

# **Apps and Teaching Strategies for Enhancing Learning in Higher Education during the COVID-19 Pandemic**

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## **ABSTRACT**

The COVID-19 pandemic introduced an abrupt change in human behavior and raised significant challenges in higher education. This pandemic has altered our learning behavior by affecting the relative importance of information and forcing teaching and learning into a framework that accommodates human behavioral measures to avoid disease transmission primarily. However, aside from Apps and digital modifications, Universal Design for Learning (UDL) strategies are also critical to reducing barriers to teaching and learning remotely at home. Many mobile Apps were created or modified to address teaching and learning strategies during the pandemic. However, complete knowledge of the quantity and quality of Apps related to coronavirus disease (COVID-19) is lacking. Also, no directory has been established listing all the Apps developed to address the COVID-19 pandemic. The purpose of this systematic review of the literature was to identify challenges that universities faced during the unexpected request for previous face-to-face classes to be taught remotely. The review was also structured to identify UDL-congruent strategies and Apps that can mitigate any number of challenges for faculty and students, including those with disabilities. Finally, this review was designed to synthesize and organize information about the strategies and Apps so that administrators and faculty can use it to address the educational needs of all of their students.

**Keywords:** universal design for learning, mobile apps, remote instruction, pandemic

## **1 Introduction**

The outbreak of the COVID-19 virus forced a major shift in university experiences for faculty and students that would have been unimaginable only months earlier. In March 2020, the pandemic forced the closure of most U.S. university campuses, obliging millions of students to finish their semester via remote learning. The rapid pivot to remote learning required mastering new learning platforms and forms of communication. In addition, it required sudden and complete dependence on digital devices and steady internet connections. Although all students faced the challenges of adapting to novel conditions in the middle of a semester, not all students began that hasty transition on equal footing. (Katz, Jordan, & Ognyanova, 2021). For example, students with disabilities were generally the last to gain access to eLearning platforms and forms of communication. Furthermore, the imposition of social distancing deepened the process of segregation and exclusion for individuals with disabilities and those from culturally and/or linguistically diverse groups.

As a result, universities wrestle with a myriad of problems in their attempts to manage the education of students with disabilities. They struggle to find creative ways and alternate



solutions to provide needed services during the pandemic while maintaining compliance with applicable laws and regulations (Kennedy, 2020). The seriousness and the complexity of the situation have created high stress, confusion, frustration, and often conflicting solutions among administrators, faculty, and staff in institutions of higher education. Teaching strategies and technology applications (Apps) that are congruent with the major principles of the Universal Design for Learning (UDL) educational framework have a vital role to play in addressing the educational needs of students and faculty during this difficult time. Thus, the purpose of the literature-based research described herein was to identify UDL-congruent teaching strategies and technology Apps that higher education personnel can utilize to deliver and support effective eLearning for students with a variety of learning characteristics and challenges.

## **2 Methodology**

### **2.1 Search Strategy**

The author reviewed the literature to identify challenges that faculty and diverse learners face during the COVID-19 pandemic (e.g., learning, accessibility and functionality technology vision, mobility, mental health, etc.) that might be ameliorated by appropriate teaching strategies and Apps. The databases of ERIC, Google, Scholar, Education Research, and PubMed were searched to identify teaching/learning strategies and Apps for providing faculty and students with instructional, social-emotional, and technological support.

The following search terms were used to identify articles related to teaching strategies: (*COVID-19 AND Apps for learning in Higher Education*); (*Teaching Strategies AND Higher Education AND COVID 19*); (*Teaching Strategies AND Higher Education AND Pandemics*); (*Academic Challenges in Higher Education during COVID-19*); (*UDL Strategies during COVID 19*). Relevant Apps were sought using the following search terms: (*COVID-19 (Apps) OR (UDL) OR (Disabilities) (Mobile Apps)*) where the search terms were used to identify relevant Apps.

### **2.2 Selection Criteria**

Three criteria were developed to guide the final selection of articles to be included in the review. First, the article had to have a publication date of March 2020 - the date the first university canceled in-person classes in favor of remote learning options - to present. Second, the article had to address COVID-19-related challenges to teaching and learning in higher education. Finally, the article had to identify teaching/learning strategies or Apps that reflected one or more of the three main principles of UDL: 1) representation - offering information in more than one format; 2) action and expression – providing more than one way for learners to interact with the material and to show what they have learned; 3) engagement – using multiple ways to motivate students and sustain their interest. (CAST, 2020; Coy, 2020; Devitt, Bray, & Chorcora, 2020; Dickinson, & Gronseth, 2020).

