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Mind the LMS Content Producer: Blackboard usability for improved productivity and user satisfaction

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Abstract

The usefulness of learning management systems (LMS) is evidenced in the literature. In particular, a great many studies have been conducted showing the effect of LMSs on various kinds of student learning. However, without instructor adoption and use of these systems and their tools, LMS usefulness is unfeasible. Blackboard is a mature platform and a market leader among LMSs. Understanding how instructors perceive the usability of Blackboard within their work contexts is an important and under-reported area in LMS research. In this study, we examine the usability of the Blackboard LMS from the perspective of the content producer. We conducted usability experiments using routine tasks ranging from basic to relatively more complex tasks. This study uses grounded theory for sense-making; two underlying generative questions central to the study are "how usable do instructors find using Blackboard overall?" And "how usable do they find Blackboard in the context repeating tasks? While the first question speaks to issues of use satisfaction, the second speaks to productivity. We report on both local and global findings within the application stemming from analysis of basic tasks on the platform. We conclude though there are general usability issues that are easier to remedy through design choices, for repeating tasks and productivity support, a change in basic the design pattern is needed.

Keywords: usability, usability testing, learning management systems, LMS, Blackboard.

1. INTRODUCTION

Initial investments in e-learning technologies and learning management systems (LMS) specifically occurred, because these tools offered flexible learning options (Chua & Dyson, 2004), improved effectiveness in teaching and learning (Mott & Granata, 2006) and realized cost reductions (Khairudin, 2011; Laurillard, 2007). Adopting e-learning technologies helps reduce costs in multiple ways: through the "reuse and sharing of resources" and the "more standardized production of materials" (Laurillard, 2007, p. 24).

The adoption and demand for digital course content continues to grow in both traditional, blended, and distance learning institutions. At the same time, public US academic institutions face persistent revenue-cost pressures dating back to 1980 (Mortenson, 2012), and particularly since the Great Recession (Mitchell & Leachman, 2015). The American Council on Education (ACE) projects that if current rates in State cuts in expenditure on higher education

continue, we will reach zero state appropriations in some states as early as within the next three years (Mortenson, 2012). These reductions in appropriations continue to result in sharp increases in student fees (Mitchell & Leachman, 2015). Productivity gains from LMS use could not be timelier.

These tools are feature rich which can be both strength as well as weakness. Richness offers greater opportunity for new ways of, and flexibility in, delivering content and engaging students. However, feature richness may also present as user-interface complexity which influences user acceptance (Coskun & Grabowski, 2005) by serving as disincentive to adopt the tool, or use the tool to its full potential.

Blackboard as the dominant LMS product has a (2015) market share of 35.2% (institutions) and 46% (enrollments) in US higher education (Edutechnica, 2015). According to Blackboard.com (2016, p. 1)

> *"aside from Google we are the number #1 website that students can't live without … 80% of the world's top academic institutions work with us. 1 in 3 US school districts use us…and serve over 20 million K-12 students"*

Omitted is an account of how many instructors use Blackboard and to what extent. Yet instructor adoption drives the use of the LMS by learners as well the extent, or depth of use. Besides instructors, instructor adoption and the extent of use should be of interest to those who select and purchase an LMS for institutions. For instructors, the interest is usability of the tool to support necessary and desired tasks.

Although many studies on LMS usability have been undertaken, many of these are survey studies focused on learners; the incidence of usability testing studies with the content producer at the core is limited. In this study, we conduct usability tests with instructors in a blended environment where instructors teach multiple courses and/or sections. The institutionally adopted LMS is Blackboard. For the study, we select routine tasks ranging from basic to relatively more complex tasks. The research method is grounded theory. The two underlying generative questions are, how usable do instructors find using Blackboard overall? And how usable do they find Blackboard in the context of repeating tasks? We are interested in the usability of Blackboard in general, as well as where it pertains to productivity and time savings.

2. RELATED LITERATURE

Learning Management Systems

Prior research on LMS has the learner as the central focus. For instance, some LMS research explores the *effectiveness* of various features within the LMS (Sowan & Jenkins, 2013) e.g. communication (Coopman, 2009); how intuitive specific design features are (Thacker, Russell, & Brawley, 2014); the user-friendliness of interface (Cavus & Zabadi, 2014); feature richness (Al-Ajlan, 2012). Several studies compare features between LMS products (Cavus & Zabadi, 2014; Coopman, 2009); Mödritscher, Neumann, and Brauer (2012) compares LMS usage between users accessing the LMS from the web vs. those accessing it via mobile devices. Other studies have focused on the use of LMS for specific skills development in a domain for the learner: English learning skills (El-Hmoudova, 2015), productive language skills (Hamat, Azman, Noor, Bakar, & Nor, 2014) information literacy (Jackson, 2007). (Al-Gahtani, 2016) investigates user acceptance by students. There is also a growing body of research that uses predictive analytics or datamining. Many of these studies use LMS data such as participation in discussion forums (Romero, López, Luna, & Ventura, 2013) to predict learner performance. Hu, Lo, and Shih (2014) use data mining techniques to develop an early warning system to identify at-risk students. (Mödritscher et al., 2012) compares the user behavior of web users vs. mobile users. Dias and Diniz (2013) develops a quantitative *quality of interaction* (QoI) model that uses fuzzy logic to estimate instructors' and students' QoI with Moodle. Such analysis is inherently grounded in transaction-level analysis and aggregations. The results of the study identified similarities and dis-similarities in interaction trends, correlations, distributions and dependencies with time-periods within the academic year. On average, Dias and Diniz (2013) find, instructors as a group "show a low-towards-moderate interaction" with the LMS "in all estimated parameters" with a "noticeable increase at the beginning of the academic year (week 2)" (Dias & Diniz, 2013, p. 47). Dias, Hadjileontiadou, Hadjileontiadis, and Diniz (2015) extends the FuzzyQoI model by integrating it with Fuzzy Cognitive Maps using the same data and FuzzyQoI as inputs.

