CLEMSON ONLINE

Learning Management System Comparative Usability Study

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Executive summary

This document reflects the process and findings of a comparative usability study of the learning management systems, Blackboard Learn and Canvas. The information from this study can be used by Clemson Online to improve the current implementation of both of these systems, in addition to supporting any further decisions to expand the usage of Canvas at Clemson University.

This study was conducted in the Usability Testing Facility at Clemson University using a within-subjects designed think aloud protocol, and accompanied by short pre- and post-study assessments. In total, five Clemson University faculty members participated in this study, representing the disciplines of English, Nursing, and Graphic Communications. Participants were asked to complete a series of 10 tasks, or five tasks each for Blackboard Learn and Canvas. These tasks represented typical user goals and places of interest for Clemson Online administrators, which included creating an item of content, making an announcement, creating an assessment, and downloading student grades to local devices. The participant's interactions with Blackboard Learn and Canvas while completing these tasks were recorded using TechSmith Morae's screen and voice recording functionality.

The data resulting from the study was analyzed using Strauss and Glaser's Grounded Theory method (1967) in order to conceptualize trends and ultimately identify usability issues in the software.

Findings

The following details the most common issues encountered by participants during usability testing:

Create an Item/Module. Participants encountered issues in both systems, although Canvas proved to be more difficult to use. Blackboard Learn exhibited semantic confusion in its link labels as participants struggled to decipher the differences between Information and Content. Canvas' multi-stage process for adding content to newly created modules was counterintuitive for instructors, which was not aided by grayed out links in the navigation menu. These grayed out items appeared to not be clickable, when they in fact were. It is possible that experience bias benefited Blackboard Learn performance.

Make an Announcement. This task was relatively simple to complete in both systems. However, it was completed more quickly in Canvas because it does not require users to specify date and time restrictions.

Create a new Assignment. Again, semantic issues caused confusion for Blackboard Learn users, as some participants were not sure why assignment generation would be listed under Assessments. Also, one participant encountered a "harsh" error message informing her that a due date was required. Conversely, when the same error scenario is encountered in Canvas, a gentler contextual error message was used instead.

Create a new Test/Quiz. Participants reported unsatisfactory experiences with both systems when creating a short assessment. Blackboard Learn's process appeared to be long, confusing, and "disjointed," while Canvas' separation of quiz settings and questions resulted in instructors forgetting to enter questions. Participants also had issues with selecting correct multiple-choice answers in Canvas.

Download student grades to the desktop. Canvas provided the superior experience in this task. Participants were able to easily find and download student grades because of the simplified structure, while two participants failed to complete this task with Blackboard.

Recommendations

We recommend that Canvas be implemented as the primary learning management system at Clemson University. Before Canvas is opened up to a wider audience, we recommend improving the default user interface by altering the appearance of grayed out menu items, adjusting the navigation menu's information hierarchy to simplify list traversal, and clarifying the icon that signifies correct answer selection in quiz creation.

We also recommend that users be provided extensive and early training for Canvas' content creation process, that copy/paste formatting issues be investigated, and that the LMS is tested further with more tasks and a broader variety of participants.

If you choose to remain with Blackboard Learn as the primary system at Clemson, we recommend that further user research be conducted in order to simplify the lists of tools and options available to users, and that faculty training focus on interface customization.

Introduction

The expansion of online education has created a demand for sophisticated, reliable, and easy-to-use technologies that can facilitate learning. Many online education programs utilize a mixture of technologies to deliver their coursework. Learning management systems (LMS) are one of the more widely used technologies because of their ability to deliver, administer, track, report, and document online course materials in an asynchronous, cloud-based format.

Blackboard Learn, owned by Blackboard Inc., is the dominant LMS on the higher education market. Canvas, by Instructure, is a rival product that has been steadily gaining support since its inception in 2008. Because of a longstanding relationship with Blackboard, Inc., Clemson University faculty have been utilizing Blackboard Learn for their online and offline courses. However, they have continually expressed their dissatisfaction with the product, and Clemson Online has officially began its investigation of Canvas as a potential LMS replacement in the future.

In a user-focused industry like online education, it is imperative to understand not only the functionality a product possesses but also the overall experience the product provides. With this notion and the problem in mind, we decided to conduct a study that compared the usability of the systems described above.

Our research question was simple: Which learning management system is easier for faculty to use? But because these systems have similar sets of extensive features and functionality, and our time for this study was limited, we were only able to test certain sections of each system. We chose the sections of the systems by identifying a series of most common tasks that faculty might use for their courses.

The findings and recommendations that resulted from this study are meant to help inform Clemson Online as they move toward a decision about which LMS to use for further development of online courses at Clemson University.

How to use this report

Certain sections of this report are supplemented by links to local copies of recordings of participant interactions with Blackboard Learn and Canvas. The links for these videos will appear as in-text citations, much like this (**Blackboard Grades 0:00 - 2:45**).

You can click the link to open the video referenced, then use your media player to travel to the specified time code. In the event that the link does not function properly (this can occur with strict security settings), you can view the videos by opening the Videos folder that is in the same directory as the provided report.

Methodology

The comparative usability study consisted of four stages: participant selection, site selection, data collection, and data analysis.

In this section, we describe in full the procedures taken during each stage of the study. First, we detail the proposed requirements for participation in the study and the profile of our actual participant pool. Second, we identify the site in which the study was conducted as well as the specifications of the hardware and software used. Third, we describe the data collection method and instruments used during each testing session with a participant during the study. Finally, we explain the method of analysis and coding variables selected in order to describe the data.

Participant selection

The study required five participants from the Clemson University faculty population who have used or could potentially use an asynchronous LMS, like Blackboard Learn or Canvas, to facilitate their courses. The standard amount of participants in a usability study is five, because research shows that five participants are able to adequately discover most usability issues for a product iteration (Nielsen, 2000; Rubin & Chisnell, 2008).

