Seeing, Thinking, Doing:
Strategic Directives for Learning Management Systems

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Abstract
Learning management systems (LMS) are online, digital environments that allow information to be shared between students that are now used at a majority of American and European universities. This paper seeks to understand the possibilities and limitations of what these systems can accomplish, and to use this information to provide a series of guidelines for using a LMS in order to support teaching and learning activities. These activities are primarily modeled between three categories: transmission of information, evaluation of teacher and learner performance, and interaction in LMS-unique environments. By examining a host of studies conducted within these models, proper guidelines for use emerge. With a thorough understanding of each of these guidelines, those employing learning management systems will have a better sense not only of what their systems can accomplish, but how teaching and learning practices can best be served by a LMS, and how a LMS can create its own subset of teaching and learning practices.

Keywords: learning management systems, teaching and learning support, constructivism

1 Introduction
In the same way that the educational practice of the twentieth century might have been characterized by John Dewey’s avocation of hands-on learning in the classroom, the practice of the twenty-first is increasingly being defined by the use of learning management systems (or LMS) which enable continuous learning at all times of day, even when the classroom itself is physically inaccessible. Learning management systems are online, digital environments that allow information to be shared between students and faculty. These systems are typically deployed at a university-wide level, and provide access to content and administrative features for specific courses. Thus while the university itself is generally responsible for maintaining the LMS network, individual classes make use of most of its features. Although the administrative components of the LMS are generally static, in some cases, skilled personnel can generate optional plug-ins that can allow IT personnel and faculty to incorporate more specialized learning environments.

In thus facilitating coursework, the benefits of a LMS are two-fold. First, by distributing materials electronically and near instantaneously, a LMS facilitates the creation and dissemination of course materials that would generally need to be dispensed during class time otherwise (Sclater, 2008). Whereas an instructor might circulate multiple copies of handouts or lecture notes during the first five minutes of a class meeting, a LMS would allow the instructor to upload these same materials so that they’re available to all students even prior to class. At the same time, a LMS allows for the creation of unique learning environments that can supplement in-class activities, empowering both students and instructors to reinforce the course material, and to engage with the material in a variety of different ways (Dougiamas & Taylor, 2003).

Learning management systems are not a new technology. At this point, learning management systems are ubiquitous enough as to be installed and used at a majority of American...
and European universities (Daalsgard, 2006). Internal measurements of LMS use by a number of universities note that more than 90% of students use their LMS at least once a week (ECAR 2009). The predominant reason that learning management systems have seen such widespread implementation is an overriding expectation that use of a LMS will enhance a student’s learning experience, and thereby leads to better individual performance (Teasley and Lonn, 2007; Liaw et al, 2008; Martin-Blas and Serrano-Fernandez, 2009).

While the literature on learning management systems is full of meaningful articles that provide specific evidence for the utility of individual LMS functions, as well as novel examples of emergent LMS technologies, at this point it remains less clear just what the comprehensive benefits of a LMS might be, how these benefits can be measured, and what a completely successful implementation of a learning management system would even look like. Nevertheless, the use of such systems has reached a critical enough mass that not supporting a LMS may well be a liability for any university; there remains the possibility, indeed the very real threat, that the sheer ubiquity of learning management systems is justification enough for universities to continue supporting them, even independent of explicit pedagogical goals. A LMS becomes just another instrumental learning tool, as commonplace as chalk, without the acknowledgement that the implementation of such a framework might well alter the way that teachers teach and that learners learn. If all parties, instead, can be made aware of how learning management systems can impact learning, then the benefits of such a system can be maximally refocused and refined.

Although a LMS is not, generally, the primary vehicle by which teaching and learning is conducted, the central premise of a LMS is that it acts to support other, perhaps more intrinsic learning endeavors. By better understanding the possibilities and limitations of what these systems can accomplish, of what they are capable of doing and in turn how they are actually used, it is thus possible to isolate a series of guidelines that might inform how learning management systems might be best utilized at present, and how they might be best extended in the future. Only by parsing the claims, tradeoffs, and utility of these methods is it then possible to structure a broader series of guidelines for their implementation more generally, in any educational context. With a thorough understanding of each of these guidelines, those currently employing or considering employing learning management systems will have a better sense not only of what their systems can accomplish, but how teaching and learning practices can best be served by a LMS, and how a LMS can create its own subset of teaching and learning practices.

These guidelines, or strategies for supporting teaching and learning, cannot merely be divined from nothing. A host of both theoretical and practical literatures have sought to explore individual components of LMS behavior, however, to this date, no comprehensive evaluation of learning management systems has been conducted to the extent that cogent, consistent guidelines for use might be deduced. This study seeks to review and isolate the primary functions of various learning management systems, dividing these functions between three broad categories: transmission, evaluation, and interaction. These distinctions are useful, because they highlight the major types of contributions that a learning management system can possibly make to supporting teaching and learning.

The second section will explore the distinctions between these three primary categories, noting examples and possible extensions for each.

The third section will draw on the research noted earlier to establish the actual guidelines for LMS implementation.