All of the above studies are dependent on the instructor choosing to use an LMS and the

extent to which instructors adopt individual tools within the LMS. And yet studies examining the impact of LMS usage on the instructor are rarer. The stream of studies that evaluate LMS from the perspective of the instructor have proposed using the ISO 9126 software quality model (Chua & Dyson, 2004; Lanzilotti, Ardito, Costabile, & De Angeli, 2006; Padayachee, Kotze, & van Der Merwe, 2010) to evaluating the quality of learning management systems. Others have used Technology Acceptance Model (TAM) and its extensions to study the adoption of these systems.

ISO 9126 quality model is a multidimensional software quality model that specifies six factors (characteristics) that are further divided into criteria (sub-characteristics). Factors are manifest externally when software is used as a result of software internal attributes. The six factors covering external and internal quality are: functionality, reliability, usability, efficiency, maintainability and portability (Al-Qutaish, 2009). Criteria for usability, for example, are then specified as: understandability, learnability, operability, attractiveness, and usability compliance (Al-Qutaish, 2009).

Chua and Dyson (2004) used ISO 9126 quality model to evaluate Blackboard 6.1 from primarily the instructor's perspective focusing on the characteristics: functionality, reliability, usability and time behavior (efficiency). Methodologically, the authors assert, they focused on the system-in-use by observing students while they were teaching them, recording student and teacher contributions to discussion boards, and recording their own experiences as teachers using the system. They also ran a test of the different tools based on the characteristics and sub-characteristics of the ISO 9126 model. In general, the assessment was qualitative, except for the timed time-behavior test. Chua and Dyson (2004) conclude that though ISO 9126 is useful in evaluating e-learning systems, it is inadequate particularly with respect to evaluating *usability*. They propose additional sub-characteristics be added to usability (consistency, simplicity, legibility, use of color, help).

Padayachee et al. (2010) develop a framework for assessing e-learning systems by expounding on the ISO 9126 quality model characteristics and sub-characteristics and mapping them to specific and explicitly identified LMS features. The framework, like the one proposed by Djouab and Bari (2016) is not tested empirically, however.

Much of the research on LMSs, from the perspective of the instructor, has been limited to studies of adoption (Padayachee et al., 2010) using TAM. However, very little research has explored why some instructors in higher education use LMSs much more extensively than others (Schoonenboom, 2014; Torrisi-Steele & Drew, 2013). It is has been suggested that there's a relationship between the epistemological thrust underlying the instructors teaching approach and the use of a learning management system (Schoonenboom, 2014). The suggestion is that two groups of instructors exist: those who focus on information transfer versus those who focus on student learning (González, 2012; Owens, 2012) According to this view, "the first group views blended learning as a mechanism for transmitting information and configures their LMS suitably whereas the second group regards blended learning as supportive of student's learning needs, and thus focus their "blended learning design on complex knowledge-building practices and skills" (Bliuc, Casey, Bachfischer, Goodyear, & Ellis, 2012; Schoonenboom, 2014, p. 248) . First, as noted by (Schoonenboom, 2014, p. 248), "this does not answer the more practical question of why some instructors use an LMS more often to perform certain instructional tasks than other tasks". Second, in our view, this view, presupposes that the LMS tools designed to support information sharing needs and those designed to support learning needs share equivalent capacities for usability, i.e. it is equivalently easy to use, learn, understand, and remember features from both types of tasks.

The Technology Acceptance Model (TAM) and its various extensions have been used in LMS acceptance studies from both a student perspective (Lin & Chen, 2013) as well instructors (Chen & Tseng, 2012; Motaghian, Hassanzadeh, & Moghadam, 2013). However, predominantly TAM has been used to examine technology acceptance at system level (i.e. the whole system); the differences in intention within different tasks are not examined (Lee, Kozar, & Larsen, 2003; Schoonenboom, 2014; Yousafzai, Foxall, & Pallister, 2007)). Schoonenboom (2014) goes further and attempts to explain the differences in LMS usage among instructors at task level. She finds that causes of low LMS use-intention vary by tool/task combination. She concludes that "for some tool/task combinations, the cause of low LMS intention is low task-importance, or low task-performance; for others, it is low LMS usefulness and yet for others, low LMS ease of use". For instance, she finds "a number of tasks

that are currently not frequently performed using a LMS, but which have potential for LMS use, the use of an LMS is regarded as useful but difficult. She concludes that "it is conceivable that training and/or simplification of the interface might stimulate LMS use". (Schoonenboom, 2014, p.253) Schoonenboom (2014) reiterates that perhaps we should be investigating tool/task/interface/combinations (Schoonenboom, 2008).

Usability studies are inherently focused on task-technology fit, even in experimental settings. A typical task is designed, performed using the technology and its designed interface, observation and analysis then attend that defined context.

