

JULY 2021

Report

University of Wisconsin System Digital Learning Environment Study

BY

Tanya Joosten, Ph.D., DETA

TO

Renee Pfeifer-Luckett
Director, Learning Technology Development
University of Wisconsin System Administration

ORGANIZATIONS

UNIVERSITY OF WISCONSIN SYSTEM



The University of Wisconsin System is one of the largest systems of public higher education in the country, educating approximately 165,000 students each year and employing 40,000 faculty and staff statewide. With 13 universities across 26 campuses and a statewide extension network, the UW System is a tremendous academic, cultural, and economic resource for Wisconsin, the nation, and the world.

The Office of Learning & Information Technology Services (OLITS) is dedicated to supporting the use of technology to enhance the teaching and learning mission of the UW System institutions. OLITS staff have responsibility for systemwide collaboration and enhancement of six major areas of Information Technology including technology for teaching and learning.

The University of Wisconsin System Digital Learning Environment (DLE) is a unique online ecosystem used by our students, instructors, and administrators to support teaching and learning. Currently, the DLE includes three, cloud-based software tools: Instructure's Canvas learning management system, Kaltura media management system, and Blackboard Collaborate Ultra web conferencing system. The DLE enables teaching and learning in all course formats (e.g., face-to-face, blended/hybrid/hyflex, and fully online) and includes more than 100 other integrated learning technology tools to meet the diverse needs of the students and instructors.

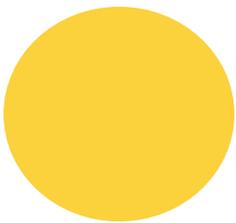
DETA RESEARCH



DETA (DETAResearch.org) was established as the National Research Center for Distance Education and Technological Advancements in 2014 with funding from the U.S. Department of Education, Fund for the Improvement of Postsecondary Education, at the University of Wisconsin - Milwaukee. DETA conducts and supports rigorous research from the course level to cross-

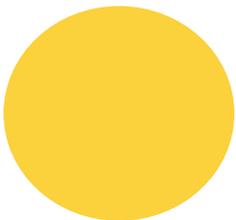
institutional studies for all educational institutional types (K-20) with a particular focus on traditionally underrepresented students. This enables DETA to help partners strategically ensure quality experiences and improve student access and success through thoughtful implementation, evaluation, and scaling of proven instructional and institutional practices and technologies.

The work was undertaken on behalf of the University of Wisconsin System Administration.



UWSA CONTACT

Renee Pfeifer-Luckett, Director
Learning Technology Development
University of Wisconsin System Administration
rpfeifer-luckett@uwsa.edu
Wisconsin.edu/DLE



DETA CONTACT

Tanya Joosten, Ph.D., Principal Investigator
DETA Research + University of Wisconsin - Milwaukee
tjoosten@uwm.edu

DETAResearch.org
detaresearch@gmail.com

EXECUTIVE SUMMARY

KEY FINDINGS

In answering the research questions, there were four primary findings: 1.) Students are generally satisfied with their experience with the DLE; 2.) Students use the DLE often for their learning tasks and feel that the majority of tasks are easy for them to perform; 3.) Students find navigation generally easy to do, but there are some challenges; and 4.) Students reported challenges with some areas, although not necessarily with high demand functions.



Students are generally satisfied with their experience.



Students use an array of functions often for their learning tasks and feel that the majority of tasks are easy for them to perform.



Students find navigation generally easy to do, but there are some challenges.



Students reported challenges with some areas, although not necessarily with high demand functions.

In the next section, we will summarize those primary findings by describing students' attitudes and behaviors from their user experience in the DLE as captured in the data collection. Overall, students generally have a positive experience within the DLE.

UWSA DLE UX STUDY | KEY FINDINGS

1. Students are generally satisfied with their experience with the DLE.

Students report that the DLE is easy to access and to use, and they perceive that Canvas is a useful system. They feel that they will continue to use it as it is available in the future and believe instructors should use it in the future. Most students are confident in their use and satisfied using Canvas. Moreover, students believe Canvas is helpful in organizing their learning.

2. Students use the DLE often for their learning tasks and feel that the majority of tasks are easy for them to perform.

The student experience in using the DLE consists of learning activities such as finding course information, staying on task, managing their time, submitting and taking assessments, tracking performance and getting feedback on assessments, and interacting in threaded discussions. Most students find the DLE beneficial and easy to use. However, students report that the way in which the instructor utilizes it can determine not only the success of their use, but also the ease in which students can experience the course site. For example, although it is reported that the general functionality to find information is easy, students reported some difficulty with finding course materials and assignments which appears to do with how the course is organized and less with the functionality of the DLE. Same sentiment in staying on task and managing their time through the calendar, to-do list, and dashboard. While students' ability to take and submit assessments is done often and without difficulty, they also enjoy the confetti functionality when they turn in their work. With noted benefits of the grades and feedback tools, the students recommend a few items be improved in functionality. Discussions were on the lower end of functions frequently used yet were still above average and easy to use.

3. Students find navigation generally easy to do, but there are some challenges.

Students navigate the DLE by:

viewing their dashboard, returning to the course home page, accessing and navigating modules, navigating course websites, finding the page with the information they need, navigating the template used for their course, finding their way back to another page, clicking back out of a page, finding their list of their course sites, working with the system interface for their course, and turning the page or moving between pages.

While half of these tasks were easy to perform, half were below average in ease of use. Students had less ease in turning or moving between pages, clicking back out of a page, working with the system interface, finding one's way back to a page, and navigating the template. Some of these challenges were attributed to the course organization of the faculty or instructor. Students also reported the most difficult areas were following breadcrumbs or navigation shortcuts, finding the page with the information they needed, and clicking through to deeper pages and topics. Students discussed getting trapped in deeper pages.

4. Students reported challenges with some areas, although not necessarily with high demand functions.

Students reported challenges in their experience with groups, accessibility and usability, integration of third-party tools (e.g., BB Collaborate), media and file management, mobile application, and notifications. While there were some benefits, students noted the challenges they experienced in these areas. Students felt that groups were the most difficult, however they still expressed an interest in working in groups. They expressed difficulty viewing closed captioning and with the usability of the color and text within the websites. Students also noted challenges within the integrations of some of the web meeting tools. Media and file management was an issue and was exacerbated by mobile devices. Finally, notifications, while appreciated, also came along with challenges.

University of Wisconsin System Digital Learning Environment



Students are generally satisfied with their experience.



Students use an array of functions often for their learning tasks and feel that the majority of tasks are easy for them to perform.



Students find navigation generally easy to do, but there are some challenges.



Students reported challenges with some areas, although not necessarily with high demand functions.

CONTENTS

- ORGANIZATIONS..... 2
 - UNIVERSITY OF WISCONSIN SYSTEM..... 2
 - DETA RESEARCH..... 2
- EXECUTIVE SUMMARY..... 4
 - KEY FINDINGS..... 4
- INTRODUCTION..... 9
 - PURPOSE..... 9
- FINDINGS I..... 10
 - ARE STUDENTS SATISFIED WITH THE DLE? 10
 - Ease of use11**
 - Perceived usefulness13**
 - Behavioral intent.....13**
 - Self-efficacy.....14**
 - Satisfaction15**
 - Learning organization15**
- FINDINGS II..... 18
 - HOW DO STUDENTS USE THE DLE?..... 18
 - Finding course information19**
 - Staying on task and time management.....21**
 - Submitting or taking assessments23**
 - Tracking performance and getting feedback on assessments24**
 - Interacting in threaded discussions27**
- FINDINGS III..... 28
 - HOW DO STUDENTS NAVIGATE THE DLE?..... 28
 - Difficulties in navigation30**
- FINDINGS IV..... 32
 - WHAT OTHER CHALLENGES ARE STUDENTS EXPERIENCING?..... 32
 - Groups33**
 - Discussions.....33**
 - Accessibility and usability34**

Integration	34
Media and file management	34
Mobile	35
Notifications.....	35
Instructor use	36
RECOMMENDATIONS.....	38
METHODOLOGY.....	40
INSTRUMENTATION	40
PARTICIPANTS.....	40
Representation by institution.....	41
Student demographic data.....	41
Student technology access to and use of technology.....	43
Student enrollment behavior and preferences.....	44
REFERENCES.....	45

INTRODUCTION

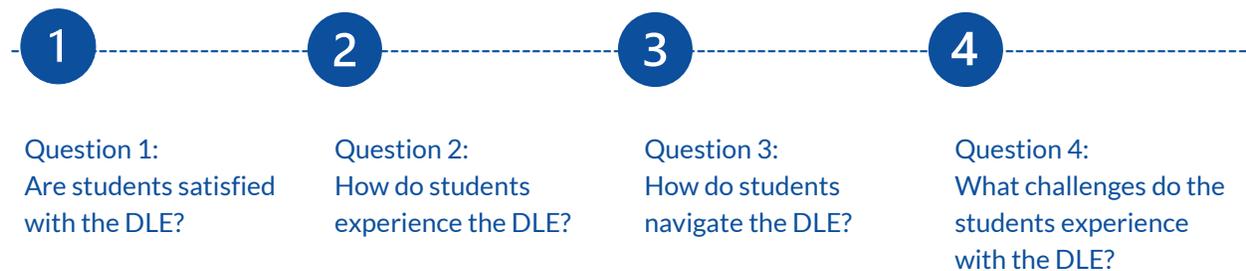
PURPOSE

The purpose of the research is to examine the student user experience (UX) of the Digital Learning Environment (DLE) within the University of Wisconsin System, one of the largest systems of public higher education in the country, educating approximately 165,000 students each year. With 13 universities across 26 campuses and a statewide extension network, 12 of the universities participated in this study of the DLE with the exception of University of Wisconsin - Madison which manages its own Canvas environment.

The DLE is an online ecosystem used by students, instructors, and administrators to support teaching and learning. It includes three cloud-based applications: Instructure's Canvas learning management system, Kaltura media management system, and Blackboard Collaborate Ultra web conferencing system. The DLE enables teaching and learning in all course formats.

The study design incorporates mixed-methodological design and data collection techniques. The study is conducted using survey methods. Instrumentation is a student survey that includes quantitative (Likert) and qualitative (free response) items. The survey includes previously validated questions and survey items informed through multiple efforts. A systematic review of existing research and environment scan of documents related to DLEs, such as learning management systems (LMSs) and related technologies and practices, were conducted to identify relevant areas of inquiry.

Research Questions



With consideration for recent challenges faced and addressed due to COVID-19 pandemic, the research provides guidance on understanding the student experience with the DLE and identify factors that can be addressed to reduce student barriers to learning with the DLE. The following research questions were proposed: 1.) Are students satisfied with the DLE; 2.) How do students experience the DLE; 3.) How do students navigate the DLE; and 4.) What challenges do the students experience within the DLE.

FINDINGS I

ARE STUDENTS SATISFIED WITH THE DLE?

GENERAL SATISFACTION WITH USER EXPERIENCE

Overall, students are satisfied with their experience in the DLE. It is easy to use, it is valid and reliable, and they intend to use it in the future and are confident in their use. Specifically, students find Canvas in the DLE is easy to use and access. They find technology reliable and valid; it does what it is supposed to do and works when they need it. Students intend to use the DLE, if it is available to them. They are confident using Canvas. The strongest components of user experience include: 1.) easy to use, 2.) perceived useful, 3.) intended use, 4.) confident in use, 5.) satisfied with their use, and 6.) organizes their learning.