Ultimately, the study concludes with a summary of its findings, as well as a final reflection on the project’s applicability to the future of learning management systems.

2 Support for Teaching and Learning

As educational tools, learning management systems are of use both to instructors, as well as their students. Most LMS platforms provide features that cater to the educational needs of either group.
A comprehensive body of research (Ioannau, 2008; Shee and Wang, 2008) suggests that individual learners are the perceived end user for LMS development, even though they are not the first (or even second) parties to touch the software. Indeed, the most belated subset of users are generally the most vital stakeholders for any kind of software, and thus their opinions ought to be especially valued (Jiang et al, 2001; Wang, 2003). Nevertheless, separate scholarship (Lonn and Teasley, 2009; Hamuy and Galaz, 2010) suggests that the actual deployment of LMS technologies has a greater potential impact on educators than it does on their charges. Generally, there remains a conviction that improving the educational practices of instructors can improve the actual implementation of the technology, and thus the learning experience of students (Hamuy and Galaz 2010). Regardless of which population benefits, then, there is a trickle-down effect that improves the overall learning experience for both parties.

Most LMS implementations aspire to facilitate one of three priorities: distributing and accessing course material, identifying different learning styles among students and educators, and establishing unique learning environments for the applied practice of specific exercises. For the purposes of this study, these categories are referred to broadly as transmission, evaluation, and interaction, respectively.

In discussing the proliferation of uses for a LMS, it is worth noting one further possibility: that the LMS might not be used at all. Although surveys and usage statistics can provide an apt diagnostic for just how instructors tend to engage with a LMS, Vodanovich (2004) suggests that even nominal enthusiasm for a LMS and electronic learning among educators does not necessarily result in higher or more advanced patterns of use. Under this model, educators use a LMS simply for the sake of using a LMS, and there is no honest impact on their teaching practice whatsoever. Given the sheer ubiquity of learning management systems, however, it is worth first parsing the claims of these systems before dismissing their utility wholesale. The next three sections track what the ostensible benefits of a learning management system might look like.

2.1 Transmission – For distributing and accessing course material

The most basic, and thus most widely adopted, purpose of LMS use is the transmission of course material (Malikowski et al, 2007). Often, these materials are the same lecture notes, slides, or course handouts that instructors would need to distribute to students manually without the aid of a LMS. As such, the marshalling of a LMS for the purpose of transmission is the feature most analogous to already common, “unplugged” pedagogical practice. Usage patterns and self-reports by educators almost universally demonstrate that the LMS is most frequently used for accomplishing these same administrative tasks (Morgan, 2003; Nijhuis and Collis, 2003). Instructor use of a LMS might thus prudently be divided between those tasks that are accomplished “before,” “during,” or “after” actual course instruction (ibid).

Since the LMS keeps a continual, static record of all the material posted for a course, students are empowered to engage with the material at any of the above units of time (before, during, or after). A LMS framework thus provides the maximal opportunity for an educator to refine the transmission of the course material over time:

“to [incrementally] deliver the educational material, to activate existing knowledge, to produce and apply new knowledge, to support the community and to motivate the students” (Georgouli et al, 2008, p. 238).

This model best approximates – and wholly satisfies – the constructivist criteria for the development of knowledge. Constructivism, most generally, is the philosophy that knowledge is acquired through direct experiences, and to the subsequent application of those experiences. As it applies to online learning, this philosophy is most prominently voiced by Marcel Lebrun and echoed by others (Lebrun, 1999; Georgouli et al, 2008). As modeled in Figure 1 below, if a student’s learning experience is sub-divided into the initial provision of information, the activation of knowledge, and the application of that knowledge, a LMS allows an instructor to continue to reinforce curricular goals during each of these periods.
Although its principal benefit is for learners, this rough hierarchy mimics, in some ways, a model noted by many researchers for how faculty come to familiarize themselves with a LMS, and adopt its features, in the first place. Many instructors first engage with a LMS not by mastering the entire system, but by engaging with a single feature, encountering challenges in the implementation of the feature, and moving on to other aspects of the platform only having worked through those earlier challenges (Rogers, 2003; West et al, 2007; Malikowski, 2008). This, for the record, is itself a constructivist approach to learning, for it makes the latent assumption that it is in the very process of mastering a single feature that instructors gain the requisite knowledge, prowess, or intuition necessary to graduate to other features.

This method has seen particular utility in applied science courses as a means of augmenting face-to-face learning. Although most applied sciences make use of laboratory time for students to run, test, and observe a variety of experiments, a LMS framework can allow instructors to introduce additional experiments (or variations on experiments) that they might not have had time to cover during the normal period of instruction (Sclater, 2008; Martin-Blas and Serrano-Fernandez, 2009). In one demonstration, by Martin-Blas and Serrano-Fernandez (2009), students in a physics class were provided with access to virtual simulations of experiments that they had already performed in class through a plug-in for the Moodle LMS (Rice, 2006) (see Figure 2). By recreating the class experience, students were able not only to mimic their live experience, but to modify variables at will, thereby either testing their knowledge of how the models in question worked, or else pushing the boundaries of the models to see where they failed. While making use of the existing material (“information provision”), this simulation allowed students to reflect on their understanding (“knowledge activation”), and ultimately to become the authors of their own experiments (“knowledge application”).

