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Edited by
Mélanie Ciussi and Marc Augier

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Assessment of Virtual Learning Environments by Higher Education Teachers and Students

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Abstract: This research focuses on the problematic of the use of virtual learning environments in a higher education institution in the north of Portugal. In this study, we set the scientific and pedagogical background of virtual learning environments, and we analyze the responses obtained from an online questionnaire conducted to 536 subjects, all teachers and students at that same higher education institution, namely 347 students and 189 teachers. The research questions of this study were set out in order to assess the frequency with which the higher education students and teachers of that institution access virtual learning environments, the value they assign to those environments as well as to their integrated tools, and also to assess the influence of users' computer skills on their access to virtual learning environments. Considering the computer skills classification of each subject of this study, three independent categories were created, both for teachers and students, associated with basic skills, intermediate skills and advanced skills, respectively. In this paper we adopt a descriptive and inferential data analysis, using the recommended statistical procedures. Results show that the majority of teachers and students access the institution's virtual environment on a daily basis. However, there are significant differences between teachers who have intermediate computer skills and those who have basic skills, as the percentage of teachers with intermediate skills accessing the virtual learning environment everyday is higher than that of the teachers who have basic computer skills. No significant differences were found among students as far as the relation between virtual learning environment access and computer skills is concerned. With regard to the assessment of the virtual learning environment, more than 80% of the teachers consider that the use of the institution's virtual learning environment is valuable to send messages or notices to students, provide the teacher's office attendance hours, provide a schedule of activities, provide students' assessment, provide the plan of students' activities, and allow students to access resources and submit assignments online. The aspects valued by more than 80% of the students were: checking exam results and receiving messages or notices from teachers. The importance of this study is mainly related to knowledge sharing with the scientific community concerned with the implementation of virtual learning environments, based on the assessment of a specific situation which involved higher education students and teachers. Although the results cannot be generalized within the scope of other institutions as the sample belongs to one institution only, the study provides indicators which may represent an asset for future studies concerning the assessment and use of virtual learning environments and the digital tools they provide in the higher education context, as well as for the understanding of the relation between the use of these environments and their users' computer skills.

Keywords: e-learning, virtual learning environments, digital resources, tools, higher education

1. Introduction

Information and communication technology (ICT) has represented a real revolution in almost all the areas and scopes of human activity. In each field of activity, ICT has played several roles, among which that of a tool of communication and promotion of interaction among people and between people and organizations.

We highlight the virtual learning environments (VLEs) as an organizing element which concentrates a big part of the teaching and research work in higher education. These environments generally constitute a coherent whole which involves several dimensions, among which we stress the use and assessment of the digital tools which integrate them. Therefore, in the context of higher education, and in order to understand the assessment that students and teachers make of VLEs, a research work was developed, aiming to answer the following questions:

- How often do higher education students and teachers access virtual learning environments?
- Does the users' computer skills level influence their access to virtual learning environments?
- What value do higher education students and teachers assign to virtual learning environments and to the tools which constitute them?

The answer to these questions may help to support options of use and adequacy of ICT to higher education institutions' educational goals. As Naveh, Tubin and Pliskin (2010) point out, understanding how the organizational factors correlate to the use and satisfaction of VLEs may help academic institutions to get higher

return on their investment in these environments. By knowing the VLE access and use frequency, as well as the value assigned by its main users, it is easier not only to define policies of VLE use in higher education institutions but also to implement the features which students and teachers value the most.

2. Virtual learning environments

Virtual learning environments (VLEs) have become the core for innovation and for educational change. As referred by Kukulska-Hulme (2012), "time of change" has become a popular refrain in the speech about higher education. The author highlights that the advances of technology and services based on technology will change experiences and the public's expectations as far as knowledge access and sharing is concerned, adding that the higher education institutions have to provide more online learning and content as well as more effective tools to find and use contents.

So that good results with information and communication technologies (ICT) may exist, their use must be supported by effective pedagogical frameworks which enable the gathering of increasingly more information, the improvement of information processing as well as its diffusion to any individual in the world (Del Val, Campos and Garaizar, 2010).

In all teaching levels, each teacher must try to provide and enhance quality learning to their students. According to Ellis et al. (2009), higher education researchers and teachers who try hard for their students to get good learning results can hardly be successful without using ICT. The authors highlight that it is still difficult to understand which the best way to use ICT is in order to enable students to involve more deeply and intentionally in learning. Similarly, and regarding the use of e-learning 2.0, Karasavvidis (2010) claims that students will have to be more active and participatory, and they will have to take more responsibility and control over their learning so that they can become more self-determined, open to cooperation, willing to share and exchange, committed to participation in online communities as well as to the construction of meanings in shared tasks.