Usability Of Information Systems

Usability is only an issue when it is lacking, or absent (Rubin & Chisnell, 2008). A thing is said to be usable when using it does not present frustration when using it (Rubin & Chisnell, 2008). In other words, "when a user can do what he or she wants to do, the way he or she expects to be able to do it, without hindrance, hesitation, or questions", the product or service is "truly usable" (Rubin & Chisnell, 2008, p. 4). Similarly, Benbunan-Fich (2001, p. 151) defines *usability* as "how *well* and how *easily* a user, without formal training, can interact with an information system or a web site". Nielsen (1996) defines usability as a measure of the *quality* of the user experience when interacting with a web-based, or traditional software application. Further, Nielsen (1993, 1996) argues, it is simplistic to measure usability using a single value, e.g. *user-friendly*. Usability is a multi-dimensional construct. Nielsen (1993, 1996) defines five attributes of usability for a product, service, system, website, it: must be *easy to learn* (so a user can readily go from not knowing the system to doing some work); be *easy to remember* (infrequent users can return after periods of inactivity without having to learn everything allover); be *efficient* (lets the expert user have high levels of productivity); be *relatively error-free or error-forgiving* (so users do not make many errors, and those errors are not catastrophic and are easily recovered from); and be *pleasant to use* (users like to use the system, and find it subjectively satisfying) (Nielsen, 1993, p. 33). Rubin and Chisnell (2008) use the following six dimensions to define usability: *learnability*; *efficiency* (the quickness with which the user's goal can be accomplished accurately and completely); *usefulness* (the degree to which a product enables a user to achieve his or her goals, and is an assessment of the user's willingness to use the product at all); *effectiveness (*the extent to which the product behaves in the way that users expect it to and the ease with which users can use it to do what they intend; measured quantitatively with error rate.*)*; *satisfaction* (user's perceptions, feelings, and opinions of the product) and *accessibility (*what makes products usable by people who have disabilities).

Usability tests are conducted to assess whether a system or tool is suited for intended purpose and target audience. A usability test "employs people representative of the target audience as study participants to evaluate the degree to which a product meets specific usability criteria" (Rubin, 2008, p. 21).

3. METHODOLOGY

Usability Testing

A usability test is characterized by the following features Gena (2005, pp. 5-6): the primary goal is to improve the usability of a product or tool; participants represent real users; participants do real tasks; users' performances are recorded; data analyzed and, as consequence, changes recommended. Tasks ought to be carefully chosen to represent realistic usage scenarios. The environment is setup so as to closely mimic reality as much as possible. If a typical end-user is expected to use the system without training, then no training is given during the test. Users are closely observed and testing sessions are recorded. In the case of Blackboard, Thacker et al. (2014) show, instructors learn Blackboard through a combination of formal training provided by IT services, self-instruction via online search and peer-learning. Nielsen (1993, 2000) argued, in usability studies, five testing subjects are sufficient, that as you add more users, you learn less and less as you keep seeing the same things over and over again. This guideline has a long history in the methodology of usability studies, however more recently there have been studies arguing that in many cases five users are not enough (Faulkner, 2003; Woolrych & Cockton, 2001).

During an experiment, a protocol called think-aloud is used. With think-aloud, users are encouraged to verbalize their thoughts while they perform experimental tasks (Barnum, 2011). Asking participants to think-aloud also "reveals important clues about how they are thinking about the product or system they are using and whether the way it works matches up with the way it was designed" (Rubin & Chisnell, 2008, p. 54). Pre/post questionnaires or

interviews are also used to gather users' opinions, feedback, feelings and attitudes about the system. The latter are used as additional sources of data.

Grounded Theory

To analyze the transcripts generated during the experimental setting and post-session interviews, we use grounded theory. Grounded theory is appropriate for the development of theory "grounded in data systematically gathered and analyzed" and where theory evolves; where study participants do not merely serve as a conduit of information but also participate in meaning-making (DiCicco- Bloom & Crabtree, 2006). Constant comparative analysis in grounded theory relies three types of coding, i.e. open coding, axial coding and selective coding. This allows for iterations between data collection and analysis. Open coding is used for preliminary segmenting, axial coding for theme-ing (generating the "codes") and selective coding for analyzing themes into cohered understandings or theory (Strauss & Corbin, 1990, 1994). In this study, we use grounded theory in analysis of session transcripts, post session interviews and for triangulating various data sources.

4. OVERVIEW OF EXPERIMENT

The study was performed at a liberal arts university (that institutionally prioritizes instructor high quality teaching in New England. Experiments were performed in an instructional support lab. The study was conducted with instructional faculty with IRB approval.

During experimentation, we use the concurrent think-aloud protocol (Rubin & Chisnell, 2008). Concurrent think-aloud is the most commonly used method for usability testing according to Van den Haak and de Jong (2003).A pre-test questionnaire and post-test interview was administered. The duration of user sessions was between 60-80 minutes. Users were not instructed that tasks are timed, though we obviously were able to assess how long it took each user to perform any of the tasks. In the entire study, participants were asked to perform four tasks of varying difficulty with the final task being the most difficult. In this paper, we focus on the first task.

Participants Usage Of LMS

Six participants (four men and two women) participated in the study, however the first participant was primarily used to pilot-test the process and assist in anticipating human needs we would have overlooked during the study. Our participants all had some prior experience using Blackboard Learn in a blended environment. Our instructors were drawn from five different areas of study: business, a natural science, language, history and the social sciences. Four of them describe themselves as intermediate users (P1, P2, P5, P6), one beginner (P3), and one advanced (P4) user of Blackboard. Additionally, in a pre-test questionnaire about their usage of Blackboard, our subjects indicated the following (see Table 1): all of them use the LMS to post course documents. The Gradebook and Email are the next most commonly used tools; four use the LMS to post syllabi and course information and assignment submission. Only three use the Announcements tool or the Discussion Board. Only one of our instructors uses Blackboard's assessment tool (i.e. tests/quizzes).

