Canvas: An Evaluation

Final Report

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HCI 504: Evaluating Digital Learning Environments

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Section 1: Introduction to Canvas Discussions

Canvas, developed and maintained by Instructure, is a popular *learning management system* (LMS) used by more than 3,000 universities worldwide, including Iowa State University (About Canvas, n.d.). It provides a host of features that address many aspects of the educational experience such as course delivery, grading, discussion management, assignment submissions, and test administration, etc. (LMS Features, n.d.). Canvas delivers its functionality primarily through a web-based software application; a subset of features is also available through native Android and iOS mobile applications. Unfortunately, evaluating a software application as complex as Canvas is beyond the scope of this evaluation. Instead, we focused on the efficacy of one particular feature of Canvas - the discussion component, which for the purposes of this report, is referred to as "Canvas Discussions." Discussions are a particularly versatile feature of Canvas as they can be used for general forums, announcement delivery platforms, or question/answer boards. For this report, we analyzed the discussion feature as it was primarily used by the students at Iowa State University's (ISU) CI/HCI 504 course, which was as a graded and interactive discussion board used on a weekly basis. We recommend that other stakeholder perspectives, such as those of instructors, be evaluated in the future in order to explore pedagogical use of Canvas Discussions.

Discussions are typically accessed through a main "Discussions" page, which presents all forums available to each student (*Figure 1*). The instructor can control viewing privileges to individual post threads to students and encourage group work.

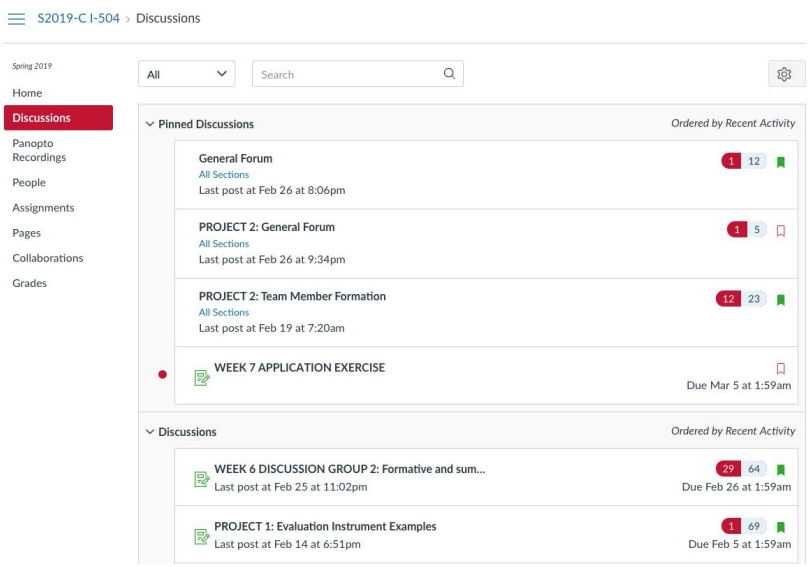

Figure 1. Student view of discussions

Context for the discussion, along with an optional due date, is set by an initial post, which can be created by an instructor or student. Other students can reply directly to the initial post or to other post responses. To help distinguish between posts, unread responses are denoted by a red tab with a count of the number of unread posts (*Figure 1*). At the thread level and post level, this appears on the right hand side. Previously read posts are indicated by a clear dot to the left of each individual post.

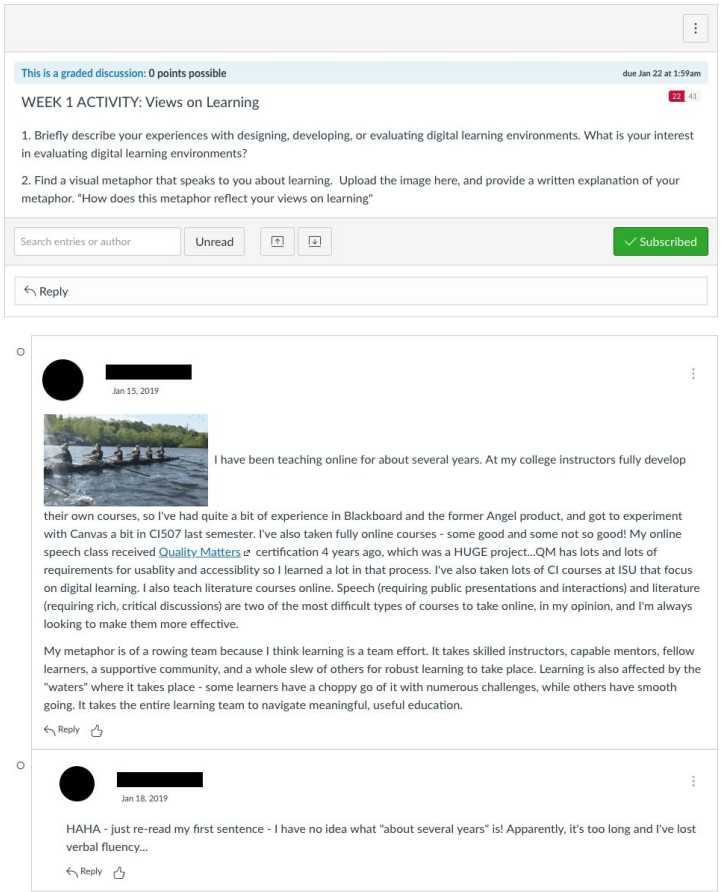

Figure 2. Student view of discussion at the post level with an initial post and replies

There are no restrictions on the number of replies, so discussions may become deeply nested. The end result is a nested structure of comments loosely and topically organized rather than chronologically organized.

The composition tools provided by Canvas encourage long-form and media-rich responses. Students can access common WYSIWYG formatting tools such as bolding, italicizing, underlining, text alignment, bulleted and numbered lists (*Figure 3*). Links to utilize external resources and third-party integrations, such as YouTube, Google Drive, etc., are also present.

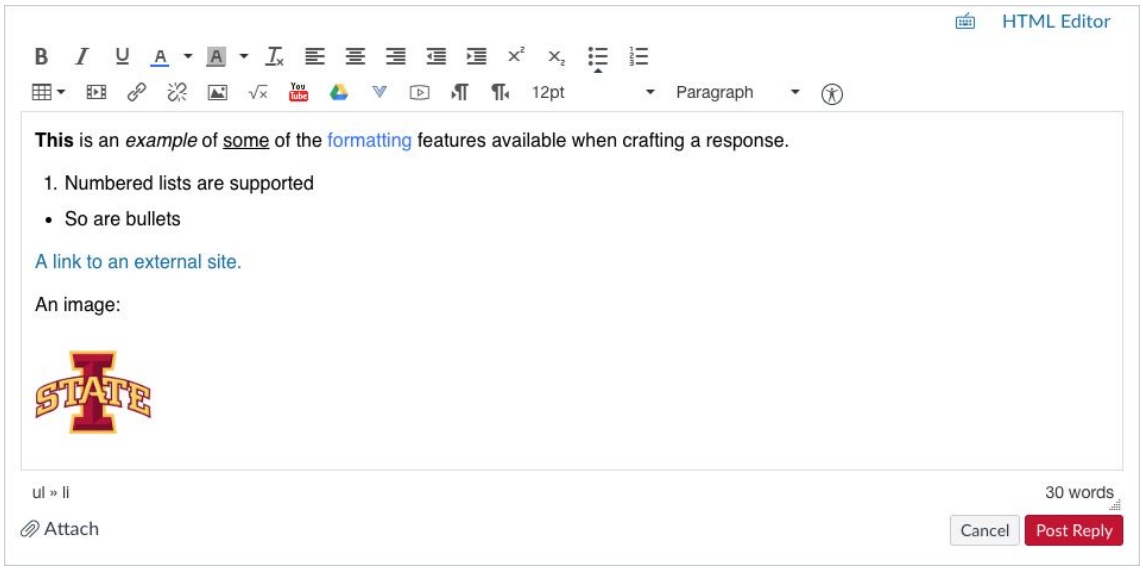

Figure 3. Formatting tools available when writing discussion content

Canvas also sends email notifications to students when classmates interact with their posts (*Figure 4*). Students who use the Canvas mobile app can also receive notifications through their mobile device.

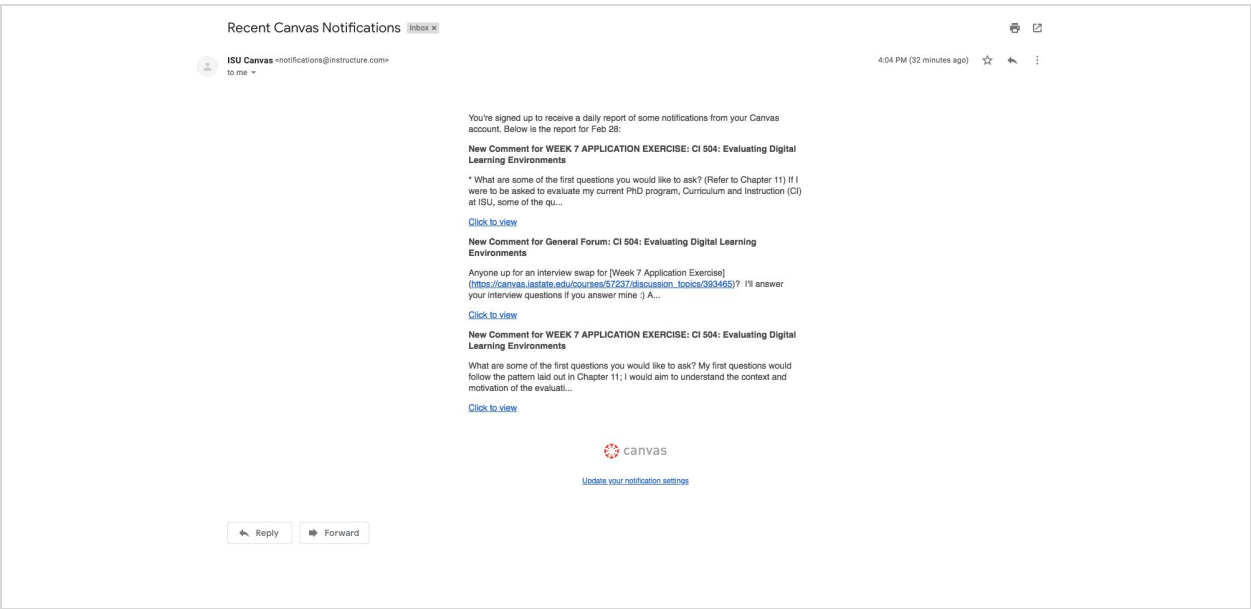

Figure 4. An example of a discussion activity email notification sent by Canvas

Section 2: Target audience

Our target audience for this evaluation was online graduate students. In the United States, the average graduate student age is approximately 33 years old (Council of Graduate Schools, n.d.). It is common for students of this age range to be proficient in everyday technologies, such as computers and mobile devices. It is also assumed that the majority of graduate students have prior experience in the workforce, and some may even be maintaining full-time careers while enrolled. Some students may pursue higher education in hopes of workplace advancement or other career field opportunities. Some students may simply be in pursuit of education for personal growth. Most students in the ISU CI/HCI 504 course were *online learners*, who are individuals that have access to learning experiences via the use of some technology (Benson, 2002). Conrad (2002) identifies online learning as a more recent version of *distance learning*, which improves access to educational opportunities for learners described as both nontraditional and disenfranchised. Online learners are typically technologically proficient and have access to the proper resources needed to succeed in a digital learning environment.