Participant profile

Our participants represented three of Clemson's five colleges: the College of Architecture, Arts, and Humanities (CAAH); the College of Business and Behavioral Sciences (CBBS); and the College of Health, Education, and Human Development (HEHD). In sum, three participants (P1, P2, P4) are from the CAAH, one (P5) from the CBBS, and one (P3) from the HEHD.

	Gender	Age	Ethnicity	Title	Academic Discipline	Blackboard Experience	Canvas Experience
P1	Female	30	Caucasian	Assistant Professor	English	Yes	No
P2	Female	48	African American	Senior Lecturer	Nursing	Yes	Yes
P3	Male	34	Caucasian	Assistant Professor	English	Yes	No
P4	Female	31	Caucasian	Assistant Professor	English	Yes	No
P5	Female	37	Caucasian	Lecturer	Graphic Communications	Yes	Yes

Table 1. Participant profile overview.

The three participants (P1, P2, and P4) who represented the CAAH are all assistant professors for the English department in the School of the Humanities. The participant (P5) who represented the CBBS is a lecturer for the Graphic Communications department. The participant (P3) who represented the HEHD is

a senior lecturer in the School of Nursing.

Our participants vary in gender, age, and ethnicity. Four participants (P1, P2, P4, P5) are female, and one participant (P3) is male, with ages ranging from 30-48 years old. Four participants (P1, P3, P4, P5) are Caucasian and one participant (P2) is African American.

All of our participants have experience using Blackboard Learn, and they identify themselves as being knowledgeable of the LMS. However, only two participants (P2, P5) have experience using Canvas. Despite their common experience with Blackboard Learn, our participants have a mixture of ambivalent feelings towards the LMS. Overall, our participants identify themselves as comfortable using online learning technologies.

	P1	P2	P3	P4	P5
"I consider myself to be knowledgeable of the Blackboard Learn LMS."	Somewhat agree	Strongly agree	Somewhat agree	Agree	Somewhat agree
"I am fond of the Blackboard Learn LMS."	Somewhat agree	Strongly disagree	Strongly disagree	Strongly disagree	Disagree
"I feel comfortable using online learning technologies."	Agree	Strongly agree	Agree	Agree	Strongly agree

Table 2. Pre-study assessment results.

Site selection

The study required a controlled laboratory environment as well as tools and resources that are conducive to usability studies. Both were made available to us with access to Clemson University's Usability Testing Facility (UTF).

Usability Testing Facility

Our participants completed the study in the UTF located in 410 Daniel Hall. The UTF is equipped with multiple computers and specific software that allowed us to conduct the study and record both audio and video during each testing session.

We set up each session using two computers in the UTF. Participants used one of the two computers to complete tasks assigned to them. The other computer was used by one of our team members to observe a participant's interactions with Blackboard Learn or Canvas while concurrently taking field notes. Both computers are equipped with software from the TechSmith Morae suite that enabled recording and the collection of various points of data.

TechSmith Morae

TechSmith Morae 3.3.2 is a software suite designed specifically for usability studies. It is made up of three components: Morae Recorder, Morae Observer, and Morae Manager.

Morae Recorder enabled us to configure the study on the first computer with the tasks our participants needed to complete. It also allowed us to record participants' on screen interactions with Blackboard Learn and Canvas while they completed assigned tasks.

Morae Observer enabled us observe their interactions during a testing session in real time on the second computer. It also allowed us to take field notes and to log coding variables while simultaneously observing.

Morae Manager enabled us to analyze and share the data collected from testing sessions. It allowed us to adjust task times and examine all of the data after the testing sessions have been completed via a single file. It also allowed us to create visuals depicting our findings.

Data collection

Four types of data were collected during the study using a pre-study assessment, a think-aloud protocol, and a post-study assessment. These data were both qualitative and quantitative, and included: demographic information, interactions with the Blackboard Learn and Canvas LMS interfaces, thoughts expressed by participants about their interactions with both LMSs, and comparative opinions after interacting with both LMSs.

Pre-study assessment

The purpose of the pre-study assessment was to collect demographic information about our participants (see Appendix A for the pre-study assessment form). It also provided insight into their experience with LMSs as well as their comfort level with online learning technologies.

The responses to these assessments provided context and assisted in explaining the data collected from the think aloud protocol and post-test assessment.

Think aloud protocol

The purpose of the think aloud protocol was to find out how our participants use the instructor's functionality in both Blackboard Learn and Canvas. It is a process "in which you encourage the participant to share his or her thoughts with you while working with the product" (Barnum, 2011, p. 19). We chose to use a think aloud protocol because it has several advantages over simply surveying or interviewing participants. The protocol allowed us to "capture performance and preference information simultaneously;" identify participants' preconceptions, expectations, and confusion; and observe "how they are thinking about doing a task and why things work or don't work for them," all while they actively engaged with the systems (Rubin & Chisnell, 2008, p. 204).

An additional technique was used during the protocol when we needed participants to elaborate on a specific thought. Known as active intervention, during moments requiring elaboration, a member of the team would "probe the participant's understanding of whatever is being tested" in order to better understand what they are doing and why (Dumas & Redish, 1999, p. 31).

During a testing session, one of our team members was designated to facilitate the protocol. This person would sit with the participant and provide them with five tasks to perform in Blackboard Learn and then in Canvas. Barnum describes this type of usability study a within-subjects design, or one in which the same participants will comparatively test the same product using the same set of tasks (2011).

The tasks were chosen out of a set of common activities instructors may perform in an LMS. They were identified with the help of Yahong Xu, an instructional technologist for Clemson Online. The following five tasks were assigned to and completed by each participant in both Blackboard Learn and Canvas:

1. Create an item or module
2. Make an announcement
3. Create a new assignment
4. Create a new test
5. Download student grades

Post-study assessment

The purpose of the post-study assessment was to find out more about what participants thought of their experience with each LMS. The assessment involved two parts: a questionnaire and a short interview. The questionnaire asked participants to respond using a six-point Likert scale to 22 statements based on Jakob Nielsen's ten heuristics for user interface design (see Appendix B for the post-study assessment form). The interview involved following up about specific issues the participant encountered and comments that they had made that were not discussed at length during the think aloud protocol.