Blackboard Feature/Tool	Used By	Use Satisfaction	Important	Not Important
From a Total of 6 Participants				
Course Documents/ Course Contents	6	5	6	
Email	5	4	2	1
Gradebook	5	2	5	
Syllabus, Course Information	4	5	4	
File/ Assignment Submission	4	3	4	
Announcements	3	6	3	
Discussion Board	3	0	0	3
Quizzes/ Assessment Tool	2	3	2	
Calendar	0		0	
Blogs	0		0	
Wikis	0		0	

Table 1 – Blackboard Usage

The third column (use satisfaction) of Table 1 indicate the level of reported satisfaction by those using the LMS tool; the fourth column (importance) indicates the percentage of subjects ranking the tool/feature as important. Notably, while only half of our subjects used the Announcements tool, all users indicated being satisfied with the tool in general, and the other either did not use the tool, or explicitly found the tool unimportant. Specifically, half our subjects explicitly indicated that they found the Discussion Board "not important" and one also found the email feature "not important". None of our participants used the Calendar, Blogs or Wikis. However, two identified SafeAssign as a Blackboard feature that they found particularly useful.

Task 1a: Assumes the scenario of the start of a semester, instructor to setup course content area for each course and send an email

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introducing him/herself to the class. Participants were instructed to set up content areas for: *course syllabus and schedule*; *tests and quizzes*; *announcements*; *assignment instructions*; *assignment submissions*; student access to the gradebook (*my grades)*; *groups*; *discussion board**; and *email*.

The next task was, sending an introductory announcement to all students. Additional tasks related to BB "assessment" related tasks. In this paper, we focus on Task 1.

The Experimental Setting

The experiments were conducted in a lab. The LMS used in this study is Blackboard Learn (Release 9.1.201410.1176541). The usability lab was approximately 8' x 9' furnished minimally with two computers on perpendicular desks facing out the window. The room is used typically for one-on-one instruction. The testing PC was equipped with Windows 10, a camera and mic with lecture capture software installed.

5. ANALYSIS

Transcripts from the think-aloud experiment sessions and post session-interviews were generated. Two researchers code each of interview scripts, and emerging codes are shown in Tables 2-5.

Content Area And Tool Links – Confusion

The first task, setting up of a Content Area that gives students ready access to materials posted by the instructor as well some of the tools offered by the LMS, we expected would be a basic and routine task. It is something that a user of the LMS must do, to some degree, at the start of every semester. We found that, regardless of the level of user experience with the LMS, there was some confusion associated with use of tools links in the content area. While all our users post content to share with students, and five of the six use the BB gradebook, every one of them expressed some degree of confusion. The four users who did not typically use tool links found the distinction between content area and tool link unclear. All four, for example, set up an Announcement tool link, but when posting announcements would access the actual tool under "Course Management." This may, however, have been merely force of habit.

On the other hand, users who had prior experience with tool links viewed the distinction more unfavorably.

P2: *"Some things are arbitrarily listed as tools"*

P4: *"It always struck me that the distinction between content and tool is useless 'cos you do the same thing, have the same choices, there's no need to make a distinction at this point"*

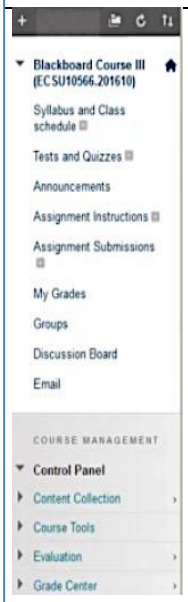
The Menu Palette	User Comments and Thoughts	Codes/Themes
	**P1**: "Would be nice to know what's the difference between using one of the dropdown like tool link, like what's the difference between using tool link and content area" **P2**: "Some things are arbitrarily listed as tools. Some things make sense where they are, some things don't." **P4**: it always struck me that the distinction between content and tool is useless cause you do the same thing, have the same choices, there's no need to make a distinction at this point [R1: You feel the distinction is unclear?] **P4**: "No it's not unclear, it's useless."	**[Open codes]** Content Area/Tool Link: Confusion Arbitrary Difference? **[Axial codes]** ☐ Proximity of links to linked objects ☐ Interface consistency ☐ User views

Table 2: User Comments and Codes

Echoing P2's sentiment above, three other participants wondered if there was a "syllabus" tool. Our advanced user describes the distinction as "useless."

From the experiment, we conclude at least three things. From a usability perspective, these are local (to a feature) and more global (across other features of BB), these are: the long menu palette, consistency in design choices, and the handling of user views.

First, the organization of the long menu palette on the left-hand side **(see Table 2 above)** where tools are located within the Course Management submenu, just below the Content Area Menu, contributes to the conceptual nebulosity between tools and tool-links. The distance (conceptual or physical) of a link to its object ought to be significant, or sufficiently pronounced; the link linked to should not be close enough to render the link nearly redundant, or a contributor to a cluttered look-and-feel. In post-session interviews, two participants said the options under course

management were too many, i.e. too much information (we discuss this theme below).