In terms of resources, access to a computer is mandatory in using a digital LMS such as Canvas. It is assumed users either own a personal computer or have access to one. Several learner skills are suggested for educational success. First, students should possess a basic understanding of how to navigate and operate a computer and perform basic tasks such as opening applications, navigating file systems, and resolving minor software issues. Experience using word processing applications, such as Microsoft Word or Google Docs is also beneficial. Although not a

requirement, experience with mobile operating systems, such as Apple iOS and Google Android, are suggested for use of a secondary and reduced-feature version of Canvas.

There are some additional social skills that aid in student success. One key skill is the ability to engage in online participation, both with peers and with instructors, as many courses have required discussions. In a recent study, facilitated discussions were perceived by students as a helpful strategy in creating engagement in online learning (Martin, et al. 2018). Additionally, other fundamental academic skills such as oral and written communication, information analyzation, critical thinking, problem solving, and the ability to collaborate with peers are necessary to student success.

Enrolled students fall into different areas of engagement attitudes. This is largely dependent on the course status and if it is required, an elective, continuing education or mandatory training. An example of mandatory training might be a laser printing class for the purposes of a certification or career preparation. If a course is required, it can generally be assumed that it is part of a program's curriculum and an area of interest to the student. Some students may feel forced into a course in order to meet graduation eligibility requirements, which may cause negative learning attitudes. Personal interest in a particular subject is likely to help students maintain attention and perform better (Liew, 2012). It can be assumed that students taking electives are taking the course primarily because of interest in the subject, and thus may have a more positive attitude towards course material. Fredrickson (2001) argues that positive emotions towards a course can promote student success because they broaden cognitive awareness of potential solutions to problems. Pekrun et al., (2004) posits that joy, hope, and pride positively correlate with student academic self-efficacy, interest and effort, and overall achievement. Negative emotions reduce

achievement on higher order cognitive processes such as problem solving, memory, and strategic thinking (Blair, 2002).

Giving students the tools necessary to accomplish course tasks is essential in fostering a positive learning experience. For example, features like discussion boards should supply essential features of word processing applications. Lack of sufficient and familiar options can lead to an unsatisfying user experience and frustration at the inability to present an idea effectively. This may create negative emotions towards an LMS and thus may inhibit student success.

Intended Outcomes

According to Instructure, an LMS can increase student engagement by creating better participation. Because the discussion component requires active student and instructor participation, it is vital to student engagement. Instructure designed Canvas with three learning *goals*: motivation, participation, and progression (Instructure, 2017). For the purposes of this evaluation, goals were thought of as long-term guidelines that help form the product vision (Kopco, 2017). As detailed in their goal research (*Figure 5*), each of Canvas's learning goals use some aspects of the discussion component to aid in student engagement.

Figure 5. Canvas's three learning goals (Instructure, 2017)

"Motivation" goals are concerned with empowering students to be proactive and enthusiastic about learning objectives. They wish to encourage growth outside a single course, strengthen student collaboration and communities-of-practice, and create student autonomy. The "Participation" goal addresses supporting learning objectives by encouraging active student work either individually or in a team scenario. The discussion component is important to this goal as flexible discussions help student and instructor conversations evolve and take different shapes other than just text. Lastly, the "Progression" goal considers ways to create student self-reflection about learning through feedback. The discussion component is often the vehicle for this feedback.

Within these main goals are learning *objectives*, which are specific to the discussion component. Objectives are strategies implemented in order to achieve learning goals; they are more specific and measurable (Kopco, 2017). In general, Canvas seeks to create "flexible discussions that

allow more time and opportunity for more students to participate…[on] a deeper level (Canvas, 2017).” Canvas Discussions aim to achieve the following objectives:

- To facilitate and increase student social connectedness through conversation, interaction, and support;
- To engage the instructor for questions, comments, and feedback;
- To create student autonomy;
- To encourage self-expression through text, audio, or video options;
- To accommodate for students with sensory disabilities;
- To create a positive sense of community.

The overall challenge Canvas Discussions face is replicating the authentic conversations of a face-to-face classroom environment with online technology. In their research, Instructure claims that there is an important balance between their digital learning environment, Canvas, and the teaching methods used to deliver it (Stein, 2015). Although pedagogical uses of Canvas are beyond the scope of this evaluation, we find it important to note this as an additional factor to the success in achieving learning goals and objectives.

Section 3: Preliminary evaluation

In general, Canvas Discussions foster peer learning and collaboration. This collaboration creates more individual student autonomy, which creates further participation and engagement. Providing robust features that facilitate asynchronous discussions helps to strengthen student

understanding of course material. The Canvas Discussions interface follows web and accessibility standards; Instructure has taken additional steps to assist students in making accessible content, which we will discuss below. There are a number of small user interface improvements that could be made to make the user experience more intuitive. In the sections below, we have segmented aspects of Canvas Discussions and will give a critique of each in terms of how they help students achieve the learning objectives.

Post options

In general, Canvas Discussions have the essential functionality needed to encourage student participation. Discussion posts offer the ability to customize responses with basic word processing features such as bold, italics, underline, font sizes and colors, and bullet or numbered lists. More advanced functionality such as YouTube embedding, Google Drive integration, and image and data visualization insertion are also provided. However, other common word processing options, such as the ability to change the typeface and adjust paragraph margins, are missing. Implementing some of these missing features will give students a higher level of content customization and ownership of work. Research has shown that when students are given tools in which to communicate their individual personalities, they achieve a higher sense of social presence, which may lead to greater course engagement (Garrison, 2009, p. 352).

Graded discussions

In many Iowa State courses, including CI/HCI 504, students have required discussions as part of an overall course grade. Some researchers have found this to be counterproductive to participation, claiming that this can cause students to post only the minimum required content (Cho and Tobias, 2016). Additionally, when evaluating similar discussion platforms, such as

Blackboard, it was found that required discussions and interactions had no impact on student achievement, satisfaction, and time spent on the course. This practice seems counter to the learning objective of facilitating student conversation, interaction, and support.

Peer feedback

Discussion post formatting options create a deeper level of student expression. Peer feedback can also aid in this expression by encouraging student problem solving and project completion. Students can give peer feedback on Canvas Discussions by responding directly to another student's post or by referencing another student's work in a post. Receiving a post response can be a satisfying experience, especially if the content includes helpful insight. Constructive feedback creates a more positive learning experience when compared to low-quality feedback, which is perceived negatively (Ching and Hsu, 2013). It should also be noted that when feedback includes thorough explanations, it is perceived as support, which will continue to encourage further student interaction. Ching and Hsu also advocate for the use of a gentle tone when responding to fellow students. As peer feedback is extremely important in creating course collaboration, Canvas Discussions might leverage artificial intelligence (AI) in the same way as Google's newly release Smart Compose (*Figure 6*). Smart Compose uses machine learning to make content suggestions to users when composing an email. Canvas Discussions could use a similar technology to encourage appropriate conversational tones or aid in prompting guiding questions.

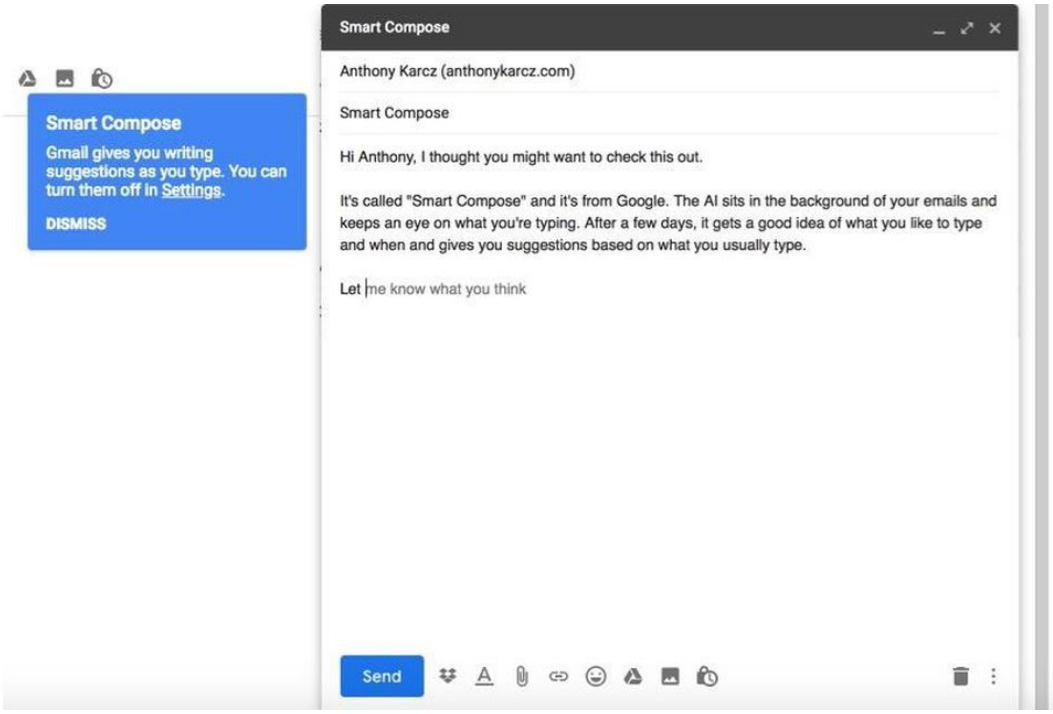

Figure 6: Google Mail Smart Compose

Accessible conversations

Canvas Discussions include functionality to make student interactions accessible to all audiences. No additional software is required to access and use the discussion feature; users only need an internet connection and a web browser. Video discussion options, such as Arc, a third-party digital learning video platform, do require a webcam and microphone. To encourage the accessibility of content, Instructure has designed a built-in feature, called the Rich Content Editor Accessibility Checker (*Figure 7*), which "verifies attributes within the editor and notifies the content creator of common accessibility errors (Canvas Beta Release Notes, 2017)." For example, this feature ensures that content is high contrast enough for visually impaired audiences.

