ΣΟΦΙΑ–SOPHIA

Investigation Article

Development of digital teaching skills to implement virtual learning environments in university teaching

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Abstract

The purpose of this research is to characterize the needs of technical support and training of university professors for managing Moodle. 65 professors were surveyed to identify their perception of skills and training needs; there were analyzed the influence of gender, age and type of recruitment. It was found a low knowledge of Moodle management by professors, low level of ability and low participation in training programs, with no differ-ence between sex, age or gender. Young professors have greater use of Moodle in teach-ing ($p < 0.05$). Men use social networks more in education ($p < 0.05$). Women argue more lack of technical support ($p < 0.05$). Full-time professors have greater knowledge of Moo-dle tools ($p < 0.05$). The results allow to conclude that to improve the integration of Moo-dle into teaching, it is required basic Moodle training and pedagogical aspects for its in-corporation into teaching.

Key words: professors' skills, higher education, professor training, information technology, educational technology.

Introduction

The use of virtual learning environments (AVA, for its initials in Spanish) in the teaching-learning process in higher education has been spreading worldwide because of its contribution in improving communication between students and professors (Zapata 2003); and for the design of practical learning and assessment activities. The advantages of using AVA in higher education have been widely reported in the scientific literature (Bidarian, Bidarian and Davoudi 2011, Ertmer et al. However, there are still difficulties in their implementation in teaching, mainly related to deficiencies in professors' skills (Kirkup and Kirkwood 2005; Hsu 2011; Sáez 2010).

The use of AVA in university teaching facilitates the use of student-centered, teaching-learning models, further promoting collaborative work and the exchange of information (Wang et al., 2013). Moodle (Modular Object-Oriented Dynamic Learning Environment), created by Martin Dougiamas in 1999, is an open source platform widely used worldwide (Naveh, Tubin and Pliskin 2010) which has a wide variety of tools for presentation of contents and design of learning activities such as forums, chats, questionnaires, blogs, lessons and tasks (Valenzuela and Pérez 2013), for which it is used as AVA.

In 2003, the Universidad de Antioquia implemented the open-source Moodle platform (Valenzuela and Pérez 2013) as an institutional AVA; and since then, it has conducted professor training courses and technical and logistical support for the integration of Moodle to teaching, which have not been effective. The Faculty of Agricultural Sciences has within its goals established in the development plan to achieve by 2016 the implementation of Moodle in a 50% in undergraduate courses, and 100% of graduate courses (FCA 2010).

According to Rodríguez, Restrepo and Aranzazu (2014), the professors of the Faculty of Agricultural Sciences have a very good perception of the permanent support with training and advice offered by the institution for the introduction of Moodle to teaching; however, about half of professors have not used this service, so they raise the need to identify strategies to achieve a better use of institutional support by professors.

Due to the above, in 2014, it was implemented a committee to promote the use of technologies in teaching at the Faculty of Agricultural Sciences, whose purpose is the exchange of ideas and opinions among innovative professors, and to provide support on pedagogical use of ICTs in line with the approaches of Ryymin, Palonen and Hakkarainen (2008); in order to help late adopters who are less interested in technology through evidence of how ICTs can improve their work (Kirkup and Kirkwood 2005). For this reason, the objective of the research was to characterize the needs of technical support and training of university professors, based on their training and perception of Moodle skills and its limitations for the implementation of this virtual learning environment in face-to-face teaching.

Materials and methods

In order to carry out the research process, a structured survey was designed according to the objectives, taking into account variables of a qualitative nature, which was submitted to expert judgment in order to verify the relevance of the questions and the proposed

methodology; and which was applied between October and December 2014 to professors of the Faculty of Agricultural Sciences of the Universidad de Antioquia.

It was used the stratified random sampling technique by gender, age group, and type of contract (full-time professor, part-time professor, assistant professor), using a uniform distribution in the choice of respondents. A reliability level of 95% and a maximum permissible error of 10% were used; the estimated parameters P and Q adopted the value of 50%, due to the fact that there are no previous studies on the use of LMS in the Faculty of Agricultural Sciences of the Universidad de Antioquia. For a total population of 185 professors, distributed in 48 full-time, 12 part-time and 125 assistant professors; the definitive size of the sample was 65 professors.