Consistency: For instance, assessment tools (e.g. tests) are tools. However, for a test to be deployed within the Content Area Menu for student access, it must be setup within a custom-created content area rather than as a tool link. Even within the logic of the constructs of the LMS, this is inconsistent when an announcement, for example, is deployed using a tool link.

User Views: The version of BB used in the study had a *student view* for the instructor, and our participants were familiar with it from their own experiences. However, they felt that "*part of the problem is there's no way that I can tell to get an accurate view of what the student sees.*" While a user view exists, it has presentation inconsistencies and, in some cases, requires additional but superfluous work from the instructor. If instructors don't get an accurate picture of what students are seeing, or it is cumbersome to do so (e.g. an instructor would need to post an assessment as a student to get an accurate picture of the student view), it would adversely affect willingness to use of the tool.

Clutter And Too Much Information

A second theme that emerges is the perception that the BB interface is too clunky presenting the user with either too many (perceived unnecessary) options, or requiring the user to deal with more information than the user feels is necessary. This phenomenon was evident in multiple ways during experiment sessions. The first is, the list of options under the course management menu; participants identified this as "too much information" or too many options. The second was a drop-down list of courses (during course copy and the copying of objects between courses) that retrieves a long list of current, previously taught and even future courses that are formally associated with the instructor. This list is ordered by a 13-digit course number, rather than a readily decipherable concept like course name, or period (i.e. semester). The third was the number of options visible for course copy execution (and other tasks).

These features lead to an interface that is inflexible and inefficient to use. Flexibility and efficiency considerations in interface design, allow users to tailor frequent actions (Molich & Nielsen, 1990; Nielsen & Molich, 1990). A capacity for an instructor to hide options they don't need, or the use of a reduced number of the most-widely used options, or even learning algorithmic tools that automatically hide unused options would improve flexibility and efficiency. Furthermore, even though it is better if a system is used without documentation (Nielsen, 2005), precise built-in help and documentation that is displayed as a user hovers over an option would help users' memory load. Or, simply displaying defaults and hiding options using an advanced options link would strike a reasonable balance between experienced and inexperienced users (Molich & Nielsen, 1990). This inflexibility and inefficiency seems to affect user satisfaction as well as a willingness to use additional capabilities of the LMS.

User Comments and Thoughts	Open Codes/Themes	Axial Codes
P3: "I don't know what these options mean so I just usually go with the default one and it usually works for me" P3: This list [list of courses taught] is annoying. Why they're not grouped together, I don't know. Why classes from Fall 2014 show up here as if I need to access those anytime. you know, I don't understand why that happens either, and they shouldn't. P6: This is too much information P2, P5: Blackboard is too inflexible and clunky to use. P4: "Layout and navigation are non-intuitive, even nonsensical"	□ Too Much Information □ Clutter □ Memory load □ Inflexible clunky	-Help and documentation -Flexibility and Efficiency -Recognition rather than recall (memory load)

Table 3: Clutter and Too Much Information

User Expectations

Another emerging theme was user expectations under specific task conditions. For instance, when setting up a course, most of our participants expect to have, at minimum, an area to post the syllabus, a gradebook, and custom a course content area for assignments and/or readings. And therefore, expect a course template to have these basic features. They felt it was inefficient to have to create these in the content area every time a course is set up.

> P1: "I'm expecting to have a gradebook, I'm expecting to have an announcement area"

> P2: *I teach unique enough classes that it's not exactly the same thing every time. But, you are always going to have a gradebook … the same type of material*

Our sixth participant suggested that when tool links are being created, it would be "nice" if the default display name on the dialog box auto-populated using the default tool-name. [See Table **4]** in the Appendix. She also remarked, it was weird that the availability checkbox was inconsistently available for custom content areas versus tool links. We note that P6 had not used tool links before, for them this inconsistency made them go back and double-check their prior actions. Design consistency, ensuring that users do not have to wonder if situations/actions mean the same thing is a heuristic of good interface design, as is matching the system to the users' real world (Molich & Nielsen, 1990). A contextually-related theme to user expectations is, productivity support for repeating tasks.

6. DISCUSSION

Productivity Support For Repeating Tasks

There is ample evidence that LMSs introduce several efficiencies in data management, distribution and communication compared to alternatives. The goal of our second generative question was assessing usability under repeating task conditions. The task required duplicating content area objects into multiple Blackboard courses to simulate typical activity at the start of the semester. There are two relevant tools in Blackboard that are intended for content duplication: *course copy* and *course merge*. The other option is, manually duplicating objects. In our experiments, some participants duplicated content manually and some used, or attempted to use course copy.

Duplication Using Course Copy

Three participants (P2, P3, and P5) either used, or attempted to use course copy to duplicate the content area (and assessment created for a task we do not report on in this manuscript.) P2 indicated they were going to use course copy (through think-aloud). They looked through the Course Management menu where tools are located. They searched around for the tool, then clicked on the home arrow icon on the Menu Palette (shown in Table 2) that brings up the list of instructor-taught courses. After voicing, "*I think this is, admittedly, one of the things that frustrates me the most about Blackboard…*" They gave up searching for the tool and started to manually recreate their Content Area.