Data analysis

Once the think aloud protocols were performed, data collected from these tests were analyzed. The Morae software provides a video recording of the user's interaction with the software during testing, in addition to a video of the participant recorded by a webcam. That video in particular illustrates non-verbal responses to stimuli, in addition to audio of the think aloud comments.

Grounded Theory method

In order to actually analyze the aforementioned data, we utilized Strauss and Glaser's Grounded Theory method of coding qualitative data (1967). This is a method established analytical method that allows data to be conceptualized into trends, and, in the context of our study, identifies the usability issues in the associated LMSs.

Coding variables

The following ten specific criteria were outlined and defined for open coding:

User responses	**Severity Scale**
E: Error – Participant navigates to the wrong menu or performs the wrong task.	4: Participant completes task with ease.
P: Positive comment – Participant identifies something that he or she likes.	3: Participant completes task with moderate difficulty.
N: Negative comment – Participant identifies something that he or she dislikes	2: Participant completes task with severe difficulty.
Q: Question – Participant asks for help or clarification.	1: Participant fails to complete task.
C: Confusion – Participant does not understand task but does not ask for help.	
R: Recommendation – Participant provides a suggestion for improving the user experience.	

Table 3. Coding variables.

These codes are observable responses that helped provide explanatory power over the participants' comments and interactions. They also helped maintain a manageable amount of data for the researcher. By determining these codes ahead of time, we effectively shortened the time needed to analyze the data, as a data logger applied these codes in Morae Observer during a testing session.

Findings

This section presents the key findings from the comparative usability study. It is divided into several subsections in order to provide the most comprehensible breakdown of our findings for both Blackboard Learn and Canvas.

The first five subsections are comprised of the five tasks each participant performed on both LMSs. Findings for Blackboard Learn and Canvas divide them further followed by a short conclusive summary for that respective task. An additional subsection is included that presents the results from the post-study assessment completed by each participant. This section concludes with a final summary giving our overall correlations between our participants' interactions with the LMSs and their assessment responses.

Our focus for comparison was the observable ease of use while interacting with Blackboard Learn and Canvas. In addition, we also took into account each participant's explicit voiced LMS preference.

Task 1: Create an Item / Create a Module

This task is a common first step for many faculty, as it allows them to upload their syllabus, PowerPoints, assigned readings, or any other documents that students will need access to throughout the semester. The testing of this process provided some insight into the barriers involved in uploading documents on each system.

Blackboard Learn

Because participants have experience using Blackboard Learn for facilitating their classes, they were able to complete this task relatively easily and quickly. However, they did express various degrees of confusion regarding the semantic choices used by the LMS.

Several participants were particularly frustrated with the Information and Content options in the left navigation menu. Participants were uncertain as to how to differentiate between these two terms because they are so similar in meaning. Participant 4 went as far as to say that they "don't know what information versus content even means" (**Blackboard Semantics 0:00-0:26**). After participants settled with one of these two options, they became distracted by another set of options using similar terms that were available in a drop-down menu: Item and Assignment (**Blackboard Semantics 0:46 - 1:05**).
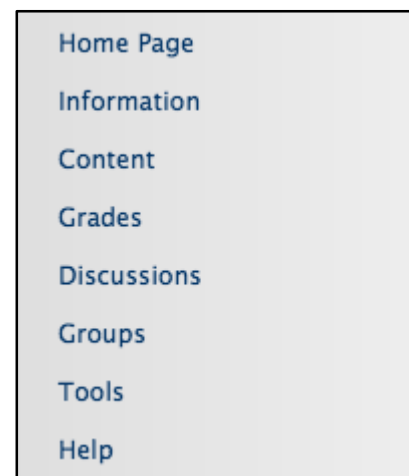

Figure 1. Blackboard Learn navigation menu

Canvas

Participants ran into a number of issues while attempting to complete this task. By default, Canvas makes some menu items gray until they are populated with content. While looking for the Modules menu item, participants would either not see it (**Canvas Grayed Out 0:00 - 0:56**) or skip over it, thinking that the feature was unavailable because it was gray (**Canvas Grayed Out 0:59 - 1:06**).

Once participants realized that they could click on Modules, they were able to move forward with the task. However, they continued to encounter issues while trying to add content to the module. For instance, once participants created a new module, they were confused about what they were supposed to do next. In most instances, participants were unable to locate the Content Page item from the drop-down menu, and instead thought that they should be able to fill in content within that window (**Canvas Adding Items 0:00 - 0:48**). One participant also noted that there was no opportunity for her to add content before creating a page.

Discussion

Although participants were able to complete this task in both systems, it raised a number of potential issues for each system. Blackboard Learn uses similar language in its default menu items, which causes confusion between the meanings of the items. Canvas, on the other hand, uses a more complicated and multi-step process for adding content.

Even with its issues, it appears that this task is easier to complete using Blackboard Learn. Faculty seemed frustrated with the syntax used in the system, but they were still able to complete the task in an efficient amount of time. The process of adding a module, a page, and then the content in Canvas seemed counterintuitive to participants, and caused them to take much more time on the task.

Task 2: Make an Announcement

This task simulates faculty communicating with their students through the LMS. Testing this task allowed us to identify ways in which communication from the professor to the students could be inhibited.

Blackboard Learn

Most participants were able to complete this task quickly using Blackboard Learn. However, some participants were confused about the role of an announcement, as well as how it differs from sending an email to the class. In addition, some participants ran into an issue when they did not restrict the dates on their announcement, which is required by the system. While this was a minor error that was easy for participants to recover from, one participant could not figure out why they would be date restricted.

Canvas

All of the participants were able to complete this task quickly using Canvas. Participants explained that the placement of the Announcements menu item was prominent and easy to find and that the process was clear and simple.

Discussion

While participants were able to complete this task in both systems effectively, it appears that the process for making an announcement is easier in Canvas than it is in Blackboard Learn. Canvas does not require announcements to be date restricted as Blackboard Learn does, which eliminates the possibility of faculty encountering a similar error message when they are trying to send out a quick message to their classes.