Figure 1. A model of constructivist learning
Figure 2. Example of a physics experiment running in the Moodle LMS

Such utility is even more comprehensive in large courses with multiple instructors. In one evaluation of a single course with upwards of 450 students and four different instructors (Fried 2007), an ad hoc LMS was generated to standardize material across each of the instructors, yet with enough flexibility that any given instructor could make allowances for his or her own additional reference materials, or for the varied learning styles of students. Even though this test program was competing with another, institutional LMS, the system in question witnessed anecdotal enthusiasm from students and faculty alike. Instructors noted a dramatically diminished investment of time and effort in distributing the relevant materials to students, especially against their face-to-face interactions, but even in comparison to the learning curve of the native LMS.

This ample enthusiasm is not to say that reliance on a LMS purely for transmission purposes is not without its pitfalls. An agglomeration of studies note that learning management systems tend to be used overwhelmingly only for their utility as online repositories for syllabi, lectures slides, and other course material, often neglecting most, if not all, of the remaining features (Sclater, 2008). This mindset is reinforced by Malikowski’s model (2007), which posits transmission as the “entry level” position for instructor exposure to a LMS. While such reliance can act as training wheels so that instructors might gradually begin to engage with more complex features, simple reliance on the most standard feature of a LMS might inadvertently lead to a kind of intellectual stagnation. Without sustained reflection by instructors on what additional features
might improve the online learning experience, such limited use can breed a culture wherein the mindset of the instructor – and thus of the institution itself – is led by the restrictions of the software rather than the actual needs of educators or their pupils (Ioannou 2008, Sclater 2008). For reasons already explored in this paper, this kind of feedback loop is actually the direct opposite of ideal.

If students are generally perceived as the true end user of LMS technology, and learning management systems are most often used for transmission purposes, it would hopefully stand to reason that the transmission of material across a LMS pays direct dividends for the learners themselves. The distribution of course material and syllabi in one sustained environment that is nevertheless amended contemporaneous with the progress of the course allows for students to dynamically reflect on the goals and benchmarks of the course (Lebrun, 1999; Merril, 2002; Georgouli, 2008). For learners, the transmission of information by way of a LMS allows for the fulfillment of constructivist principles in a way that static, face-to-face distribution (by way of even frequent handouts and photocopies) cannot (ibid).

In specific studies, learning management systems have demonstrated express utility in enhancing learner autonomy, specifically in cultural contexts where pupils might be reluctant to question instructor authority (Sanpraset, 2009). This too is a direct model of constructivist utility, for it is through the very process of interrogation that students are expected to acquire new knowledge.

Despite looming concerns among educators that the availability of lecture notes and other materials over a LMS might discourage course attendance, Grabe et al (2005) found that although the electronic availability of course material was, in fact, a leading excuse for missing class, most LMS activity took place just prior to the specific course meetings, suggesting that students were accessing material to bring to class with them. This would suggest that a LMS acts as a gateway to, rather than a substitute for, course activities. What’s more, those students who made regular use of the LMS for this purpose (especially those who accessed partial lecture outlines rather than detailed notes) actually performed better on exams and exercises than those who did not. Although the actual changes to exam scores were omitted, the researchers noted that the difference between user groups was statistically significant (ibid).

It is not surprising that the most basic function of a learning management system is likewise the most widely used. At the same time, however, the use of a LMS for transmission has then greater consequences for a greater number of users. Specifically for educators with a constructivist framework in mind, the transmission of course material in a continuous, online venue is the surest method of allowing students access to that material at each stage in their accumulation and application of knowledge.

2.2 Evaluation - For identifying different learning styles

One of the benefits to LMS use is that it provides users with a built-in opportunity to reflect critically on the utility of the LMS to their teaching or learning. Most learning management systems come pre-configured with some kind of analytic software, so that faculty can track, at a minimum, which students have visited the LMS domain, how often, and which materials they’ve accessed. More refined operations, or plug-ins for open-source software’s, can render this same information more sensitively, so that instructors might better monitor not only what students are doing on the LMS, but how they’re doing it, what difficulties they’re encountering, and how this information relates, transparently, to that of their peers (Sclater, 2008; Graf et al, 2009).

A potential caveat to this approach, however, is the suggestion that even highly sensitive usage statistics can yet make it difficult for instructors to distinguish between the individual learning styles of their students (Dohn, 2009; Graf et al, 2009). The introduction of more data points, for untrained faculty, can only add to the confusion (ibid). Here the comparison is always made not between various types of LMS use, but between LMS use and face-to-face interactions,
with the assumption that migrating class discussions into a virtual forum doesn’t allow for the same types of observation as the seminar room. As such, much research into the evaluative capacity of learning management systems lies in isolating what the correct areas for evaluation even are.