- 1 DLE is easy to use.
- 2 The DLE is useful.
- 3 Students intend to use the DLE if available.
- 4 Students are confident in their use of the DLE.
- 5 Students are satisfied with their use of the DLE.
- 6 The DLE organizes student learning.

Students really like having everything in one place for all of their courses instead of having to manage multiple websites. Students commonly report the DLE is intuitive and has a good user interface. They report that it is easy to navigate, yet ironically, navigation is also presented as a common challenge.

Ease of use

In examining the user experience and usability of the DLE, student responses reveal a high perception of ease of use, or the degree to which a person believes that Canvas would be free of effort, when asked about their experiences with Canvas in the DLE. They responded very positively to statements about ease of use, including Canvas is easy to access (M = 4.43; SD = .80), I felt comfortable using Canvas (M = 4.43; SD = .74), and Canvas provides a convenient way to access course materials (M = 4.34; SD = .88). See Table 1.

TABLE 1 | GENERAL EASE OF USE

	TTL	Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Canvas is easy to access.	433	4.43	0.80	5	1.20%	11	2.50%	24	5.50%	148	34.20%	245	56.60%
I felt comfortable using Canvas.	439	4.43	0.74	4	0.90%	6	1.40%	25	5.70%	165	37.60%	239	54.40%
Canvas provides a convenient way to...	453	4.34	0.88	8	1.80%	17	3.80%	26	5.70%	163	36.00%	239	52.80%

Notably, the ease of use was lauded by both traditional and non-traditional students alike with one student commenting, “[i]t is really user-friendly even for an older student such as me who isn't always as tech-savvy as younger students.”

“It is really user-friendly even for an older student such as me who isn't always as tech-savvy as younger students.”

They also felt that the technology was valid and reliable. Students reported that Canvas does what it is supposed to do (M = 4.41; SD = .82) and works when they need it (M = 4.26; SD = .90). See Table 2.

TABLE 2 | VALIDITY AND RELIABILITY OF TECHNOLOGY

	TTL		Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
Canvas works when I need it.	460	4.26	0.90	6	1.30%	20	4.30%	45	9.80%	166	36.10%	223	48.50%	
Canvas does what it is supposed to do.	486	4.41	0.82	7	1.40%	10	2.10%	31	6.40%	165	34.00%	273	56.20%	

Other non-traditional students also report they found the system easy to learn and use with one student adding “for a person out of school for 20+ years, it was not that difficult to learn.”

With special interest in navigation, the study examined it separately as well. Students agree that the user experience and usability in regard to navigation is easy. Students report that it is easy to navigate (M = 4.17; SD = .96); the features and navigation within Canvas are easy to use (M = 4.17; SD = .94), and they are able to easily navigate back and forth through pages (M = 4.07; SD = 1.09). See Table 3.

TABLE 3 | EASE OF NAVIGATION

	TTL		Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
It is easy to navigate.	437	4.17	0.96	12	2.75%	23	5.26%	28	6.41%	189	43.25%	185	42.33%	
The features and navigation within Canvas were easy...	445	4.17	0.94	9	2.02%	25	5.62%	38	8.54%	185	41.57%	188	42.25%	
I am able to easily navigate back and forth through pages.	486	4.07	1.09	15	3.09%	43	8.85%	55	11.32%	155	31.89%	218	44.86%	

When professors utilize the course site sections and functions (e.g., modules, assignments) appropriately, students find the site navigation simple and straightforward.

One student stated: “I like how everything is organized within the course page with the words on the side such as ‘Discussions,’ ‘Modules,’ ‘Announcements,’ and ‘Syllabus.’ It makes it very easy to find everything as long as my professors are also organized.”

“I like how everything is organized within the course page with the words on the side such as ‘Discussions,’ ‘Modules,’ ‘Announcements,’ and ‘Syllabus.’ It makes it very easy to find everything as long as my professors are also organized.”

Perceived usefulness

Students feel strongly that the experience is useful, or they believe that using the system will enhance their performance. Specifically, students report that they think it is useful to support courses with Canvas (M = 4.37; SD = 0.83). They also report that Canvas helps them follow their course activities (M = 4.35; SD = 0.91) and is useful to follow course activities online (M = 4.34; SD = 0.90). See Table 4.

TABLE 4 | PERCEIVED USEFULNESS

	TTL	Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
I think it is useful to support courses with Canvas.	451	4.37	0.83	6	1.33%	9	2.00%	40	8.87%	152	33.70%	244	54.10%
Canvas helps me follow my course activities.	455	4.35	0.91	12	2.64%	13	2.86%	24	5.27%	163	35.82%	243	53.41%
Canvas is useful to follow course activities online.	467	4.34	0.90	9	1.93%	17	3.64%	31	6.64%	160	34.26%	250	53.53%

Behavioral intent

Students report strong agreements with statements related to behavioral intent or the individual’s intent to perform a conscious act, such as the use of Canvas in the DLE. They responded that if they have access to courses in Canvas, they intend to use it (M = 4.61; SD = .70)

and use it frequently ($M = 4.31$; $SD = .91$). They also believe that courses should be supported with Canvas in the future ($M = 4.28$; $SD = .90$) and those instructors should continue to use Canvas ($M = 4.28$; $SD = 1.06$). See Table 5.

TABLE 5 | BEHAVIORAL INTENT

	TTL		Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
If I have access to courses in Canvas, I intend to use it.	417	4.61	0.70	3	0.72%	4	0.96%	23	5.52%	92	22.06%	295	70.74%	
If courses are supported w/ Canvas, I intend to use...	413	4.31	0.91	7	1.69%	11	2.66%	52	12.59%	119	28.81%	224	54.24%	
In the future, the courses should be supported w/ Canvas.	453	4.28	0.90	6	1.32%	14	3.09%	60	13.25%	141	31.13%	232	51.21%	
I think the instructors should continue to use Canvas.	431	4.28	1.06	20	4.64%	10	2.32%	49	11.37%	103	23.90%	249	57.77%	

Self-efficacy

Students report high levels of agreement with statements related to self-efficacy or the belief an individual has in their ability to successfully perform certain behaviors, such as using Canvas in the DLE. Students reported that they agree or strongly agree with statements, such as I am confident in using Canvas ($M = 4.44$; $SD = .83$), I felt very confident using Canvas ($M = 4.27$; $SD = .89$), and I am confident in using Canvas even if I have never used such a system before ($M = 4.22$; $SD = .98$). See Table 6.

TABLE 6 | SELF-EFFICACY

	TTL		Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
I am confident in using Canvas.	457	4.44	0.83	7	1.53%	12	2.63%	24	5.25%	144	31.51%	270	59.08%	
I felt very confident using Canvas.	463	4.28	0.89	9	1.94%	14	3.02%	40	8.64%	178	38.44%	222	47.95%	
I am confident in using Canvas even if I have never used...	442	4.22	0.98	9	2.04%	25	5.66%	44	9.95%	146	33.03%	218	49.32%	

Satisfaction

Students are satisfied, the extent to which a user is pleased with the system, with Canvas and the DLE. Students feel that Canvas is a satisfactory system ($M = 4.25$; $SD = .89$), and the tools are satisfactory ($M = 4.08$; $SD = 1.01$). They also reported that they were satisfied with the courses conducted with the support of the system ($M = 4.06$; $SD = 1.09$).

TABLE 7 | SATISFACTION

	TTL		Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
Canvas is a satisfactory system to perform activities.	439	4.25	0.89	6	1.37%	19	4.33%	40	9.11%	168	38.27%	206	46.92%	
The tools in the Canvas are satisfactory...	473	4.08	1.01	16	3.38%	25	5.29%	51	10.78%	192	40.59%	189	39.96%	
I am satisfied with the courses conducted with...Canvas.	486	4.06	1.09	22	4.53%	29	5.97%	54	11.11%	173	35.60%	208	42.80%	

Learning organization

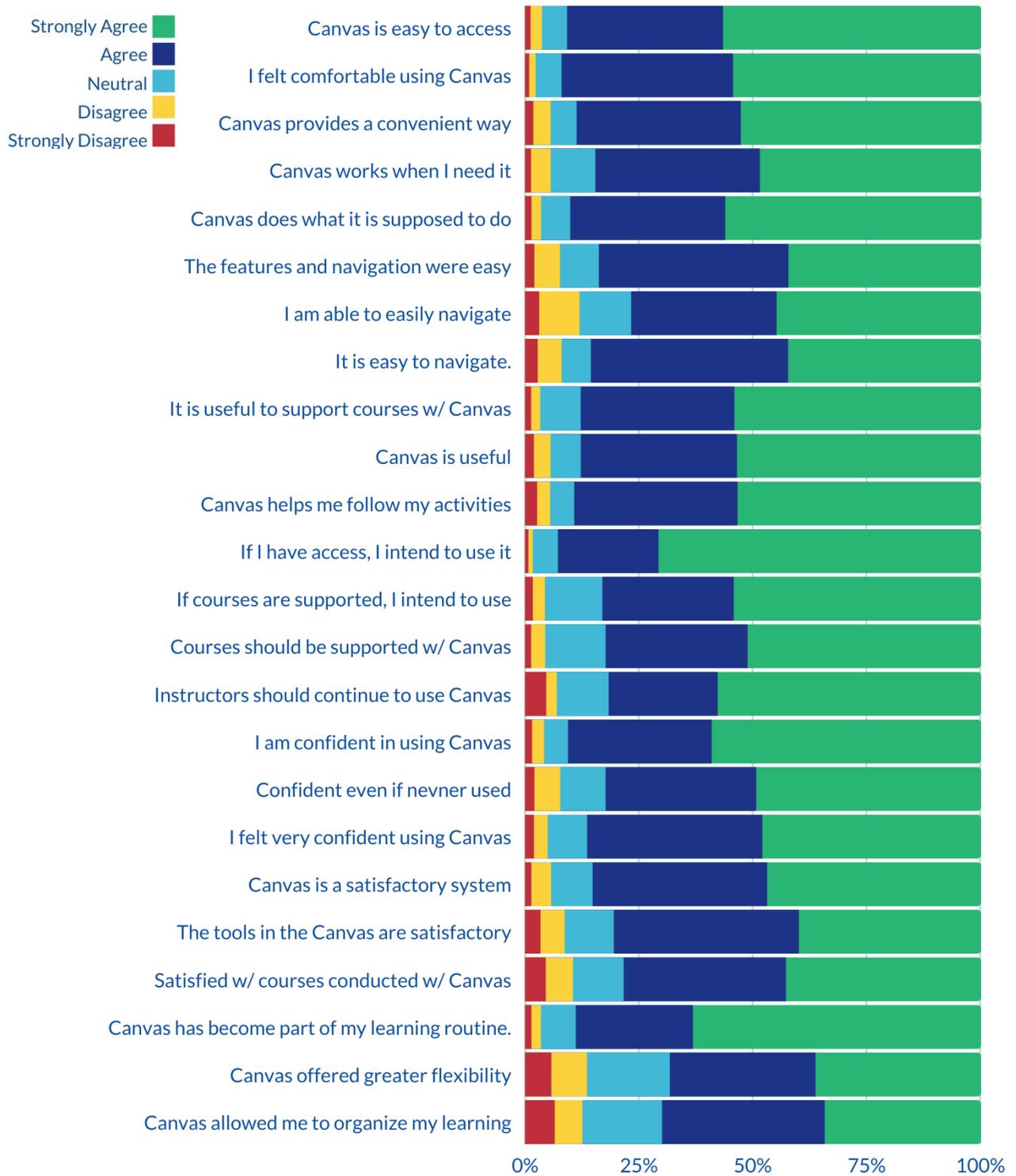
Students report high levels of agreement in that Canvas had become part of their learning routine ($M = 4.47$; $SD = .83$). At somewhat lower levels of agreement, they felt it offers them the flexibility to learn ($M = 3.85$; $SD = 1.16$) and allows them to better organize and structure their learning ($M = 3.85$; $SD = 1.15$).