Task 3: Create a new Assignment

This task is a commonly used feature that faculty use to assign and collect student work. It provided us with information about places in the systems that interfere with the creation of new assignments.

Blackboard Learn

This task caused the same semantic confusion that appeared in Task 1. Participants explained that they were still unsure of the difference between an Assignment and an Item, and they were initially confused as to why an assignment would be listed under Assessments because they thought that it would be separated from tests and quizzes.

Once participants got past the initial semantic confusion, they were able to post an assignment. However, one participant did not set a due date before posting, which resulted in a red error message at the top of the screen before she could proceed, which made her "feel irritated" (**Blackboard Error Messages 0:00 - 0:53**). The participant commented that she did not appreciate that the error message appeared "harsh," and that it would have been more helpful if it had appeared closer to the place where the error occurred.

Canvas

Just as in Task 2, all of the participants were able to complete this task quickly using Canvas. They said that the Assignments menu item was clearly visible in the main navigation, and that they were becoming familiar with the conventions of the system. However, a different participant forgot to enter a due date for the assignment in Canvas, which led to an error message. When asked about what had happened, the participant said that she had forgotten to include a due date for the assignment and the system provided a "friendly" error message in the form of a chat bubble. She emphasized that it was placed near where the error was made, which made it easy for her to fix the error without wasting time.

Discussion

Both systems required a due date for assignments, which caused multiple participants to take more time to complete the task than they anticipated. However, participants felt that Canvas provided a simpler process for creating the assignment, as the menu item that they were looking for was readily available in the main navigation rather than placed in a submenu labeled Assessments.

In addition, Canvas provided a gentle, effectively placed error message when users forgot to include a due date; whereas Blackboard Learn placed the error message toward the top of the page and used harsh, unnatural language to explain to the user where he or she made an error. Users could misinterpret the higher placement and harsh language used by Blackboard Learn as a system-level error, which could cause more confusion and draw them away from the position on the page where the initial error was made.

Task 4: Create a new Test/Quiz

This task is a commonly used feature that faculty use to assess students' understanding of material. Testing this task allowed us to see the types of errors that faculty may make when they attempt to create a test in the systems.

Blackboard Learn

Participants struggled to complete this task using Blackboard Learn. Multiple participants commented on the "long, disjointed" test setup process, and one asked where to enter test questions before she had completed the test setup. This participant placed the question that was given to her in the Instructions text box without realizing that she had not finished setting up the test. Once she hit submit, she realized that she needed to go back and delete the question from the Instructions text box, which she said was frustrating and "antithetical" to way that she would want to do it (**Blackboard Tests 0:00 - 0:38**). Another participant experienced great difficulty in determining if the test he created was available for student use (**Blackboard Error Messages 0:42 - 1:31**)

Canvas

Participants encountered a number of issues during the quiz setup process in Canvas as well. Unlike Blackboard Learn, Canvas allows users to create the quiz and its questions in the same window. The system separates the two functions with tabs toward the top of the window: Settings and Questions. While participants initially indicated that they liked this organization, a number of them forgot to go back to the Questions tab and input the given question. Instead, they submitted the test without any questions, thinking that there would be another window that would allow them to input questions.

The participants also had a difficult time figuring out how to select the correct answer in the multiple-choice quiz format. One participant looked through the HTML editor to try to find a place to indicate the correct answer before she realized that she had to click on the arrow beside the possible answer. Another participant said that the phrase "Possible Answer" was "instantly confusing" for her because it made it seem like any of the answers that she input could be correct, and was generally confused about the minimal aesthetics of the feedback system (**Canvas Multiple Choice 0:22 - 1:31**).

Discussion

Each system caused significant confusion for participants as they completed this task, and therefore it is unclear which system performed better. Participants were confused by Blackboard Learn's long setup process but were also unable to remember that the quiz settings and questions appeared in the same window in Canvas. This indicates that neither of the methods offered by the LMSs provides an effective user experience for setting up a test or quiz.

However, Blackboard Learn did provide a superior experience in one aspect of this task. Participants were confused by the way that Canvas made them select the correct answer in a multiple choice question, and they found the radio buttons next to each answer in Blackboard Learn to be an easier or more familiar method of selection.

Task 5: Download student grades to the desktop

This task simulates faculty making a copy of their grades from the systems for their own records. The testing of this process provided insight into the types of issues that faculty run into while attempting to download information from the systems.

Blackboard Learn

Overall, participants found downloading grades with Blackboard Learn to be very difficult and faced a number of challenges when attempting to complete this task (**Blackboard Grades 0:00 - 2:45**). Participants were clearly overwhelmed by the large amount of options they had access to in Blackboard Learn's Grade Center (**Blackboard Grades 0:52 - 1:08**). In order to download student grades, participants were confronted with three drop-down menus with multiple options using unfamiliar language. Upon surveying the options they had, participants were not able to find an apparent option to just download grades. A few participants were distracted by the Grading Periods and Grading Schemas options under the Manage dropdown, admitting they had no idea what that meant (**Blackboard Semantics 0:22 - 0:43**).

Two participants failed to complete the task. One unexpectedly modified the anticipated procedure by opening the browser's print dialog and saving the grades as a .pdf (**Blackboard Grades 0:00 - 0:50**).

Canvas

Participants were able to complete this task in Canvas very quickly. Because of the system's condensed left navigation menu, participants were able to locate the Grade option almost immediately. Once inside the Grade dashboard, participants demonstrated very little difficulty figuring out how to download student grades.

One participant, however, was confused after discovering the individual view within the Grade dashboard. Canvas defaults to a global view that lists every student's' grade in a course. The participant curiously clicked on the Switch to Individual View link while searching for an option to download grades. Once in the individual view, he discovered he could not download grades unless he completed a long form. Rather than take the time to fill the form out, the participant preferred to return to the global view, but he had some difficulty because of a slight change in the navigation. Despite the inconvenience brought about by these differing Grade views, this participant was impressed by how easy it was to find the Download Grades option in the global view dropdown menu.