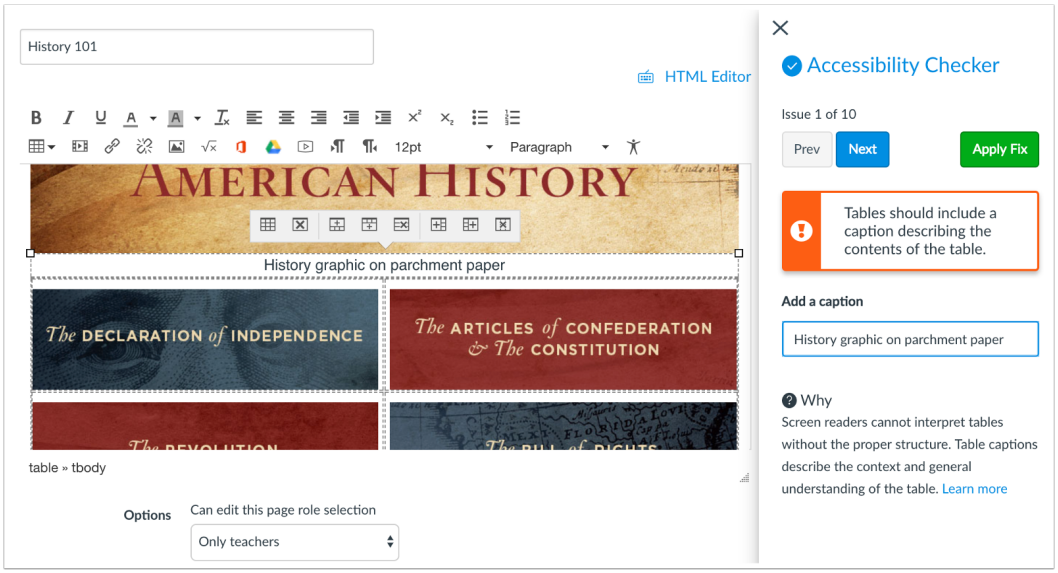

Figure 7. Canvas Discussions Accessibility Checker

Asynchronous communication

Canvas Discussions provide an effective way to facilitate conversations without requiring synchronous communication. As many universities now offer online programs, this format allows for students in multiple time zones to collaborate. In order to segment discussions or create teams, instructors are able to create separate group discussion boards. This feature allows students to collaborate with each other on a more global scale. For example, this paper includes the work of three students in three different time zones. This experience is unique to distance learning and is not possible in a more traditional, on-campus learning environment.

The asynchronous features of Canvas Discussions also allows for learning environment flexibility, which creates student engagement. For example, students have more time for reflection because discussion posts do not require an immediate answer. Some researchers have found that this type of reflection leads to greater content-related work, whereas similar

on-campus situations were found to be not nearly as productive (Hratstinksi, 2008). Asynchronous features also encourage better task planning when compared to the time management of on-campus students.

Customizable course experience

The features of Canvas Discussions are flexible and scalable, allowing for a customizable learning experience. However, much of the structure and experience is decided by the instructor, who has the ability to customize the discussions to fit the needs of each course. For example, instructors can determine the lifespan of the discussion, who can take part in the discussion, if editing capabilities are allowed, etc. Instructors should consider the student experience across multiple courses. For example, a student enrolled in multiple courses may have various Canvas Discussion experiences. In one course, a student may have an active discussion board with multiple threads, but in another course, there may be no discussion board at all.

Ease of use

Canvas Discussions encourage student expression with a large offering of conversation tools. This allows students to add depth and clarity to their responses by using word processing formatting techniques or by writing HTML markup. However, our preliminary evaluation of Canvas Discussions revealed some issues with the user interface related to these tools. A look at user reviews on Capterra, a software review site, exposes many problems with the organization of discussions. Although the threaded conversation model allows for a user to chronologically follow the evolution of a post thread, some reported that discussion threads become lengthy. Unfortunately, there is no way to filter post content other than through a search function and an "Unread" button, which can cause users to spend extra time scrolling through pages of posts.

There also seems to be confusion about how to reply to a post. Users will often incorrectly respond to another user when they intended to respond to the initial post. As one user on Capterra mentioned "When replying to someone else's discussion board post, it's difficult to see the response as a Reply, versus a new post all-together. Replies are only slightly indented, so at a quick glance, it's hard to tell if it's a reply or a new post."

Additionally, some users had issues with the email notification system. If a student has posted to a discussion thread, they are automatically "subscribed" to that thread and are sent periodic email updates about the continuing discussion. Unfortunately, these updates are not always within the context of a student's work and can speak generally to the discussion thread, making the email notifications of little value. Canvas does allow these notification settings to be adjusted. This is controlled within each student profile, but requires some user discovery in order to find the location. The only quick option is to unsubscribe from each discussion thread, which means a user would need to manually check each thread for updates.

We also discovered some problems with the *semiotics* of the user interface elements. Semiotics refers to how users interpret iconography in the user interface. The green icon to the right of each discussion thread (*Figure 8*) typically denotes a "bookmark." Users interpret interacting with this icon as a way to save a shortcut to the discussion thread. However, clicking the icon will instead subscribe you to the thread to receive email notifications when new replies have been posted.

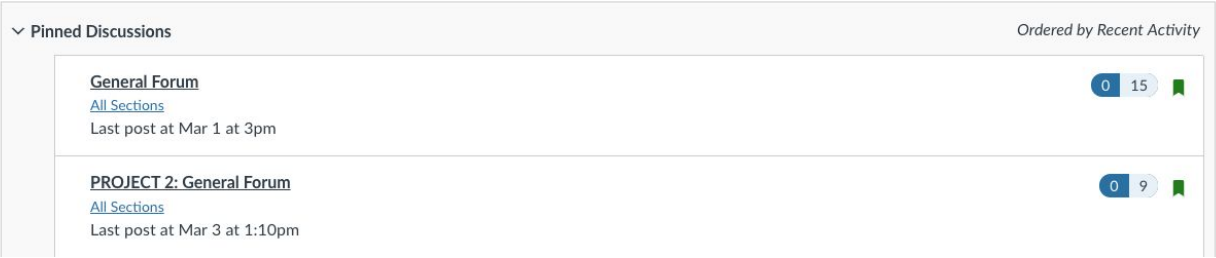

Figure 8. The "bookmark" icon is misleading to some users

Digital literacy and training

For younger students, sometimes referred to as digital natives, Canvas Discussions can be a familiar platform for participating in discussions. However, the concept of online discussion forums is relatively new when compared to more traditional classroom methods. Older students may struggle to understand how to use the tool appropriately. As some users on Capterra report, students that are not tech-oriented seem to struggle through the Canvas experience (Canvas [Web Reviews]). One might argue that this is not a fault of the Canvas product, and that universities should offer adequate onboarding training. But training does not always help with infrequent tasks, such as changing subscription preferences. Others argue that training does not eliminate the need for product usability, which is sometimes considered a "blame-the-user" attitude. This school of thought teaches that usable applications should require little to no training, which cause users to retain what they learn better (Ross, 2010). Overall, the design of Canvas Discussions succeeds in its primary function: to provide discussion features that encourage student engagement. The platform provides the essentials needed to fulfill this function, but room for improvement exists.

Section 5: Matrix of Evaluative Questions and Instruments of Data Collection

Pre-evaluation interviews

To guide the evaluation planning process and form evaluative questions, we conducted preliminary interviews with individuals representative of key stakeholder groups, specifically students and instructors. Participants were asked a series of both open-ended and reflective questions regarding their experience with online discussions in a digital learning environment. More specifically, they were asked about how they collaborated and communicated in current or past online courses and about the effectiveness of the course-provided communication tools.

Regarding student participation, the overall sentiment was that required discussions resulted in a minimum response length from students. Ironically, this lack of participation encouraged some students to respond with *more* feedback when given certain peer review assignments. Some products discussed, such as Peer Grade, create additional student incentive by using tactics like gamification. For example, participants said that when they provided discussions past the required length, the platform would reward them with encouraging messages and emojis. Some participants stated that this type of reinforcement further inspired them to write even more feedback.

Regarding student advancement of learning, some platforms discussed created educational opportunities outside of the course. For example, one course used Slack, a messaging platform, to create communities-of-practice. Current and previous students of the course could join a Slack "channel," similar to a discussion board, where they could share and discuss course content in either an academic or professional context. Participants reported that this type of interaction was

extremely helpful in allowing them to see how others applied knowledge from the course to real-world situations. Participants also reported they shared multimedia such as PDFs, hyperlinks, images, etc. over the Slack platform. They mentioned that some of the resources shared, such as blogs and podcasts, were very valuable in supporting their learning goals.

Matrix

Below is our evaluative question and instrument matrix that guided our evaluation of Canvas Discussions. Each question and instrument is explained in detail below the matrix.

Evaluative Questions	**Instruments**		
	Open question interview	Observational usability study	Closed question survey
1. Do Canvas Discussions help students improve?	✓		✓
2. Do Canvas Discussions create social connectedness?	✓		✓
3. Do Canvas Discussions encourage student participation?	✓		✓
4. Do Canvas Discussions provide tools to give students a positive outlook on course assignments?	✓		✓
5. Are Canvas Discussions easy and intuitive to use?	✓	✓	✓

During our planning stage, we used multiple resources to form the above evaluation questions. As graduate students at Iowa State University and participants on the Canvas platform, we were not only evaluators, but also product stakeholders; we have used multiple LMSs and understand the value that online discussions can bring to a learning environment. As mentioned above, we conducted a pre-interview session with several participants to investigate concerns and issues

when using similar online discussion platforms. These interviews proved to be valuable in identifying how certain stakeholder groups value different aspects of an LMS. We also obtained additional stakeholder and expert opinions by analyzing comments on reputable software review websites, such as Capterra.com. Although these reviews are anecdotal and may be influenced by individual priorities, they did expose some commonalities. For example, many instructors reviewing Canvas mentioned the discussion thread organization as a point of user frustration. Lastly, we considered various professional standards, such guidelines and rubrics from other universities, that serve as evaluative instruments for online discussion environments.

Evaluative Questions

Question 1: Do Canvas Discussions help students improve?

The goal of this question was to determine if Canvas Discussions are beneficial to student learning. Related questions:

- Do Canvas Discussions encourage communities-of-practice?
- Do Canvas Discussions help students understand course content?

Question 2: Do Canvas Discussions create social connectedness?

The purpose of this question was to understand how Canvas Discussions affect social aspects of learning. Related questions:

- Do students find Canvas Discussions engaging?
- Do Canvas Discussions help students connect and participate with each other?
- Do Canvas Discussions provide a positive social experience?

Question 3: Do Canvas Discussions encourage student participation?