The survey was applied with the voluntary participation of professors. The database was prepared in an electronic sheet according to the format outlined in the survey, and a strict quality control was carried out in three stages of the investigative process in order to guarantee the results and conclusions generated by the information.

For the statistical analysis of the data, the statistical package SAS version 9.0 was used. We used multivariate analysis of variance (Manova) with orthogonal canonical contrast based on percentages, establishing the dimensionality of the multidimensional comparison by means of the criterion of maximum likelihood, observing the greater significant own value. The study was carried out using qualitative variables associated to the topics of interest: training in the use of LMS, perception of the quality of the training received in LMS management, Moodle tools used in teaching, use of applications in teaching, computer use for academic purposes, training needs in the use of applications for academic purposes and reasons for not using Moodle. These variables are associated with binomial and multinomial probabilistic distributions. The analysis was complemented by univariate and bivariate frequency distributions using contingency tables.

Results

Regarding the sample, a distribution by age range was found: 13.9% aged 20-30 years; 64.6% aged 31-50 years; and 21.5% aged 51-75 years. The gender distribution was 60% male and 40% female. Regarding the type of contract, 43.1% were full-time professors; 16.9% part-time and 40% assistant professors.

As it can be seen in Table 1, in terms of computer tools used by professors to support teaching, e-mail and search engines stand out. Statistical difference ($p < 0.05$) was found in favor of men in the use of social networks; we also detected statistical difference in favor of the age group of 31 to 50 years in the use of search engines; and in favor of the younger group in the use of Moodle ($p < 0.05$). No statistical difference was found in the type of university labor link ($p > 0.05$).

In terms of the institutional offer of training courses for the use of Moodle in teaching, the majority of professors (72.3%) know and received information (86.1%) from the Program for the integration of technologies into teaching. No statistical difference was found between genders, age or type of labor link ($p > 0.05$). Regarding the program's offer of courses, the highest participation by professors, as shown in table 2, is basic Moodle for professors (46.8%); with very low participation levels, lower than 11% in the other courses. 46.1% of professors did not participate in any course.

On the other hand, the participation of professors in professor training programs was very low; only 13.8% participated in the course "Comprehensive appraisal of learning;" 6.2% in "Collaborative learning;" 6.2% in "Operational didactic model;" and 78.5% stated that they did not participate in any training course. No statistical difference was found between genders, age or type of labor link ($p > 0.05$). Regarding the self-perception about the ability to manage Moodle, as it is shown in Table 3, professors have an acceptable level of knowledge about the management of the tool resources for information, *i.e.*, the development of tags and links to files or web pages, and in the use of questionnaires; in addition to the elaboration of question banks and the evaluations from them. For other tools such as tasks (preparation of activities for receiving reports and workshops), resources for activities, forums and lessons (targeted self-assessment activities and practice), the knowledge of professors is deficient. No statistical difference was found between genders, age or type of labor link ($p > 0.05$).

Regarding the use of Moodle, 72.3% of professors have not uploaded courses on the platform, and the main reason they argue is the lack of training. Table 4 shows a statistical difference ($p < 0.05$) in favor of the female gender in terms of the lack of technical support to elaborate contents (Table 4). There was also a statistical difference ($p < 0.05$) in favor of younger professors regarding lack of training and lack of knowledge of Moodle tools; in favor of senior professors regarding

Table 1. Computer tools used in teaching

Tool	Percentage										
	Total	sex		Value *p*	Age			Value *p*	Labor link		Value *p*
		M	F		21 a 30	31 a 50	51 a 75		Full time	Part-time	
Blogs	15.4	12.8	19.3	0.4906	11.1	13.9	23.0	0.6862	10.2	23.1	0.165
Email	92.3	89.7	96.1	0.3498	100	90.7	92.3	0.6469	92.3	92.3	0.999
Search engines	72.3	76.9	65.4	0.3160	66.7	79.1	53.9	0.0461	71.8	73.1	0.911
Social networks	29.2	38.4	15.4	0.0451	22.2	32.6	23.1	0.7212	28.2	30.8	0.827
You tube	1.5	0.0	3.9	0.2232	0.0	2.3	0.0	0.7797	0.0	3.9	0.223
AVA (Moodle)	10.7	7.7	15.4	0.3347	22.2	6.9	15.4	0.0307	12.8	7.7	0.521