TABLE 8 | LEARNING ORGANIZATION

	TTL		Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
Using Canvas has become part of my learning routine.	432	4.47	0.83	6	1.39%	9	2.08%	33	7.64%	111	25.69%	273	63.19%	
Using Canvas offered greater flexibility to learn the way I want.	435	3.85	1.16	25	5.75%	34	7.82%	79	18.16%	139	31.95%	158	36.32%	
Canvas allowed me to better organize and structure my learning.	446	3.85	1.15	29	6.50%	27	6.05%	78	17.49%	159	35.65%	153	34.30%	

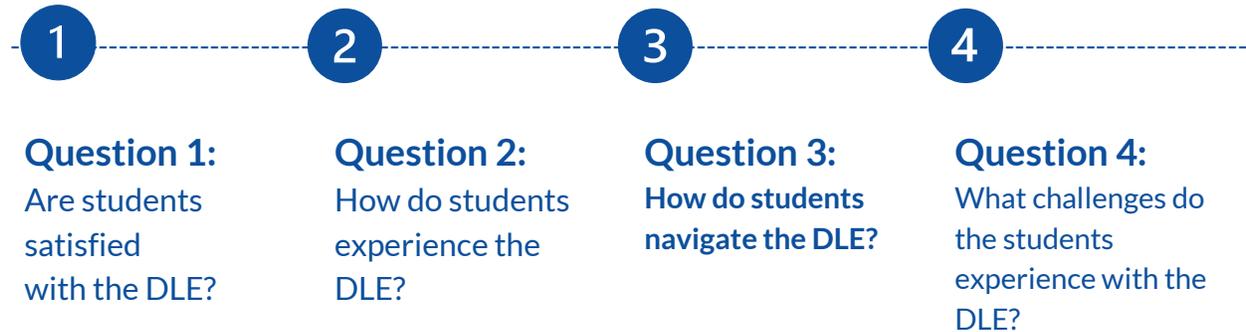
See Figure 1 for an overview of the Likert items described in Tables 1 through 8.

FIGURE 1 | LIKERT SCALES OF AGREEMENT FOR USER EXPERIENCE WITH DLE



University of Wisconsin System Digital Learning Environment

Research Questions



Findings

✓ **Easy to use**

Easy to access and use leaving students comfortable using it

✓ **Confident in use**

Confident in using even without previous experience

✓ **Perceived as useful**

Useful, supportive, and helpful for students in completing activities

✓ **Satisfied with their use**

Sufficient system and tools to support courses

✓ **Intended future use**

Students plan to use it (and so should instructors)

✓ **Organizes learning**

Becoming part of every students' learning routine

FINDINGS II

HOW DO STUDENTS USE THE DLE? USER EXPERIENCE IN FREQUENCY AND EASE OF USE

In examining the functions students perform in using the DLE, we found that students most often use the DLE for some primary functions: 1.) finding course information, 2.) staying on task and time management, 3.) submitting or taking assessments, 4.) tracking performance and getting feedback on assessments, and 5.) interacting in threaded discussions.

- 1 Finding course information
- 2 Staying on task and time management
- 3 Submitting or taking assessments
- 4 Tracking performance and getting feedback
- 5 Interacting in threaded discussions

Finding course information

Students often use the DLE to find course information including assignments (M = 4.59; SD = .65), course materials (M = 4.53; SD = .69), documents (viewing, M = 4.40; SD = .70; downloading, M = 4.18; SD = .84), and other files (M = 4.30; SD = .77). They less often view videos, but it was still above average (M = 3.93; SD = .93). Importantly, finding assignments and course materials are things that are very often done by students. However, they also report that the organization of course materials and assignments by an instructor can make these tasks difficult.

Students find most of the frequently performed functions easy to use as well. They report at or above average levels that it is easy to download (M = 4.22; SD = .87) and view documents (M = 4.07; SD = .93), view videos (M = 4.03; SD = .92), and access files (M = 3.96; SD = 0.93). However, they did report below average ability in finding things such as assignments (M = 3.94; SD = 1.00) and course materials (M = 3.86; SD = .99), yet these two items are still somewhat high in the reported ease of use. Also, although they don't often use these functions, they reported above average ease of use in viewing full screen (M = 4.09; SD = .95) and viewing the syllabus (M = 3.99; SD = .96). Worthy of note, downloading documents was very easy for students. The technological functionality of Canvas seems frequently used and easy to use. See Table 9.

Importantly, students report that accessing, viewing, and downloading course information is influenced by how the instructor sets up the course. Students describe well set up courses as making their experience easy, but poorly organized courses can make a course confusing and frustrating. For instance, students report that some instructors “dump” the course materials into a module or modules without organizing them and without creating a hierarchy using headers and indentations. They also describe that file titles and naming are ambiguous. Organization of materials can make it or break it. Simple and consistent organization of course content makes a clear difference in the student learning experience. Students describe that both ends of the organization spectrum can be overwhelming with excessive or vague organization increasing site navigation difficulty. “At times you have to dig to locate the resource starting at the top of the course and scrolling until you locate the item.”

“I loved when teachers had modules for every class period. Where you could go to the page and see the itinerary for that day, all assignments were linked in there, as well as any power points or additional resources.”

TABLE 9 | FINDING COURSE INFORMATION

	TTL	Descriptive		Never		Rarely		Sometimes		Often		Always	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Finding assignments	791	4.59	0.65	7	0.88%	3	0.38%	20	2.53%	245	30.97%	516	65.23%
Finding course materials	758	4.53	0.69	7	0.92%	4	0.53%	32	4.22%	249	32.85%	466	61.48%
Viewing documents	763	4.40	0.70	3	0.39%	8	1.05%	55	7.21%	310	40.63%	387	50.72%
Accessing files the instructor has shared	791	4.30	0.77	5	0.63%	9	1.14%	94	11.88%	322	40.71%	361	45.64%
Downloading documents	741	4.18	0.84	8	1.08%	22	2.97%	92	12.42%	327	44.13%	292	39.41%
Viewing videos	791	3.93	0.93	11	1.39%	47	5.94%	162	20.48%	335	42.35%	236	29.84%
	TTL	Descriptive		Very difficult		Difficult		Neutral		Easy		Very easy	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Downloading documents	979	4.22	0.87	12	1.23%	33	3.37%	113	11.54%	386	39.43%	435	44.43%
Viewing fullscreen	921	4.09	0.95	14	1.52%	48	5.21%	153	16.61%	331	35.94%	375	40.72%
Viewing documents	1024	4.07	0.93	13	1.27%	57	5.57%	158	15.43%	415	40.53%	381	37.21%
Viewing videos	1038	4.03	0.91	7	0.67%	65	6.26%	181	17.44%	423	40.75%	362	34.87%
Viewing the syllabus	968	3.99	0.96	15	1.55%	66	6.82%	167	17.25%	389	40.19%	331	34.19%
Accessing files the instructor has shared	1055	3.96	0.93	14	1.33%	70	6.64%	182	17.25%	472	44.74%	317	30.05%
Finding assignments	1011	3.94	1.00	18	1.78%	86	8.51%	178	17.61%	389	38.48%	340	33.63%
Finding course materials	1017	3.86	0.99	16	1.57%	96	9.44%	195	19.17%	419	41.20%	291	28.61%

When properly organized, the modules are also a helpful way to manage assignments and course materials. One student said they liked the “Canvas modules for visualizing work that needs to be completed each week of each course.” Others suggest well-organized modules can help them identify and locate class materials by class period or unit. For example, a student stated, “I loved when teachers had modules for every class period where you could go to the page and see the itinerary for that day. All assignments were linked in there as well as any PowerPoints or additional resources.”

Students often reported that instructors did not organize the course using the available and appropriate course site sections, making finding information and navigation difficult. For instance, they often reported that the syllabus wasn't under the 'Syllabus' tab or section but was embedded in a module which caused them to have to scroll around to find it. Also, they reported that assignments could not be found under 'Assignments.' They had to remember what module the instructor posted it in or scroll through the whole course to find an assignment sheet.

Staying on task and time management

Students often use the DLE to help them stay on task by tracking due dates ($M = 4.45$; $SD = .80$), finding the agenda or list of things to do ($M = 4.25$; $SD = .95$), and receiving notification either from email ($M = 4.16$; $SD = 1.07$) or from course updates and deadlines ($M = 4.05$; $SD = 1.00$).

Students report that most of these functions are easy to perform. They report at or above average levels of ease of use in receiving notifications to their email ($M = 4.22$; $SD = .91$), receiving notifications to their phone ($M = 4.00$; $SD = 1.02$), which is not seldom done, and finding the agenda or list of things to do ($M = 3.96$; $SD = 1.04$). Yet, there were a couple functions that fell below average levels of ease of use, including tracking due dates ($M = 3.85$; $SD = 1.09$) and receiving notifications of updates of the course site and deadlines ($M = 3.93$; $SD = 1.03$). Although they were below average levels on these two items, the ease of use was still somewhat high. Notably, receiving notifications via email was very easy for students. See Table 10.

Students very often mentioned liking features that made keeping track of assignments and due dates easier. Top mention was the calendar function, followed by the to-do list function, and then the dashboard. Students commonly mentioned they liked these features; however, students also report if an instructor does not set up an assignment correctly or does not add due dates, they do not show up on the calendar or to-do list. Importantly, the visualization of a student's progress was repeatedly noted as helpful to their learning enhancing their ability to manage time and stay on task.

Students stated that the calendar is the most beneficial feature to help them stay on task and meet deadlines. One student specifies, “I am a visual learner and seeing what tasks and what assignments were due made it easier for me to stay on top of things.” Many students commented they rely on the calendar to stay organized as they can easily access due dates and assignment pages for all of their courses from one place. One student suggested they may have been less successful without the feature, “[i]f Canvas didn't have the calendar feature, I don't think I would be completing assignments on time. I check the calendar at least 3 times a day and go to

assignments from there most of the time rather than through the course page. I love it; it's super helpful for me to see my assignments for all my classes that way rather than in list form on for each individual class.”

“If Canvas didn't have the calendar feature, I don't think I would be completing assignments on time. I check the calendar at least 3 times a day and go to assignments from there most of the time rather than through the course page. I love it; it's super helpful for me to see my assignments for all my classes that way rather than in list form on for each individual class.”

Another feature, the to-do list, allows students to prioritize and plan their work for the week. One student mentions, “[f]or someone like me who is pressed for time, being able to see a grid of upcoming assignments was extremely helpful. The visual made planning a snap.” As assignments are submitted, they are automatically removed from the to-do list, which students frequently mentioned helped them track their work. For instance, one student reports, “when I submit an assignment the assignment goes away, so I have a checklist of what I need to complete each week. I can see at a glance what is due today, tomorrow, and so on. It really helped me prioritize my studying.”