P3 knew where to find the tool, opened it and through trial and error eventually succeeded in copying the entire Content Area Menu template into multiple courses. Arising errors were related to, the long list of available options and that default options on the course copy tool did not copy tool links; it copied only the custom created content area. They then worked out that by clicking "Select All" at the top of the page all content area menu items including tools links, but not assessments. P5 experienced similar problems to P3 with the presented options, he attempted the course copy a couple of times and couldn't understand why the tool links would not copy across. He settled on copying the custom content area using course copy and manually duplicated the tool links. We note, no actual content had yet to be posted

Overall, our observations from this part the usability experiment showed the following. Participants use the course copy tool because they want efficiency; they want to productively use their time and to avoid the frustration of knowing a repeating task is time misspent. Whether the Blackboard designers intend for course copy to be used to duplicate minor changes or additions isn't entirely clear, the presence of content would have yielded a different set of copy results.

Nonetheless, users are looking for efficient solutions. Second, the usability of the course copy tool with its myriad of visible options makes the tool harder to use even for users who have evidently used it multiple times. There are 36 check-box and radio-button options displayed all at once! (See Table 5, Appendix). Given that, the use of Blackboard is not the primary occupational activity for instructors, it would be more surprising if they dedicated the time needed to understand these options, than not. Third, even with course copy, users still yearned for more efficient ways of capturing repeating tasks. *"You know, it'd be nice is if I could copy not just to [course II] here but also if I could copy into [course III] at the same time but I guess, I can't do that".*

Fourth, it is not always easy to find the course copy tool. Curiously, of the users who chose to use course copy, P2 appeared to be the most comfortable with using tools being admittedly a user of tools. However, it appears P2 concluded the search for the course copy tool, given the task, was not worth it, thus choosing to abandon the search for a previously-used tool and

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continue manually, the latter the least efficient but perhaps more readily recallable option.

7. CONCLUSIONS

Although, our work is in progress and additional usability experiments are planned, it nevertheless appears, to support repeating tasks for content producers, at minimum, the basic design pattern in Blackboard would need to change from the current paradigm where objects come to life only after explicit association with a course (see Figure 1 below). Here, an instructor can only deploy objects as a function of editing an existing course.

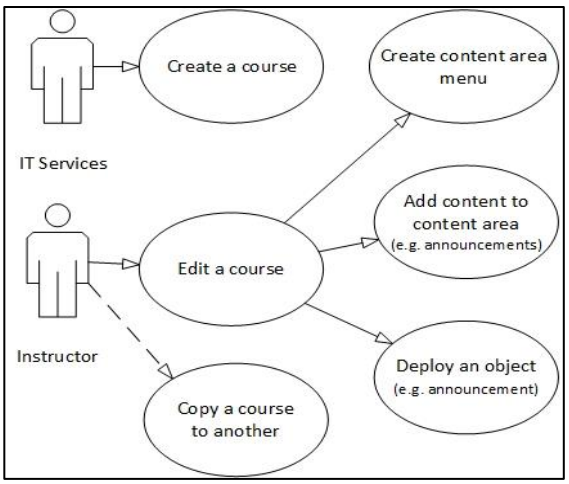

Figure 1- Current Design Pattern

To facilitate efficiency for repeating-task operations, this pattern needs to change to allowing objects to be created and thereafter associated or deployed to one or multiple courses (See Figure 2). This is an approach that is used by the LMS platforms from some textbook vendors.

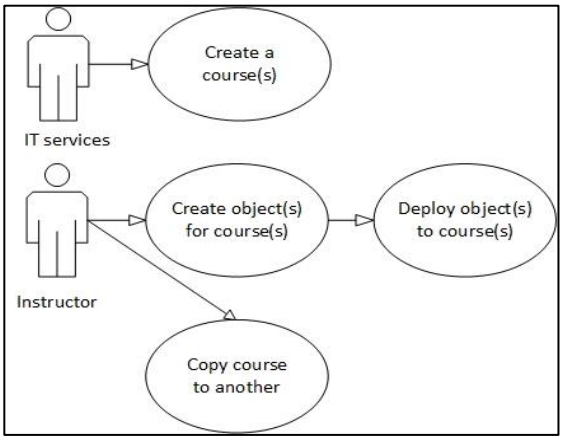

Figure 2- Alternative Design Pattern

Such a change would obviate the redundancy of creating or copying the same content for the purpose of deploying it multiple times, regardless of object complexity. It would free up instructor time associated with mundane Blackboard work. We believe it would improve perceptions of ease of use which influences the adoption of additional features. The other usability problems, e.g. a clutter interface, would still need to be addressed, however, these seem relatively simpler or cheaper to modify from a designer perspective. The latter usability issues seem at odds with an application that was first released 19 years ago.

The limitations of our study relate to the number of subjects, task and institutional context. We deliberately chose tasks that are typical and repetitive in a predominantly teaching environment. To address some of these, we are also following up with an institutional survey to evaluate user satisfaction across a broader sample of the population within our specific institutional context. Nevertheless, we anticipate in environments where an instructor teaches 1-2 courses at a time, the demands of repeating tasks are meaningfully reduced. However, an interface with 36 selection options on one screen is a generalizable usability issue.

8. REFERENCES

Al-Ajlan, A. S. (2012). A comparative study between e-learning features. In E. Pontes, A. Silva, A. Guelfi & S. T. Kofuji (Eds.), *Methodologies, Tools and New Developments for E-Learning* (pp. 191-214). https://www.intechopen.com/books/methodologies-tools-and-new-developments-for-e-learning: INTECH Open Access.

Al-Gahtani, S. S. (2016). Empirical investigation of e-learning acceptance and assimilation: A structural equation model. *Applied Computing and Informatics, 12*(1), 27-50.