Source: self-made, 2015

Table 2. Professors' participation in permanent training courses of the Program for the integration of technologies into teaching

Type of program	Total	Value p		
	%	Genres	Age	Labor link
Basic Moodle for professors	46.8	0.2302	0.1453	0.0873
Advanced Moodle workshop	3.0	0.2476	0.1234	0.0873
Training of virtual tutors	6.0	0.5347	0.7170	0.5347
Virtual learning environments	10.6	0.8727	0.5073	0.0762
Treatment of digital images	4.6	0.8129	0.4869	0.8129
Media (audio and video) workshop	4.6	0.3421	0.4497	0.8129
Author tools workshop	4.6	0.8129	0.1155	0.8129
Web 2.0 tools workshop	6.1	0.5347	0.7177	0.5347

Source: self-made, 2015

Table 3. Professors' skills in the use of Moodle

Tool	Géneros*										Value p
	Skill (%)										
	1		2		3		4		5		
	M	F	M	F	M	F	M	F	M	F	
Forum	25.6	11.5	17.8	11.5	28.2	34.6	20.5	38.8	7.9	3.6	0.146
Resources for activities	23.0	11.5	25.6	19.2	28.2	30.7	15.3	26.9	7.9	11.7	0.118
Resources for information	5.1	0.0	23.1	7.7	28.2	34.6	30.7	42.3	12.9	15.4	0.104
Tasks/activities	25.6	19.2	23.0	7.7	23.0	26.9	12.8	30.7	15.6	15.5	0.191
Questionnaires	18.0	15.3	28.2	7.7	20.5	26.9	15.4	30.7	17.9	19.4	0.201
Lessons	38.5	30.7	23.1	15.4	28.2	26.9	5.1	19.2	5.1	7.8	0.179

Tool	Skill (%)															Value p
	1			2			3			4			5			
	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	
Forum	33	16	23	0	21	8	44	26	38	23	33	15	0	4	16	0.743
Resources for activities	33	14	23	22	26	15	22	30	31	11	23	15	12	7	16	0.677
Resources for information	0	2	8	11	21	8	11	28	51	55	37	15	24	12	18	0.291
Tasks/activities	33	19	31	11	19	14	11	28	23	22	21	15	23	13	17	0.866
Questionnaires	22	12	31	44	19	8	11	28	15	11	23	23	12	18	23	0.334
Lessons	55	32	31	22	21	15	11	33	23	12	9	15	0	5	16	0.237

Labor link***

Tool	Skill (%)															Value p
	1			2			3			4			5			
	P	O	C	P	O	C	P	O	C	P	O	C	P	O	C	
Forum	20	15	19	10	20	23	33	15	27	30	35	23	7	15	8	0.682
Resources for activities	18	20	19	18	20	31	35	30	19	26	20	12	3	10	19	0.902
Resources for information	5	5	0	13	20	23	36	30	23	33	30	38	13	15	16	0.692
Tasks/activities	23	25	23	23	25	8	26	35	23	23	10	15	5	5	31	0.091
Questionnaires	18	20	15	18	30	23	31	25	12	21	15	23	12	10	27	0.376
Lessons	31	40	42	26	20	12	31	30	23	12	7	8	0	3	15	0.599

Source: self-made, 2015, * M: Male, F: Female; ** J: 21-30 years, A: 31-50 years, M: 51-75; ***P: Full-time, O: Part-time, C: Assistant.