Students report that the dashboard, if utilized by professors, served as a benefit in a student’s experience. For instance, students explain that they “love the dashboard to view upcoming assignments, [wishing] there were a way to force instructors to add their assignments to it.” Additionally, students express that “having professors able to add assignments and dates in advance makes it easy to keep track of due dates.” Students interact with the DLE to find assignments and use the dashboard very frequently. While students are able to track due dates, find the agenda, and receive notifications through other features, instructors who set up assignments appropriately and better integrate the dashboard in their courses may impact a student’s efficiency, learning effectiveness, and ability to stay on task. As one student mentioned,

“[t]he dashboard keeps me updated on upcoming assignments, which is helpful for someone such as myself who works full time and has a hectic schedule.”

TABLE 10 | STAYING ON TASK AND TIME MANAGEMENT

	TTL		Descriptive		Never		Rarely		Sometimes		Often		Always	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
Tracking due dates	803	4.45	0.80	9	1.12%	15	1.87%	56	6.97%	249	31.01%	474	59.03%	
Finding the agenda or list of things to do	757	4.25	0.95	16	2.11%	27	3.57%	96	12.68%	229	30.25%	389	51.39%	
Receiving notifications to your email	790	4.16	1.07	33	4.18%	36	4.56%	91	11.52%	245	31.01%	385	48.73%	
Receiving notifications of course site updates*	717	4.05	1.00	21	2.93%	38	5.30%	100	13.95%	283	39.47%	275	38.35%	
	TTL		Descriptive		Very difficult		Difficult		Neutral		Easy		Very easy	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%	
Receiving notifications to your email	1021	4.22	0.91	14	1.37%	41	4.02%	130	12.73%	354	34.67%	482	47.21%	
Receiving notifications to your phone	825	4.00	1.02	25	3.03%	43	5.21%	153	18.55%	293	35.52%	311	37.70%	
Finding the agenda or list of things to do	983	3.96	1.04	23	2.34%	81	8.24%	172	17.50%	345	35.10%	362	36.83%	
Receiving notifications of course site updates*	953	3.93	1.03	24	2.52%	79	8.29%	159	16.68%	365	38.30%	326	34.21%	
Tracking due dates	1042	3.85	1.09	34	3.26%	107	10.27%	187	17.95%	365	35.03%	349	33.49%	

Notifications will be discussed further in the challenges section.

Submitting or taking assessments

Students often use the DLE to submit or take assessments, including assignments or quizzes. Students frequently submit assignments (M = 4.67; SD = .56), upload files (M = 4.32; SD = .80), and take quizzes (M = 4.19; SD = .87). Submitting assignments was very often done. They also found these activities easy for them to do. Students report above average ease of use for taking a quiz

(M = 4.36; SD = .76), submitting assignments (M = 4.34; SD = .80), and uploading files (M = 4.14; SD = .95). Markedly, taking quizzes and submitting assignments is very simple for students to do. See Table 11.



Students appreciate the ease of submitting assignments. Many students specifically noted how they enjoy the confetti ‘reward’ animation that appears upon submission. One student noted, “I love how you submit something in Canvas, how confetti come down on the screen! It makes me feel like I got something done, which I did!”

TABLE 11 | SUBMITTING AND TAKING ASSESSMENTS

	TTL	Descriptive		Never		Rarely		Sometimes		Often		Always	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Submitting assignments	544	4.67	0.56	1	0.13%	3	0.39%	19	2.45%	207	26.74%	474	59.03%
Uploading files	351	4.32	0.80	8	1.08%	17	2.30%	56	7.59%	306	41.46%	389	51.39%
Taking a quiz	300	4.19	0.87	15	2.00%	20	2.66%	75	9.99%	341	45.41%	385	48.73%
	TTL	Descriptive		Very difficult		Difficult		Neutral		Easy		Very easy	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Taking a quiz	988	4.36	0.76	4	0.40%	28	2.83%	65	6.58%	407	41.19%	484	48.99%
Submitting assignments	1022	4.34	0.80	11	1.08%	22	2.15%	81	7.93%	406	39.73%	502	49.12%
Uploading files	961	4.14	0.95	18	1.87%	51	5.31%	114	11.86%	377	39.23%	401	41.73%

Tracking performance and getting feedback on assessments

Students often use the DLE to track their academic performance and receive feedback on their assessments, including viewing score of assignments and feedback (M = 4.42; SD = .74), tracking individual grades (M = 4.30; SD = .81), reviewing assignment feedback and grades (M = 4.30; SD =

.81), viewing their overall grades (M = 4.22; SD = .87), reviewing discussion feedback and grades (M = 4.19; SD = .88), and reviewing quiz results (M = 4.16; SD = .94). Additionally, students also find these functions easy. They report above average ease of use for viewing overall grade (M = 4.33; SD = .88), tracking individual grades (M = 4.21; SD = .88), reviewing quiz results (M = 4.17; SD = .86), viewing scores of assignments and feedback (M = 4.12; SD = .96), and reviewing assignment feedback and grades (M = 3.99; SD = 1.03). However, they reported that reviewing discussion feedback and grades was somewhat challenging with the average responses falling below the mean average of the other items (M = 3.92; SD = 1.03) while the average ratings were still somewhat high. Viewing overall grades and tracking individual grades are very easy for students to complete. See Table 12.

Students appreciate being able to see their grades and feedback at any time. Students report that it helped them more clearly understand their performance. One student said, "I found the grade screen very helpful to keep me updated on my progress." Another student remarked, "the responses to coursework and the grade details are beneficial to understanding where I am in the class and how things are going." They also liked certain grade features that helped them understand their performance. For instance, the 'what-if grades' feature was cited as a well-liked feature across multiple free response questions in the student survey. Students like seeing what grade they need on an assignment to keep their overall course grade up. One student explained, "the ability to enter 'what-if' grades, [is] especially useful if the professor has all assignments and proper weighting added. I like this so I can see what score I need to keep or increase my grade." Many other students mentioned using this feature to view scenarios such as the student who commented, "I like the ability to test different grades for assignments so I can prepare myself for my 'worst case scenario' grade."

Students also like the feedback feature. In response to what they like, one commented that they liked "getting feedback on long-form written assignments because it provides me with understanding of how to better do similar assignments in the future." Also, the built-in communication features also facilitate a positive learning experience. One student said, "I like how the professors are able to give feedback for our assignments, and we are able to reply back to the professor right there if we have questions."

Finally, student comments suggest they prefer the way the grades are displayed within the app when compared to viewing grades on the desktop site. One student reported finding grades on the desktop as challenging suggesting improving "the way grades are shown as it is difficult to find the grades online unlike [in] the app." When asked to suggest improvements a number of students also suggested changes to the desktop grade pages to be more like the app experience. One student suggested adding the card view to the desktop version. They stated, "desktop view [should] allow grades to show on the card view not just on mobile app." Meanwhile, others suggested duplicating the mobile dashboard experience in the full desktop site to allow them to view all of their grades at once suggesting to, "add a dashboard similar to mobile on the desktop version. Specifically, where you can see grades of all courses at once."

TABLE 12 | TRACKING PERFORMANCE

	TTL	Descriptive		Never		Rarely		Sometimes		Often		Always	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Viewing scores of assignments and feedback	750	4.42	0.74	4	0.53%	10	1.33%	61	8.13%	268	35.73%	407	54.27%
Tracking individual grades	769	4.30	0.81	5	0.65%	17	2.21%	88	11.44%	291	37.84%	368	47.85%
Reviewing assignment feedback and grades	783	4.30	0.81	4	0.51%	18	2.30%	95	12.13%	289	36.91%	377	48.15%
Viewing your overall grade	765	4.22	0.87	11	1.44%	23	3.01%	91	11.90%	303	39.61%	337	44.05%
Reviewing discussion feedback and grades	744	4.19	0.88	13	1.75%	17	2.28%	105	14.11%	291	39.11%	318	42.74%
Reviewing quiz results	745	4.16	0.94	20	2.68%	19	2.55%	105	14.09%	281	37.72%	320	42.95%
	TTL	Descriptive		Very difficult		Difficult		Neutral		Easy		Very easy	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Viewing your overall grade	992	4.33	0.88	12	1.21%	41	4.13%	84	8.47%	330	33.27%	525	52.92%
Tracking individual grades	1003	4.21	0.88	8	0.80%	51	5.08%	102	10.17%	401	39.98%	441	43.97%
Reviewing quiz results	982	4.17	0.86	5	0.51%	44	4.48%	133	13.54%	398	40.53%	402	40.94%
Viewing scores of assignments and feedback	982	4.12	0.96	15	1.53%	59	6.01%	138	14.05%	352	35.85%	418	42.57%
Reviewing assignment feedback and grades	1013	3.99	1.03	21	2.07%	90	8.88%	148	14.61%	369	36.43%	385	38.01%
Reviewing discussion feedback and grades	962	3.92	1.03	21	2.18%	88	9.15%	162	16.84%	365	37.94%	326	33.89%

Interacting in threaded discussions

Students often interact in threaded discussions. They view an instructor's or their classmates' discussion posts (M = 3.96; SD = 1.00), post discussion messages (M = 3.96; SD = 1.02), and reply to discussion posts (M = 3.93; SD = 1.05). It is important to note that these activities are performed less often than the other activities reported previously, and the activities reported are above average in their ratings of overall activities that students report.

Students report that these items are above average in ease of use. They are able to easily reply to discussion posts (M = 4.30; SD = 0.80), post discussion messages (M = 4.29; SD = 0.82), and view their instructor's or their classmates' discussion posts (M = 4.12; 0.90). To be specific, posting and replying to discussion messages are very easy for students. See Table 13.

Students reported liking some of the functions of the discussions. A student reported that "I like that you can't read anyone else's messages until you have submitted because otherwise people just paraphrase what someone else said."

TABLE 13 | INTERACTING IN THREADED DISCUSSIONS

	TTL	Descriptive		Never		Rarely		Sometimes		Often		Always	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Viewing discussion posts*	732	3.96	1.00	20	2.73%	44	6.01%	131	17.90%	286	39.07%	251	34.29%
Posting discussion messages	740	3.96	1.02	18	2.43%	60	8.11%	116	15.68%	288	38.92%	258	34.86%
Replying to discussion posts	776	3.93	1.05	26	3.35%	55	7.09%	137	17.65%	289	37.24%	269	34.66%
	TTL	Descriptive		Very difficult		Difficult		Neutral		Easy		Very easy	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Replying to discussion posts	1007	4.30	0.80	7	0.70%	29	2.88%	87	8.64%	412	40.91%	472	46.87%
Posting discussion messages	965	4.29	0.82	6	0.62%	28	2.90%	108	11.19%	362	37.51%	461	47.77%
Viewing discussion posts*	963	4.12	0.90	9	0.93%	49	5.09%	139	14.43%	386	40.08%	380	39.46%

FINDINGS III

HOW DO STUDENTS NAVIGATE THE DLE?

USER EXPERIENCE IN FREQUENCY AND EASE OF USE OF NAVIGATION FUNCTIONS

UWS instructors and staff had identified navigation of the DLE as an area where deeper investigation is needed. Students most often navigate the DLE by: 1.) viewing your dashboard (M = 4.57; SD = .76), 2.) returning to the course home page (M = 4.52; SD = .67), 3.) accessing (M = 4.46; SD = .74) and 4.) navigating modules (M = 4.42; SD = .75), 5.) navigating course websites (M = 4.39; SD = .83), 6.) finding the page with the information they need (M = 4.37; SD = .70), 7.) navigating the template used for their courses (M = 4.31; SD = .86), 8.) finding their way back to another page (M = 4.31; SD = .74), 9.) clicking back out of a page (M = 4.20, SD = .83), 10.) finding the list of their course sites (M = 4.17; SD = .94), 11.) working with the system interface for their courses (M = 4.15; SD = .95), and 12.) turning the page or moving between pages (M = 4.02; SD = .98). See Table 14.