One early study by Collins et al (2005) attempted to integrate stored digital video with the Blackboard LMS (Hazari, 2002) as a means of simulating real-world scenarios for various professional programs. Students would record their responses to a series of prompts (see Figure 2), while their peers would use the system’s online discussion board to critique and evaluate the performance. Specifically, the four researchers involved in Collins’s team applied this method to courses in teaching, child therapy and library reference services. Students in the teaching course used the LMS software to conduct peer reviews of hypothetical teaching conferences focusing on writing strategies. Following along the lines of the constructivist model for knowledge acquisition, this interactive arrangement allowed students to engage with the course material at three possible sites of knowledge transmission (Lebrun, 1999; Georgouli et al, 2004). First, by seeing others proceed through the exercise, students were able to review the earlier (knowledge provision) stage of their instruction. In commenting upon it, students were compelled to reflect critically on what they had learned as it applied to a real-world example. Finally, in being critiqued themselves, students were asked to put their knowledge into practice. Similar results were observed for each of the courses in which this process was used. Additionally, the researchers noted the adaptability of this method to facilitating relationships between faculty and students; rather than simply engaging in a one-way dissemination of information, here the students themselves became the moderators of the course dialogue, allowing the instructor to better shape the structure of the course material to respond to the students’ needs. Among the participants, the only complaint was that they would have preferred more hands-on experience with the mechanism. As proven by the diversity of disciplines in which it was used, applications for this pedagogy were and are far-reaching.

![Figure 3. Video peer assessment exercise embedded in an LMS](image)

Although “evaluation,” in the terms of Collins et al, refers to the actual process that students and instructors are undergoing, learning management systems can likewise be deployed
as automated evaluative tools. One example is found in a program designed to monitor students’ interactions in a LMS environment, which would then use this information in order to construct more efficient groupings for class activities (Sun et al., 2008). Similar studies have reinforced the potential of learning management systems to evaluate student performance through data mining (Romero 2008). Here, by taking advantage of the unique capacity of the LMS to create data points from a student’s approaches to learning (something clearly less possible in the actual classroom), the program was able to seek out learning styles that would be maximally complimentary. A demonstration of one of these pairings, along with the interaction patterns between the students, is seen in Figure 4.

![Figure 4. Example of interactions among suggested group pairings formed by LMS plug-in](image)

With a host of different learners and learning styles, to say nothing of teaching styles, available, one difficulty might be found merely in isolating the appropriate types of interactions between learners to evaluate. The research model provided by Malikowski et al. (2007) provides one instructive, albeit vague, suggestion.

Evaluation can be formative, summative, and it is based on a learning goal or activities during a lesson. Details more specific than these are influenced by the educational theory being used in the course. (Malikowski et al., 2007, p. 262)

What any given evaluation, or evaluatory mechanism, might prioritize thus depends upon the overarching philosophy of the educator or institution, be it a constructivist, behaviorist, or cognitivist approach, or any number of variations in between: the tools brought to bear vary with the toolbox, so to speak.

More specifically, most of the more recent studies noted within this article employ a constructivist framework as the baseline for their observations. Cavus (2007) suggests that this is because constructivism best aligns itself with the claims of Web-based, synchronous, collaborative learning, which is itself the focus of much research. These approaches thus maintain that “effective learning relies on active engagement by the student, and high levels of interaction, in social-dialogical environments and in real-world situations,” and would evaluate success based on the correspondence between these variables (ibid).
Although we might expect some subset of the literature to concern the utility of a LMS for instructor self-evaluation, no material towards this end is available at this time.

Little study of this category has been made for its applicability to students, at least explicitly. More often than not, enhanced evaluation potential seems to be a consequence of some other primary function than the outright goal of the investigation. This was the case in Collins et al (2005), above, where the collaborative video sharing LMS plug-in became a formal means for students to reflect on their own progress in the course at length, both in evaluating their own performance, and in comparing it to that of their peers.

Since the purpose of this very study is to formulate some kind of evaluative framework for the claims of learning management systems more generally, it would only follow that one of the most vital components of a LMS is to offer the tools for evaluation itself. By presenting instructors and learners with an opportunity to assess a student’s progress in real-time, learning management systems enable users to model their behavior patterns, to change these behavior patterns, and to indeed alter whole pedagogies in order to better suit a student’s needs. It is the evaluative function that makes the very adaptability of learning management systems possible.

2.3 Interaction – For the establishment of unique learning environments

Regardless of educational philosophy, the primary interest of most LMS use is how, and by what means, end users are able to interact with it. Several targeted studies have made use of a LMS to create unique methods for students to access, explore, and thus, presumably, to learn specific material. In most cases, student use of a LMS for these purposes was generally optional, allowing for the isolation of something of a control group to distinguish between the participants. For each of these cases, researchers noted heightened student enthusiasm and satisfaction with the LMS mechanism, as well as heightened achievement, however this achievement was measured. Just one example (Cavus, 2007) witness a 15-point differential on assessment papers (on a 100-point scale) for students using the interactive method of instruction rather than traditional teaching methods. Despite varying levels of satisfaction, most students are content to use their LMS voluntarily, and only attribute to their use of the system to a desire to fulfill social norms when a course makes LMS use explicitly mandatory (Venkatesh and Davis, 2000).