Table 4. Reasons of professors who have not uploaded their courses in Moodle

Tool	Percentage										
	Sex		Value p	age			Value *p*	Labor link			Value *p*
	M	F		21-30	31-50	51-75		Full time.	Part-time.	Assistant	
Lack of training	25.6	26.9	0.912	44.4	23.2	23.0	0.041	20.05	35.5	34.6	0.412
Lack of trust on Moodle management	15.3	7.7	0.362	22.2	9.3	15.3	0.536	10.2	15.6	15.6	0.734
Lack of knowledge about Moodle tools	12.8	19.2	0.496	44.4	9.3	15.3	0.028	5.1	31.2	30.8	0.034
Lack of technical support to elaborate contents	12.8	30.7	0.043	22.2	16.2	30.8	0.523	23.1	15.8	15.4	0.326
Lack of technical support to upload materials onto the platform	12.8	19.2	0.496	22.2	6.9	38.4	0.012	17.9	12.3	11.5	0.287
Lack of support on the usefulness of Moodle for teaching	12.8	7.7	0.521	22.2	9.3	7.7	0.492	7.9	15.7	15.4	0.084
Lack of time to receive training and elaborate contents	12.8	19.2	0.495	0.0	20.9	7.7	0.206	17.9	12.8	11.5	0.0519

Source: self-made, 2015

the lack of technical support to upload materials in the platform ($p < 0.05$); and in favor of full-time professors in terms of greater knowledge of Moodle tools ($p < 0.05$).

As for the professors' knowledge about the goal of the development plan to achieve that 50% of the courses have any AVA uploaded on the Moodle platform, 46.1% of the respondents said they knew the goal. Differences were found between age groups ($p = 0.0243$) and between type of labor link ($p = 0.0429$); no difference between genders was found ($p = 0.6181$).

In terms of the basic support needs to contribute to the goal of the development plan, the main need expressed by the professors is training in the general management of Moodle, followed by advice for the development of basic contents such as text documents and slides presentations (Table 5). A significant difference ($p < 0.05$) was found in favor of men in the need for support to adjust contents to copyright norms; and in favor of full-time professors in terms of less requirement of advising to perform the instructional design of courses ($p < 0.05$). No statistical difference was detected among ages ($p > 0.05$).

Table 5. Basic support services required by professors for uploading courses in Moodle

Support service	Percentage										
	sex		Value p	Age			Value p	Labor link			Value p
	M	F		21-30	31-50	51-75		Full time. .	Part-time	Assistant	
Training for general management of Moodle	56.4	57.6	0.91	77.7	53.5	53.8	0.40	53.8	32.5	61.5	0.42
Specific training to use tools	46.1	51.4	0.24	44.4	53.5	52.8	0.88	48.7	57.6	57.6	0.54
Support to perform the instructional design of a course	51.2	53.8	0.82	66.6	46.5	61.5	0.42	41.1	70.9	69.2	0.04
Support for the development of text and slides contents	41.1	30.7	0.44	33.3	36.5	53.8	0.37	30.7	45.2	46.1	0.38
Support for contents adjust to copyright norms	69.2	42.3	0.03	55.5	60.4	61.5	0.90	56.1	63.2	61.5	0.48
Support to upload resources onto Moodle	64.1	46.1	0.15	66.6	55.8	53.8	0.81	53.8	61.5	61.5	0.462

Source: self-made, 2015

Regarding specialized support needs, the main need expressed by the respondents is training for audio and video editing, followed by production of audio and video content; see table 6. No statistical difference was found between genders, age or type of labor link ($p > 0.05$).

Regarding the knowledge about what a digital educational resource is, 78.4% of professors expressed knowing what it is. There was no statistical difference between genders, age or type of labor link ($p > 0.05$). When inquiring about the willingness to include the elaboration of contents and the uploading of courses in their work plan, 89.2% of professors expressed their willingness. No statistical difference ($p > 0.05$) was found between genders, age or type of labor link. In relation to the number of hours estimated for uploading a course, professors state on average that they require 82 hours.

