	.087
Co-evaluations (you assess your peers and they assess you)	Assumption of equal variances	2.048	.153	-.983	38.723	.076
	No assumption of equal variances			-1.825	34.788	.340

Consultations or surveys	Assumption of equal variances	4.421	.036	-2.749	432	.006
	No assumption of equal variances			-3.259	38.760	002**

Notes:
Sig = level of significance
gl = degree of freedom
* significant at p≤0.05 –
** significant at p≤0.01
Source: Self development.

Table 5 shows cases in which the H0 formulated with the following tools have been rejected: forums, Wiki, tasks (remittance of files for grading or feedback), glossary, videos (YouTube, Vimeo, etc.) and consultations or surveys.

The levels of rejection have been different as observed in the Table above. We can infer that teachers who had use the different tools the most were those that indicated a greater didactic mastery of AVAs.

On the other hand, we noticed that the tools that did not show significant differences were due to two fundamental reasons: the common use of the tool (e-mail) or the little use by the teachers (blog, videoconference, online questionnaires and consultations or surveys).

We also analyzed whether there were or not significant differences from a statistical standpoint between the teachers that had used AVA and the frequency of use of different tools. Table 6 shows the values the Leven test and the Student t casted for independent samples.

Table 6. Independent sample test, didactic proficiency

		Levene equality of variances test		t test for equality of means		
		F	Sig	t	GL	Sig. (bilateral)
e-mail	Assumption of equal variances		.000	-3.445	591	.001
	No assumption of equal variances			-2.445	48.378	.018*

Forums	Assumption of equal variances	.042	.839	-1.110	465	.267
	No assumption of equal variances			-1.112	38.388	.273
Blog	Assumption of equal variances	.110	.740	-.131	392	.896
	No assumption of equal variances			-.123	35.865	.903
Wiki	Assumption of equal variances	1.480	.225	-.823	395	.411
	No assumption of equal variances			-.875	41.998	.387
Tasks (remittance of files for grading or feedback)	Assumption of equal variances	1.283	.258	-4.019	535	.000**
	No assumption of equal variances			-3.721	46.92	.001
Glossary	Assumption of equal variances	1.801	.180	-.690	406	.490
	No assumption of equal variances			-.775	46.080	.442
Videos (YouTube, Vimeo, etc.)	Assumption of equal variances	1.049	.306	-2.253	485	.025*
	No assumption of equal variances			-2.310	49.581	.025
Videoconference / audioconference	Assumption of equal variances	1.209	.272	-.749	383	.455
	No assumption of equal variances			-.804	45.653	.425
Online questionnaires	Assumption of equal variances	.092	.762	-.760	418	.448
	No assumption of equal variances			-.740	48.446	.463
Co-evaluations (you assess your peers and they assess you)	Assumption of equal variances	2.440	.119	-1.035	395	.301
	No assumption of equal variances			-1.095	41.903	.280

Consultations or surveys	Assumption of equal variances	2.621	.106	-1.490	425	.137
	No assumption of equal variances			-1.599	43.018	.117

Notes:
Sig = level of significance
GL = degree of freedom
* significant at p≤0.05 –
** significant at p≤0.01
Sorce: Self development.

In this case, the H0 has been rejected only in the e-mail, videos (YouTube, Vimeo, etc.), and in the tasks (remittance of files for grading or feedback) with an alpha risk of error of 0.05 in the first and in the third cases, as well as in the 0.001 in the second. The reason for the higher frequency of use in the case of e-mail and tasks is that these are activities strongly associated with the use of a platform.

Lastly, we analyzed whether there was a relation between the different proficiencies studied and the AVA frequency of use; hence, we applied the Pearson correlation coefficient and obtained the values shown in Table 7.

Table 7. Relation between the technical proficiency and didactic proficiency with utilization frequency AVA

Domain	Correlation	Sig
Technical proficiency	0.448	.029*
Didactic proficiency	0.419	.014*

Notes:
Sig = level of significance
* significant at p≤0.05 –
Source: Self development.

The values obtained allow us to point out three aspects: the establishment of moderate relations between the variables related; the relations are positive; hence, when the variables raise, the other does it in the same direction and that the relations found are significant at p≤0,05.

CONCLUSIONS, LIMITATIONS AND FUTURE LINES OF RESEARCH

The first conclusion of our study is that, in general, the use of AVA and more specifically of Moodle, has become a technology strongly used by teachers, fact that has been reinforced by comments of different authors

(Chávez and Verdezoto, 2018; Kerimbayev *et al.*, 2017; Solano and Abella, 2017). In other words, teachers consider LMSs as technological tools that have strong potentialities of being incorporated in teaching. Now, this initial perception has been determined by its frequency of use among other variables, for the technical and didactic proficiency teachers claim having as shown in this study given the correlations that exist between both proficiencies and the AVAs frequency of use.