Discussion

Participants inarguably had a superior experience using Canvas in comparison to Blackboard Learn when tasked to download student grades, and they expressed their preference for Canvas very clearly (**Blackboard Grades 1:09 - 2:45**). We believe this is largely due to the simplified navigation structure utilized in Canvas. Its Grade dashboard and download grades option were not hidden among lengthy menus or unfamiliar language, making it easier for participants to complete the task.

Participants needed to exhume and decipher the correct option in Blackboard Learn. Those who were successful in completing the task were not able to download grades without frustration. One participant was particularly annoyed by the amount of clicking she needed to do in order to complete an action as simple as saving a file (**Blackboard Grades 0:52 - 1:08**). Another participant expressed the only reason why she knew how to download grades in Blackboard Learn is because she contacted Clemson Computing and Information Technology (CCIT) for assistance in the past.

Quantitative study data

A wealth of quantitative data was collected during the usability study as well. In order, these graphs represent the time spent on task completion, the average severity score for each task (lower is worse), and the degree of success for each task. In each graph, tasks 1-5 represent Blackboard Learn, whereas tasks 6-10 represent Canvas.

Time on task

Figure 2 shows the variations between the amounts of time participants spent on each task. It demonstrates that the two most time-consuming tasks for most participants (Task 6: Creating a module and Task 9: Creating a quiz) occurred in the Canvas system. However, the two least time-consuming tasks for most participants (Task 7: Creating an announcement and Task 10: Downloading student grades) occurred in Canvas as well. The most time-consuming task for a single participant (Task 3: Creating an assignment) occurred in the Blackboard Learn system, whereas the least time-consuming task for a single participant (Task 10: Downloading student grades) occurred in the Canvas system.
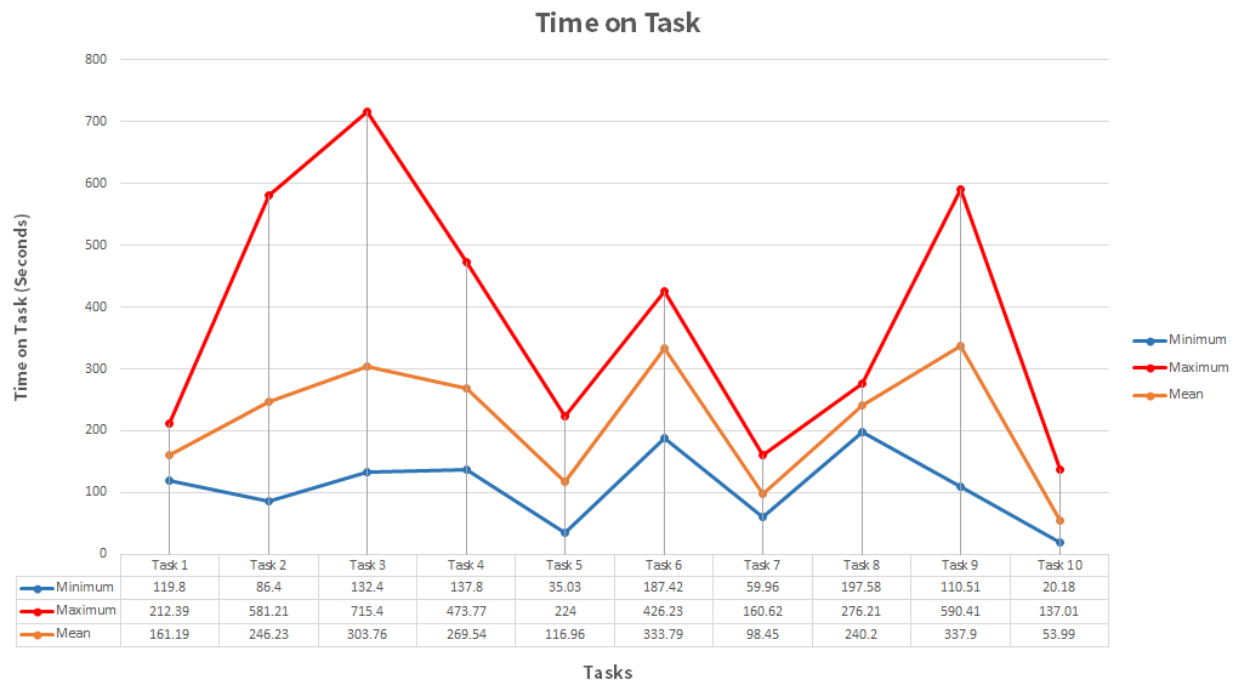

Time on Task

	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10
Minimum	119.8	86.4	132.4	137.8	35.03	187.42	59.96	197.58	110.51	20.18
Maximum	212.39	581.21	715.4	473.77	224	426.23	160.62	276.21	590.41	137.01
Mean	161.19	246.23	303.76	269.54	116.96	333.79	98.45	240.2	337.9	53.99

Figure 2. Minimum, maximum, and average time spent on tasks.

Average severity score and success distribution by task

Figure 3 demonstrates the average values of the severity scores that we assigned to each participant's ability to complete the task. Below are the meanings for each of the scores:

   4: Participant completes task with ease.

   3: Participant completes task with moderate difficulty.

2: Participant completes task with severe difficulty.