Al-Qutaish, R. E. (2009). *An investigation of the weaknesses of the ISO 9126 international standard.* Paper presented at the Computer and Electrical Engineering, 2009. ICCEE'09. Second International Conference on.

Barnum, C. (2011). *Usability Testing Essentials*. Burlington, MA: Elsevier.

Benbunan-Fich, R. (2001). Using protocol analysis to evaluate the usability of a

commercial web site. *Information & Management*, 151-163.

Blackboard.com. (2016). Who We Are. Retrieved July 15, 2016, from http://www.blackboard.com/about-us/who-we-are.aspx

Bliuc, A.-M., Casey, G., Bachfischer, A., Goodyear, P., & Ellis, R. A. (2012). Blended learning in vocational education: teachers' conceptions of blended learning and their approaches to teaching and design. *The Australian Educational Researcher, 39*(2), 237-257.

Cavus, N., & Zabadi, T. (2014). A Comparison of Open Source Learning Management Systems. *Procedia - Social and Behavioral Sciences, 143*, 521-526.

Chen, H.-R., & Tseng, H.-F. (2012). Factors that influence acceptance of web-based e-learning systems for the in-service education of junior high school teachers in Taiwan. *Evaluation and Program Planning, 35*(3), 398-406.

Chua, B. B., & Dyson, L. E. (2004). *Applying the ISO 9126 model to the evaluation of an e-learning system.* Paper presented at the Proc. of ASCILITE.

Coopman, S. J. (2009). A critical examination of Blackboard's e-learning environment. . *First Monday [S.I.], 14*(6).

Coskun, E., & Grabowski, M. (2005). Impacts of User Interface Complexity on User Acceptance and Performance in Safety-Critical Systems. *Journal of Homeland Security and Emergency Management, 2*(1).

Dias, S. B., & Diniz, J. A. (2013). FuzzyQoI model: A fuzzy logic-based modelling of users' quality of interaction with a learning management system under blended learning. *Computers & Education, 69*, 38-59.

Dias, S. B., Hadjileontiadou, S. J., Hadjileontiadis, L. J., & Diniz, J. A. (2015). Fuzzy cognitive mapping of LMS users' Quality of Interaction within higher education blended-learning environment. *Expert Systems with Applications, 42*(21), 7399-7423.

DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical education, 40*(4), 314-321.

Djouab, R., & Bari, M. (2016). An ISO 9126 Based Quality Model for the e-Learning Systems. *International Journal of Information and Education Technology, 6*(5), 370.

Edutechnica. (2015). LMS Data – Spring 2015 Updates. Retrieved Dec 23, 2016 from http://edutechnica.com/2015/03/08/lms-data-spring-2015-updates/

El-Hmoudova, D. (2015). Developing English Learning Skills in Blackboard Virtual Learning Environment. *Procedia-Social and Behavioral Sciences, 199*, 517-524.

Faulkner, L. (2003). Beyond the five-user assumption: Benefits of increased sample sizes in usability testing. *Behavior Research Methods, 35*(3), 379-383.

Gena, C. (2005). Methods and techniques for the evaluation of user-adaptive systems. *The Knowledge Engineering Review, 20*(1), 1-37.

González, C. (2012). The relationship between approaches to teaching, approaches to e-teaching and perceptions of the teaching situation in relation to e-learning among higher education teachers. *Instructional Science, 40*(6), 975-998.

Hamat, A., Azman, H., Noor, N. M., Bakar, K. A., & Nor, N. F. M. (2014). Evaluation of an LMS for Productive Language Skills. *Procedia - Social and Behavioral Sciences, 118*, 134-139.

Hu, Y.-H., Lo, C.-L., & Shih, S.-P. (2014). Developing early warning systems to predict students' online learning performance. *Computers in Human Behavior, 36*, 469-478.

Jackson, P. A. (2007). Integrating information literacy into Blackboard: Building campus partnerships for successful student learning. *The Journal of Academic Librarianship, 33*(4), 454-461.

Khairudin, N. (2011). *Use Of Non-Financial Measures In Information Technology Decision Making: A Design Research Study Of Learning Management System (LMS)*

Decision Making In Universities. Paper presented at the PACIS.

Lanzilotti, R., Ardito, C., Costabile, M. F., & De Angeli, A. (2006). eLSE methodology: a systematic approach to the e-learning systems evaluation. *Educational Technology & Society, 9*(4), 42-53.

Laurillard, D. (2007). Modelling benefits-oriented costs for technology enhanced learning. *Higher Education, 54*(1), 21-39.

Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for information systems, 12*(1), 50.

Lin, S., & Chen, S.-F. (2013). Innovation attributes and pedagogical quality: a concretization of joint theories on course management systems acceptance. [journal article]. *Quality & Quantity, 47*(4), 2309-2317.

Mitchell, M., & Leachman, M. (2015). Years of Cuts Threaten to Put College Out of Reach for More Students. Retrieved Dec 20, 2016 from http://www.cbpp.org/research/state-budget-and-tax/years-of-cuts-threaten-to-put-college-out-of-reach-for-more-students

Mödritscher, F., Neumann, G., & Brauer, C. (2012). *Comparing LMS usage behavior of mobile and web users.* Paper presented at the Advanced Learning Technologies (ICALT), 2012 IEEE 12th International Conference on.

Molich, R., & Nielsen, J. (1990). Improving a human-computer dialogue. *Communications of the ACM, 33*(3), 338-348.