This suggests the need to establish teacher training plans to incorporate LMSs in teaching, plans, that according to the proposal of Mishra and Koehler (2006) and Koehler and Mishra (2008) in their TPACK model, must go beyond the instrumental training and reach other dimensions, preferably didactics since our research reveals that teachers have higher perceptions regarding the technical proficiency and their proficiency for the educational use of AVA and its tools. This aspect seems to be a constant, whether the teachers carry out their professional activities in a face-to-face or a virtual mode (Chávez and Verdezoto, 2018).

Teachers who are the subject of study of this paper, show different technological and didactic proficiencies according to the different technologies incorporated in AVAs, their training in blog, wikis, videoconference/audioconference, online questionnaires and consultations or surveys is particularly necessary, above all when some of these tools enhance the development of collaborative learning.

The didactic proficiency, among the two proficiencies mentioned, is the most significant for teachers to incorporate the tools in their educational practice. Even if teachers possess a high technical proficiency, an important number of teachers do not incorporate the tools AVA offer them in their professional practice given their low didactic training.

It is possible that the tools are not used for a number of reasons such as the complexity of the platform, consider that the tool does not offer opportunities of educational use, or the beliefs or attitudes that teachers have toward this technology.

Lastly, most of the uses we have found indicate that teachers make use of the platforms as repositories of learning objects or information collection of students; i.e., exclusive uses of transmitters of information and remittance of grades and administrative clarifications (Brooks & Pomerantz, 2017).

Our research suggests a series of actions that, given its relation to other studies, can perfectly be transferred to other contexts; more specifically, we can point out at:

- The need to train teachers in using ICTs in general, and in particular AVA, before incorporating these tools in their educational practice.

- The implementation of training models in the use of ICTs in the classroom for teachers seeking a more pedagogical than technological training; in this case, models such as the TPACK may suggest proposals for this.

- The design of AVA environments so teachers can select the tools that, according to their beliefs, they consider important to their educational practice.

This research presents a series of limitations that must be considered when interpreting the results:

- The study has been tackled with the self-reporting technique

- The sample has been narrowed down to a concrete context.

- The type of sample used, for convenience, has a series of limitations from the methodological standpoint.

As actions of improvement for the incorporation of Moodle, our research suggests different aspects:

- Train teachers to master the didactic more than the technological use of tools.

- Not incorporate a platform without first implementing training actions.

- Incorporate usual tools of the platforms that are being generated from Web 2.0

- There is a strong differentiation in the frequency of use of the tools teachers mobilize on the platform.

As, future lines of research, we propose the following:

- Replicate the research in other contexts, national as well as international.

- Since one of the limitations is to have worked with self-perceptions and self-assessments offered by teachers regarding the technical and didactic mastery, it would be convenient to replicate the study with other methodologies such as non-participative observation, learning analytics, through the assessment of activities carried out by teachers within the platform, as well as the execution of tasks by teachers and the assessment of the quality of execution.

Relate the technical proficiency, didactic proficiency and frequency of use of ICTs with the beliefs teachers have of said tools.

REFERENCES

Adams, S.; Cummins, M.; Davis, A.; Freeman, A.; Hall, C. G. & Ananthanarayanan, V. (2017). *NMC Horizon Report: 2017 Higher education edition*. Austin, Texas: The New Media Consortium.

Alonso, M. (2018). Percepción estudiantil sobre la calidad de un ambiente de aprendizaje mixto apoyado por Moodle. *Pixel-Bit. Revista de Medios y Educación,* vol. 53, pp. 193-205.

Avello, R.; López, R. y Vázquez, S. (2016). Competencias TIC de los docentes de las escuelas de Hotelería y Turismo cubanas. *Universidad y Sociedad*, vol. 8, núm. 1, pp. 63-69.

Ay, Y.; Karada, E. & Acat, M. (2015). The Technological Pedagogical Content Knowledge practical (TPACK Practical) model: Examination of its validity in the Turkish culture via structural equation modeling. *Computers & Education,* vol. 88, pp. 97-108.

Badia, A.; Garcia, C. & Meneses, J. (2017). Approaches to teaching online: Exploring factors influencing teachers in a fully online university. *British Journal of Educational Technology,* vol. 48, núm. 6, pp. 1193-1207. doi:10.1111/bjet.12475.

Brooks, D. C. & Pomerantz, J. (2017). *ECAR Study of Undergraduate Students and Information Technology*. Louisville, CO.