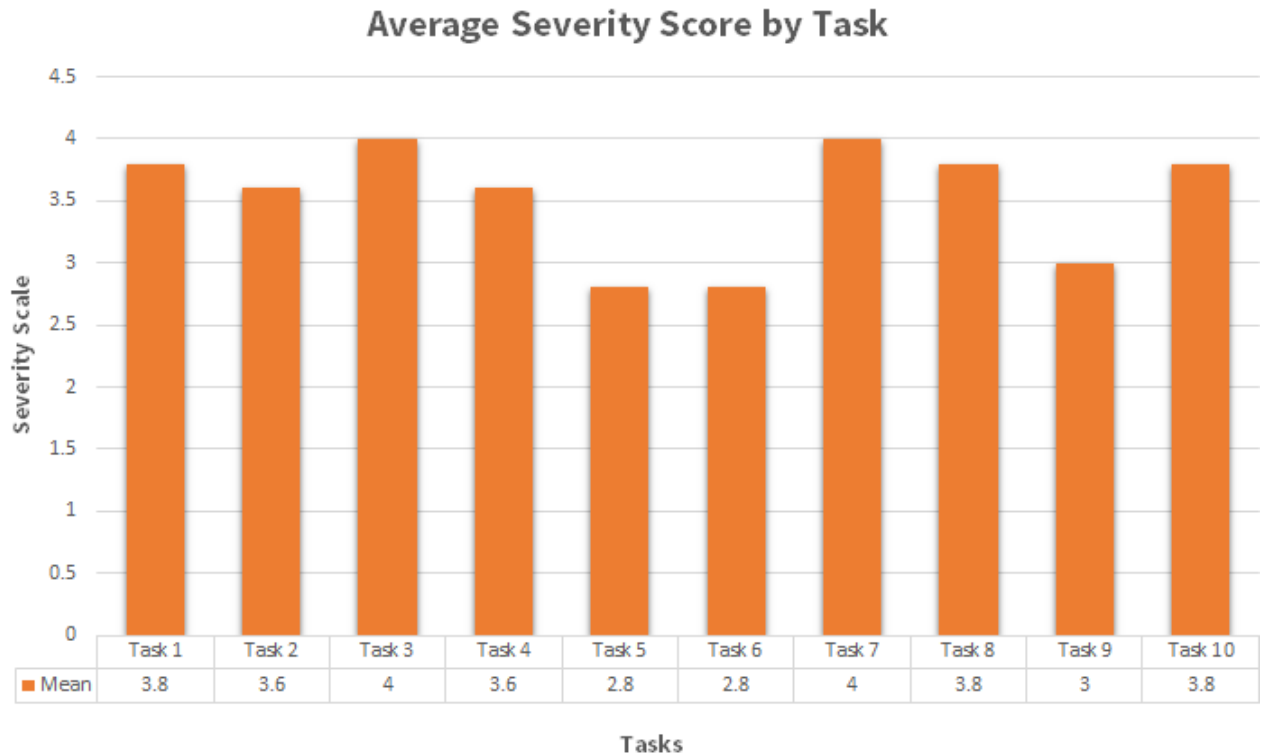**1:** Participant fails to complete task.

Average Severity Score by Task

Severity Scale	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10
■ Mean	3.8	3.6	4	3.6	2.8	2.8	4	3.8	3	3.8

Tasks

Figure 3. Average severity score by task.

The two lowest average scores, or difficult to complete tasks (Task 5: Downloading student grades and Task 6: Creating a module), occurred in Blackboard Learn and Canvas, respectively. Similarly, the two highest average scores, or easier to complete tasks (Task 3: Creating an assignment and Task 7: Making an announcement) occurred in Blackboard Learn and Canvas, respectively, as well.

Figure 4 provides a more detailed look at the distribution of severity scores that we assigned to each participant. This graph demonstrates the instances in which participants failed to complete the tasks (Task 5: Downloading student grades and Task 9: Creating a quiz), which resulted in a severity score of 1. However, the majority of tasks in both systems were completed with ease or with only moderate difficulty.
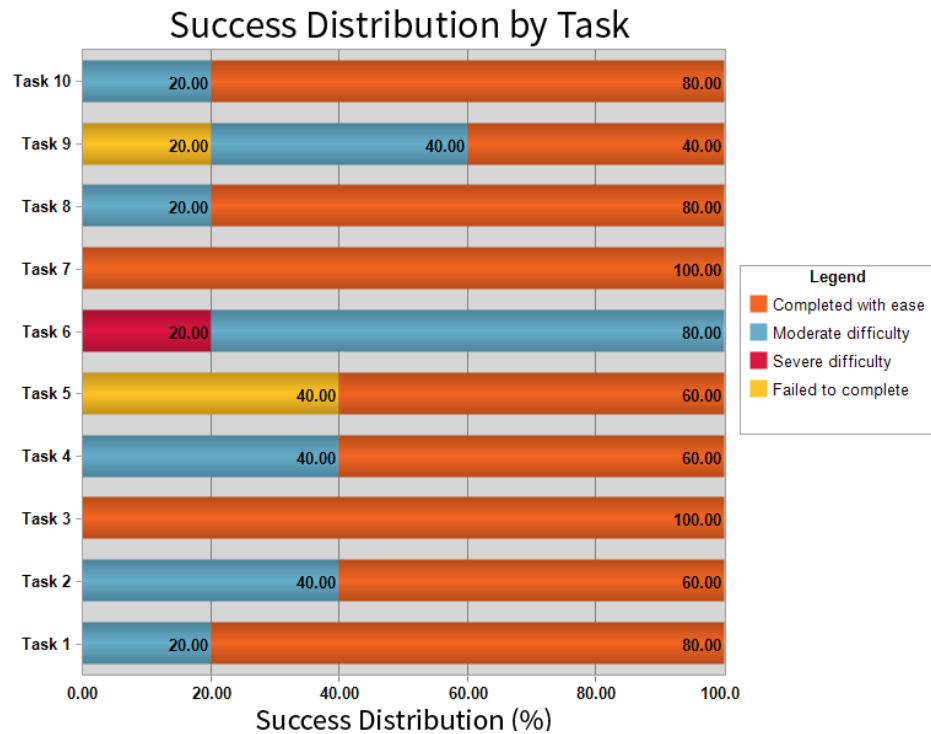

Figure 4. Success distribution by task.

Discussion

Figures 2 - 4 give insight into each system's ease of use when the tasks we provided are performed.

It is important to note that the times shown in Figure 2 may not reflect the normal amount of time an average user would spend on each task because of the nature of the think aloud protocol. This is especially true for participants who took the most amount of time on tasks. Often during testing, participants would stop what they were doing and explain what they were thinking about the software in certain situations. This would not happen if a faculty member was using either system on their own in a natural scenario.