The most common method of LMS interaction, now familiar to anyone with experience with the platform, is the online class discussion board. One of the preliminary investigations into the efficacy of such discussions for fostering learning was led, not coincidentally, Martin Dougiamas and Peter Taylor, the two principal architects of Moodle (Dougiamas and Taylor, 2003). Dougiamas and Taylor attempted to weigh student responses to a survey, termed the Constructivist On-Line Learning Environment Survey (COLLES), against the actual outcomes of student participation on a Moodle discussion board (pictured, in generic form, in Figure 5 below). The researchers noted that among all students in the course, even those whose COLLES profile seemed to suggest a high aptitude for intuitively constructivist methods of learning, students seldom ever asked any questions in their discussion comments, and rather tended to support a previous statement as a means of introducing and reflecting on their own thoughts. Tellingly, the proposed response to this problem on the part of the researchers was to alter the actual teaching methods employed in future iterations of the course, providing students with a longer window in which to produce their comments. In so doing, the implementation of the LMS was reconciled with the actual format of the course in order to be maximally productive.
Comparatively, the initial experiment conducted by Dougiamas and Taylor took place at an early moment in the history of learning management systems. Subsequent studies have separately attempted to examine students’ interactions with one another via a LMS. Cavus (2007) employed a customized LMS environment for the collaborative, real-time learning of Java programming. Using a plug-in for the open source LMS Moodle, participating students would use the interface to produce their own Java code while simultaneously being able to access the work of their instructors and classmates. Students would use the environment both as a supplement to conventional course instruction, and as an actual substitute for face-to-face learning. One of the merits of the system extolled by the researchers was the ability of the LMS to facilitate specific, scheduled engagements between students and faculty through a single mediated environment, allowing students to ask questions of the instructor and each other while simultaneously watching others manipulate code, or manipulating the code themselves. A separate consequence of the study was its avocation of more complex collaborative environments. Cavus actually deployed two different environments, a basic tool and a more advanced one, and noted significantly higher rates of success for those students who used the more advanced mechanism. Between the two mechanisms, the basic tool perhaps most closely approximates the standard communications features of a LMS, with private messaging and access to course material as its principle features; the most significant feature added to the advanced model was the decidedly more “unique” ability of students to access the output of their instructors and peers in real-time. The difference between these two environments is noted in Figures 6 and 7.
Another study by Chen et al. (2008) attempted to implement the same collaborative mechanism on an even smaller scale. Most learning management systems are structured around the individual classes that students happen to be enrolled in, with the instructor of each course responsible for maintaining content. Chen et al. piloted a custom LMS, dubbed GroupNet, which strove to appeal to smaller groups of mobile users. After being installed on a learner’s laptop, cell phone, or other mobile device, the GroupNet software would automatically join a (typically wireless) network, and would connect the learner with other users who were engaged in similar types of learning activities. The utility of such interaction was twofold. On one hand, the automated supervision of the software would allow for the formation of ad hoc study groups, and could distribute slightly different sample problems to both learners.
based on their prior learning history, which would cater to their individual strengths and encourage collaborative discussion as a means of problem solving. This would facilitate the educational benefits of collaboration already noted earlier. A separate benefit to a mobile LMS would allow students in, say, a life sciences course to engage in hand-on experiments and fieldwork where the site of a given lab might be entirely dependent upon the learner’s location, processed via GPS. As the researchers conclude, both setups would have added utility for universities with large off campus populations, where students might otherwise have difficulty finding ways to work together.

Isotani et al (2009) designed a wholly custom LMS interface that allowed students to collaboratively construct, identify, and modify geometric objects. This study bears some similarity to Martin-Blas and Serrano-Fernandez’s online recreation of physics experiments, as discussed earlier (Martin-Blas and Serrano-Fernandez, 2009). More comprehensively, however, the purpose of the Isotani study was to create a theory-aware authoring tool: that is, a LMS interface that might have one static interface, but which would provide specific prompts for users that would best align with the course’s particular pedagogical philosophy. Figure 8 models how this might be accomplished. Using a variety of input data about the educator’s pedagogical choices, as well as the learner’s individual profile, the system generates problems, prompts, and solutions that can help coach the learner through the steps required to correctly model the geometric objects. This allows students to approach the same problem from two different pedagogical standpoints, and to still achieve the same, correct outcomes. This system marks the fullest step in using LMS systems not only improving student and educator performance, but in actually teaching both parties how to perform more efficiently. The Isotani study perhaps best models the simultaneous integration of two types of LMS activity: the interactions between the student and the software become a means of evaluating the student’s performance, and this evaluative data, in turn, is used to automatically generate yet further evaluative content.