Mortenson, T. G. (2012). State Funding: A Race to the Bottom. *Budget and Appropriations*. Retrieved Dec 20, 2016 from http://www.acenet.edu/the-presidency/columns-and-features/Pages/state-funding-a-race-to-the-bottom.aspx

Motaghian, H., Hassanzadeh, A., & Moghadam, D. K. (2013). Factors affecting university instructors' adoption of web-based learning systems: Case study of Iran. *Computers & Education, 61*, 158-167.

Nielsen, J. (1993). Iterative user-interface design. *Computer, 26*(11), 32-41.

Nielsen, J. (1996). Usability metrics: tracking interface improvements. *IEEE Software, 13*(6), 12-14.

Nielsen, J. (2000). Why you only need to test with 5 users: Useit. com Alertbox.

Nielsen, J. (2005). Ten usability heuristics for user interface design. Retrieved May 22, 2017 from https://www.nngroup.com/articles/ten-usability-heuristics/

Nielsen, J., & Molich, R. (1990). *Heuristic evaluation of user interfaces.* Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems.

Owens, T. (2012). Hitting the nail on the head: the importance of specific staff development for effective blended learning. *Innovations in Education and Teaching International, 49*(4), 389-400.

Padayachee, I., Kotze, P., & van Der Merwe, A. (2010). ISO 9126 external systems quality characteristics, sub-characteristics and domain specific criteria for evaluating e-Learning systems. *The Southern African Computer Lecturers' Association, University of Pretoria, South Africa*.

Romero, C., López, M.-I., Luna, J.-M., & Ventura, S. (2013). Predicting students' final performance from participation in on-line discussion forums. *Computers & Education, 68*, 458-472.

Rubin, J., & Chisnell, D. (2008). *Handbook of usability testing: How to plan, design, and conduct effective tests*. Indianapolis: Wiley.

Schoonenboom, J. (2008). The effect of a script and a structured interface in grounding discussions. *International Journal of Computer-Supported Collaborative Learning, 3*(3), 327-341.

Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers & Education, 71*, 247-256.

ISSN: 2473-3857
v3 n4387

Sowan, A. K., & Jenkins, L. S. (2013). Designing, delivering and evaluating a distance learning nursing course responsive to students needs. *International journal of medical informatics, 82*(6), 553-564.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research* (Vol. 15): Newbury Park, CA: Sage.

Strauss, A., & Corbin, J. (1994). Grounded theory methodology. *Handbook of qualitative research, 17*, 273-285.

Thacker, J., Russell, M., & Brawley, S. (2014). Learning Management System Comparative Usability Study.

Torrisi-Steele, G., & Drew, S. (2013). The literature landscape of blended learning in higher education: the need for better understanding of academic blended practice. *International Journal for Academic Development, 18*(4), 371-383.

Van den Haak, M. J., & de Jong, M. D. (2003). *Exploring two methods of usability testing: concurrent versus retrospective think-aloud protocols.* Paper presented at the Professional Communication Conference, 2003. IPCC 2003. Proceedings. IEEE International.

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Appendices and Annexures

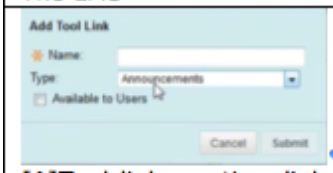
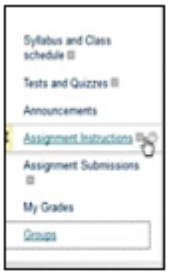
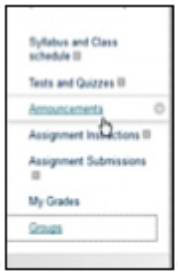
The LMS	User Comments and Thoughts	Codes/Themes
 [A]Tool-link creation dialog box ---   Syllabus and Schedule, a custom content area, has an availability check-box next to the text. Announcements and My Grades (tool-links) do not.	P6: I guess I was thinking that it would be nice if the default name was what the tool link is, so I don't have to type it and then you could change it if you want but then... --- P1: "Some of these features, for instance, I'm expecting to have a gradebook, I'm expecting to have an announcement area, I shouldn't have to add it." P2: "I teach unique enough classes that it's not exactly the same thing every time. But, you are always going to have a gradebook..., the same kind of material" P6: It's kind of weird that the tool links don't have the box showing that they're available or not ---	[Open codes] • → It would be *nice* • → I *expect* • → It's *weird* [Axial Codes] • → Matching system to user's real world • → Consistency and standards

Table 4 –User Expectations- Comments and Codes

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The LMS Interface	User Comments and Thoughts	Codes/Themes
	P2: "I think this is, admittedly, one of the things that frustrates me the most about Blackboard." P3: I just created… I might use course copy because, I mean it's just going to save me *time* from having to manually do this like 9 times, even though you're not saving a huge amount of time. P3: "I don't know what these options mean so I just usually go with the default one and it usually works for me" P3: "You know, it'd be nice is if I could copy not just to [course] II here but also if I could copy into [course] III at the *same time* but I guess, I can't do that" P5: So normally what I'd do in order to do that for all of the (sections) is course copy and just (copy) yea copy it, … "but apparently that only works for the non-tools [frown] P5: "Ok, but the other thing is it might take *a while* for that to actually go through so maybe I should set it up individually."	[Open codes] □ Frustration □ Time □ Efficiency [Axial Codes] □ Productivity

Table 5: Course Copy-LMS Interface, User Comments, Themes