Buabeng-Andoh, C. (2012). An exploration of teachers' skills, perceptions and practices of ICT in teaching and learning in the ghanaian second-cycle schools. *Contemporary Educational Technology,* vol. 3, núm. 1, pp. 36-49.

Cabero, J. & Barroso, J. (2016). ICT teacher training: A view of the TPACK model/Formación del profesorado en TIC: una visión del modelo TPACK. *Cultura y Educación,* vol. 28, núm. 3, pp. 633-663.

Cabero, J. y Pérez, J. L. (2018). Validación del modelo TAM de adopción de la realidad aumentada mediante ecuaciones estructurales. *Estudios sobre Educación,* vol. 34, pp. 129-153.

Celik, V. & Yesilyurt, E. (2013). Attitudes to technology, perceived computer self-efficacy and computer anxiety as predictors of computer supported education. *Computers & Education*, vol. 60, núm. 1, pp. 148-158.

Chaljub, J. (2019). La plataforma digital Seesaw: su integración en una clase dinámica. *Pixel-Bit. Revista de Medios y Educación*, vol. 54, pp. 107-123.

Chávez, V. A. y Verdezoto, R. H. (2018). Importancia de las herramientas y entornos de aprendizaje dentro de la plataforma e-learning en las

universidades de Ecuador. *EDUTEC Revista Electrónica de Tecnología educativa,* vol. 65, pp. 68-92. dx.doi.org/10.21556/edutec.2018.65.1067

Del Prete, A.; Cabero-Almenara J. y Halal, C. (2018). Motivos inhibidores del uso del Moodle en docentes de educación superior. *Campus Virtuales. Revista científica Iberoamericana de Tecnología Educativa,* vol. 7, núm. 2, pp. 69-80.

Del Prete, A. y Zamorano-Huerta, L. (2015). Formación inicial del profesorado de educación básica en Chile: reflexiones y análisis sobre las orientaciones curriculares en TIC. *Revista de Pedagogía,* vol. 36, núm. 99, pp. 91-108.

Delgado-García, M.; García-Prieto, F. J. y Gómez-Hurtado, I. (2018). Moodle y Facebook Moodle and Facebook as virtual learning teaching tools of mediation: The opinion of teachers and university students. *Revista Complutense de Educación,* vol. 29, núm. 3, pp. 807-827.

Deniz, L. & Algan, C. (2007). Validity and reliability studies of the Information and Communication Technologies (ICT) self-efficacy scale in education. *Journal of Education Sciences*, vol. 25, núm. 25.

González, F. (2017). De la era de la perplejidad a la era de las oportunidades: finanzas para el crecimiento. En BBVA. *La era de la perplejidad. Repensar el mundo que conocíamos* (pp. 8-39). Madrid: Taurus.

Guri-Rosenblit, S. (2018). E-Teaching in Higher Education: An Essential Prerequisite for E-Learning. Journal of New Approaches in Educational Research, vol. 7, núm. 2, pp. 93-97. doi: 10.7821/naer.2018.7.298

Horvat, A.; Dobrota, M.; Krsmanovic, M. & Cudanov, M. (2015). Student perception of Moodle learning management system: A satisfaction and significance. *Interactive Learning Environments,* vol. 23, núm. 4, pp. 515-527. doi: 10.1080/10494820.2013.788033

Inzunza, B.; Rocha, R.; Márquez, C. & Duk, M. (2014). Asignatura virtual como herramienta de apoyo en la enseñanza universitaria de ciencias básicas: implementación y satisfacción de los estudiantes. *Formación Universitaria,* vol. 5, núm. 4, pp. 3-14.

Jenaro, C.; Martín, M. E.; Castaño, R. y Flores, N. (2018). Rendimiento académico en educación superior y su asociación con la participación activa en la plataforma Moodle. *Estudios sobre Educación,* vol. 34, pp. 177-198.

Kerimbayev, N.; Kultan, J.; Abdykarimova, S. & Akramova, A. (2017). LMS Moodle: Distance international education in cooperation of higher education institutions of different countries. *Educ Inf Technol,* vol. 22, pp. 2125-2139. doi: 10.1007/s10639-016-9534-5.

Kinchin, I. M. (2012). Avoiding technology-enhanced non-learning. *British Journal of Educational Technology,* vol. 43*,* núm. 2, pp. E43–E48. doi: 10.1111/j.1467-8535.2011.01264.x

Leiva, J.; Ugalde, L. y Llorente, M. C. (2018). El modelo TPACK en la formación inicial de profesores: modelo Universidad de Playa Ancha (UPLA), Chile. *Pixel-Bit. Revista de Medios y Educación,* vol. 53, pp. 165-177. doi: http://dx.doi.org/10.12795/pixelbit.2018.i53.11.