Figure 3 is particularly useful in quickly determining the tasks that caused users the most problems in both systems, while Figure 3 dives deeper into task completion by depicting the distribution of severity scores. Immediately you can see that Canvas' most problematic task (Task 6: Create a module) proved to be difficult for all participants. It is also clear that 40% of participants failed to complete Task 5 in Blackboard Learn (Task 5: Downloading student grades).

Post-study assessment results

Questionnaire

The questionnaire that participants filled out after completing the usability study was based on Jakob Nielsen's ten heuristics for user interface design (Appendix B). Tables 4 and 5 summarize the results of this questionnaire and provide information about the ways in which participants perceived these heuristics in effect within Blackboard Learn and Canvas, respectively.

Table 4 indicates that participants felt there were a number of problem areas within the Blackboard

Learn system. Of these problem areas, two received a fully negative response; all of the participants disagreed with the statements that the system uses a minimal design and is easy to use. Two other statements (that Blackboard Learn provides users with control and freedom throughout the system and that it makes objects, actions, and options visible) received a negative response from four of the five participants.

Blackboard Learn	Agreement (%)	
	Agree	**Disagree**
Provides appropriate feedback when I make a change.	80%	20%
Uses familiar language and concepts throughout the system.	60%	40%
Provides me with control and freedom throughout the interface.	20%	80%
Uses consistent interface elements throughout the system.	100%	0%
Helps me avoid making errors.	80%	20%
Makes objects, actions, and options visible.	20%	80%
Uses a minimalist design.	0%	100%
Helps me recover from errors that I make.	80%	20%
Provides me with easily accessible help and/or documentation.	80%	20%
Is easy to use.	0%	100%
I would prefer Blackboard over Canvas for my classes.	0%	100%

Table 4. Post-study assessment results, Blackboard Learn.

Table 5, in contrast, indicates that participants felt Canvas excelled in terms of the ten heuristics. The majority of participants agreed with each of the statements provided. Three of the statements (that Canvas provides appropriate feedback when a user makes a change, that it provides users with control and freedom throughout the interface, and that it helps users avoid making errors) received one dissenting opinion, respectively.

In addition, all of the participants indicated that they would prefer Canvas to Blackboard Learn for their own classes.

Canvas	**Agreement (%)**	
	Agree	**Disagree**
Provides appropriate feedback when I make a change.	80%	20%
Uses familiar language and concepts throughout the system.	100%	0%
Provides me with control and freedom throughout the interface.	80%	20%
Uses consistent interface elements throughout the system.	100%	0%
Helps me avoid making errors.	80%	20%
Makes objects, actions, and options visible.	100%	0%
Uses a minimalist design.	100%	0%
Helps me recover from errors that I make.	100%	0%
Provides me with easily accessible help and/or documentation.	80%	0*
Is easy to use.	100%	0%
I would prefer Canvas over Blackboard for my classes.	100%	0%

Table 5. Post-study assessment results, Canvas.

Interviews

The short interviews conducted after administering the questionnaire provided a number of other insights into participants' perceptions of the functionality and aesthetics of the two learning management systems.

One participant, who is a new faculty member at Clemson, said that she had to spend a few hours at the

beginning of the semester learning the Blackboard Learn interface, as she had not had an opportunity to use it in other institutions. She explained that while she was able to figure out most of the things she wanted to do with the system, she was ambivalent about having to use it here and that she would feel more comfortable with an open source alternative, such as Moodle.

Another participant said that he actively avoided using Blackboard Learn due to his prior experience with the system. He mentioned that the overall look of the default interface that was used for the study had improved in terms of overall aesthetics since the last time that he logged in. However, he said that he preferred the general look and feel of Canvas to Blackboard Learn, and that he would probably use an LMS in his classes more often if it were Canvas.

The other participants' comments echoed this sentiment, but not just because of the aesthetics of Canvas. One participant said that she thought the menu structure of Canvas was much simpler than that of Blackboard Learn. Specifically, she explained that Blackboard Learn "hides important and useful links within long menus and submenus," whereas Canvas makes "fewer features more apparent and accessible."

Discussion

The post-study assessments helped to give more information about the ways in which participants felt about their experiences with both systems. Participants seemed to be unhappy with Blackboard Learn, and although they often took more time on tasks using Canvas, they discussed their experience with it in a much more positive tone. They appeared to be interested in learning the competing system, and they did not seem to mind when some tasks were different or more time-consuming than what they were used to with Blackboard Learn.

All of the participants expressed disdain for the main navigation in Blackboard Learn and had positive comments about Canvas' navigation in comparison. Although a number of them had initial confusion with some of the grayed out menu items and other quirks of the system during the usability study, they were willing to overlook those issues during the post-study assessment.

Based on the feedback from the post-study assessment, participants would prefer to use Canvas to Blackboard Learn as the LMS that they use for their courses.

Recommendations

Implement Canvas as the primary LMS at Clemson University

As suggested by multiple points of data in this study, it appears that faculty are ready for an alternative to Blackboard Learn at Clemson, and Canvas is not only a viable option, but a strong one. During the test portion of the study, Canvas performed better than or as well as Blackboard in every task, other than the first (Create a module). However, it's important to keep in mind that this discrepancy is likely exacerbated due to experience bias, as all faculty have used Blackboard extensively in the past, but only two have ever used Canvas.

To prepare for a switch to Canvas, we recommend introducing the system to Clemson faculty through a structured transition period. This time can be used to control the influx of users to the Canvas population, so that each adequate training and technical support resources can be provided.

Based on the results of this usability study, we also suggest improving the default user interface of Canvas with the following changes:

Figure 5. A portion of the Canvas menu showing gray links.

- **Either have navigational elements (Assignments, Quiz, etc.) pre-populated with unpublished example content, or simply adjust system to not gray out empty areas.** Many participants were confused by the grayed out links of unpopulated menu items.