Students reported that half of these frequently performed tasks were also easy to do. Students reported above average ease of use ratings for viewing the dashboard (M = 4.55; SD = .69, returning to the course home page (M = 4.33; SD = .89), finding the list of course sites (M = 4.27; SD = .86), accessing modules (M = 4.20; SD = .88), navigating the course websites (M = 4.01; SD = .97), and navigating modules (M = 3.98; SD = .96).

Students also reported that half of these frequently performed task were below average in ease of use, including turning the page or moving between pages (M = 3.94; 0.98), clicking back out of a page (M = 3.92; SD = 1.03), working with the system interface for your courses (M = 3.86; SD = .92), finding one's way back to another page (M = 3.85; SD = 1.05), navigating the template (M = 3.84; SD = 1.02), and finding the page with the information needed (M = 3.63; SD = 1.05). See Table 15.

Distinctively, viewing the dashboard and returning home were both navigational tasks that were very often performed and very easy to do. Accessing modules is also done frequently and finding a list of course sites was very easy to do; however, finding the page with the information one needs was difficult for students.

Students report that how the course is organized can make navigating the site difficult. They declare professors may “put all the coursework into one page, and it would become very cluttered and difficult to find specific material.” Moreover, students describe the process of finding assignments when professors create “too many modules” or “extremely long and confusing modules,” and how that creates challenges as they attempt to find relevant materials needed to

prepare for important assignments like examinations. In general, unorganized classes exacerbated frustrations for students trying to find assignments and materials for each week. A severe lack of organization for courses even caused a student to drop two online classes because the student felt “no direction” from the course page created by the professor. “Most of the navigation difficulties result from teachers organizing their Canvas pages in confusing manners.”

It appears the deeper the pages are, the more difficult they are for students to navigate. They are challenged with finding materials sometimes due to disorganization. Also, it is a challenge moving pages or returning to the page they want once they have achieved deeper navigation.

TABLE 14 | FREQUENCY OF NAVIGATIONAL TASKS

	TTL	Descriptive		Never		Rarely		Sometimes		Often		Always	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Viewing your dashboard	777	4.57	0.76	4	0.51%	18	2.32%	50	6.44%	167	21.49%	538	69.24%
Returning to the course home page	742	4.52	0.67	4	0.54%	4	0.54%	37	4.99%	251	33.83%	446	60.11%
Accessing modules	796	4.46	0.74	4	0.50%	14	1.76%	55	6.91%	259	32.54%	464	58.29%
Navigating modules	750	4.42	0.75	3	0.40%	13	1.73%	63	8.40%	260	34.67%	411	54.80%
Navigating your course websites	767	4.39	0.83	9	1.17%	17	2.22%	67	8.74%	245	31.94%	429	55.93%
Finding the page with the info you need*	755	4.37	0.70	3	0.40%	6	0.79%	59	7.81%	326	43.18%	361	47.81%
Navigating the template used for your courses	724	4.31	0.86	8	1.10%	18	2.49%	88	12.15%	237	32.73%	373	51.52%
Finding your way back to another page	756	4.31	0.74	3	0.40%	9	1.19%	80	10.58%	324	42.86%	340	44.97%
Clicking back out of a page	765	4.21	0.83	4	0.52%	20	2.61%	114	14.90%	304	39.74%	323	42.22%
Finding the list of your course sites	728	4.17	0.94	12	1.65%	31	4.26%	104	14.29%	256	35.16%	325	44.64%
Working with the system interface for your courses	672	4.15	0.95	15	2.23%	20	2.98%	106	15.77%	236	35.12%	295	43.90%
Turning the page or moving between pages	750	4.02	0.98	20	2.67%	34	4.53%	130	17.33%	294	39.20%	272	36.27%

TABLE 15 | EASE OR DIFFICULTY OF NAVIGATIONAL TASKS

	TTL	Descriptive		Very difficult		Difficult		Neutral		Easy		Very easy	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
Viewing your dashboard	1030	4.55	0.69	6	0.58%	6	0.58%	64	6.21%	297	28.83%	657	63.79%
Returning to the course home page	998	4.33	0.89	10	1.00%	44	4.41%	94	9.42%	311	31.16%	539	54.01%
Finding the list of your course sites	966	4.27	0.86	6	0.62%	32	3.31%	125	12.94%	332	34.37%	471	48.76%
Accessing modules	1039	4.20	0.88	14	1.35%	40	3.85%	112	10.78%	432	41.58%	441	42.44%
Navigating your course websites	1011	4.01	0.97	18	1.78%	66	6.53%	169	16.72%	395	39.07%	363	35.91%
Navigating modules	997	3.98	0.96	10	1.00%	71	7.12%	195	19.56%	369	37.01%	352	35.31%
Turning the page or moving between pages	970	3.94	0.98	8	0.82%	82	8.45%	207	21.34%	338	34.85%	335	34.54%
Clicking back out of a page	1014	3.92	1.03	18	1.78%	93	9.17%	193	19.03%	355	35.01%	355	35.01%
Working with the system interface for your courses	907	3.86	0.92	12	1.32%	50	5.51%	229	25.25%	376	41.46%	240	26.46%
Finding your way back to another page	984	3.85	1.05	18	1.83%	107	10.87%	196	19.92%	342	34.76%	321	32.62%
Navigating the template used for your courses	958	3.84	1.02	28	2.92%	73	7.62%	199	20.77%	381	39.77%	277	28.91%
Finding the page with the information you need	1020	3.63	1.05	33	3.24%	120	11.76%	262	25.69%	384	37.65%	221	21.67%

Difficulties in navigation

Students often reported having difficulty navigating to the pages or content for which they were looking, particularly when posted content was not aligned with the site labels. One student commented, “sometimes assignments were hidden in Canvas, and I could not find them by directly clicking on the assignment in the syllabus.” Another student explained, “[o]ften professors create

their own types of navigation, and they differ by course. Sometimes discussions are located in different places like the 'groups' tab which can be confusing, and sometimes buttons they include like 'view assignment' or 'go to homepage' end up not working or leading to an error page." When examining the **most difficult areas** for students, they reported most difficulty with navigation including following breadcrumbs or navigation shortcuts (M = 3.52; SD = 1.04), finding the page with the information you need (M = 3.63; 1.05), and clicking through to deeper pages and topics (M = 3.68; 1.06).

Students reported having difficulty navigating to or back out of deeper pages and topics. Navigating around to the deeper pages to find information, and then being able to get back from a page without starting over from the overall site homepage was a common complaint. One student said, "[t]here is no good way to just click 'back' to a previous page. Seems like you always have to go back to the course home page." Students discussed getting trapped in deeper levels. One student said, "if one Canvas class has multiple sections, you can get trapped in your section's discussion posts, and it is difficult to get back to the course home page without starting over with 'my dashboard.'" Another commented, "I'm constantly going back to the home page then scrolling to do the next item in the course. It's a pain."



Students frequently attributed their challenges with navigation or finding the materials they needed with instructor organization as described by one student, "[i]t depends on how the professor lays it out. Some do a very good job, and everything is easy, but others make using Canvas a nightmare. It's more dependent on the professor." Another said, "[t]he layout of the Canvas home page (for a specific course) is confusing and has too much information. It is laid out in a way that makes it hard to find assignments that are due in the near future."

FINDINGS IV

WHAT OTHER CHALLENGES ARE STUDENTS EXPERIENCING?

USER EXPERIENCE IN EASE OF USE

Beyond the difficulties briefly explain in the previous sections, we specifically analyzed the data based on those Likert items that were below the mean in ease of use indicating more difficulty in performing the activities and based on the qualitative data where students expressed difficulty or areas within the DLE that needed attention. The areas with the most challenge for students were: 1.) groups, 2.) discussions, 3.) accessibility and usability, 4.) integration of third-party tools, 5.) media and file management, 6.) mobile, 7.) notifications, and 8.) instructor use.

- 1 Groups
- 2 Discussions
- 3 Accessibility and usability
- 4 Integration
- 5 Media and files
- 6 Mobile
- 7 Notifications
- 8 Instructor use

Groups

The most difficult activity for students to perform out of 55 activities was working in groups ($M = 3.14$; $SD = 1.17$). It also was an activity that was seldom performed by students ($M = 2.95$; $SD = 1.12$).

Students had a lot of difficulty with group work ranging from being able to find where the group work was taking place within the system (e.g., a small group discussion is in a different spot than the full class discussion) to communicating and collaborating on work in the group online. Navigation was a major challenge for the group's function. One student reported that "the groups made checking discussion posts and prompts more difficult because they do not send notifications the same way the rest of Canvas announcements work."

Surprisingly, students reported that they liked working in groups. Students like discussing in small groups rather than the entire class. One student remarked, "I like that the groups are smaller. More in-depth discussion that way. Otherwise, half my time is reading through 30 posts." Another shares similar preference for group discussions, "[i]n the past, they have been helpful. They help break down a large class into small pieces so multiple people can have a legitimate discussion instead of 10 people talking over each other." Yet, several students reported complementing groups with other communication platforms. For instance, one student mentioned, "I think it is easy to find groups on Canvas, but I would make communicating to group members more convenient. We ended up emailing each other or using Snapchat as it was way quicker and easier than Canvas."

Alternatively, the assignment developed by instructors can be problematic. "I appreciated the opportunity to work with a varied group of students and to learn from the students in my groups," but "I found the discussions to be the least valuable part of this course." They also expressed wanting more of a chance to social connect and get to know each other. "I certainly didn't mind doing the exercise, but it doesn't facilitate getting to know other students."

Discussions

Although students sometimes use the discussions and felt it was pretty easy to post and respond, there were lots of negative comments from students in the free response questions about discussion organization, navigating threads and discussions, and embedding media. Students reported problems with discussion forum organization, "[d]iscussion forum organization is not the most visually friendly...specifically, it isn't obvious when someone has responded to a side conversation or single poster (as opposed to the overall post theme). There is a tiny little indent." Students reported navigation issues in discussions and finding desired interactions, "they're clunky to navigate into, and I often don't realize I have messages in that area," and "[t]he main issue was the thread of discussions. When they became lengthy and people were replying to certain ones, I at first didn't realize that I had to click on the + to see more of the conversations. So, finding the most recent post could be a struggle and missing posts was easy." Another student commented, "[f]inding specific discussion threads when responding. Once there are a lot of

responses, finding the specific thread to respond to becomes more difficult." Finally, students complained of media challenges, "[b]eing able to copy and paste charts and tables into discussion posts. Having to redo such items into the discussion post site is time consuming and awkward."

Additionally, the distinction between class and group discussions was an issue. For example, one student mentions that the "[h]ardest part is multiple locations for discussions. I have the class discussions and the group or team discussions. For a couple assignments I was late getting to them due to not knowing that I had to go to a separate area for group work." We will discuss groups more in our next section.

Accessibility and usability

Students are reporting problems with viewing closed captioning ($M = 3.42$; $SD = 1.04$) although it is seldom used ($M = 2.27$; $SD = 1.34$). Yet, it is a critical component for all students. For instance, students reported that they couldn't find closed captions or often didn't even know closed captioning was available. When asked for an area for improvement on student stated, "[c]losed captioning on videos because I like to read what the professor is saying as they talk because it helps me focus much better." All videos should have closed captions.