This question analyzed Canvas Discussions through the lens of student participation. The intent was to understand if online discussions led to better student participation. One of the Canvas learning goals is to increase student participation by "getting students actively working on tasks, individually or with peers" (Instructure, 2017). By keeping students engaged in asynchronous discussions, they may have more time to participate in the course on a deeper level.

Related questions:

- How often do students revisit their posts to check for replies?
- How often do students create *more* discussion content than what is required?
- How often do students contact the instructor through a discussion board?

Question 4: Do Canvas Discussions provide tools to give students a positive outlook on course assignments?

A positive learning experience greatly increases the efficacy of learning (Kirkpatrick, 1998). Do Canvas Discussions have an overall positive effect on students' learning experiences? Related questions:

- Do students enjoy using Canvas Discussions?

Question 5: Are Canvas Discussions easy and intuitive to use?

This question focused on the user experience and how it affected student learning. Related questions:

- Do students understand how to create discussion posts?
- Do students understand how to edit existing discussion posts?
- Do students understand how to modify discussion post settings?

- Do students use rich media functionality in discussion posts without explicit direction?
- Is it clear how to incorporate rich media content into posts?
- Is it easy to navigate through a discussion?
- Do Canvas Discussions offer the tools needed to sufficiently present an idea? If not, which tools are missing?
- What feature of Canvas Discussions is used most often? Which features are rarely or never used?

Instruments

Instrument 1: Open question interview

Fitzpatrick, et al. (2011) speak to the value interviews can bring to an evaluation: "Only through hearing and interpreting the stories of others through interviews can the evaluator learn the multiple realities and perspectives that different groups and individuals bring to an object or experience." In particular, our interview was an "open question" interview; Newby (1992) describes the purpose of open question interviews in *Training Evaluation Handbook*: "The key feature of an open question is that there is no single answer to be expected from it, and answers will rarely be brief." This neatly described our goal in using this instrument as our method of evaluation: to collect opinions and reactions that we may not have considered ourselves.

More specifically, the purpose of this interview was to understand how participants felt about Canvas Discussions. This portion of the evaluation qualitatively answered many of the

evaluation questions in the matrix above and also uncovered new questions and insights. The open-ended questions included in this interview can be viewed in Appendix A.

Instrument 2: Observational usability test

Fitzpatrick, et al. (2011) describe our reasoning for including observations in our evaluation: "Observations are essential for almost all evaluations." This instrument served as the foundation of our evaluation; all of the data collected by other instruments was within the context of these observations. Observations allowed us to see how participants directly interacted with Canvas Discussions and helped inform our recommendations below.

In order to simulate a real-world discussion environment, we created a private Canvas course, called "Themes of Emerging Technology." The student view of the dashboard was populated with multiple course modules. Weekly modules reflected one example of a commonly-used online course structure with assignments, readings, and discussions (*Figure 9*). For the purposes of our evaluation, participants were only asked to interact with the discussion portion of the course.

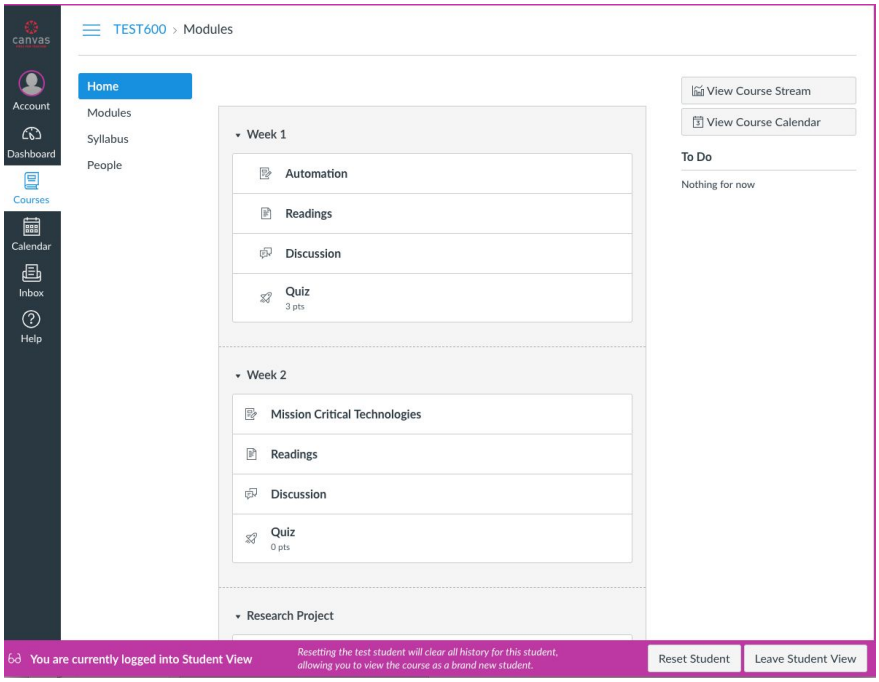

Figure 9. Student view of the Canvas dashboard

To summarize the assignment, participants were asked to navigate to the Week 1 discussion thread for further instructions. The discussion thread instructed them to watch a short video clip, answer a related question, and respond to one other participant's post.

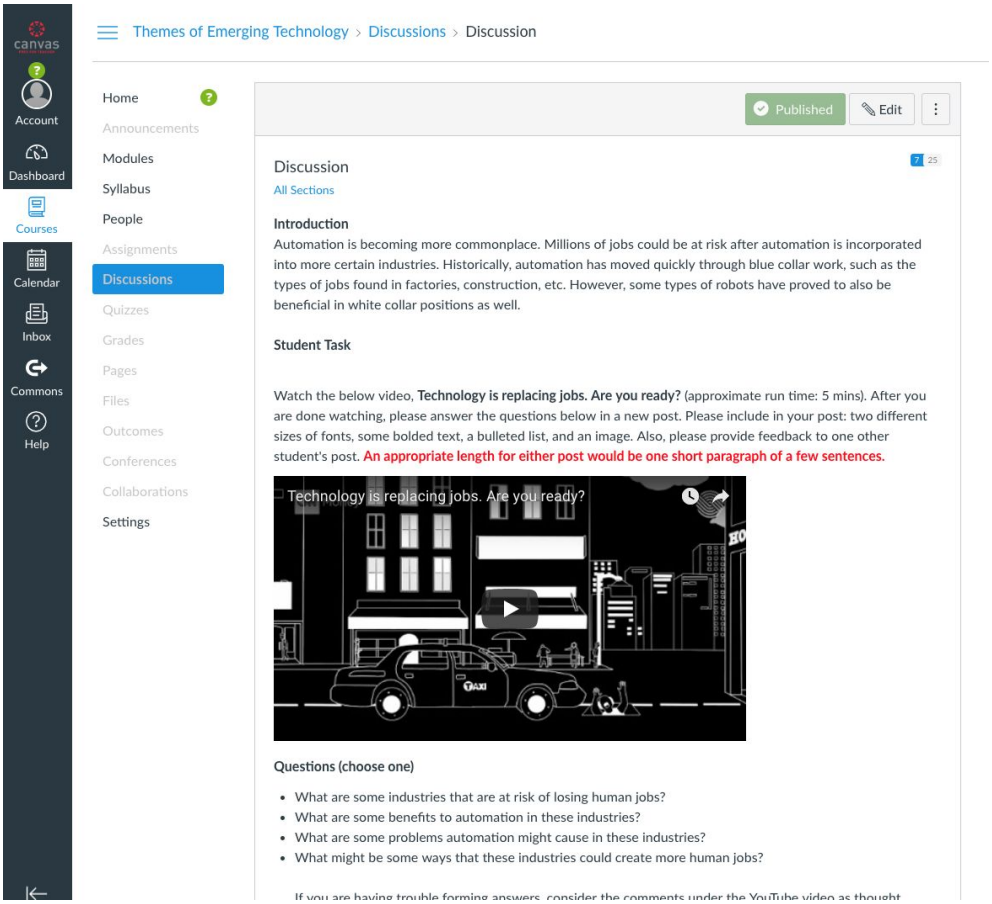

Figure 10. The Canvas discussion board intended for usability test

The video we selected was "Technology is replacing jobs. Are you ready?" by CNN Business. It was roughly six minutes long and discussed the rise of automation and its impact on industry in the United States. For the purposes of the pilot study, our team had already pre-populated some discussion posts into the thread.

Using the screen sharing feature of a video conference application, such as Skype or Zoom, an evaluator walked the participant through a number of common discussion tasks. The evaluator

recorded the test session and it was reviewed in detail after the session was complete. The details of each specific task is listed in Appendix B.

Instrument 3: Closed question survey

According to Westat, et al. (2010), surveys are a good way to gather descriptive data that can cover a wide range of topics. Additionally, because our participants were online, we were able to leverage free software to both administer survey questions and receive participant answers. In contrast to the "open question" interview that served as our first evaluative instrument, this survey was "closed question." The advantages of this format is that very specific and unambiguous data is obtained and that the analysis of data is easier (Newby, 1992). Our reason for selecting this evaluative instrument was to create contrast with the data from the first two instruments. While the interview and observation provided us with qualitative data, the survey provided us with hard data to be used in a quantitative analysis. Not only did this help to easily summarize participant data, but helped to create benchmarks to use in the future (Rubin and Chisnell, 2008). The survey consisted of a number of statements in which the participants were asked to rate their agreeableness on a scale of 1 (strongly disagree) to 5 (strongly agree). This survey was administered through a Google Form, which the participant completed after the evaluation concluded. The statements included in the survey are listed in Appendix C.

Section 6: Pilot test

Our pilot test was conducted with a participant representative of our target audience. This individual was previously an online graduate student at a large university. Having recently taken an online course, he also matched the skill set requirements of our target audience; he was familiar with the Canvas platform, had good digital literacy, online social skills, and a positive attitude towards learning. Instrument 1, the open question interview, was administered in person. Instrument 2, the observational usability test, was administered over a Skype video conference with the evaluator recording the participant's screen for further review. Instrument 3, the closed question survey, was sent to the participant in a follow up email proceeding the usability test.

By conducting the pilot test, we were able to identify areas of technical difficulty with our evaluation set up. For example, if participants had an existing Canvas account, the database will recognize their account. We had to provide the participant with additional instructions for this scenario. Also, because Skype required some additional set up and instruction for new users, we allowed evaluators to use Zoom, a similar video conferencing platform, as a faster option. Because we had not initially developed a thorough checklist, it was difficult to keep the evaluation moving smoothly, which caused the actual test time to be longer than expected. There were some organizational improvements that were made such as creating a repository for all evaluator resources like interview scripts, observational matrices, and participant status sheets. Our pilot test participant was also helpful in identifying problems with interview questions, specifically in some questions being redundant or too long. In conclusion, the pilot test exposed the importance of organization and planning before, during, and after the evaluation.