López, López y Prieto, (2018). Tendencias innovadoras en la formación on-line. La oferta web de postgrados e-learning y blended, learning en España. *Pixel-Bit. Revista de Medios y Educación*, vol. 53, pp. 1-15. doi: http://dx.doi.org/10.12795/pixelbit.2018.

Mateo, J. (2012). La investigación ex post-facto. En Bisquerra, R. (coord.), Metodología de investigación educativa, 195-229. Madrid: La Muralla.

Matosas-López, L., Aguado-Franco, J. C., & Gómez-Galán, J. (2019). Constructing an instrument with behavioral scales to assess teaching quality in blended learning modalities. *Journal of New Approaches in Educational Research*, vol. 8, num. 2, pp. 142-165. doi: 10.7821/naer.2019.7.410

O´Dwyer, L. & Bernauer, J. (2014). *Quantitative research for the qualitative researcher*. California: Sage.

Park, J. (2014). Course evaluation: Reconfigurations for learning with learning management systems. *Higher Education Research & Development*, vol. 33, núm. 5, pp. 992-1006.

Parsons, A. (2017). Accessibility and use of VLEs by students in further education. *Research in Post-Compulsory Education*, vol. 22, núm. 2, pp. 271-288.

Pettersson, F. (2018). On the issues of digital competence in educational contexts–a review of literature. *Education and Information Technologies*, vol. 23, núm. 3, pp. 1005-1021.

Poitras, E., Doleck, T., Huang, L., Li, Sh. & Lajoie, S. (2017). Advancing teacher technology education using open-ended learning environments as research and training platforms. *Australasian Journal of Educational Technology,* vol. 33, núm. 3, pp. 32-45.

Pozuelo, J. (2014). ¿Y si enseñamos de otra manera? Competencias digitales para el cambio metodológico. *Caracciolos*, vol. II, núm. 1, pp. 1-21.

Ramos-Pardo, F. J.; Sánchez, P. y Sánchez, J. (2012). Usos pedagógicos de Moodle en la docencia universitaria desde la perspectiva de los estudiantes. *Revista Iberoamericana de Educación,* vol. 60, pp. 15-38.

Rienties, B.; Giesbers, B.; Lygo-Baker, S.; Ma, H. W. S. & Rees, R. (2014). Why some teachers easily learn to use a new virtual learning environment: A technology acceptance perspective. *Interactive Learning Environments*, vol. 24, núm. 3, pp. 539-552.

Rodríguez, A.; Raso, F. y Ruiz-Palmero, J. (2019). Competencia digital, educación superior y formación del profesorado: un estudio de meta-análisis en la Web of Science. *Pixel-Bit. Revista de Medios y Educación*, vol. 54, pp. 65-81.

Sabariego, M. (2012). El proceso de investigación (parte 2). En R. Bisquerra (coord.). *Metodología de la investigación educativa* (pp. 127-163) (3ª. ed.). Madrid: La Muralla.

Siemens, G. & Weller, M. (2011). El impacto de las redes sociales en la enseñanza y el aprendizaje. *Revista de Universidad y Sociedad del Conocimiento (RUSC*), vol. 8, núm. 1, pp. 157-163. Recuperado de http://rusc.uoc.edu/ojs/index.php/rusc/article/view/v8n1-siemensweller/v8n1-siemens-weller

Sinclair, J. & Aho, A. M. (2018). Experts on super innovators: Understanding staff adoption of learning management systems. *Higher Education Research & Development*, vol. 37, núm. 1, pp. 158-172.

Solano, H. y Abella, V. (2017). Factores determinantes de la aceptación de Cisco Netscape: estudio empírico basado en TAM. *Pixel-Bit. Revista de Medios y Educación,* vol. 51, pp. 211-225.

Umoru, T. (2012). Barriers to the use of Information And Communication Technologies in teaching and learning business education. *American Journal of Business Education,* vol. 5, núm. 5, pp. 575–580.

Vázquez, M. H. y Burrial, A. T. (2017). Factores que influyen en el aprendizaje mixto (*blended-learning*) y colaborativo en Moodle en didáctica de las ciencias experimentales en el grado de maestro en Educación Primaria. En *Propuesta de innovación educativa en la sociedad de la información* (pp. 48-60). Eindhoven, NL: Adaya Press.

Yanacón-Atía, R. y Menini. M. (2018). Indicadores colaborativos individuales y grupales para Moodle. *Campus Virtuales*, vol. 7, núm. 1, pp. 125-139