Others reported challenges with the usability and font. "The font is the same throughout the site, with no way of emphasizing drawing attention. Just black text on white background. By changing texts or color blocking, the site becomes compartmentalized, similar to physical folders being different colors or different sized textbooks."

Integration

One area that was reported as more difficult for students was accessing other integrated tools ($M = 3.65$; $SD = 1.05$) within the DLE (e.g., BB Collaborate Ultra, Cisco WebEx), yet again, this function is less often used ($M = 3.23$; $SD = 1.36$). While using and accessing DLE integrated tools was seen as difficult, students also liked how they could connect to other third-party tools straight from Canvas. One student says, "I love that it connects to things like McGraw-Hill Connect. External software is sometimes easier to use and more dedicated to specific subjects, but the grades and agenda items automatically update in Canvas, which is awesome."

Media and file management

Students report that embedding media ($M = 3.51$; $SD = 1.10$) and managing files ($M = 3.63$; $SD = 1.04$) are difficult for students. While embedding media ($M = 2.80$; $SD = 1.20$) was rarely performed, managing files ($M = 3.51$; $SD = 1.04$) is sometimes a needed function by students.

Adding media or formatting discussion posts was a common challenge. Students reported that the time to upload videos is too lengthy and can take multiple tries for the upload to complete. Students are also limited to the types of files they can upload. Many reported having to change file types, upload multiple documents separately, and they cannot upload videos to discussion posts. "In class discussions it does not allow you to upload more than one file. There were a few times

this semester where I needed to upload more than one file and had to post two separate discussions.”

Mobile

Students did not often use the mobile app ($M = 3.25$; $SD = 1.44$) and is was considered below average in ease of use ($M = 3.82$; $SD = 1.04$). More specifically, students reported issues viewing media on mobile devices. The limited functionality of the app often led students to revert back to a laptop or desktop. One student reported, “I really like using it on my phone. I can easily go through content, but videos are too hard to watch on my phone. It seems like I can't make them full screen. Because of this, I often have to revert back to my laptop.”

Several students reported difficulty reviewing feedback on a mobile device and a problem with frames. One student said, “[r]eviewing feedback on assignments and papers is easy on my laptop but difficult via the Canvas app on my iPad. The windows are small and hard to resize, meaning that I’m trying to scroll through a 15-page paper two inches at a time.”

Students commented not only on the difficulties viewing feedback but also submitting assignments and participating in discussions. They said, “[i]t's easy to navigate between different courses and view grades (the latter of which is mainly why I'd access Canvas on my phone anyways), but the more in-depth aspects such as viewing feedback, submitting assignments, and participating in discussions is a little out of the phone's depth.” Another student commented on the challenges in uploading files from the app as well recommending improving the app “[m]aking it easier to upload files of a larger size and uploading files from mobile in general.”

Another student reported multiple frames and scrollbars. “Also, when looking at something, either a pdf or a PowerPoint, there are two sliders for viewing the page and it is really annoying to balance the two.” This is also a problem on the windows-based instance with certain media.

Notifications

As we discussed in the section on staying on task and time management, students often track due dates, view the calendar, use the task list, and receive notifications. They even find receiving notifications to their phone and email easy as well as finding the agenda or list of things to do. Markedly, however, they find tracking due dates and receiving notifications of course site updates and deadlines as more difficult.

Qualitative findings reveal some challenges student’s experience in notifications. Many students noted that they did not know how to set up their notifications or notification preferences. Students often commented that there were too many notifications, or the notifications were not what they needed. For instance, students did not like the email with the weekly summary nor did they like receiving double notifications or notifications all night about things. With that, many said they turned off notifications due to getting too many.

Notifications are an important aspect of the Canvas LMS. Students liked that they were updated when new grades were submitted or reminders that assignments are due. “I use my Canvas notifications to see what assignments are due each day as dashboard sends a notification to my phone the day an assignment is due.” Multiple students were unaware that phone notifications were an option but were more inclined to use a phone notification over email. However, students who received both types of notifications were frustrated with the number they received. One student reported that “[i]t’s annoying to get both an email notification and a regular notification about the same thing on my phone. I wasn’t able to figure out how to select one or the other.” Dashboard notifications were reported as most helpful. “I prefer using the Canvas dashboard notifications because sometimes the emails are not descriptive and just prompt you to go to the course site anyway.”

A general theme was that notifications should be more easily customizable to match the frequency and type each student prefers. “I want to be able to pick and choose more specifically what types of notifications I get.” Students also wanted additional types of notifications for changes to assignment deadlines and activity for peer review and discussion posts. One student said “I would like to receive a notification if an assignment due date is changed in the calendar because I don’t check it on a daily basis. Sometimes a professor will change a due date days before notification of that change is communicated.” Another mentioned that “[i]t would be nice to get notifications though when someone comments on a post or submits their initial post so I can view it and respond appropriately when needed.”

Instructor use

Inconsistencies from class to class was a very common comment. Students struggled with learning how each professor set up the course and where to find various things like their syllabus or assignments, rubrics, and other artifacts. Students repeatedly report confusion and frustration with the lack of consistency between courses, which they often attribute to instructors who do not use the standard course tabs or fail to organize their course. One student commented, “each professor tends to set up their class differently in Canvas, which is confusing. They don’t always use the categories; usually just throw everything on the Home Page.” This often impacted part-time or working students, “I would have all instructors use it uniformly and I would also keep the user experience simple and not too customizable. For a part-time student, like myself, it would be super helpful to have it set up the same for each class.” Also, sometimes the courses weren’t organized much as one student clarified, “[s]ome instructors tend to have everything dumped into a non-chronological format. I wish that it was the default to use chronological format when organizing these files.”

When asked what to improve in their experience, students repeatedly asked for training for faculty so that courses are set up in ways that are more organized and easier to follow. Other complaints around things like managing assignments and due dates were often reported due to an instructor not setting these up to work with the calendar, to-do list, or dashboard. It is clear that the organization and set-up of the course makes or breaks the class. Poor organization, including course materials and assignments, put in unusual places confuses and frustrates students.

Students especially want instructors to be more consistent with inserting correct due dates, uploading the syllabus to the correct location, and organizing documents in modules. A lack of due dates often meant features such as the calendar and to-do list could not be used. Many students wanted to improve Canvas by “making sure each instructor has to post a due date on their assignments so that it shows up in the calendar.” Yet others ask instructors to make sure due dates are updated from previous semesters and consistent such as a student who explained, “I had an instructor put a discussion post due on the wrong date in the calendar and I was docked points for not knowing the correct date that it was due in the syllabus...It can be confusing when there are conflicting due dates (e.g., Canvas calendar says one thing and the syllabus says something else).”

Students also suggested improvements such as a search function to aid them in locating files that instructors may not have saved in the main course tabs “[s]ome sort of search function might be nice, whether on the homepage or within the individual courses. Each of my professors organized their Canvas pages differently, and it sometimes took a while to figure out where they were keeping everything and how to find all the files I needed. Having a search function may help eliminate some frustrations and save people time when they have professors that are a little less organized or who have a lot of miscellaneous files laying around.”

When asked how to improve Canvas students frequently asked for greater instructor training, often attributing course issues to lack of instructor skill and not issues with the system itself. “I’d train the professors better. I know we were all adapting on the fly, but any inconsistencies were always due to teacher error rather than website problems.” One student suggested greater training around organization basics such as creating a good layout of materials with the learner in mind stating, “[p]rofessors should have some (or better) training for how to design modules in such a way that they are easier to navigate. Nothing major, just using text headers, indentations, and page naming systems that are clear and consistent.” Others suggest training so instructors can make better use of Canvas’ features, “[t]rain the professors how to use every feature correctly. Maybe even create course templates for professors to just fill in with their content to make things easier.”

“Professors should have some (or better) training for how to design modules in such a way that they are easier to navigate.”

RECOMMENDATIONS

Based on the findings of the study, we propose the following recommendations to improve the student experience within the DLE and in their interactions with Canvas and the other tool.

- 1. Test the user experience.** To best understand barriers students will have, it is an effective practice to navigate your course as a student ensuring that the course is easy to use and supports their learning.
- 2. Improve course site organization.** Fully use each of the course site features (e.g., syllabus, assignments, modules, pages, and discussions) and improve their course design and organization, including module layout, to reduce barriers to finding course materials, activities, and assignments.
- 3. Revisit the depth of a course.** While students report getting lost in the deeper levels of the course sites, it is important for faculty and instructors to examine this depth and potentially build more breadth through careful organization of modules and pages.
- 4. Fully utilize assignment dates.** Utilize due dates to populate the dashboard, calendar, and to-do lists to help students manage their time and stay on task.
- 5. Timely update grades and feedback.** Students appreciate the grades and feedback feature including understanding their academic performance and communicating directly with the instructor regarding their feedback.
- 6. Design discussion activities.** While students find the discussions activities enjoyable, the activities need to be carefully pedagogically designed and set-up in the discussion areas to avoid organizational and navigational challenges.
- 7. Make all courses accessible.** Media in courses should be accessible including closed captioning or transcripts for all audio and video for all students.
- 8. Support student use of notifications.** Develop course sites to provide effective notifications for students and provide students with training and orientation to how to effectively use notifications, so it does not hinder their learning.
- 9. Improve faculty and instructor training and development.** By improving training and development for faculty and instructors, students' perception that course site inconsistency hinders their learning can be reduced.

10. Offer more blended and online courses. Students have a preference for blended and online classes with only about 3 out of 10 students preferring fully onsite classes after the initial phase of COVID-19 vaccinations.

11. Ensure all students have devices and broadband. While most students do have a device, broadband, and a study environment, approximately 1 out of 10 students may not necessarily have the needed technology nor environment for their courses and will need these resources.

Areas for further investigation into the Canvas functionality, instructor design and use, and student experience include groups, integration, mobile, communications, and media.

METHODOLOGY

To answer the research questions, data were collected from a student survey where students self-reported their experience with the DLE using a mixed-methods approach. The survey instrument developed assesses student experience in their courses. The survey requested that students report on their experience with, use of, and attitude towards the technologies and in relation to student outcomes (e.g., engagement and learning). Moreover, students were asked about their previous experience with technology, digital learning experience, enrollment preferences, and demographics. The survey also included a series of free-response or open-ended questions to explore students' experiences in greater detail in their own voice.

INSTRUMENTATION

Students enrolled in a Canvas course site were recruited through a Canvas inbox message or an e-mail message and asked to complete a web-based survey. Students received items randomly selected from a pool of items based on the associated measure to reduce survey fatigue yet providing a complete picture of the student experience. The survey requested that students report their (a) perceptions of their experience in the DLE, (b) perceptions of student outcomes, and (c) student characteristics. For detail on the student demographic and outcomes measures, see Joosten, Cusatis, and Harness (2019), Joosten and Cusatis (2020), or Joosten (2020).

Survey instrumentation developed includes existing validated and reliable survey variables, measures, and items from the a.) DETA Research Toolkit (Joosten, 2020) supported by the Every Learner Everywhere network and the WICHE Cooperative for Education Technology, b.) systematic review of the literature (e.g., Borsci, 2015; Findik-Coskuncay, Alkis, & Ozkan-Yildrin, 2018), c.) environmental scan of other postsecondary education documentation and reports (e.g., University of Minnesota, The Penn State University, EDUCAUSE), and d.) meetings with UW instructors, staff, and students.