Table 6. Special support services required by professors for the development of contents for courses in Moodle

Service	Percentage										
	sex		Value p	Age			Value *p*	Labor link			Value *p*
	M	F		21-30	31-50	51-75		Full time	Part-time	Assistant	
Production of audio and video contents	62.4	61.5	0.88	60.4	58.6	64.9	0.86	62.4	63.5	62.4	0.92
Training for audio and video contents edition	77.2	68.9	0.73	70.6	72.6	74.6	0.82	70.8	72.6	75.1	0.86
Images processing	80.2	85.4	0.89	81.3	80.2	85.2	0.79	81.2	80.6	86.5	0.85
Training for images processing	77.9	75.4	0.78	76.3	70.9	69.8	0.87	74.2	71.6	72.3	0.80
Production of digital educational resources	70.6	73.5	0.91	75.6	70.8	69.5	0.85	68.9	76.2	73.7	0.77
Training for producing digital educational resources	80.5	79.6	0.71	81.4	80.2	83.4	0.92	82.6	80.2	83.4	0.89

Source: self-made, 2015

Discussion of results

The results of this study indicate a significant difference ($p < 0.05$) in favor of professors of the younger age group in the use of Moodle; which are consistent with the findings of other authors (Buabeng-Andoh 2012, Inan and Lowther 2010) who have found a positive correlation between age and ICTs use, with a greater tendency for young people to use technologies, a situation that is mainly explained by the lack of preparation of the seniors for the use of these technologies in their classes.

One of the computer tools most used by professors as support for teaching is search engines, with significant difference in favor of those aged over 51 years in terms of the lowest use. This situation is explained by the lack of familiarity of older professors with the use of this tool, a situation that also affects the promotion of their effective use among students for access to specialized information. In this regard, other authors (Zaman and Hossain 2012) have found that very few professors teach students how to effectively search for information on the internet.

As for professors training in the use of Moodle in teaching, although most of them know and have received information on the offer of training courses from the technology integration program to university teaching, it has not been achieved a significant participation of professors in them; about half of them who have not participated in any course. This situation evidences that the strategies implemented by the institution for the integration of Moodle into teaching do not correspond to the needs of professors, which, as other authors suggest, requires a personalized attention, according to the specific need of each professor, as a strategy to achieve an increase in the use of ICTs in teaching (Haydn and Barton 2007, Rodríguez, Restrepo and Aranzazu 2014).

Regarding pedagogic training courses, the participation of professors is very low, although continuous improvement must be considered as a necessity in the educational process. These factors may be the causes of the low implementation of Moodle found in the Faculty of Agricultural Sciences, since other studies (Peeraer and Petegem 2011; Umoru 2012) report that one of the factors that affects professors' confidence in the use of ICTs is the lack of self-training, both in technological and pedagogical skills, aspects that must be combined to achieve effective use of technologies in learning.

According to the findings of other studies (Unal and Ozturk 2012), the use of ICTs in the classroom is generally associated with the support of the traditional method of professor-centered teaching, so pedagogical training is also important for integrating Moodle to teaching, in the search for change towards a student-centered teaching method through creative learning (Gulavani and Joshi 2012, Peeraer and Petegem 2011). In this respect, other authors point out the need to change the role of professors towards them as facilitators of learning

through the use of participatory learning methods, and the adoption of collaborative learning (Jadhav 2011).

Professor training should, therefore, not be restricted to workshops and training, but also to the permanent accompaniment to professors for the identification of tools according to their teaching methods, since according to other studies (Shahadat Hossain Khan, Hasan and Clement 2012), professors need evidence on the impact of ICTs to make their lessons more interesting, motivating and fun; they also raise the need to create spaces for collaboration networks that allow, as other authors (Ryymin, Palonen and Hakkarainen 2008) state, the exchange of knowledge and support for the pedagogical use of ICTs. At the same time, it is important that from curricular practices, professors be encouraged to use ICTs in teaching through processes in line with institutional needs and policies (Jadhav 2011), with the support of managers to innovative initiatives (Riascos-Erazo, Ávila-Fajardo and Quintero-Calvache 2009).

The results of this study also indicate that in spite of the institutional offer of training in Moodle, in general terms the professors' perception of their ability to handle Moodle is deficient. This situation evidences the need to make changes to the methodology of institutional support for the integration of Moodle to teaching through training programs, as it is suggested by other studies (Rodríguez, Restrepo and Aranzazu 2014), less generic and more applied to specific needs of professors; these programs should include, in addition to theoretical-practical classes, a process of accompaniment to the professor for implementing the knowledge acquired to their teaching activities, because according to the findings of other authors (Buabeng-Andoh 2012; Hsu 2011; Sorgo, Tatjana and Kocijancic 2010), it has been found a positive correlation between teaching skills and their self-confidence in the use of technologies, for which they are factors that predict the use of ICTs in teaching.