Section 7: Description of the Data Collection Process

The evaluation was administered as follows:

Dates: April 1 – April 21, 2019

Time allotted: 45 minutes per participant

Location: Remote

Evaluators: Nathan Friend, Drew Swanwick, Elizabeth Holloway

Participants: 3 expert Canvas users (Iowa State University graduate students), 4 novice Canvas users

Materials: Personal desktop or laptop computer with audio/video capability, Canvas test environment: https://canvas.instructure.com/courses/1564761, Zoom and/or Skype video conferencing platforms, Google Docs

Procedure: Welcome script and instructions (2-5 minutes), interview (10-15 minutes), usability test (15-20 minutes), survey (2-5 minutes).

Additional evaluator materials:

- Consent and Authorization Form: https://bit.ly/2GBNPof
- Evaluation Checklist: https://bit.ly/2L1Pjhi
- Evaluation Script: https://bit.ly/2Vst6g8
- Participant List: https://bit.ly/2DzkLNw
- Interview Questions: https://bit.ly/2ISSYLz
- Closed Question Survey: https://bit.ly/2GD5LyS
- Observational Matrix: https://bit.ly/2UVnv2G

Each evaluator was responsible for administering two or more evaluation sessions with selected test participants. The open question interview portion of the evaluation was administered over Zoom or Skype, which was recorded for later review. Any difference in video conferencing platforms did not impact the evaluation. The evaluator verbally asked the participant each question while recording their responses in a Google Sheet. After the interview was complete, the evaluator reviewed participant responses in order to form an overview of the participant's attitude towards Canvas Discussions. This portion of the evaluation took between 10–15 minutes.

Immediately after the interview, the evaluator conducted the observational usability study. The evaluator started by asking the participant to share their screen and then read each task to the participant as described in Appendix B, starting with logging in to the Canvas course. Login credentials were previously provided to the participant via email. While the participant worked through each task, the evaluator took notes using the observational matrix described in Chapter 10 of the *Handbook of Usability Testing* (Rubin & Chisnell, 2008) and as seen in *Figure 11*.

Task	Elapsed Time	Notes
Task 1: Logging in to Canvas	0:05	Logged in immediately via new user. No notable issues.
Task 2: Selecting a particular discussion	:04	Was able to locate and find discussion board with no issue.
Task 3: Composing a new response	6:31	Located proper "Reply" button with no hesitation. Was very quick and sure of using the WYSIWYG tools within her response window.
Task 4: Upload image	9:51	At 16:30 there was some hestitation in using the image embed functions. User navigated away from the window to google in order to find an image. User then saved the image to her desktop before returning to Canvas only to find a prompt for a URL. User did have another option to upload the photo already on her desktop, but did not use this.
Task 5: Create table	1:34	User had no problem with this task. Was able to quickly find the icon representing the table and insert the table with labels. No noteable issues.
Task 6: Responding to an existing post	:18	Will locating a post to respond to, user seemed to scroll up and down the page. This could be due to her not understanding where to create a response post. Once she located and took time to read a post, she seemed to have no problem "Liking" and creating a response to another student.
Task 7: Update notification setting	1:20	User navigated straight to the top of the page to the "More" icon, shown by three vertical dots, which actually leads you to an option to mark all posts either as read or unread.
Overall	20:20	User did satisfactory job locating text editing and other elements. Had some issues understanding the structure of the threading and locating the unsubscribe button.

Figure 11. Observational matrix for evaluator use during usability tests

This portion of the evaluation took between 15 – 20 minutes.

After the usability test was completed, the evaluator sent a link to the closed question survey to the participant's email and instructed them to complete it concluding the video conference. This survey took between 2–5 minutes. The survey, administered by Google Forms, automatically populated a Google Sheet with all survey responses. The total time of the evaluation was between 30–45 minutes. It should also be noted that all participants signed a consent and authorization form and were reminded of its contents at the start of the interview.

Section 8: Data Analysis Plan

According to Fitzpatrick, et al. (2011), the aim of data analysis is to reduce and synthesize information and allow for inferences about populations. The methods we used to gather data and make inferences used a mix of both qualitative and quantitative data. These evaluative

instruments were an open question interview, an observational usability test, and a closed question survey. To gather qualitative data, we used an open question interview followed by an observational usability test. The open question interview consisted of nine questions intended to provide a sense of participant digital proficiencies and affinities, familiarity with the Canvas platform, other experiences using online discussions, and attitude towards learning. For the observational usability test, data was recorded in an observational matrix (*Figure 11*). Observations regarding participant behavior, success and errors, time-on-task, general participant pace, and any other remarkable observations were captured in this matrix. An example of a remarkable observation would be a participant asking for task clarification. Once testing concluded, we reviewed the matrix for analysis. The resulting qualitative data was then analyzed to search for possible themes or patterns in the data. Once themes were exposed, our team then discussed potential solutions for areas of Canvas Discussions needing improvement.

In the last portion of the evaluation, participants conducted a closed question survey hosted on Google Forms. According to Rubin & Chisnell (2008), the primary purpose of a post-test questionnaire or survey is to gather preference information from participants in order to understand product strengths and weakness. This was accomplished in two ways. First, once the participants completed the survey, our team analyzed the results provided through Google Forms. Google Forms has an option to generate a spreadsheet (*Figure 12*) that includes the participant's name, timestamp of when the survey was completed, and the participant's responses.

Timestamp	What is your name?	[Online discussions are an effective learning tool for me]	[I enjoy online discussions]
4/9/2019 21:30:41	p1	Somewhat agree 4	Neither agree nor disagree 3
4/11/2019 11:55:16	p2	Somewhat disagree 2	Strongly disagree 2
4/12/2019 12:48:13	p3	Somewhat agree 4	Neither agree nor disagree 3
4/12/2019 13:56:52	p4	Strongly agree 5	Strongly agree 5
4/15/2019 12:29:56	p5	Strongly agree 5	Somewhat agree 4
4/16/2019 16:39:08	p6	Somewhat agree 4	Somewhat disagree 2
4/16/2019 16:49:53	p7	Strongly agree 5	Somewhat agree 4

Figure 12. Google Sheet containing data populated from Google Forms

Google Forms also generated a color-coded bar graph (*Figure 13*) of the results for easier visualization of the data.

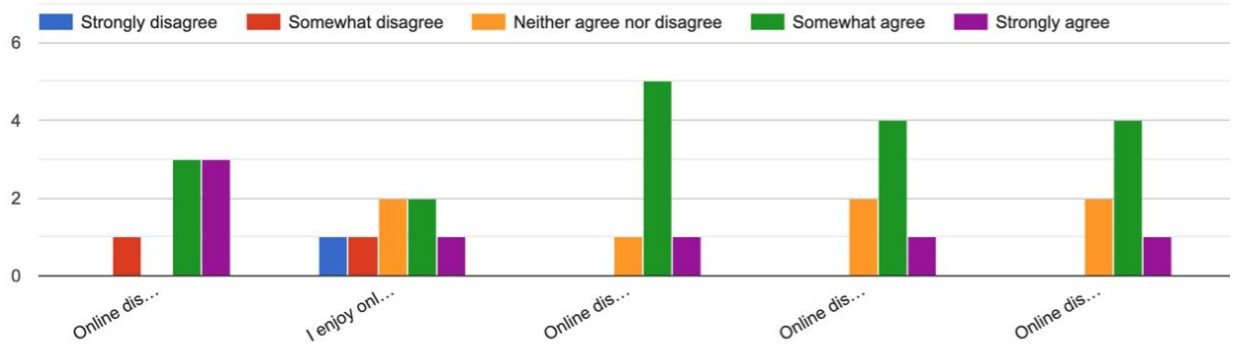

Figure 13. Bar graph generated by Google Forms

Second, the answers were measured using a five-point Likert scale and assigned the following values: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, 5 = strongly agree. By assigning quantitative values to each metric, we were able to obtain precise measurements and insight from each question. Taking the mean from each score allowed us to determine if the participants felt negatively (1 - 2.4), neutral (2.5 - 3.5), or

positively (3.6 - 5) about a particular feature of the product. For example, if a mean score fell around 4.5, this reflected a largely positive result, but still suggested that participants may have felt there was room for improvement. Using data from our other collection methods, we analyzed and determined what might prevent some scores from having the highest possible rating and where potential room for improvement lies.

Section 9: Results and Findings

In our general analyzation of the data, qualitative data gathered in Instrument 1, the open question interview and Instrument 2, the usability test, was further evaluated and organized into themes. Videos from the participant sessions were further reviewed to record any remarkable observations into our Observational Matrix. The quantitative data gathered in Instrument 2, the usability test, and Instrument 3, the closed question survey was calculated in terms of mean values. Mean times gathered during the usability test were calculated along with aggregated observations in our observational matrix in the example shown in *Figure 14*. Additional usability test results can be found in the accompanying *Observational_Matrix.xlsx* document.

Task	Elapsed Time	Notes
Task 1: Logging in to Canvas	:05 :20 :48 :05 :10 :02 :02 **M = 0:19**	Was able to instantly log in almost instantly. No issues when logging in. Was able to log in almost immediately. Login page was slow to load. Issues with UI on Canvas login screen. User was not sure if he needed to set a password or not. Note: for first time users, there maybe need to be a password confirm area as this is general UI practice. Logged in immediately via new user. No notable issues. No problems logging in to Canvas. Instantly logged in Logged in quick
Task 2: Selecting a particular discussion	:08 :10 :51 :04 :05 :03 :05 **M = 0:18**	Asked question about which post was the right discussion. Was able to select the appropriate discussion immediately. No issues here. In hindsight we maybe needed to include the date for the week instead of putting "Week 1", which is an arbitrary label. Was able to locate and find discussion board with no issue. Was able to select the correct discussion immediately. Instantly found and clicked. Quick to find

Figure 14. Example of mean completion times and observations from the Observational Matrix