*Full instrumentation, codebook, and references are available upon request.

PARTICIPANTS

Students were recruited via Canvas Inbox and email. Students received informed consent, and some students did not consent to the study (n=69). The cases where consent was not received were removed. The remaining sample of students' (n=4879) responses was included in the analysis. The analysis will only include these students.

Students across the University of Wisconsin System (n = 101,757) who were enrolled at one of the 12 campuses were recruited to complete a survey. Specifically, participants who accessed the survey and gave consent were students enrolled in a Canvas course site within the University of Wisconsin System Administration DLE.

Representation by institution

Of the 12 institutions that were included in the study, the University of Wisconsin - Milwaukee had the greatest student survey return or completion rate (24.18%) as it is the largest institution taking part in the study. The University of Wisconsin - Oshkosh (10.56%) and the University of Wisconsin - Stevens Point (10.46%) followed with just over 10% each. The remainder of the institutions each comprised less than 10% individually, including the University of Wisconsin - Whitewater (8.46%), University of Wisconsin - Platteville (8.07%), University of Wisconsin - Eau Claire (7.89%), University of Wisconsin - La Crosse (7.71%), University of Wisconsin - Stout (6.80%), University of Wisconsin - Green Bay (6.39%), University of Wisconsin - River Falls (3.54%), University of Wisconsin - Superior (2.75%), and the University of Wisconsin - Parkside (1.72%). Other students' institutions were not reported (1.48%). All institutions are represented in the sample. University of Wisconsin - Madison is not hosted on the University of Wisconsin System server or Canvas application and was not included in the study. See Figure 2.

Student demographic data

Participants reported gender as female (n = 2055; 66%), male (n = 981; 34%), non-binary or non-conforming (n = 74; 2%), and transgender (n = 19; 1%). They reported their race or ethnicity as White or Caucasian (n = 2569; 85%), Asian (n = 205; 7%), Hispanic (n = 154; 5%), Black or African American (n = 107, 4%), American Indian or Native (n = 29; 1%), Pacific Islander (n = 5; 1%), and two or more races (n = 117; 4%). See Table 16. Racially minoritized students were calculated based on race and ethnicity data (n = 564; 12%).

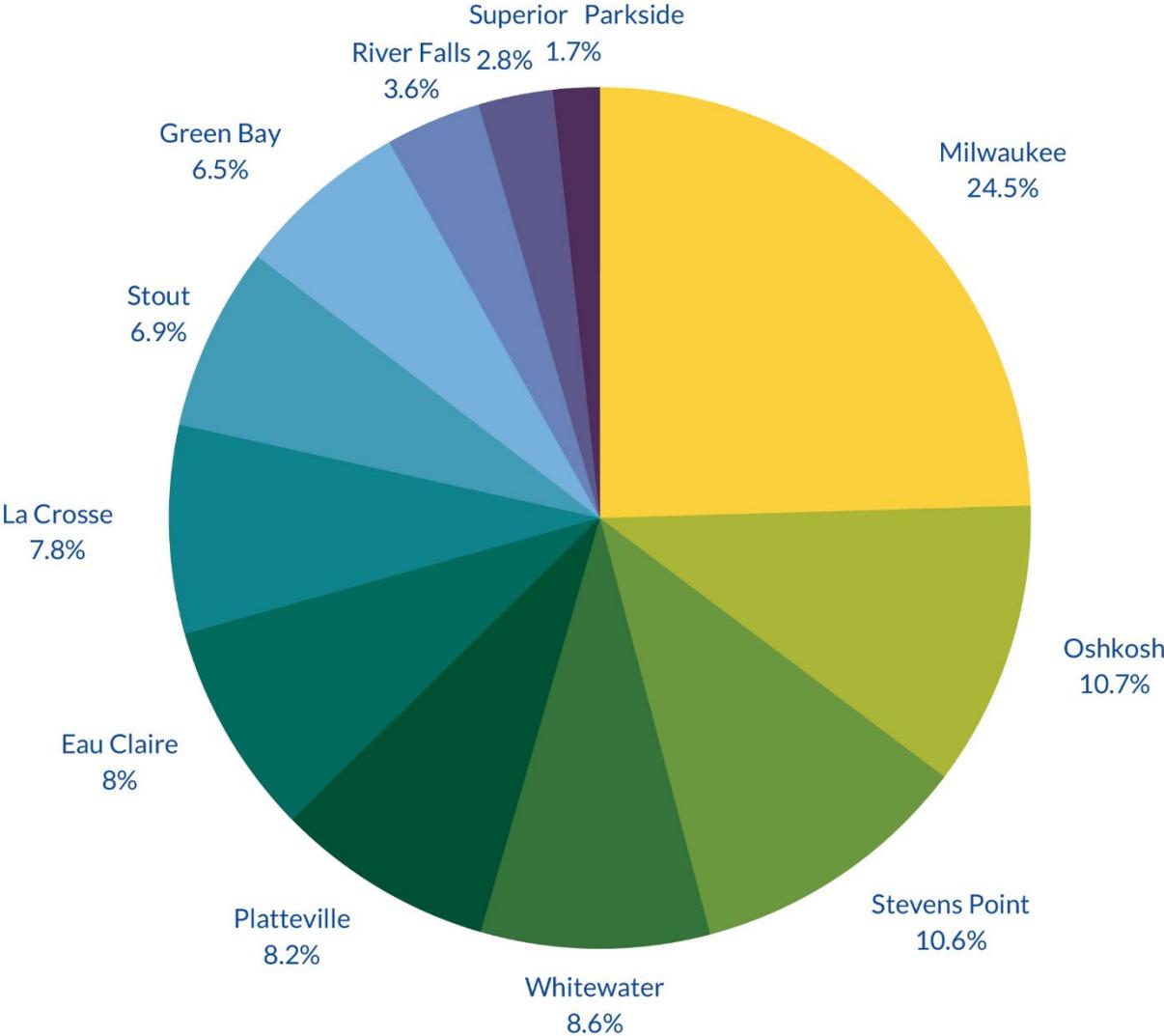
Participants reported their year in school as freshman (n = 566; 19%), sophomore (n = 515; 17%), junior (n = 617; 21%), senior (n = 611; 20%), or graduate student (n = 689; 23%). Some students reported "other" and noted that they were enrolled in a certificate program, second-degree program, high school dual enrollment, or another program or experience beyond traditional undergraduate or graduate degree programming.

Participants reported their Pell grant eligibility (n = 907; 40%). Pell grant eligibility provides information as to whether or not a student is poverty affected requiring additional financial resources through aid including employment. Students also reported their employment status. Students reported working part-time (n = 1393; 45%), full time (n = 958; 31%), unemployed looking to secure work (n = 377; 12%), and unemployed not looking to secure work (n = 346; 11%).

Students reported whether or not they had a disability or impairment (n = 327; 11%). An instrument was administered to better understand the student population with a disability or requiring an accommodation (n = 1141; 23%).

Although we were unable to gather student information system data with generational data, we did ask students about their parents' education in order to determine this measure. While less than optimal, we were able to capture a first-generation sample (n = 753; 15%).

FIGURE 2 | INSTITUTIONAL REPRESENTATION



Approximately 45% (n = 2180) of the students that completed the survey are potentially traditionally underrepresented students. Underrepresented variable was calculated based on multiple measures including the student reporting as poverty-affects, racially-minoritized, a first-generation college student, or disabled.

It is important to note that not all students completed the demographic section. The demographics are placed at the end of the survey to reduce survey fatigue and to prioritize the

more important behavioral and attitudinal data. Future analysis may incorporate student information system data for further analysis of demographic factors.

Student technology access to and use of technology

Students reported their preparedness and readiness for online learning as their access to technology and study environment. Most students reported they had access to technology, including I have a laptop (M = 4.85; SD = .64), I have a phone with Internet access (M = 4.84; SD = .58), and I have a computer (M = 3.61; SD = 1.7). Students also strongly reported having a study environment for online learning, including I have reliable and fast Internet in my home or somewhere I can study online (M = 4.39; SD = .93) and I have a good environment in which to study for my courses (M = 4.29; SD = .98). See Table 16.

Technology and broadband are a challenge for some student: approximately 3% of students do not have a laptop, and 7% do not have broadband internet. Additionally, Over 8% of student do not have a good study environment.

TABLE 16 | STUDENT TECHNOLOGY AND ENVIRONMENT ACCESS

	TTL	Descriptive		Strongly disagree		Somewhat disagree		Neutral		Somewhat agree		Strongly agree	
	n	M	SD	Count	%	Count	%	Count	%	Count	%	Count	%
I have a laptop	3259	4.85	0.64	67	2.10%	15	0.50%	22	0.70%	124	3.80%	3031	93.00%
I have a phone with Internet access	3250	4.84	0.58	42	1.30%	10	0.30%	44	1.40%	236	7.30%	2918	89.80%
I have a computer	3193	3.61	1.70	804	25.20%	111	3.50%	318	10.00%	249	7.80%	1711	53.60%
I have reliable and fast Internet	3255	4.39	0.93	65	2.00%	160	4.90%	132	4.10%	967	29.70%	1931	59.30%
I have a good environment in which to study	3254	4.29	0.98	64	2.00%	206	6.30%	223	6.90%	984	30.20%	1777	54.60%

Students reported their previous online experience as the number of fully online courses they have taken. The majority of students reported they had no previous experience with online courses (n = 1315; 41%) followed by 1 to 4 courses (n = 1203; 37%). The remainder of students reported having taken 5 to 8 courses (n = 317; 10%), 9 to 12 courses (n = 131; 4%), and 12 or more courses (n = 250; 8%).

Students also reported their previous online experience as the number of blended or hybrid courses they have taken. A majority of students reported no previous experience with blended or hybrid courses (n = 2049; 64%). The remainder of students reported 1-4 courses (n = 908; 28%), 5-8 courses (n = 129; 4%), 9-12 courses (n = 54; 2%), and 12 or more courses (n = 85; 3%). See Table 17.

While the majority of students have experience in an online course, it is often a limited number of courses. Also, the majority of student do not have previous experience with blended and hybrid courses. This lack of experience leads to a greater need to manage students' expectations and ensure their online learning readiness and familiarity with course design and technology when enrolling in these course modalities.

TABLE 17 | STUDENT EXPERIENCE BY COURSE MODALITIES

	TTL	0		1 to 4		5 to 8		9 to 12		12 or more	
	n	Count	%	Count	%	Count	%	Count	%	Count	%
Fully online	3216	1315	40.90%	1203	37.40%	317	9.90%	131	4.10%	250	7.80%
Blended or hybrid	3225	2049	63.50%	908	28.20%	129	4.00%	54	1.70%	85	2.60%

Student enrollment behavior and preferences

Students reported their course enrollments prior to, during, and post pandemic as well as their overall enrollment preferences. Prior to the pandemic, students reported their course enrollment as all on-campus (n = 1632; 52%), mostly on-campus (n = 378; 12%), blended (n = 276; 9%), mostly online (n = 153; 5%), and all online (n = 722; 23%). During the spring term in which the survey was administered, students reported their course enrollment as all on-campus (n = 95; 3%), mostly on-campus (n = 119; 4%), blended (n = 503; 16%), mostly online (n = 623; 19%), and all online (n = 1908; 59%). Students reported that after the initial phase of COVID-19 vaccinations their preference for course enrollment as all on-campus (n = 917; 29%), mostly on-campus (n = 653; 21%), blended (n = 529; 17%), mostly online (n = 189; 6%), and all online (n = 850; 27%). See Table 18. Students are anticipating enrolling in courses that require less time on-campus and more blended and online courses.