The results of this study also indicate that a high percentage of professors have not uploaded Moodle-based courses, with no difference between age groups; and the main reason professors argue is the lack of training.

We found a statistical difference ($p < 0.05$) favoring female gender in terms of perceived lack of technical support to elaborate contents; other authors (Shahadat Hossain Khan, Hasan and Clement 2012) raise the need to establish mechanisms to encourage women to adopt ICTs in education.

On the other hand, the statistical difference found in favor of the younger ones in terms of lack of training and lack of knowledge of Moodle tools can be explained according to what was stated by other authors (So et al. 2012), that new generations tend to use a limited range of technologies, among which apparently Moodle is not found. In this same sense, it is surprising that for the case of full-time professors, who manifest to have greater knowledge of Moodle tools, it is not appreciated an application of this knowledge to uploading courses in this platform.

These findings are consistent with professors' low knowledge of the development plan goals, regarding the use of Moodle and, consequently, their low level of compliance. In this regard, other studies have reported that effective promotion of ICTs use in the classroom is related to the involvement of all actors related to the subject, such as students, professors and administrative staff through the construction of a collective vision with the contribution of knowledge, skills and attitudes of everybody (Shahadat Hossain Khan, Hasan and Clement 2012).

As for the support needs expressed by professors for the integration of Moodle to teaching, it is emphasized training in general management of Moodle, despite being the course with the greatest participation of professors; secondly, we found the development of basic contents such as text documents and slide shows. These results allow us to infer that faculty professors who are in the process of integrating technologies into their teaching still remain in the phases of passivity and dependence on technical support (Barak 2007); for this reason, it is required support to reach the phases of partial independence and total independence. In terms of the services required, a difference was found in favor of the female gender only for the need of support in the adjustment of contents to copyright norms. In this regard, other authors (Sang et al., 2010) did not find significant differences between genders in the integration of ICTs in teaching.

With regard to the willingness to prepare contents and upload courses, a high percentage of professors would be willing to include these activities in their work plan, which indicates that with institutional support in accordance with the specific needs of professors, it can be achieved a favorable impact in the integration of Moodle in teaching. In this respect, other authors (Haydn and Barton 2007) have found that investments should be directed towards promoting the exchange of face-to-face knowledge and experiences among

professors using mentors who coordinate small groups of professors. In this sense and according to other authors (Sang et al., 2010), it is important to take into account the beliefs about constructivism of professors, as they significantly influence the attitude toward the use of ICTs in teaching.

One aspect that was not taken into account in this study, but which should be considered in the integration of Moodle in teaching is related to the training of students, since according to the findings of other studies (García-Valcárcel and Tejedor 2009; Shazli Hasan Khan 2012), students need a more structured support to incorporate ICTs in their learning process; currently, they acquire skills on the subject in a self-taught way. In this respect, other authors (Castro Sánchez and Chirino Alemán 2011) emphasize the importance of this development of digital competences in students, that it be accompanied by professors, so these must incorporate those skills into their teaching role (Rassiah, Chidambaram and Sihombing 2011).

Conclusions

The results of this study allow us to conclude that the needs of support for professors to improve the integration of Moodle to teaching are focused on the basic use of Moodle and the pedagogical aspects for its incorporation into teaching-learning; men aged over 31 require further technical and training support.

Taking into account that the university has a wide offer of technical and pedagogical training for professors in the use of Moodle for teaching, and that most professors would be willing to include the development of courses in their work plan, it is required the implementation of a process of formation and permanent accompaniment to identify tools according to their teaching methods, which would encourage them to use ICTs in teaching through the implementation of the knowledge acquired in their teaching activities.

On the other hand, it is necessary to improve the computer skills of professors, so that they can guide students in the use of ICTs for learning through the development of digital skills.

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