Question	**Survey Response** *(Rounded to closest %)*
1) Online discussions are an effective learning tool for me	Somewhat disagree = 14%, Somewhat agree = 43%, Strongly agree = 43% Mean = 4.14
2) I enjoy online discussions	Strongly disagree = 14%, Somewhat disagree = 14%, Neutral = 29%, Somewhat agree = 29%, Strongly agree = 14% Mean = 3.28
3) Online discussions help me better understand course content	Neutral = 14%, Somewhat agree = 71%, Strongly agree = 14% Mean = 4
4) Online discussions help keep me engaged in the course	Neutral = 29%, Somewhat agree = 57%, Strongly agree = 14% Mean = 3.85
5) Online discussions help me connect with classmates	Neutral = 29%, Somewhat agree = 57%, Strongly agree = 14% Mean = 3.85
6) I find that I am more engaged in courses that include a mandatory discussion component	Somewhat disagree = 14%, Somewhat agree = 86% Mean = 3.71
7) I often participate in online discussions more than what is required by the instructor	Strongly disagree = 14%, Somewhat disagree = 14%, Neutral = 29%, Somewhat agree = 43% Mean = 3
8) The discussion feature of Canvas does a good job of facilitating online discussions	Somewhat disagree = 14%, Neutral = 29%, Somewhat agree = 29%, Strongly agree = 14% Mean = 3.71
9) I find Canvas Discussions easy to use	Somewhat agree = 71%, Strongly agree = 29% Mean = 4.28
10) When posting content in a Canvas discussion board, I often use rich text features, such as bold, italic, alignment, or bulleted lists	Somewhat disagree = 14%, Neutral = 14%, Somewhat agree = 43%, Strongly agree = 29% Mean = 3.85
11) When posting content in a Canvas discussion board, I often embed rich media content such as photos or videos	Somewhat disagree = 14%, Neutral = 29%, Somewhat agree = 29%, Strongly agree = 14% Mean = 2.71
12) The text editing features provided by Canvas help me express my ideas	Somewhat disagree = 14%, Neutral = 14%, Somewhat agree = 43%, Strongly agree = 14% Mean = 3.42
13) The text editing features provided by Canvas are easy to use	Somewhat agree = 57%, Strongly agree = 43% Mean = 4.42

Figure 15. Likert scale results of Canvas ease of use for novices as compared to experts

Answers to the closed question survey were also organized. Each Likert scale answer value (for example, “2 = somewhat disagree”) were totaled in terms of percentages. Mean values were

calculated to represent the overall question responses (*Figure 15*). In the sections below, we report our findings from this data.

Ease of use

In our post-usability test survey, when asked if Canvas was easy to use, both the majority of novice and expert users selected "Somewhat Agree" (*Figure 16*).

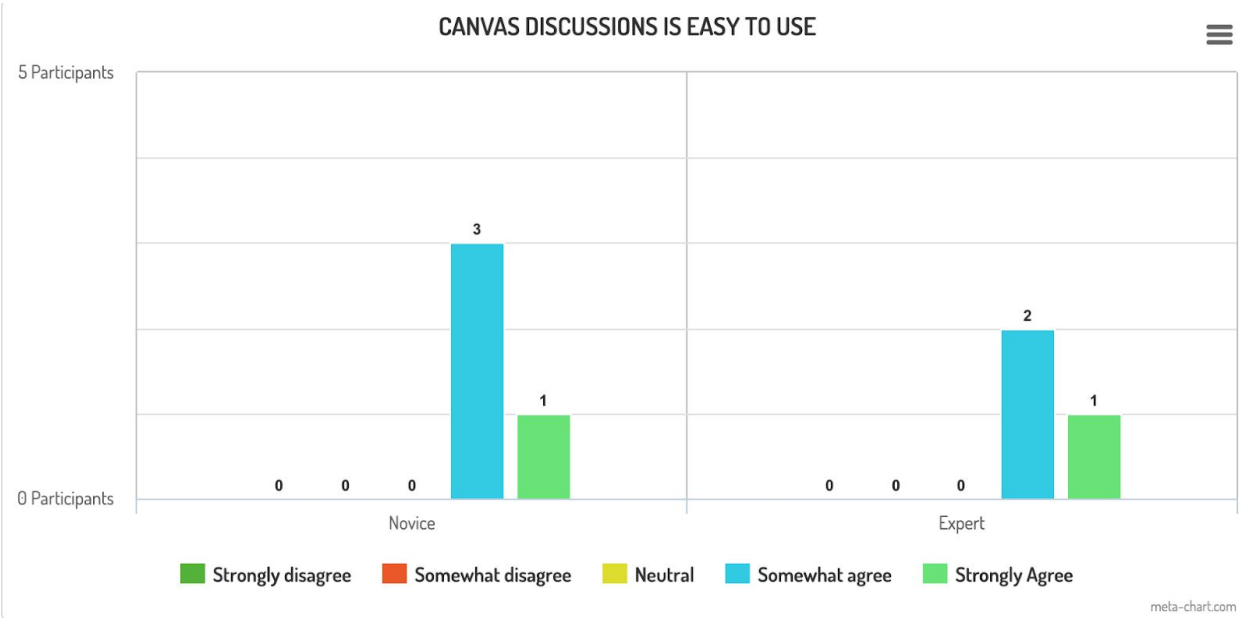

Figure 16. Likert scale results of Canvas Discussions ease of use for novices as compared to experts

Novice users had difficulty understanding the layout of discussion threading.

Novice users of Canvas found it difficult to navigate the threading model. Most expert users found creating a new post fairly intuitive. They clicked on the correct "Reply" button with little or no hesitation. However, replying to an existing post was more challenging for novice users. They were less confident in how to begin a reply and were unsure if their reply was properly

nested. One participant vocalized their confusion with the threading system and asked for clarification from the evaluator.

Confusion about the threading mechanics of Canvas is understandable as discussion threading is far from standardized in other similar software applications. Some popular messaging applications, like iMessage and Android Messages, present the discussion as a single thread of messages ordered chronologically. Other applications, like Facebook Messenger and Slack, allow a single level of nesting. Still others, like Reddit and most online forum software, allow infinitely-nested comments, much like Canvas. With so many different methods of discussion facilitation, it is hardly a surprise that some users found learning another threading model challenging.

Participants had some difficulty finding the notifications settings page.

In general, participants were unsure about how to access the notification settings and followed a number of false leads before discovering the correct location. The ways participants searched for these settings varied. Some participants attempted to unsubscribe from the discussion thread by opening up the “More Options” menu on the initial discussion post. Others searched for an “Account” page. Still others tried the accessing the “Dashboard” link. Most were able to find the page after a reasonably small number of explorations.

We did not observe a large performance difference between novice and expert users during this task. This could be because updating notification settings in Canvas is not a common task.

Users were slowed by the lack of icon labeling on the notifications settings page.

Users struggled to understand the icons on the notifications settings page.

Figure 17. An example of the notifications settings interface

Most participants mentioned that they did not immediately understand what each icon represented, and attempted to search for a legend for clarification. For example, one participant expressed, "I can't tell what the icons mean." Some participants scrolled to the top of the page, thinking an explanation would be listed in the label above each column. However, as shown in *Figure 18*, column labels only differentiate between email and mobile notifications.

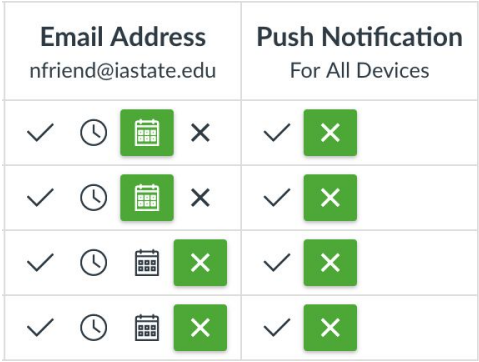

Figure 18. The headers located above the icon columns

Most participants were able to locate the icon legend, which is formatted horizontally directly under the page title as shown in *Figure 19*.

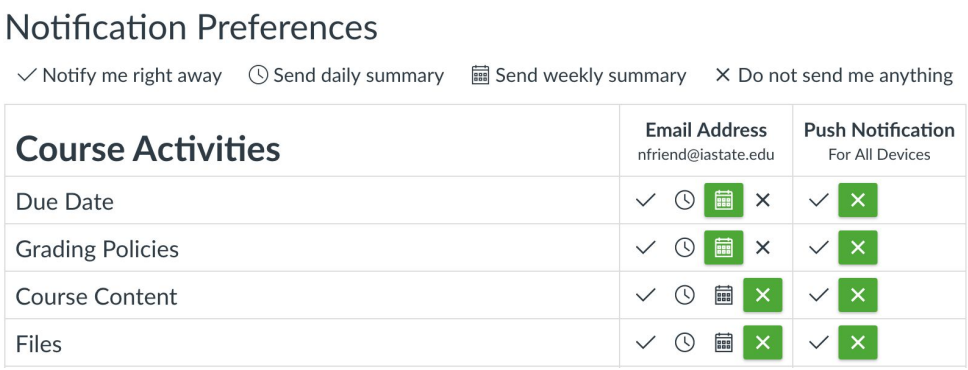

Figure 19. A view of the icon legend that is displayed under the page title

Most participants proceeded to scroll up and down between the discussion settings section and the icon legend in order to disable notifications. Overall, both novice and expert participants struggled with this interface and spent a large amount of time and effort to understand the iconography.

Users were confused by the image upload process.

The most concerning usability issue we found was the image upload process. Only a minority of our participants were able to complete the image uploading task successfully; those that did complete this task successfully did so with some difficulty. When asked to embed an image, participants were quickly able to identify the “Embed Image” button in the text editor toolbar. However, almost all participants hesitated or expressed confusion at the resulting “Insert / Edit Image” dialog:

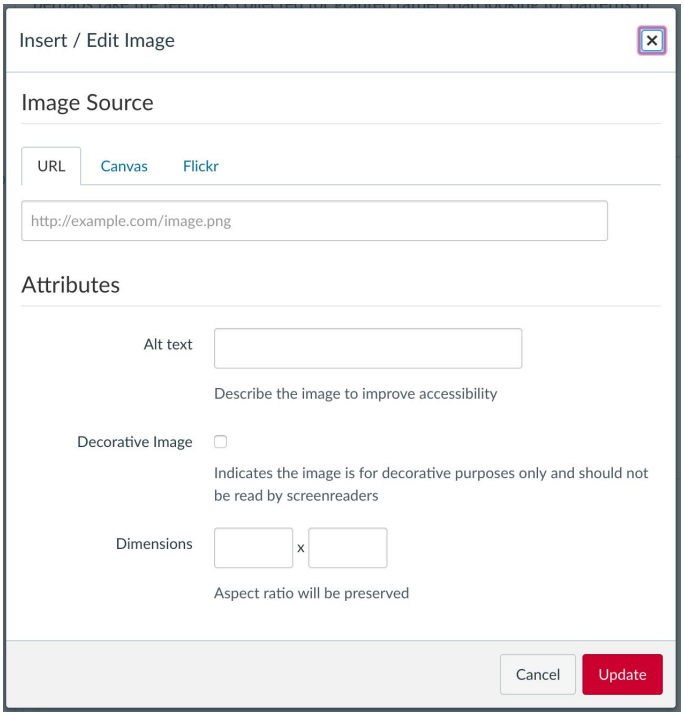

Figure 20. The "Insert / Edit Image" dialog

Users typically explored each of the nested tabs several times before expressing frustration and confusion at their inability to complete the task.

Most participants tried some or all of the following methods:

- Closing the dialog and searching for a different button in the editor toolbar
    - Some participants tried the "Insert/Edit Media" button
- Dragging and dropping an image file into the text editor
- Copying and pasting an image into the text editor

Unfortunately, all of these attempts were unsuccessful.

A subset of participants were successful in this task. One way is to select the “Canvas” tab and upload an image to the “My files” folder:

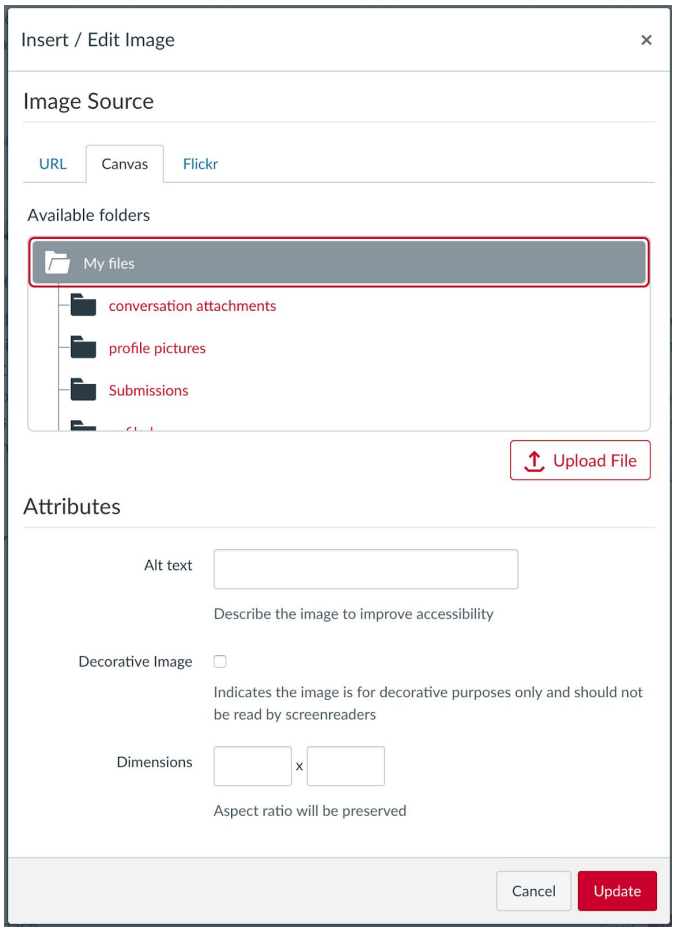

Figure 21. The correct way to embed an image in a discussion post

The remaining participants completed this task in a number of alternative ways:

- Finding an existing image (e.g., searching Google Images) and using the “URL” tab
- Finding an existing image through the Flickr integration

Unfortunately, some participants were not able to complete this task as they had explored all options with no success.

Here are a few quotes that summarize participant experiences:

> "It does not give me the choice to easily pick an image from my laptop."
>
> "Maybe there's a different image embed option that I need to pick."
>
> "It is slightly tricky to find how to do this."
>
> "I want to be able to get an image from my computer, but I'm having difficulty doing that."
>
> "That was more convoluted than it needed to be!"

In general, both novice and expert participants found the image upload process to be much more difficult than other websites. This issue also surfaced in our survey, where most participants disagreed with the statement "When posting content in a Canvas discussion board, I often embed rich media content such as photos or videos." We hypothesize that the difficulty of embedding images may play a role in the underutilization of this feature.

Expert users were able to perform some tasks much more quickly than novice users.

Unsurprisingly, we found that prior experience with Canvas greatly increased the speed at which participants completed their tasks. The average expert user was able complete all tasks in slightly under ten minutes. On the other hand, novice users spent an average of sixteen minutes completing tasks. However, this difference was not as pronounced for tasks that included less

frequently used features of Canvas, such as the notifications page. For example, we observed little difference in the time it took expert and novice users to update their notification settings.

Online discussions were seen as a positive engagement method, even when participation was mandatory.

Six out of seven participants responded that they strongly or somewhat agreed with the statement "Online discussions are an effective learning tool for me." Our open question interviews confirmed this result; participants generally reported that online discussions contributed positively to their learning experience. In addition, when expert users were asked about their opinion of Canvas Discussions, few had strong opinions - the tool simply worked as expected. This is an indicator that Canvas Discussions do a good job of accomplishing their primary task: facilitating online discussions.

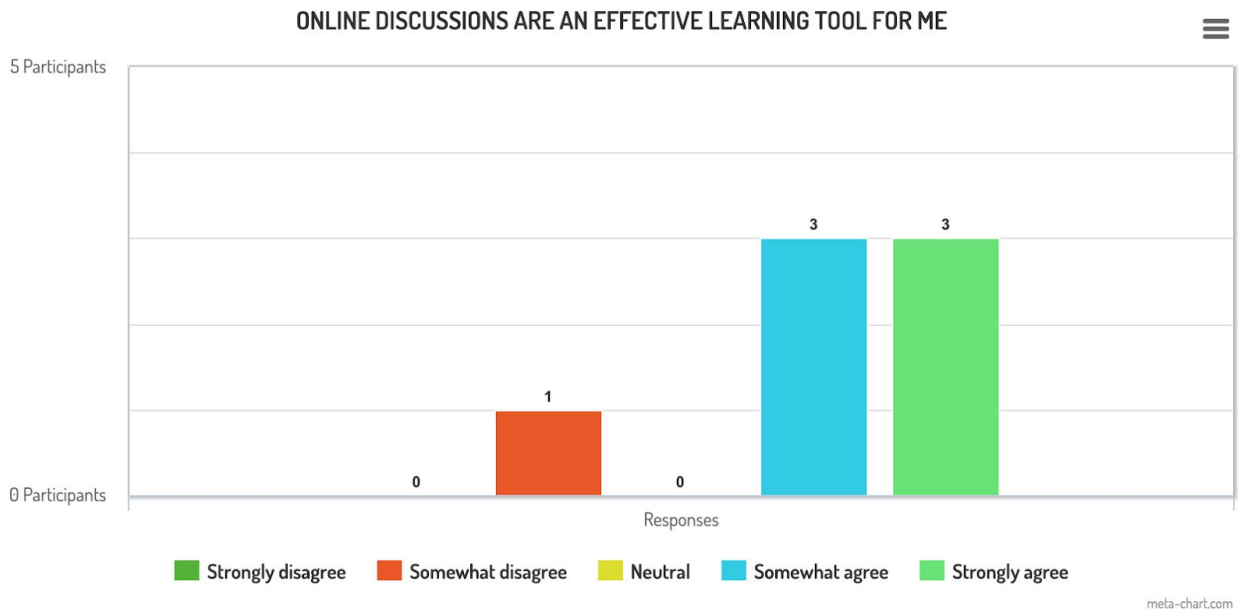

Figure 22. Likert scale results of participant responses to "Online discussions are an effective tool for me"

Section 10: Recommendations

Based on our evaluation of the Canvas discussion component, we are able to make several suggestions.

Refactor the discussion board user interface

As stated previously, many participants had trouble understanding the format of the discussion board. This was also an area of concern we had identified in our initial product critique. To summarize, some participants audibly expressed confusion with the lack of organization of the discussion thread. It was unclear if they were creating their initial response to the instructor's task or responding to another student. We suggest refactoring the user interface so that a visual hierarchy is used. The user interface should use universal design principles found in other similar products that afford conversation such as message boards, email or mobile phone messaging. For example, responses to one student's initial post could switch from left to right text alignment, or they could simply indent under the parent post. Replies could also be expandable and collapsible as to not only create visual organization but to also save time on scrolling through long discussion threads. Additional user interface aids can add to organization, such as sorts, filters, shortcuts to navigate to the newest or oldest posts. The open source discussion board platform, Flarum, is a good example of a design that organizes potentially long and complex conversations well (*Figure 23*).

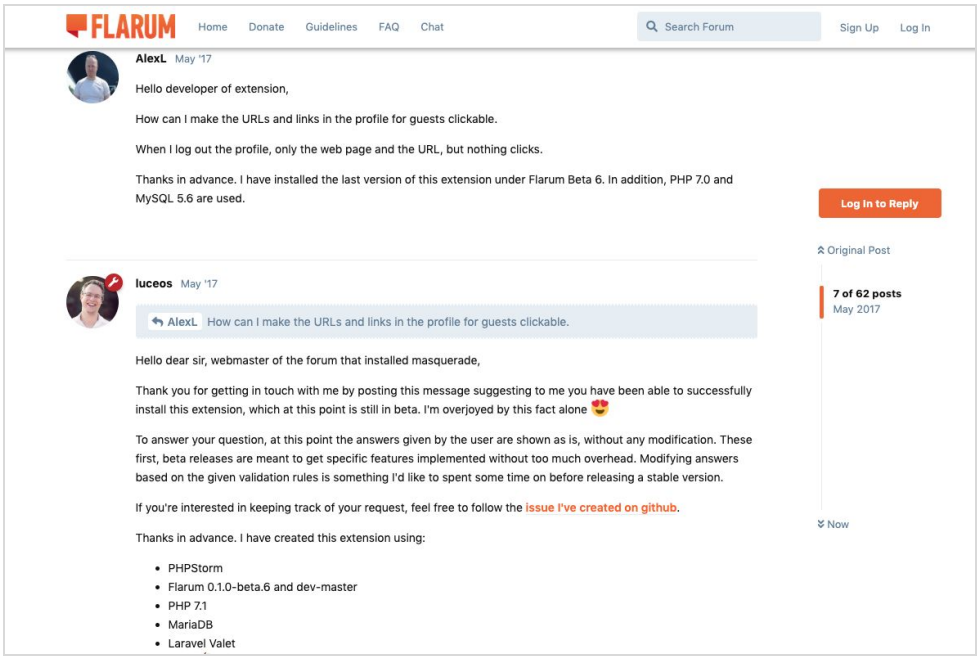

Figure 23. User interface elements on a discussion board, from Flarum

Improve discussion notification settings paths and thread subscriptions

Another area for improvement in the Canvas Discussions user interface is the “Subscription” button. Although most students agreed that Canvas was overall easy to use, some had trouble finding this feature, and one participant did not find it at all. Subscribing or unsubscribing to a thread directly impacts a student’s retention with course discussions. As such, it needs to be highly visible. Currently, the subscription button appears in the bottom right hand corner of the original post, which can get visually lost if the post is long. We would again suggest following emerging universal design principles and anchor this option to the upper right hand corner of the page. It may also be denoted by a gear icon, which is commonly interpreted as “settings”, to control user interactions within the context of the page or user tasks.