As we might imagine, the fashioning of these learning environments by different researchers required a commensurate shift in the teaching methods used to actually manage the course. This shift would approximate the sort of action suggested by Dougiamas and Taylor discussed earlier (Dougiamas and Taylor, 2003). At the same time, there is the suggestion that the implementation of a LMS for the purposes of interaction has its own, independent impact upon teaching methods as well. Bowers (2006) suggests that LMS use has comprehensive benefit for instructors in intraprofessional programs, not only because it improves student performance, but because it

![Figure 8. Model of a theory-aware authoring tool for integration with an LMS](image)
allows instructors to engage with a variety of materials from a variety of perspectives that might best serve the disparate pedagogical interests required of certain professions, such as nursing.

This behavior, however, might be atypical. In evaluating faculty use of learning management systems, many studies have found that the features of any given LMS which allow instructors to create interactive learning activities, from discussion forums and quizzes to wholly unique interactive portals, are the least-utilized feature overall (Ansorge and Bendus, 2003; Morgan, 2003; Nijhuis and Collis, 2003; Dutton et al., 2004; Woods et al., 2004). Even these results might prove misleading, for even where faculty self-report that their primary use of a LMS is in establishing unique approaches to pedagogical problems, their actual usage patterns suggest that their actual chief preoccupation is the (earlier) transmission of information (Morgan, 2003; Nijhuis and Collis, 2003).

Interaction provides the most novel sequence of end user experiences, and marks the fullest potential for learning management systems to introduce teaching and learning strategies that would be otherwise inconceivable in the real world. It is perhaps a testament to the versatility of this category that even the handful of mechanisms discussed here provide only a cursory window on the possible applications and permutations of what an interactive system might be. Isotani’s model, although potentially the least sensational of all the software plug-ins enumerated thus far, presents, even in its threadbare design, a limitless recombination of pedagogical goals, challenges, and solutions. We might, in parting, see this capacity for continual reconfiguration as a metaphor for the very process of learning management systems themselves.

3 Guidelines for LMS Implementation

Given the wide variety of applications for learning management systems sketched thus far, it would seem likely that the possible array of implementations or applied pedagogies would be near infinite. Nevertheless, broad trends prominent in the literature make it possible to structure a series of guidelines for how a LMS might be best utilized. Point by point, the following section provides a series of possible recommendations.

3.1 Build system around faculty and student needs

No matter what the function – transmission, evaluation, or interaction – learning management systems, like American electoral politics, are a two-party system. Although students are ultimately the final target of any pedagogical refinement (Lonn and Teasley, 2009; Hamuy and Galaz, 2010), educators are more likely to be effected by sudden changes to a LMS platform. Likewise, any change which affects actual teaching practices, even as simple a change as minimizing the time required for instructors to distribute course materials, has potential consequences for how the students are taught, and thus how they might learn (Hamuy and Galaz, 2010). Thus any proposed LMS should make an attempt to appeal to the priorities and needs of both groups.

3.2 Take advantage of pedagogical adaptability

As given by the simple variety of activities catalogued here, learning management systems, regardless of developer, enable a wide array of learning activities that can be designed to cater to any number of different teaching styles or pedagogical theories (Malikowski et al, 2007; Isotani, 2009). With appropriate developer or IT support, open-source platforms allow for an LMS to be modified endlessly. Although a platform Blackboard is configured with a host of pre-installed features, even its very function is analogous to that of an actual blackboard; instructors supply whatever content they are motivated to supply, and are restricted only by the dimensions of the frame. The LMS thus creates a pedagogical instrument that is, essentially, pedagogically neutral
(Sclater, 2008). Nevertheless, by enabling such malleability to take place, learning management systems tend to reinforce an educational model that fulfills many of the explicit goals from constructivist philosophy for instructors and learners alike (Lebrun, 1999; Georgouli et al, 2008). Failure to acknowledge the adaptability of an LMS platform, as suggested by some (Sclater, 2008; Mott, 2010), is to, if only accidentally, allow the institutional processes of the university to align themselves with whatever the software is capable of rather than vice versa.

3.3 Allow learners to learn for themselves

As given by the sheer volume of articles manifesting this theory, the claims of learning management systems seem favorably aligned towards the express goals of educational constructivism. Even as a LMS empowers the instructor to experiment with a variety of top-down approaches to managing course material, LMS use can encourage students to provide their own answers for how to best navigate the course material (Collins et al, 2005; Georgouli, 2008; Sanpraset, 2009). Yet precisely because many LMS features (no matter how adaptable) are exclusively within the dominion of faculty or administrators to modify, it remains important to acknowledge this potential utility of learning management systems, or to design exercises which reward these types of learning.

3.4 Use the open-ended availability of the LMS to rethink pedagogy

Because its content is preserved continuously, and is free to be accessed at any time, LMS systems might be used to augment learning at any point during a student’s instruction. Prudent use of a LMS might thus address how the system itself can contribute to learning before, during, and after the period of conventional course interaction (Morgan, 2003; Nijhuis and Collis, 2003). Although they themselves have utility at any point during instruction, the three broad types of categories for LMS use, transmission, evaluation, and interaction, might themselves be seen to roughly correspond to the three chronological stages of a successful LMS implementation: material is first provided through transmission before the course has begun, evaluation aids a better understanding of how students are learning while the course is in progress, and various interactive features can be accessed outside the classroom once the class session has ended.