The implementation of ICT in any institution must be carefully thought up and planned, although in many cases, as pointed out by Mahdizadeh, Biemans and Mulder (2008), educational institutions do not pay enough attention to questions such as how, what and why ICT must be implemented.

According to McGill and Hobbs (2008), ICT have increasingly influenced higher education, since their role has changed from being supplementary to being the core of teaching and learning. Thus, ICT represents an essential element to the creation of learning environments technologically advanced, about which Brooks (2011) highlights that evidence strongly suggests that, regardless all the other factors, ICT has a significant and positive impact on students' learning. Van Schaik, Martin and Vallance (2012) add that technology can and must be applied in a useful way to change students' role, turning them into active participants in their own learning and enabling teachers to assume a supportive role to students in several modalities. In other words, the adequate use of ICT in learning environments can enable students to change a passive learning model into an active learning model.

Considering the complexity and the dimensions that a VLE can incorporate, it is not easy to find a consensual definition of VLE. However, it is essential to analyze and value several approaches, so that each user, namely students, teachers and researchers can explore the parts of each approach which better meet their aims.

Virtual learning environments and their associated tools provide students and teachers with great conditions for the promotion of joint dialogue and reflection. Conde et al. (2012) suggest that both students and teachers use means of communication available in their learning contexts to perform learning activities and improve their results.

Brown (2010) suggests that there are authors who claim that VLEs have only had a small impact on the higher education pedagogy, although they consider them a great commercial success but likely to be replaced by Web 2.0, as they consider the latter more suitable for individualist styles as well as students and teachers' abilities and needs. The same author adds that Web 2.0 has the potential to change the nature of learning and teaching in a substantiated way, namely through the creation of learning networks which may challenge the role of traditional institutions more effectively than prior technologies.

On the other hand, according to Palmer and Holt (2012) in a study which involved 6800 responses during the period between 2004 and 2011, the classifications of VLE satisfaction increased significantly in all the assessed items.

Information and communication technology has the potential to revolutionize the classroom and enable the acquisition of higher skills such as setting out problems; drawing up questionnaires; and organizing, evaluating and building knowledge. However, it also enhances movements of superficial memorization and coverage of contents (Bonk and Zhang, 2008).

The use of ICT in formal teaching and learning contexts at higher education level, and especially the use of VLEs as well as of the tools which integrate them demands quite a lot of persistence, knowledge and flexibility. According to Tucker and Morris (2011), the approaches to the implementation of flexible education integrate five categories of flexibility: knowledge; time; content; access requirements; and pedagogy. Each program can integrate flexibility elements from each of these categories, which implies that any teaching and learning configuration is flexible in some way.

3. Methodology

This study assumes characteristics of the quantitative research paradigm as far as its nature is concerned, and it highlights aspects related to the use of a virtual learning environment (VLE), namely the Sakai environment, adopted since 2008 by the Portuguese higher education institution where the study was carried out.

This study presents descriptive and interpretative features. Data collection procedures consisted of carrying out two online questionnaires, one for students and another one for teachers. The questionnaires were carried out in the last semester of the 2011/2012 school year in the institution where the researchers work. The Sakai community was responsible for drawing up and validating the questionnaires and 24 higher education institutions were involved in the process. The study involved 536 subjects of the same institution, among which 347 undergraduate students and 189 higher education teachers, all of whom accepted the request to answer the questionnaires.

The sample of students was obtained within a population of 6943, which corresponds to 5% of the institution's students. Among these subjects, 63.7% are female and 37.3% are male. The sample of teachers was obtained within a population of 502 teachers, thus corresponding to 38% of the institution's teachers. Among these subjects, 45.5% are male and 54.5 are female. The computer skills of the sample subjects were classified into basic, intermediate and advanced skills. Within the students' sample, 11.5% have basic computer skills, 70.6% have intermediate skills, and 17.9% have advanced skills. Within the teachers' sample, 16.4% have basic skills, 65.1% have intermediate skills, and 18.5% have advanced skills.

The results are presented according to the sequence of the research questions. We present a descriptive data analysis, followed by an inferential analysis of the situations in which such analysis is required.

4. Results

With these results we intend to present the achievement of the goals set for this research, namely understand the assessment that both students and teachers make of the virtual learning environments (VLEs). As referred by Palmer and Holt (2010), understanding which VLE elements are used and valued by students and teachers will represent an essential element for effective decision making as far as future investments in e-learning are concerned.

The results are presented according to the following topics: higher education students and teachers' perceptions regarding VLEs access frequency; the influence of students and teachers' level of computer skills on the VLEs access; higher education students and teachers' assessment of VLEs and their integrated digital tools.

4.1 Higher education students and teachers' perceptions regarding virtual learning environments access frequency

4.1.1 Assessment of the access frequency to virtual learning environments

The assessment of the access frequency to VLEs focused on the students and teachers' perceptions regarding access to the VLE to which they are connected.

In Table 1, we present the results concerning access to the institution's VLE. From observing Table 1 we conclude that the institution's VLE is used on a daily basis by a high percentage of students (59.4%) and teachers (47.1%). Also, the percentage of students accessing the VLE is higher than that of teachers. If we consider the sum of the percentages associated with the options "everyday" and "few times per week", we can see that the vast majority of students (82.7%) and teachers (81%) access the VLE on a weekly basis.

Table 1: Access to the institution's VLE

During this semester, you have accessed the institution's VLE:	Students (n=347)	Teachers (n=189)
Everyday (once or more)	59.4%	47.1%
Few times per week	23.3%	33.9%
Once a week	6.9%	12.2%
Few times per month	3.7%	2.1%
Few times per semester	5.5%	3.7%
Never	1.2%	0%

4.1.2 The influence of students and teachers' level of computer skills on the VLEs access

Over the last two decades, particularly, a huge effort has been put into the creation, diffusion and use of digital Technologies. In general, educational institutions have already adhered to these technologies, but they present different levels of knowledge concerning the VLEs access, use and benefits. After classifying the computer skills of the sample subjects of this study into basic, intermediate, and advanced, we analyze the influence of these skills on the variables under study.

In Table 2, we present the relation between the teachers' computer skills and the access frequency to the VLE.

Table 2: Relation between the teachers' computer skills and the access frequency to the VLE

Computer skills	Teachers' access to the institution's VLE						Total
	Never %	Few times per semester %	Few times per month %	Once a week %	Few times per week %	Everyday %	%
Basic (n=31)	0.0	57.1	0.0	26.1	16.7	11.2	16.4
Intermediate (n=123)	0.0	14.3	50.0	60.9	59.1	75.3	65.1
Advanced (n=35)	0.0	28.6	50.0	13.0	24.2	13.5	18.5

In order to assess the influence of computer skills on the access to the institution's VLE, the groups of teachers were named as follows: teachers with basic skills (TBS); teachers with intermediate skills (TIS); teachers with advanced skills (TAS). The subjects' computer skills were considered as an independent variable, and the score obtained by each subject in the assessed items was considered as a dependent variable. The numerical scoring was given to the items as follows: Never (0); Few times per semester (1); Few times per month (2); Once a week (3); Few times per week (4); Everyday (5). According to this numerical scoring, the higher the score is, the higher the access frequency to the institution's VLE is.

By applying Levene's test of homogeneity of variance, and considering the equality of variances among the teachers' groups (TBS, TIS, TAS) as a null hypothesis, we found that it is possible to reject the null hypothesis at a significance level of 0.033, which means that there is no equality of variances. Therefore, in order to compare the means of the three groups, we used Welch and Brown-Forsythe's test, with which it was possible to reject the null hypothesis of equality between the three groups' means by a significance level of 0.012 and

0.013, respectively. Thus, it is possible to say that there are significant differences in the VLE access depending on the teachers' computer skills.

By comparing each pair of groups using Levene's test of homogeneity of variance, we found that an equality of variances is assumed between the groups TBS and TAS, and the groups TIS and TAS. By applying Tukey's test, we found that there are no significant differences between the means of each pair of the teachers' groups compared.

Between the groups TBS and TIS, the equality of variances is not assumed. Therefore, Tamhne's T2 test was used to compare the means, and the results show that there are significant differences between the two groups (sig 0.04).

Based on these results, it is possible to say that there are significant differences between the teachers who have basic computer skills and those who have intermediate computer skills as far as VLE access is concerned. What stands out from observing Table 2 is that there is a higher percentage of VLE access among the teachers who have intermediate skills than among those who have basic skills.

A similar analysis of students' scoring was carried out concerning the influence of their computer skills on their access to the institution's VLE. The groups of students were named as: students with basic computer skills (SBS); students with computer intermediate skills (SIS); and students with advanced computer skills (SAS).

In Table 3, we present the relation between the students' computer skills and the access frequency to the institution's VLE.

Table 3: Relation between the students' computer skills and the access frequency to the VLE

Computer skills	Students' access to the institution's VLE						Total
	Never %	Few times per semester %	Few times per month %	Once a week %	Few times per week %	Everyday %	%
Basic (n=40)	25.0	21.1	23.1	4.2	12.3	10.2	11.5
Intermediate (n=245)	25.0	63.2	69.2	75.0	69.1	72.3	70.6
Advanced (n=62)	50.0	15.8	7.7	20.8	18.5	17.5	17.9

After carrying out an analysis similar to that described above when comparing teachers' groups, we found that there are no significant differences between the score means obtained by each pair of students' groups. In other words, there is no evidence that the students' computer skills have an influence on the access frequency to the institution's VLE.

4.2 Higher education students and teachers' assessment of VLEs and their integrated digital tools

The use of VLEs and of the digital tools which constitute them depends on the answers that they can provide to their potential users, as well as on the value that those users assign to them, namely with regard to the answer to educational goals which enable the interaction between teachers and students. As Albirini (2006) points out, when the universities promote the use of ICT, they need to understand the teachers and students' attitudes towards its use.

Therefore, we will assess the value assigned by higher education students and teachers to the institution's VLE concerning interaction, the submission of assignments, and the access to contents and support tools to the courses.

4.2.1 Interaction

As far as interaction is concerned, we present, in Table 4, the value assigned by undergraduate students to the VLEs for the development of interaction with their teachers.

Table 4: Value assigned by students to the use of the institution's VLE for the interaction with teachers (n=347)

For the interaction with teachers, the VLE is valuable to ...	Not used %	Disagree %	Neutral %	Agree %
Check the schedule of activities	6	5	13	76
Receive messages or notices	1	1	3	94
Do online tests	29	10	23	37
Check exam results	1	1	3	95
Use the plan of activities	12	5	15	68
Check the teacher's office attendance hours	7	4	12	77
Participate in groups	20	6	21	54
Monitor my progress	17	9	23	52

By observing Table 4, it is possible to say that the most valued aspects as far as interaction with teachers is concerned are: checking exam results; receiving messages or notices; checking the teacher's office attendance hours; and checking the schedule of activities.

Bearing in mind that the VLEs can be a meeting place between teachers and students, we also assessed the value assigned by teachers to the VLE concerning interaction. Data is presented in Table 5.

Table 5: Value assigned by teachers to the use of the institution's VLE for the interaction with students (n=189)

For the interaction with students, the VLE is valuable to ...	Not used %	Disagree %	Neutral %	Agree %
Provide the schedule of activities	4.2	1.6	9.0	85.2
Send messages or notices	2.1	1.1	2.1	94.7
Provide online tests	32.8	6.3	20.6	40.2
Provide exam results	4.8	4.8	9.0	81.5
Provide a plan of activities	7.4	2.6	9.0	81.0
Provide the teacher's office attendance hours	5.8	0.5	5.8	87.8
Create and monitor working groups	22.2	1.6	15.3	60.8
Monitor their progress	18.5	4.8	25.4	51.3

The data in Table 5 enable us to infer that the aspects most valued by a higher percentage of teachers as far as interaction with students is concerned are: sending messages or notices; providing the teacher's office attendance hours; providing the schedule of activities; providing exam results; and providing a plan of activities. Stress should be laid on the fact that both students and teachers, with the due adaptations, seem to value the same aspects of VLEs as far as interaction is concerned.

4.2.2 Submission of assignments and access to contents

The value assigned by students and teachers to the submission of assignments and the access to contents is presented in Table 6.

Table 6: Value assigned by students and teachers to the institution's VLE for the submission of assignments and access to contents

For the submission of assignments and access to contents, the VLE is valuable to ...	Students (n=347)				Teachers (n=189)			
	NU %	D %	N %	A %	NU %	D %	N %	A %
Submit assignments	9	3	11	78	5.8	2.1	4.2	87.8
Submit part of my assignments	14	8	19	60	10.6	1.6	13.8	74.1
Share parts of the assignments with colleagues	18	9	20	53	18.5	4.2	24.9	52.4
Cooperate with colleagues in the fulfillment of tasks	18	8	21	53	9.5	1.6	11.1	77.8
Read or comment on colleagues' assignments	20	12	24	44	21.2	10.1	32.8	36.0
Ask questions before the lesson	16	11	20	53	7.9	3.2	15.3	73.5
Ask questions during the lesson	21	21	23	35	24.3	18.0	28.0	29.6
Ask or answer questions after the lesson	12	7	17	64	6.3	2.6	12.7	78.3
Share contents with colleagues	18	9	20	54	15.3	3.2	23.3	58.2
Access bibliographic resources	10	5	13	72	3.7	1.1	6.3	88.9
Provide feedback on the course	15	7	20	58	11.6	2.6	11.1	74.6

Caption: NU – Not used; D – Disagree; N- Neutral; A – Agree

With regard to the submission of assignments or the access to contents, the three aspects valued by a higher percentage of students and teachers are: submitting assignments and accessing bibliographic resources, and asking or answering questions after the lesson. This analysis shows similar results to those obtained in previous studies (Mahdizadeh, Biemans and Mulder, 2008; Palmer and Holt, 2012).

4.2.3 Support tools to courses

The assessment of the digital tools which integrate the institution's VLE was made by higher education teachers and students. In table 7, we present the assessment made by both students and teachers.

Data in Table 7 show that the VLE tools most valued by a higher percentage of students are: resources; notices; messages; and assignments, thus confirming results obtained in previous studies (Carvalho, Areal and Silva, 2011; Palmer and Holt, 2010).

Table 7: Students and teachers' assessment of digital tools as a support to the courses

The following tools are valuable as a support to the courses	Students (n=347)				Teachers (n=189)			
	NU %	D %	N %	A %	NU %	D %	N %	A %
Schedule	18	5	24	53	20.1	2.1	15.3	62.4
Notices	1	1	3	94	0.0	0.0	1.6	98.4
Resources	1	1	2	96	0.5	0.0	1.1	98.4
Assignments	6	2	7	86	4.2	0.5	9.5	85.7
Online tests	29	5	21	45	36.5	4.8	22.8	36.0
Drop box	23	4	20	52	18.5	2.6	13.2	65.6
Messages	4	1	6	90	2.1	2.1	4.8	91.0
Forums	29	7	23	40	31.2	3.2	21.7	43.9
Roster	10	3	25	62	1.1	0.5	3.2	95.2
Search	21	4	22	52	14.3	3.2	14.8	67.7
Summaries	13	3	16	69	1.6	0.5	5.3	92.6

Caption: NU – Not used; D – Disagree; N- Neutral; A – Agree

The Institution's VLE tools most valued by a higher percentage of teachers are: resources; notices; messages; roster; and summaries.

5. Conclusions

The results are supported by data obtained through questionnaire, in a study which involved 347 undergraduate students and 189 teachers at a Portuguese higher education institution, and which focused on these subjects' perceptions regarding the access frequency to the institution's virtual learning environment and the assessment they made of that same environment. The following conclusions were drawn from this study.

The percentage of students who access the institution's virtual environment on a daily basis is higher than the percentage of teachers.

The computer skills of the participants in this study were classified, by themselves, into basic skills, intermediate skills, and advanced skills. Both students and teachers were divided into three independent groups according to that classification. The percentage of subjects accessing the institution's virtual learning environment on a daily basis is higher among both students and teachers who have intermediate computer skills than among those who have advanced or basic skills. However, when comparing the various groups of students and the various groups of teachers, significant differences were found only between the teachers who have intermediate skills and those who have basic skills. In this regard, a higher percentage of teachers who have intermediate skills were found to access the VLE on a daily basis.

The virtual learning environment assessment was made taking into account aspects related to interaction, the submission of assignments and the access to contents and support tools to the courses.

As far as interaction is concerned, the aspects most valued by a higher percentage of students were: checking exam results; receiving messages or notices; checking the teacher's office attendance hours; and checking the schedule of activities. With regard to the interaction with students, the aspects most valued by a higher percentage of teachers were: sending messages or notices; providing the teacher's office attendance hours; providing the schedule of activities; providing exam results; and providing a plan of activities.

Considering the submission of assignments and the access to contents, the aspects most valued by a higher percentage of both students and teachers were: submitting assignments; accessing bibliographic resources; and asking or answering questions after the lesson.

Among the virtual learning environment support tools to the courses, the ones valued by a higher percentage of students, over 90%, were: resources (as a support to the courses); notices; messages; and assignments.

The virtual learning environment tools valued by a higher percentage of teachers, over 90%, were: resources (as a support to the courses); notices; messages; register; and summaries.

The conclusions of this study cannot be generalized within the scope of other institutions since all the subjects taking part in this study belong to the same institution. However, it gives a set of indicators which should be taken into account for future studies, namely concerning the influence of users' computer skills on the access to the institution's environment, and the assessment of virtual learning environments as well as of the digital tools which integrate them.

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