At the account level, participants also had difficulty locating both the “Notification Preferences” page and its accompanying legend. We recommend including an easier path to this, possibly also under the same settings placement suggested above. One icon could control both the subscription settings for that particular thread and give the user the option to navigate to the “Notification Preferences” page.

Improve image upload experience

Participants also had issues with the image embed options offered by Canvas. Although Canvas offers Flickr-hosted image search capability with automatic image embed, many participants had an image from a separate location, either the web or their own desktop, that they wanted to use. The option to use a custom image is not immediately exposed and requires multiple steps, as mentioned above. We recommend improving the user experience of uploading an external image by making this option more obvious.

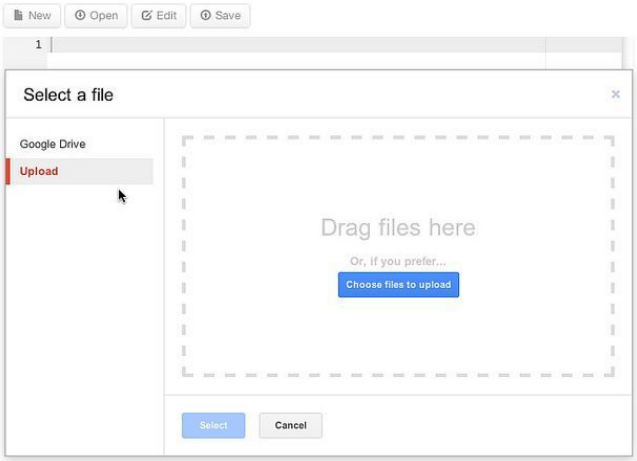

Figure 24. Google Drive’s upload image option

Many websites feature a prominent "Upload Image" button (*Figure 24*), have an easy drag-and-drop feature, or the ability to copy and paste an image location. Or, working within Canvas's current interface, instead of defaulting to the "URL" tab, we recommend defaulting to the "Canvas" tab, but renaming it "Upload Image," as this is the true purpose of this tab. The tab label "Image Source" is confusing to some users.

User assistance

In assisting novice users, and even expert users, we recommend Instructure implement thoughtfully placed descriptive tool tips to assist in basic tasks. Another option is to offer emails to help guide the user in less frequently performed tasks, such as notification updates. It is worth noting that Iowa State University did send email notifications to enrolled students about the integration of Canvas as a new learning management system. They offered some initial resources and self-guided training as part of their onboarding plan. We encourage more frequent emails with training opportunities for students throughout the semester as reminders that there are resources for user assistance. Although we did not evaluate the pedagogical use of Canvas, we also see a need for the instructor to provide guidance in some of these troublesome features as they relate to the course structure.

Section 11: Conclusion

Overall, we agree with our initial critique of the product: Canvas Discussions foster peer learning and collaboration in order to achieve the goal of increasing student participation and engagement. However, a number of the insights we gained through our evaluation differed from our original assessment. Below are a few of these differences.

Post options

Our original critique hypothesized that learners would feel limited by the communication tools offered by Canvas Discussions and that greater engagement could be achieved by augmenting its text editing capabilities. However, our interviews with novice and expert users revealed that most users were satisfied with the text editing tools provided by Canvas. They felt they could adequately express themselves using the existing text editing features.

Graded discussions

Our initial critique of Canvas Discussions was critical of online discussions as a concept, stating that online discussions can be counterproductive to participation. However, our survey data found that learners do often participate in online discussions more than what is required. They also generally feel that online discussion help them process and engage with course content.

Ease of use

Our preliminary evaluation of Canvas Discussions exposed a number of potential problems with the Canvas Discussions user experience (UX) and user interface (UI). One of these potential problems was in the UX of responding to another student's post. Our initial critique was correct in identifying this feature as a potential source of confusion; however, our usability test revealed this to be less of a concern to users than anticipated. As noted in our "Results and Findings" section, our initial evaluation was accurate for novice users of Canvas; they seemed to lack awareness of the response location of their posts. We anticipated this be the same for expert users, but it was not the case. They had a much quicker mean time in finishing the post response tasks, even with long threading. This is likely due to their familiarity of working within the

constraints of this design flaw.

Another potential issue we noted in our original critique was the semiotics of the user interface elements. This issue was validated in our usability test. The difference was that participants seemed to struggle more with the icons on the "Notifications Settings" page than our original focus of concern, which was the icons on the discussion thread page. This could be because there were significantly more icons to interpret on the "Notifications Settings" page.

Finally, participants struggled much more with the image upload process than originally anticipated. We expected that manipulating notification settings would be the most difficult task of our usability session. This was not the case as *all* participants encountered issues with uploading an image.

Overall, our evaluation of Canvas Discussions, and particularly the usability test, were invaluable in informing our recommendations and improvements for Canvas Discussions. Our initial critique made of number of accurate recommendations, but our hands-on evaluation of the product provided us with evidence and data to validate these claims as well as uncovered other unexpected conclusions.

Section 12: Considerations for Future Evaluations

Our evaluation was limited in its scope due to time constraints of our participants; each test session only lasted between 30-45 minutes. In order to create a more real-world course experience, an evaluation would need to be conducted over a longer period, perhaps a few weeks. This would allow students to interact with additional features that are used in more mature discussions such as email notifications, long threading, and usable peer and instructor

feedback. We suggest that shorter evaluations of Canvas Discussions be reserved for novice users.

As mentioned in our initial product critique, some of the value created by Canvas Discussions is interconnected with pedagogical use. Because Canvas and its discussion component are highly customizable, an instructor may be able to improve the user experience through their course design. Additionally, novice user experience could be further improved through instructor or teaching assistant demonstration and assistance. Universities should encourage Canvas Discussions training before classes commence or instructors should incorporate training exercises as part of course assignments to get students more familiar with the features. Less frequently used Canvas Discussions features, such as subscription settings, might warrant explicit instruction if required discussions are a large part of the course work.

Section 13: Team Member Responsibilities

All team members took turns leading a deliverable. Team leads were responsible for setting agendas, delineated workloads, identifying questions, and keeping the team on task to meet deadlines. Elizabeth Holloway was the team lead for the Context Report. Nathan Friend was the team lead for the Learners' Try-Out Plan. Drew Swanwick was the team lead for the Learners' Try-Out Implementation. To test the evaluation process, all team members were responsible for running the evaluation on at least two participants. Team members largely stuck to their area of expertise as assigned in the Try-Out Implementation and this Final Report. Drew Swanwick was responsible for aggregating and visualizing data. Nathan Friend was responsible for interpreting this data into results and findings. Elizabeth Holloway was responsible for generating recommendations from the results and findings.

Appendix A

Instrument 1: Open question interview

1. What is your level of experience with the Canvas discussion component? (For example: how long have you used it? For how many courses?)
2. What tasks have you used Canvas Discussions for?
3. In the past or in your current courses, have your discussions on Canvas been required by your instructor?
4. Do you find Canvas Discussions easy to use? If not, what would make it easier?
5. What features do you like best about Canvas Discussions? What do you dislike?
6. Do you feel that Canvas Discussions gives you sufficient tools with which to communicate your ideas? Are there any tools you would like to see added?
7. Has Canvas Discussions been helpful to your learning experience? Why or why not?
8. Have you received peer or instructor feedback on Canvas Discussions? If so, what type, and has it helped you with your course work?
9. Does Canvas Discussions make you feel connected to students and faculty? If so, how? If not, what would help?

Appendix B

Instrument 2: Tasks included in the observational usability test

Task 1: Logging in to Canvas

Participants were provided with a private course link sent to the email address they provided. The participant navigated to the course dashboard view as seen in *Figure 9*. The participant completed this task successfully if they were able to log in to Canvas with little or minimal guidance.

Task 2: Viewing the list of all available discussions and selecting a particular discussion

The evaluator instructed the participant to locate and open the discussion thread for Week 1. The participant completed this task successfully if they arrived at the correct discussion page.

Task 3: Composing a new response to a discussion post

The evaluator instructed the participant to create a short reaction post to the video clip that included, at minimum, the following:

1. Two different sizes of fonts
2. Bolded text
3. A bulleted list

Some of the existing posts purposely excluded these rich text requirements. If the test participant had trouble coming up with content, the evaluator provided ideas by asking thought provoking and guiding questions. The goal of this task was not to create academically valuable content, but

rather to test the functionality of the Canvas text editing features. The participant completed this task successfully if they were able to create a post that contained all of the rich text requirements.

Task 4: Upload an Image

The evaluator instructed the participant to upload one image to the discussion board. For the purposes of this evaluation, any picture was considered acceptable, as long as it was appropriate (i.e. no graphic imagery). The participant completed this task successfully if they were able to upload an image through means available on the discussion board (Canvas upload, URL link, Flickr). Inability to upload an image to the discussion board was considered a task failure.

Task 5: Create a table

The evaluator instructed the participant to create a table anywhere on the discussion board using the built-in table creator tool included in the Canvas discussion toolbar. The criteria of this task was that the participant create the table with four rows and four column and include arbitrary column headings. This task was considered to have been completed successfully if the participant created a 4x4 table with column headings. Inability to create the table or add proper titles was considered a failure. Both criteria were required for the task to be considered successful.

Task 6: Responding to an existing post

The evaluator instructed the participant to create a short response to an existing post. For this evaluation, our team pre-populated the discussion thread with original posts and responses that were of appropriate content and length. The participant completed this task successfully if they

were able to craft and submit a response to the existing post. It should be noted that responding to the *original* thread, or an incorrect post, was considered a failure.

Task 7: Updating the user's personal discussion notification settings

For the final task, the evaluator asked the participant to unsubscribe from email notifications from Canvas Discussions. The participant completed this task successfully if they correctly unsubscribed from discussion post emails. Unsubscribing from notifications other than discussion posts was considered a failure.

Appendix C

Instrument 3: Closed question survey

The live version of the Google Form used to administer this survey can be viewed here: https://goo.gl/forms/Ecohot9powuU4dMi2

Rate how much you agree with each statement on a scale of 1 (strongly disagree) to 5 (strongly agree):

1. Online discussions are an effective learning tool for me
2. I enjoy online discussions
3. Online discussions help me better understand course content
4. Online discussions help keep me engaged in the course
5. Online discussions help me connect with classmates
6. I find that I am more engaged in courses that include a mandatory discussion component
7. I often participate in online discussions more than what is required by the instructor
8. The discussion feature of Canvas does a good job of facilitating online discussions
9. I find Canvas Discussions easy to use
10. When posting content in a Canvas discussion board, I often use rich text features, such as bold, italic, alignment, or bulleted lists
11. When posting content in a Canvas discussion board, I often embed rich media content such as photos or videos
12. The text editing features provided by Canvas help me express my ideas
13. The text editing features provided by Canvas are easy to use

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