- **Adjust the navigation's information hierarchy to simplify list traversal.** Both Blackboard and Canvas provide a wealth of navigation links to users in their respective navigation area. The study of human factors suggests that long lists tax cognitive resources, which is evidenced by participants having to slowly parse these lists. From a design perspective, there are several ways to alleviate this. We suggest improving the information structure of the Canvas navigation by adding headings to group similar items, abbreviating the list by condensing the list to only including the essential and most used tools, and reorganizing the list so that trafficked links appeared higher.

- **Clarify the icon that signifies correct answer selection in quiz creation.** Many participants experienced confusion when trying to select the correct answer for a multiple-choice question when creating a quiz in Canvas. A simple text label should be able to clearly denote if the selected answer is correct or not.
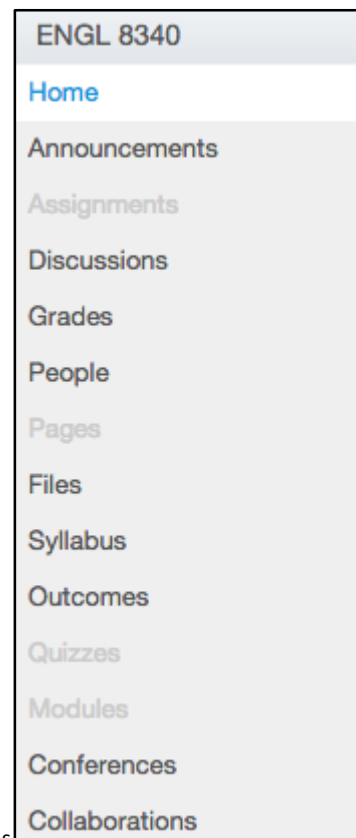
Educate users of content creation processes

As mentioned, we highly recommend having targeted technical and logistical support in place for faculty acclimating to the new system. Because the usability issues found in Canvas during this study primarily lie within the content creation systems in place (creating modules, items, quizzes, etc.), we specifically suggest bolstering support for those processes. This support should take the form of readily available custom help documents and frequent workshops.

Fix copy/paste formatting issues

During testing, the built-in text editor for both Canvas and Blackboard would often provoke anger from participants because of its inability to properly format pasted text copied from a Microsoft Word document. Unfortunately, there is not likely a technical "fix" for this issue. HTML editors will naturally distort the XML markup that accompanies Word documents. Adjusting for this would mean that the system would somehow have to strip the Word formatting before actually being placed into the LMS editor. This fix would require support from the developers of the Canvas product.

However, while not as user-friendly, behavioral changes could be introduced to offset for this issue. Instead of right-clicking and pasting, or pressing CTRL+P, the user could execute the paste command by pressing CTRL+SHIFT+P. This sequence pastes copied content in plain text, without any preconfigured formatting, which makes styling content easier. This minor shift in action could improve the user experience for intermediate users, and be introduced with training materials.

Further testing of Canvas

While it has been illustrative, our sample of instructors is not entirely representative of the Clemson University population. Further testing and research must be conducted to confirm user acceptance of this product and to discover potential usability issues. We recommend testing more faculty of different disciplines and experiences and considering different common LMS tasks to test. We also highly recommend examining the product from alternative viewpoints, such as student usage of the system, or looking into its mobile accessibility.

If you choose to stay with Blackboard Learn, try to simplify

Most issues we discovered in Blackboard resulted from overly complicated processes or unyieldingly long lists. We would recommend conducting user research to discover what tools and options are being most frequently used in Blackboard, and then try to make those links the most prominent and the accessible. Beyond that, targeted training and materials will help instructors become more adept at navigating the Blackboard Learn system. We particularly recommend emphasizing course shell customization so that users can personalize the robustness of Blackboard to better suit their workflow.

Conclusion

This study has compared the Blackboard Learn and Canvas learning management systems according to data collected from extensive usability testing. As a result of user's experiences with these systems during testing, we recommend that Clemson Online consider Canvas as the primary LMS at Clemson University, although usability issues still need to be addressed.

We appreciate the help and support of Clemson Online over the course of this study, and we are indebted to the Clemson University faculty who assisted us by participating.

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APPENDIX A: Pre-study assessment

The following pre-test questionnaire should take about five minutes to complete.

1. Sex (Please circle one):   Male   Female

2. Age: _____

3. Ethnicity: _____ Asian

    _____ African American

    _____ Caucasian

    _____ Hispanic/Latino

    _____ Native Hawaiian/Pacific Islander

    _____ Other: _____

4. Occupation: _____

5. Please indicate your level of agreement with the following statement: "I consider myself to be knowledgeable of the Blackboard learning management system."

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

6. Please indicate your level of agreement with the following statement: "I am fond of the Blackboard learning management system."

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

7. Please indicate your level of agreement with the following statement: "I feel comfortable using online learning technologies."

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

APPENDIX B: Post-study assessment

Please indicate your level of agreement with the following statements.

Blackboard

1. Blackboard provides appropriate feedback when I make a change.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

2. Blackboard uses familiar language and concepts throughout the system.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

3. Blackboard provides me with control and freedom throughout the interface.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

4. Blackboard uses consistent interface elements throughout the system.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

5. Blackboard helps me avoid making errors.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

6. Blackboard makes objects, actions, and options visible. I don't have to remember where things are.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

7. Blackboard uses a minimalist design.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

8. Blackboard helps me recover from errors that I make.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

9.   Blackboard provides me with easily accessible help and/or documentation.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

10.   Blackboard is easy to use.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

11.   I would prefer Blackboard over Canvas for my classes.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

Canvas

12.   Canvas provides appropriate feedback when I make a change.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

13.   Canvas uses familiar language and concepts throughout the system.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

14.   Canvas provides me with control and freedom throughout the interface.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

15.   Canvas uses consistent interface elements throughout the system.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

16.   Canvas helps me avoid making errors.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

17.   Canvas makes objects, actions, and options visible.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

18.   Canvas uses a minimalist design.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

19.   Canvas helps me recover from errors that I make.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

20.   Canvas provides me with easily accessible help and/or documentation.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

21.   Canvas is easy to use.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree

22.   I would prefer Canvas over Blackboard for my classes.

Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree