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## CLASSIFICATION OF THE FEATURES IN LEARNING MANAGEMENT SYSTEMS

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### ABSTRACT

A Learning Management System (LMS) can be analyzed by sorting the features into four groups; tools for distribution, tools for communication, tools for interaction and tools for course administration. This classification was used for the first time when the use of LMS at the School of Engineering, University of Borås, in the year 2004 and the academic year 2009-2010 was investigated. The results from this longitudinal investigation confirmed the suspicion that lecturers used the available LMS predominantly to distribute documents to students, and that the pattern of use did not change over time. In this article the authors asserts that this classification is necessary to convincingly demonstrate the pattern of use and to analyze the pedagogical application of an LMS. The classification system works regardless of what brand of LMS is used, and it allows the connection between educational procedures and features in the LMS to be analyzed. Today, platforms, similar to a LMS are used in industry and government to handle information, staff development and internal communication. The possibility to analyze the use of such platforms may have beneficial effects on society beyond and outside universities.

**KEY WORDS:** Information and Communication Technology, E-learning, Learning Management systems, Engineering Education, Higher Education.

## CLASIFICACIÓN DE LAS HERRAMIENTAS EN SISTEMAS DE GESTIÓN PARA EL APRENDIZAJE: UN STUDIO DE CAMPO SUECO

### RESUMEN

Un Sistema de Gestión para el Aprendizaje (SGA, con siglas en inglés LMS) puede ser analizado clasificando sus características o herramientas en cuatro grupos; herramientas de distribución, herramientas de comunicación, herramientas de interacción y herramientas de administración de curso. Esta clasificación se realizó por primera vez en un estudio sobre el empleo de un SGA, en la Escuela de Ingeniería, Universidad de Borås, Suecia, en el año 2004 y el año académico 2009-2010. Los resultados de esta investigación longitudinal confirmaron la sospecha, que los profesores usan el SGA asequible predominantemente para distribuir documentos a los estudiantes, y que el patrón de empleo no cambia a través del tiempo. En este artículo los autores afirman, que esta clasificación es necesaria, para demostrar de manera convincente el patrón de uso y para analizar la aplicación pedagógica de un SGA. El sistema de clasificación es válido sin importar, cual es el SGA que se emplea, y permite en el análisis, la conexión entre formas educacionales y características del SGA. Hoy día, plataformas de aprendizaje, similares a un SGA, son utilizadas en la industria y en entidades públicas para manejar la información, desarrollo del personal y comunicación interna. La posibilidad de analizar el empleo de estas plataformas, puede tener efectos beneficiosos para la sociedad y exteriormente de las universidades.

**KEY WORDS:** Tecnologías de la información y la comunicación, E-learning, Sistemas de Gestión para el Aprendizaje, Educación en Ingeniería, Educación Superior.



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## 1. INTRODUCTION

To make a smooth transition into a knowledge driven economy is a problem for the entire society. In all organized enterprises the people concerned must work together, giving each other encouragement, support and feedback (Butakov et al., 2013). We expect there will be more and more use of the Internet for educational purposes (Kargidis et al., 2003), but also within industry and government (Alsabawy et al., 2013; Piña, 2013). A recurring theme in the literature about ICT in education is that while new technologies create new possibilities, they also require significant changes in attitudes and leadership (Kats, 2013; Scott, 1999).

Universities, government and industry today faces the problem to transform the organization, in order to reap the benefits of modern technology (González-Gallego et al., 2014). Many companies and government agencies use platforms, similar to a Learning Management System (LMS) to handle information, staff development and internal communication (Ndou, 2004). When a platform is used in industry, the administrators and executive staff is faced with the same problems we see in education (Yan-Xin et al., 2014).

Since the smooth use of Information and Communication Technology (ICT) requires support from administrators, educational technologists and technicians, staff in charge of ICT will have to manage and cooperate with a new network of people (Butakov et al., 2013). It follows, that preparing for future changes and challenges is an important issue for all institutions, not only universities and schools of Engineering (González-Gallego et al., 2014; Kats, 2013).

Learning Management Systems (LMS) can be defined as a 'toolbox' of programs intended to support learning, teaching and course administration. Most modern LMS (proprietary or freeware) have many features in common, for example; shared documents, discussion boards, assessments, grade book, chat room (Britain & Liber, 1999; Dias et al., 2014). We agree that communication, interaction and educational efforts are very important in industry and government as well (Kats, 2013; Ndou, 2004; Yan-Xin et al., 2014), and that the use of LMS should not be limited to schools (Alsabawy et al., 2013). It is natural, but slightly unfortunate, that the term LMS tend to limit our thinking to educational institutions. We feel strongly that the use of LMSes can be a force of innovation in a wide range of activities, if it is used to elicit collaboration and interaction. An LMS can also facilitate the use and distribution of open-access documents and freeware, in education called Open Educational Resources (OER) (D'Antoni, 2009; Garrote Jurado & Pettersson, 2012).

Changing one's teaching and learning paradigm can be both challenging and rewarding (Scott, 1999) and the development of new procedures based both on pedagogic and technical methods used in distance education and web-based learning, as well as the knowledge of how students learn outside school and university environments, is recognized as keys to optimizing Engineering Education and attracting a wider range of students (UNESCO, 2010, p. 47-49; 2011, p. 17; 2013, p. 4-7).

### **Scope and purpose of the study**

This paper is based on research that has been published previously by Ramon Garrote Jurado and Tomas Pettersson (Garrote Jurado, 2006; Garrote Jurado & Pettersson, 2011). Results from that research are used to highlight the importance of an appropriate classification of features when the use of LMSes is analyzed. The results are relevant to a wide range of organizations as platforms with similar features are used in industry and government. The results provide useful information about critical points in the utilization and implementation process of a LMS.

### **LMS, teaching and learning**

In the last decade most institutions for higher education in developed countries have made a Learning Management System (LMS) available to their lecturers. Many institutions have also made considerable efforts to implement the use of LMS as a common tool in the educational process (Butakov et al., 2013; Klobas & McGill, 2010; Paulsen, 2003; Weaver et al., 2008). More than 90 percent of academic institutions in USA had implemented a LMS platform in 2008 (Hill et al., 2009). In 2012 the global market for LMS was estimated to grow to nearly \$2 billion during 2013 (McIntosh, 2013). Actually, it reached \$2.5 billion at the end of the year and is expected to continue to grow nearly 25% in the coming years (Piccioli, 2014).

A lot has been written about possible beneficial impact from the use of LMS in higher education and the use of ICT to elicit interaction and collaboration (Dias et al., 2014; Kats, 2013; Sims, 1999). With the development of internet interactions have become an essential part of learning processes in e-learning (Donnelly, 2010) and high



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hopes of quality improvement appear to be connected to tools in the LMS that facilitate teacher-to-student or student-to-student synchronous or asynchronous interaction (Dias et al., 2014, p. vii-x; Shah-Nelson, 2013, p. 172-191).

There are sometimes disagreements about the pedagogical or educational value of interaction (Anderson, 2003). According to constructivist theories of learning, interaction is an important part of the learning experience and hence Online Asynchronous Discussion (OAD) and similar tools may enhance the learning experience considerably (Cronjé, 2006; Nunes & McPherson, 2003; Yarusso, 1992). As pointed out by Lawrence Hopperton (1998), the OAD tools provide "...the potential for a greater level of cognitive interaction and intra-action. Written language, in the context of educational computer conferencing, is interactive, anticipating or reacting to the ideas or queries of other participants". Apparently this is also the opinion of the providers of educational software: "Asynchronous conferencing or discussion groups form the heart of many VLEs (Virtual Learning Environments) as they provide the means for students to engage in collaborative exchange about topics on the course." (Britain & Liber, 2004, p. 5). It has also been asserted that both scholarly and social interaction may enhance learning by promoting the creation of a community of learners (Irwin & Berge, 2006, p. 3ff). An OAD may also serve as a mean to elicit interaction in workplace communities (Garrote Jurado, 2007).

A number of the tools that are available in a LMS are often used merely to replace existing technology, for example, copying machines (Dutton et al., 2004). It has been convincingly demonstrated that if lecturers get to choose what tools to use in the available LMS they will strongly favor the tools that facilitate distribution of information from teacher to learner (Bongalos et al., 2006; Garrote Jurado, 2012; Garrote Jurado & Pettersson, 2007; Phillips, 2006). In the past teachers copied and distributed their notes in class. Today, when they use a LMS, their notes are often copied into an online resources folder. The choice of tools that they use depends on how they perceive the use of that tool impacting on their workload. If it saves time they are likely to use it. If it takes additional time to learn how to use it and implement it then they are less likely to use it (Mahdzadeh et al., 2008).

## **2. THE USE OF LMS AT THE SCHOOL OF ENGINEERING, UNIVERSITY OF BORÅS**

The School of Engineering have approximately 70 employees and currently offers 19 different study programs at Diploma, BSc, MSc and PhD level in Engineering. In the academic year 2009-10 there was 2311 students registered, 1125 of them was full time students.

In 2004 there was no general policy for the use of LMS at the University of Borås (UB). Two different LMS were used, Luvit and WebCT. WebCT was used at the School of Engineering, the School of Business and Informatics and the School of Textiles. In 2007 a procurement process was completed and a LMS called Ping Pong was introduced for all faculties at UB. Since 2008 Ping Pong is the only LMS supported by UB. At the School of Engineering it is now policy that it should be used in all courses and that a course evaluation should be performed, using the "survey" tool.

In 2005 the first author of this article was assigned to handle the LMS WebCT, administration, technical support to teachers and students as well as provide pedagogical support to the teachers. As system administrator it was possible to look at the use of different tools in the LMS in each course. The investigation was conducted using an observation scheme. A spread sheet was created with a column for each tool in the LMS, and every course was assigned one row. 197 courses registered in WebCT in the year 2004 were examined, but only 107 were given at the School of Engineering. There was no apparent difference in the pattern of use of tools for those 107 courses and the remaining 90.

In 2011 all courses that were offered during the academic year from August 2009 to June 2010 at the School of Engineering, a total of 187 courses was investigated. The result was then compared with the results from the 2005 investigation. To enable a comparison of the results the procedure in the 2005 investigation as were followed as closely as possible. The scheme of observations was tested by two people independently examining 10 courses following the instructions. The obtained results were in full agreement.

### **Changed circumstances**

In 2004 the teachers who used WebCT had to choose the tools they wanted to activate and if a tool was activated but never actually used in the course it was labeled "exists". When a course is registered in Ping Pong at the School of Engineering today the following tools are added to the course by default; What's new, Overview, Contents, Documents, Surveys, FAQ, Participants, Message Board, Discussion and Ask/Answer questions.



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Because the label “exists” will then be given to those tools in all courses if the teacher has not deliberately taken them away it is only pertinent to look at the tools ‘in use’ for a comparison between results obtained in 2005 and 2011.

### 3. CLASSIFICATION OF TOOLS

To enable a comparison between two or more different LMS it is necessary to classify the different tools. When two or more different LMS are compared a number of issues have to be considered. There may be some tools available in one LMS but not in the other. E-mail, discussion board etcetera, may be used in a course within or outside of the LMS. Tools that are very much alike may still be used differently depending on equipment and internet connections and even if some tools are perfectly similar, how they are used may depend on what other tools are available. For this investigation the tools were divided into the following four groups, depending on their perceived impact on the educational process.

1. **Tools for distribution** that allow lecturers to upload documents, available to students. Earlier it was mainly text documents and today it may also be different kinds of media files. Nevertheless the process is still one-way, that is, teacher-to-learner distribution of information.
2. **Tools for communication** that allow information to go either way as well as from student-to-student. The most common example is E-mail.
3. **Tools for interaction** which call for reaction and feedback. Discussion boards are the most typical example. These tools are of great interest since they may promote student activity and cooperation, hence enhancing the learning experience.
4. **Tools for course administration** tools that are used to monitor and document the educational process, rather than facilitate teaching or learning. A special case is the tool “surveys” in Ping Pong. It technically facilitates interaction in many ways but was only used to enable a course evaluation in the courses investigated in this study. Because of the way it was used, the tool was classified as a tool for course management and not as a tool for interaction.

With the tools divided into the four groups above it is possible to look at the pattern of use even though two different LMS were involved. Tools may be used in different ways and the classification of specific tools depends on how the tool was used in the investigated courses. The use of the tool “surveys” in Ping Pong is an example of this.

#### **Limitations**

In this study the interpretation of the results is founded on a classification of all tools, based on how they were used. The classification of tools in this study is based on actual use of tools and the results reflect the methodological application of the tools and not the functionality of the tools or the LMS.



#### 4. RESULTS

Table 1: the use of tools for distribution in 2004 and 2009-10

Table 1: Tools for Distribution

WebCT, 2004 (N=107)			Ping Pong 2009-10(N=185)		
Tools for Distribution	n		Tools for Distribution	n	
Organizer Page	69	64%	Link (URL)	10	5%
Single Page	73	68%	Documents	136	74%
URL	58	54%	Overview	164	89%
Syllabus	41	38%	Contents	128	69%
Content Module	67	63%	Podcasts	0	0%
Glossary	9	8%			
Student Tips	4	4%			
Image Database	2	2%			
Multimedia	2	2%			
CD-ROM	0	0%			

In the figures below tools that were used in less than 5% of the courses are omitted.

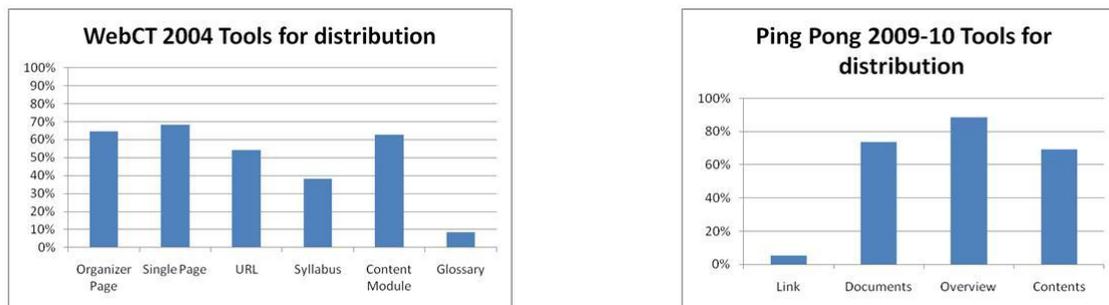


Figure 1: The use of tools for distribution, 2004 and 2009-10

The number of tools used to disseminate information is lower in Ping Pong than in WebCT. Both systems offer similar functions as the tool “Document” in Ping Pong may include text, image and multimedia files. In Ping Pong the tool “Link” is rarely used, but links to internet sites or other parts of the LMS can be included in any text.

Table 2: the use of tools for communication in 2004 and 2009-10

Table 1. Tools for Communication

WebCT, 2004 (N=107)			Ping Pong 2009-10(N=185)		
Tools for Communication	n		Tools for Communication	n	
Mail/Private post	36	34%	Participants	163	88%
Calendar	16	15%	Message Board	30	16%
Student tips	4	4%	What's new	21	11%
Student Homepages	2	2%	Ask/Answer questions	40	22%
			Calendar	4	2%
			FAQ	3	2%
			Log book	1	1%



In the figures below tools that were used in less than 5% of the courses are omitted.

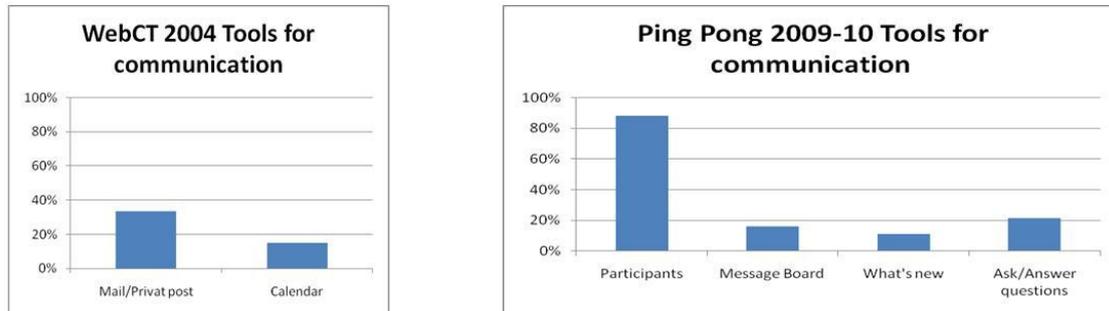


Figure 1. The use of tools for communication, 2004 and 2009-10

In Ping Pong there is no integrated mail system. The tool “Participants” works as a mail list and connects the user to an external mail client.

Table 3: the use of tools for interaction in 2004 and 2009-10

Table 2. Tools for Interaction

WebCT, 2004 (N=107)			PingPong 2009-10(N=185)		
Tools for Interaction	n		Tools for Interaction	n	
Discussion	34	32%	Discussion	21	11%
Chat	7	7%	Assignments	24	13%
Self-test	6	6%	Project groups	17	9%
Assignments	22	21%	Tests	5	3%
Student Presentations	1	1%	Chat	0	0%
Whiteboard	0	0%			

In the figures below tools that were used in less than 5% of the courses are omitted.

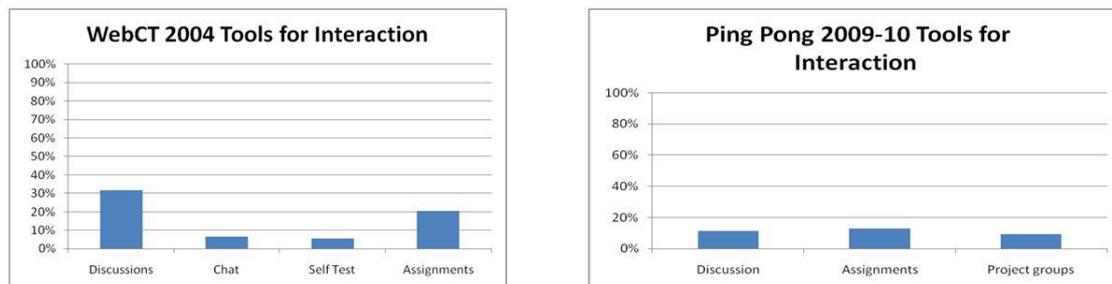


Figure 2. The use of tools for interaction, 2004 and 2009-10

The tools in this group were rarely used; in addition, the use of “Discussion” has dropped by two thirds in five years. This result confirms our fears that lecturers refrain from using tools that are focused on the learners’ activity and interaction.

Table 4: the use of tools for course management

Table 4. Tools for Course Management

WebCT, 2004 (N=107)			Ping Pong 2009-10(N=185)		
Tools for Course Management	n		Tools for Course Management	n	
Quizzes/Surveys	26	24%	Surveys	158	85%
My Grades	30	28%	Objectives	16	9%
My Progress	0	0%	Statistics	8	4%
			Portfolio	1	1%
			Reports	0	0%



In the figures below tools that were used in less than 5% of the courses are omitted.



Figure 3. The use of tools for Course Management, 2004 and 2009-10

The current policy at the School of Engineering is that a course evaluation should be performed, using the tool “Surveys” in Ping Pong. However, if a lecturer prefers to conduct the course evaluation in some other way he or she may do so.

### Comparison of the utilization of tools

The use of tools follows the same basic pattern in the investigations in 2005 and 2011. The tools for distribution are used far more than tools for communication or tools for interaction. Many tools available in the LMS are hardly used at all and lecturers choose to use tools that facilitate their teaching process without affecting the pedagogical or methodological design of their courses.

The most significant deviation is the decline in the use of OAD. That decline is interesting since it suggests a decline in teaching practices that call for student activity and collaboration.

The biggest apparent difference (the use of the tool “Survey” in the latter investigation) is explained by a policy decision at the School of Engineering to use the LMS in the course evaluation process. It meant that the tool “Surveys” was used to collect students’ opinions in most courses. The tool “Participants” enables the lecturers to send group E-mail to their students and may be used to bring the course evaluation questionnaire to the students’ attention. Those two tools were consequently used in most courses, but that is not to be taken as an indication of a change in the teaching practice.

At the school of engineering the available LMS was used by many lecturers to distribute information from the teacher to the students in both 2004 and 2009-10. Tools for interaction were used sparingly; furthermore, there is a considerable decline in the use of tools for interaction from 2004 to 2009-10. Looking at the results it appears that little has happened in the period 2004 to 2010 with respect to the lecturers’ practice. The patterns of use are similar and there is nothing to suggest that access to a LMS and the technical and pedagogical support that has been available for about ten years has had any significant impact on the education process.

## 5. ANALYSIS OF THE RESULTS

In the literature about the use of LMS three points stand out. The first is the high hopes linked to LMS as a tool to facilitate flexibility in education and to enhance the learning experience by supporting student centered methods and the creation of effective learning environments (Blin & Munro, 2008; Bush & Mott, 2009; Findik & Ozkan, 2010; Ubell, 2000; Wilson & Stacey, 2004).

Secondly, many educational institutions have made substantial efforts in terms of time and money to buy and maintain LMS and provide the technical and pedagogical support needed to run them (Brill & Galloway, 2007; Browne et al., 2006; Czerniewicz & Brown, 2009; Marshall, 2004).

A third notion is that, in spite of such institutional efforts and a promising initial phase, many lecturers only use a LMS to distribute documents to students. That indicates that access to computers, internet and technical support does not suffice to change the lecturers practice (Blin & Munro, 2008; Selwyn, 2007). This is also true at the school of engineering and in the literature we reviewed we found nothing to suggest that the use of LMS at the School of Engineering is not typical of many universities in the western world.



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The results of this investigation substantiated the hypothesis that lecturers primarily choose to utilize tools that facilitate the teaching process without affecting the pedagogical or methodological design of courses.

## 6. DISCUSSION

There are two basic perspectives to look at the usefulness of interactive methods and tools in education. One is teacher-centered and is mainly concerned with how a tool may facilitate the lecturers' work within a set frame of teaching practices and institutional traditions. The choice of the lecturer, to use or not to use a certain tool, may be perfectly understandable from the teachers' perspective while it may be unfortunate from the students' perspective. With that distinction in mind it is easy to see how there can still be such a wide gap between the theoreticians' high expectations about the impact of LMS on the educational process and the lecturers' choice of tools.

The other, learner-centered, perspective, favored by most learning theorists, is that it is students who learn and therefore the teacher's role is to facilitate that learning. The first perspective tends to focus on subject specific competencies whereas the latter includes generic competencies such as the students' development of information-handling skills, problem-solving skills and the general application of subject knowledge. This perspective is much more comprehensive than one that concentrates on transmitting and testing the subject specific content of a course.

The decision to use the tools available in a LMS depends on the balance of perceived effort and the expected contribution to the course. It makes sense that the balance between perceived usefulness and perceived ease of use decide the actual use of any available technology (Al-Busaidi & Al-Shihi, 2010). When teachers in higher education are asked to identify barriers to the use of educational technology lack of time and lack of support are the most common answers (Al-Senaidi et al., 2009).

Shortness of time and lack of support will of course lower the perceived ease of use, but that does not explain why lecturers utilize tools that facilitate distribution of information far more than tools for interaction. The answer to why tools for distribution of information are utilized much more than tools for interaction must be found in the "perceived usefulness" of tools.

Consider the example, a lecturer who wants the students to use a discussion forum actively. It will likely take some effort to keep the discussions on track, as it has been asserted that "the higher-level processes related to collaboration in an OAD may need to be more explicitly and effectively promoted in order to counteract a tendency on the part of participants to remain at the level of individual rather than group or collaborative effort." (Murphy, 2004). Of course, then it is a matter of how much confidence we have in the students' ability, if lecturers think that they must monitor all activity, they will think twice before utilizing discussion forums and other tools (Lonn & Teasley, 2009).

Many companies and government agencies use platforms, similar to a LMS, to handle information, staff development and internal communication (Ndou, 2004). When a platform is used in industry, the administrators and executive staff is faced with similar problems as those we see in education (Yan-Xin et al., 2014). In fact, for both universities and industry, the basic problem is to transform the organization, in order to reap the benefits of modern technology (González-Gallego et al., 2014). We feel strongly that the use of LMSes can be a force of innovation in a wide range of activities, if it is used to elicit collaboration and interaction.

## 7. CONCLUSIONS

Universities all over the world have invested time and money to make a LMS available to lecturers and students. This study indicates that many such efforts will be wasted if the leaders in the educational system do not implement staff development to raise the awareness about the pedagogical sound use of LMSes.

The need to analyze the way ICT is used is not only an issue for educational institutions. Platforms with similar features as a LMS are used in industry and government to handle information and reap the benefits of modern technology. Developing competence and confidence in the pedagogical use of ICT can have positive spin-off effects in a wide range of activities (UNESCO, 2011, p. 16-17).

The pattern of use of a LMS only becomes visible when different features are classified as above. The four categories allow a comparison between LMSes, but perhaps more important is the possibility to outline the way



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an LMS is utilized. It means the classification can be a valuable tool in research, but also in organizational development.

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