TABLE 18 | STUDENT ENROLLMENT BEHAVIORS BY COURSE MODE AND TIME

	TTL	All on-campus		Mostly on-campus		Blended		Mostly online		All online	
	n	Count	%	Count	%	Count	%	Count	%	Count	%
Predominant mode prior to pandemic	3161	1632	51.60%	378	12.00%	276	8.70%	153	4.80%	722	22.80%
Predominant mode currently (spring) during the pandemic	3248	95	2.90%	119	3.70%	503	15.50%	623	19.20%	1908	58.70%
Predominant mode preferred for the fall term	3138	917	29.20%	653	20.80%	529	16.90%	189	6.00%	850	27.10%

*Indicates items were truncated or reworded for table formatting.

REFERENCES

- Angelone, L., Warner, Z., & Zydney, J.M. (2020). Optimizing the technological design of a blended synchronous learning environment. *Online Learning*, 24(3), 222-240. <https://doi.org/10.24059/olj.v24i3.2180>
- Auten, B., Croxton, R., & Tingelstad, C. (2020). Extending our reach: Integrating librarians and library resources into Canvas. *Medical Reference Services Quarterly*, 39(2), 101-112. <https://doi.org/10.1080/02763869.2020.1734395>
- Baldwin, S. & Ching, Y. H. (2019). Online course design: A review of the Canvas Course Evaluation Checklist. *International Review of Research in Open and Distributed Learning*, 20(3). <https://doi.org/10.19173/irrodl.v20i3.4283>
- Bernard, R. M., Brauer, A., Abrami, P. C., & Surkes, M. (2004). The development of a questionnaire for predicting online learning achievement. *Distance Education*, 25(1), 31-47. <https://doi.org/10.1080/0158791042000212440>
- Bhattacharjee, A. (2001b). Understanding information systems continuance: An Expectation-confirmation model. *MIS Quarterly*, 25(3), 351-370. <https://doi.org/10.2307/3250921>
- Borsci, S., Federici, S., Bacci, S., Gnaldi, M., & Bartolucci, F. (2015). Assessing user satisfaction in the era of user experience: comparison of the sus, UMUX, and UMUX-lite as a function of product experience. *International Journal of Human-Computer Interaction*, 31, 484-495. DOI: 10.1080/10447318.2015.1064648
- Casey, K., & Patrick, S. (2020). *A Promise for equitable futures: Enabling systems change to scale educational and economic mobility pathways*. Vienna, VA: Aurora Institute.
- Chen, B., Chang, Y., Ouyang, F., Zhou, W. (2018). Fostering student engagement in online discussion through social learning analytics. *The Internet and Higher Education*, 37, 21-30. <https://doi.org/10.1016/j.iheduc.2017.12.002>
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19(2), 189-211. <https://doi.org/10.2307/249688>
- Dargusch, J., Harris, L.R., Reid-Searl, K., & Taylor, B.A. (2017). Creating first-year assessment support: lecturer perspectives and student access. *Distance Education*, 38(1), 106-122. DOI:10.1080/01587919.2017.1299566
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. <https://doi.org/10.2307/249008>
- Fathema, N., & Akanda, M. H. (2020). Effects of instructors' academic disciplines and prior experience with learning management systems: A study about the use of Canvas. *Australasian Journal of Educational Technology*, 36(4), 113-125. <https://doi.org/10.14742/ajet.5660>

Findik-Coşkunçay, D., Alkiş, N., & Özkan-Yildirim, S. (2018). A structural model for students' adoption of learning management systems: An empirical investigation in the higher education context. *Journal of Educational Technology & Society*, 21(2), 13-27.

<http://www.jstor.org/stable/26388376>

Garcia, J.G., Gangan, M.G.T., Tolentino, M.N., Ligas, M., Moranga, S.D., & Pasilan, A.A. (2020). Canvas adoption assessment and acceptance of the learning management system on a web-based platform. *ASEAN Journal of Open Distance Learning*, 12(1).

Gao, F., & Sun, Y. (2017). Comparing the use of a social annotation tool and a threaded discussion forum to support online discussions. *Internet and Higher Education*, 32, 72-79.

<https://doi.org/10.1016/j.iheduc.2016.10.001>

Green, K.R., & Chewing, H.L. (2020). The fault in our systems: LMS as a vehicle for critical pedagogy. *TechTrends*, 64, 423-431. <https://doi.org/10.1007/s11528-020-00480-w>

Grossi, M.G.R., Elias, M.C.A.S., Chamon, C.M., & Leal, D.C.C.C. (2018). The educational potentialities of the virtual learning environments Moodle and Canvas: A comparative study. *International Journal of Information and Education Technology*, 8(7), 514-519.

<https://doi.org/10.18178/IJNET>

Harindranathan, P., & Folkestad, J. (2019). Learning analytics to inform the learning design: Supporting instructor's inquiry into student learning in unsupervised technology-enhanced platforms. *Online Learning*, 23(3), 34-55. <https://doi.org/10.24059/olj.v23i3.2057>

Holmes, W., Nguyen, Q., Zhang, J., Mavrikis, M., & Rienties, B. (2019) Learning analytics for learning design in online distance learning. *Distance Education*, 40(3), 309-329.

<https://doi.org/10.1080/01587919.2019.1637716>

Joyce, M., & Kirakowski, J. (2015). Measuring attitudes towards the internet: The general internet attitude scale. *International Journal of Human-Computer Interaction*, 31, 506-517.

<https://doi.org/10.1080/10447318.2015.1064657>

Koohang, A.A. (1989). A study of attitudes toward computers: Anxiety, confidence, liking, and perception of usefulness. *Journal of Research on Computing in Education*, 22(2), 137-150.

<https://doi.org/10.1080/08886504.1989.10781909>

Kumi-Yeboah, A., Dogbey, J., & Yuan, G. (2017). Online collaborative learning activities: The perceptions of culturally diverse graduate students. *Online Learning*, 21(4), 5-28.

<https://doi.org/10.24059/olj.v21i4.1277>

Kumi-Yeboah, A., Sallar, A.W., Kiramba, L.K., & Kim, Y. (2020). Exploring the use of digital technologies from the perspective of diverse learners in online learning environments. *Online Learning*, 24(4), 42-63. <https://doi.org/10.24059/olj.v24i4.2323>

- Kutis, B. (2020). scaffolding the formal analysis assignment in art history courses to promote learning. *Journal of Teaching and Learning with Technology*, 9, 30-35. <https://doi.org/10.14434/jotlt.v9i1.29162>
- Laurillard, D., Charlton, P., Craft, B., Dimakopoulos, D., Ljubojevic, D., Magoulas, G., & Whittlestone, K. (2013). A constructionist learning environment for teachers to model learning designs. *Journal of Computer Assisted Learning*, 29, 15–30. <https://doi.org/10.1111/j.1365-2729.2011.00458.x>
- Lee, M. K., Cheung, C. M., & Chen, Z. (2005). Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation. *Information & Management*, 42(8), 1095-1104. <https://doi.org/10.1016/j.im.2003.10.007>
- Liu, J.C. (2019). Evaluating online learning orientation design with a readiness scale. *Online Learning*, 23(4), 42-61. <https://doi.org/10.24059/olj.v23i4.2078>
- Martínez-Torres, M. R., Toral Marín, S., Garcia, F. B., Vazquez, S. G., Oliva, M. A., & Torres, T. (2008). A Technological acceptance of e-learning tools used in practical and laboratory teaching, according to the European higher education area. *Behaviour & Information Technology*, 27(6), 495-505. <https://doi.org/10.1080/01449290600958965>
- Mpungose, C.B., & Khoza, S.B. (2020). Postgraduate students' experiences on the use of moodle and canvas learning management system. *Technology, Knowledge and Learning*. <https://doi.org/10.1007/s10758-020-09475-1>
- Muller, K., Scalzo, K.A., Pickett, A.M., Dubuc, L., Dugan, L., McCabe, R., Pelz, W., & Simiele, D. (2020). Ensuring online learning quality: Perspectives from the State University of New York. *Online Learning*, 24(2), 254-268. <https://doi.org/10.24059/olj.v24i2.2004>
- Nickell, G.S., & Pinto J.N. (1986). The Computer Attitude Scale. *Computers in Human Behavior*, 2, 301-306. <https://doi.org/10.1037/t13500-000>
- Park, S. (2017). Analysis of time-on-task, behavior experiences, and performance in two online courses with different authentic learning tasks. *International Review of Research in Open and Distributed Learning*, 18(2), 213-233. <https://doi.org/10.19173/irrodl.v18i2.2433>.
- Ranga, J.S. (2020). Factors influencing student learning in semi-flipped general chemistry courses. *Journal of Chemical Education*, 97(8), 2130-2139. <https://doi.org/10.1021/acs.jchemed.9b01165>
- Rhode, J., Richter, S., Gowen, P., Miller, T., & Wills, C. (2017). Understanding faculty use of the learning management system. *Online Learning*, 21(3) 68-86. <https://doi.org/10.24059/olj.v%vi%i.1217>
- Robinson, H.A., Kilgore, W. & Warren, S. J. (2017). Care, communication, learner support: Designing meaningful online collaborative learning. *Online Learning*, 21(4), 29-51. <https://doi.org/10.24059/olj.v21i4.1240>

- Roblyer, M. D., & Marshall, J. C. (2002). Predicting success of virtual high school students: Preliminary results from an educational success prediction instrument. *Journal of Research on Computing in Education*, 35(2), 241-255. <https://doi.org/10.1080/15391523.2002.10782384>
- Romero Martínez, S.J., Ordóñez Camacho, X.G., Guillén-Gamez, F.D., & Bravo Agapito, J. (2020). Attitudes toward technology among distance education students: Validation of an explanatory model. *Online Learning*, 24(2), 59-75. <https://doi.org/10.24059/olj.v24i2.2028>
- Ross, S.R.P.J., Volz, V., Lancaster, M.K., & Divan, A. (2018). A generalizable framework for multi-scale auditing of digital learning provision in higher education. *Online Learning*, 22(2), 249-270. <https://doi.org/10.24059/olj.v22i2.1229>
- Selwyn, N. (1997). Students' attitudes toward computers: Validation of a computer attitude scale for education. *Computers and Education*, 28, 35-41. [https://doi.org/10.1016/S0360-1315\(96\)00035-8](https://doi.org/10.1016/S0360-1315(96)00035-8)
- Taylor, S., & Todd, P. (1995a). Assessing IT usage: The Role of prior experience. *MIS Quarterly*, 19(4), 561-570. <https://doi.org/10.2307/249633>
- Taylor, S., & Todd, P. (1995b). Understanding information technology usage: A Test of competing models. *Information Systems Research*, 6(2), 144-176. <https://doi.org/10.1287/isre.6.2.144>
- Virtanen, M.A., Haavisto, E., Liikanen, E., & Kaariainen, M.(2020). Ubiquitous learning environments in higher education: A scoping literature review. *Educ Inf Technol*, 23, 985–998. <https://doi.org/10.1007/s10639-017-9646-6>
- Xu, D., & Jaggars, S.S. (2013). Adaptability to online learning: differences across types of students and academic subject areas. *Community College Research Center Working Papers*, 54. <https://doi.org/10.1353/jhe.2014.0028>

END