3.5 Develop hybrid strategies for face-to-face and distance learning

Learning management systems are used in every manner of educational environment, either as a mere auxiliary component of ordinary course work (Woods et al, 2004; Sclater, 2008; Martin-Blas and Serrano-Fernandez, 2009), or else as an independent means of fostering distance learning where conventional face-to-face communication might be impossible (Collins, 2004; Sclater, 2008). Various systems have proved equally adept at either implementation. This allows both instructors and administrators to design courses, platforms, and activities that make maximal use of students’ learning time.

3.6 Explore the potential to evaluate both faculty and students

Although the most obvious reason for using a LMS is that doing so might improve student performance (Teasley and Lonn, 2007; Liaw et al, 2008; Martin-Blas and Serrano-Fernandez, 2009), there is little certainty as to what “improved performance” would even entail. Most individual studies of LMS use seek to correlate student use of the LMS, or LMS multimedia, with higher scores on exams and course evaluations. Although this emphasis on grades is the priority of many researchers, however – and thus, it stands to reason, instructors – it
has historically been suggested that students don’t necessarily use a LMS in order to attain better grades, and don’t see their grades as a function of LMS use (Pan et al, 2005). Recent work has found that a task-technology fit evaluation of students’ response to technology revealed only a weak correlation between LMS use and grades (Martin-Blas and Serrano-Fernandez, 2009; McGill and Klobas, 2009). While this does not eliminate a very real connection between the two variables, this test does demonstrate that the “achievement of higher grades” through the use of a LMS “is not necessarily the [explicit] goal” for a majority of students (McGill and Klobas, 2009).

The “task-technology fit” used by McGill and Klobas, among several others, asks users to first evaluate the sorts of tasks that they’d prefer or expect to see from a given technological system (McGill and Klobas, 2009). Thereafter, these expectations are compared to users’ hands-on evaluations in order to gauge the suitability of any given system (here, specifically a learning management system) to fulfilling the required tasks. Studies using this model conclude that the “ease of use” is generally the most important factor when any party, students or faculty alike, hope to select a LMS. Besides this model, the predominant measure for evaluating student satisfaction with a LMS is the Technology Acceptance Model (or TAM), introduced first and most comprehensively by Selim (2003) and Abdalla (2005). When asked to evaluate multiple products, or multiple variations of the same product, user satisfaction under this model can be judged through a series of pair-wise evaluations, placing the “Best Product Overall” against the “Best Product in Category X” in order to isolate the “distance from perfection” of any given system. Such a process can likewise be used to determine the areas of an existing LMS that might be the most in need of an upgrade (Shee and Wang, 2008). The ability to make such decisions is, it’s worth noting, enhanced thanks simply to the inherent evaluatory and data mining potential of learning management systems themselves.

Actual surveys of student satisfaction using the TAM index find that student priorities are generally concentrated on the “ease of use” and “usefulness” of the system in place (Selim 2003, Abdalla 2005, Shee and Wang 2008).

3.7 Incorporate external learning spaces

If students prioritize ease of use in their LMS interactions, that standard might be further extended so that it encompasses additional platforms that students are already using and are familiar with. If we concede that the communications features of native LMS features are infrequently used (Sclater, 2008), at least when not likewise coupled to a unique, specific environment, as noted by any number of specific studies, then one potential remedy might be to make fuller use of the communications mechanisms that students are already using elsewhere. By tapping into the already omnipresent network of social networks (from blogs to Facebook to Twitter and so on down the line), the marshalling of Web 2.0 technologies for pedagogical purposes might provide a more intuitive user experience while also allowing for a degree of user investment, customization, and ownership simply not possible in most commercial LMS applications (Daalsgard, 2006; Sclater, 2008).

Dissent against this model is leveled primarily from a theoretical perspective: the logic of blogs holds that simple participation in the forum counts as relevant experience, yet the point of discrete education is generally to provide an environment prior to the exercise of applied experience; blogging makes the assumption that students already know what they need to know (Dohn, 2009). Any integration of blogs with a conventional LMS environment would thus need to modify not only the learning tools themselves, but actual educational practices.
3.8 Allow the LMS to be used in ways that don’t rely on the conventional size of the classroom

Learning management systems have the benefit of being able to accommodate not only a variety of activities, but a variety of sizes of activities. If a LMS-friendly activity can be applied to a group of 500 students (as in Aaron Fried’s 2007 study) with the same ease that it can be applied to 30, or 7, there is literally no size constraint to what a LMS can accomplish. In the same way that individualized learning constitutes just a component of a student’s learning experiences involving smaller groups or the whole class (Robinson and Sebba 2010), so the “class” itself is just another arbitrary grouping that is part of a range of a student’s learning environment. Although most LMS design is formulated among individual courses, with the instructors of these courses maintaining absolute fiat over system content, it might be useful to think of a LMS as being able to accommodate significantly larger or significantly smaller groups of users. LMS activities can be designed and implemented then for the course-based systems that are already in place, but with additional attention paid to the needs of other subdivisions of students. Past a certain point, this ability to expand and contract the scope of a LMS might indeed render the LMS interface itself irrelevant.

In order to make these changes, however, it is perhaps first relevant to understand how one could even begin to go about amending the existing system. If a vast majority of universities already make use of some kind of learning management system at the course level, any potential reform will doubtless begin by amending some system already in place.

Tiedemann (2002) specifically recommends that the most effective LMS implementation is grounded in the best possible assortment of already-used tools. This conviction is reinforced by later studies (Selim, 2003; Abdalla, 2005, Shee and Wang, 2008) which found that the ease of use was the most important factor for student satisfaction with a LMS; improving upon the familiar is the surest way of ensuring that the transition between systems or pedagogies does not become jarring.

This is not to say that there are no lessons for refining the use of systems already in place. If, as we’ve seen, instructors spend a majority of their time transmitting or first establishing content, streamlining this process as much as possible is advisable, if only in the hopes that minimizing the amount of labor required for “before class” processes will provide more time for refinement of “in class” exercises (Nijuis and Collis, 2003). Although this may not directly impact students, hopes are that there could be something of a trickle-down effect in terms of the final educational product presented to learners.

At the same time, whereas all the studies cited find different methods of gauging student achievement and satisfaction, the fullest lesson of the very discrepancy lies in realistically evaluating the difference between student perceptions of LMS use and the actual outcomes. A number of studies (Selim, 2003; Abdalla, 2005; Pan et al, 2005; Ioannou, 2008; McGill and Klobas, 2009; Hamuy and Galaz, 2010) maintain this fact, suggesting, perhaps, that learning management systems are now such a commonplace part of the educational experience that students no longer actually expect a LMS to improve their actual learning. Once the province only of universities, learning management systems are increasingly being integrated into secondary-level education. While it is obviously the hope of LMS manufacturers that a single, stellar implementation can alter this expectation, if we do hope to effectively measure students’ reactions to LMS software, a simple evaluation of its utility, without attention paid to a specific pedagogical checklist, might no longer be enough.

3.9 Be ready for the end

As the range of features and systems incorporated into learning management systems continues to expand, it remains possible that there might soon be a point where a static learning management
system itself is no longer needed. A fear remains that LMS, by virtue of their sheer ubiquity, tend to maintain the educational status quo (Mott, 2010). The most radical suggestion for future LMS use would dissolve the commercially-enforced “course-based” model of LMS use entirely, allowing for the creation of either larger (departmental) or smaller (study groups) units of LMS access as the case may require. This ability to cater to context awareness is perhaps the feature most lacking from most LMS products (Amelung et al, 2007). As given by the study by Chen et al (2008), where mobile or handheld devices were used to assemble ad hoc study groups, this sort of implementation is entirely possible in ways that don’t necessarily require interaction through a LMS interface.

One obvious drawback to this method is the sheer distribution of LMS mechanisms at the present moment. If a truly large-scale network, incorporating a number of different departments or universities, was to be attempted, they would need to exchange information in a technologically intelligible way. As they exist currently, however, most LMS products are not equipped to talk to one another (Sclater, 2008). A solution to this present problem might be found in the earlier recommendations of Averigou et al (2002), which suggested the establishment of a firmly encoded pattern language that could map out all possible LMS features and implementations, possible problems, and their solutions. By working in the same language, it would thus become easier not only for developers to generate compatible products, but for end users to prioritize areas for potential upgrades and augmentations.

4 Summary and Conclusions

Learning management systems are not only becoming more prominent, but their very domain is expanding. The first generation of LMS designers were the university IT administrators and commercial professionals who put the first systems in place; now, however, it is becoming yet easier and easier for instructors and learners to begin to tailor systems to suit their own needs. As students become more adroit with technology, and as student groups themselves become more diffuse, the likelihood that learning management systems will evolve or transition to include some other type of medium – be they GPS devices or social networks – remains high. When confronting this future, it is imperative to have a workable set of criteria by which the priorities of a LMS, or any learning environment even without that name, might be weighed. This is made only easier because learning management systems themselves encourage users to reflect on their own efficacy.

This paper reviewed a host of applied and scholarly articles in order to form a comprehensive account of the claims, consequences, and potential applications of online learning management systems. Using this literature as reference, the paper then generated a series of guidelines for successful LMS implementation.

The guidelines established here are as much a template for educators and students as they are for university administrators. Model LMS behavior constitutes a continuous revision of conventional authority structures, such that the authority of the pedagogy is gradually ceded towards broader and broader groups of end users. However a LMS might be incorporated, the readiest lesson for all concerned parties is that the system is not an end unto itself, but an all-purpose tool that can molded to accommodate any number of applications and philosophies.
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