## **3 Results**

The methodology described produced 30 articles that met the three selection criteria. Two tables were developed and populated to efficiently review these articles. Tables 1 and 2 provide key information regarding UDL-congruent teaching/learning strategies and Apps, respectively, for enhancing teaching and learning in higher education during the pandemic.

### 3.1 UDL-congruent strategies for enhancing teaching and learning

Eighteen (18) articles reviewed suggested strategies for addressing COVID-19-related teaching and learning challenges in higher education. Among the student-focused challenge areas, these articles addressed were: content delivery; student engagement; stressors impacting female students, in particular; mental health; student support; and digital inequality (Kushwaha, 2020). The articles also addressed faculty-focused challenges related to teaching and learning. These faculty-focused challenge areas included: faculty workloads; social-emotional issues; tenure and promotion; institutional support; professional development needs; technology-related difficulties; and monitoring of COVID-19 transmission. The teaching/learning strategies suggested by a significant majority of articles for addressing these challenges were fully congruent with the three major principles of UDL (CAST, 2020; Coy, 2020; Devitt, Bray, & Chorcora, 2020; Dickinson & Gronseth, 2020) Specifically, 11 articles addressed all three principles; three (3) articles were moderately congruent, addressing two principles and four (4) articles were minimally congruent in that they addressed only one (1) of the principles.

**Table 1:** *Strategies for Enhancing Teaching-Learning During the COVID-19 Pandemic*

<b>AUTHOR</b>	<b>DATE</b>	<b>CHALLENGE</b>	<b>STRATEGY SUGGESTED</b>	<b>UDL Congruence</b>
Dickinson & Gronseth	6/5/20	<ul style="list-style-type: none"> <li>. Delivering content in real-time</li> <li>. Enabling active learning and reflective practice</li> <li>. Preventing privacy threats</li> <li>. Providing options for perception</li> <li>. Using simulations</li> </ul>	<ul style="list-style-type: none"> <li>. Facilitate small group conversations</li> <li>. Increase security in synchronous sessions</li> <li>. Provide functional improvements</li> <li>. Modify task design</li> </ul>	1, 2, 3
CAST	5/6/20	<ul style="list-style-type: none"> <li>. Engagement</li> <li>. Representation</li> <li>. Action and Expression</li> </ul>	<ul style="list-style-type: none"> <li>. Work alone or with others</li> <li>. Receive information via various cultural, sensory, linguistic modes</li> <li>. Individualized expression</li> </ul>	1, 2, 3
Devitt, Bray & Chorcora	7/8/20	<ul style="list-style-type: none"> <li>. Engagement</li> <li>. Professional Development</li> </ul>	<ul style="list-style-type: none"> <li>. Transactional modes of communication</li> <li>. Virtual platform delivery</li> <li>. UDL Platform</li> </ul>	1, 2, 3

Chronicle of Higher Ed Ao, B. Mickey, E. Community Change Zahneis, M.	2020 12/21/20 9/4/20 4/15/20 7/22/20	<ul style="list-style-type: none"> <li>. Mental Exhaustion</li> <li>. Stressors of women (work-life balance, diminished child-care, etc.)</li> <li>. Physical health/safety</li> <li>. Tenure and Promotion process</li> <li>. Lack of institutional support</li> </ul>	<ul style="list-style-type: none"> <li>. Counseling</li> <li>. Health Check-Ins</li> <li>. Delay promotion</li> <li>. Delay tenure for one year</li> </ul>	1
Sherlock, J.	8/11/20	<ul style="list-style-type: none"> <li>. Planning for the unknown</li> <li>. Supporting students</li> </ul>	<ul style="list-style-type: none"> <li>. Digital one-stop shopping</li> <li>. Planning conferences and lectures</li> <li>. Blended learning</li> <li>. Transition activities</li> <li>. Self-service</li> </ul>	1
Noor, S.; Isa, F. Md. & Mazhar, F.F.  Teachers, S.	2020   8/28/20,	<p>Technology Issues:</p> <ul style="list-style-type: none"> <li>. Poor network infrastructure</li> <li>. Lack of technical knowledge</li> <li>. Limited educational resources</li> <li>. Poor mental health</li> </ul>	<ul style="list-style-type: none"> <li>. Emergency training of professors</li> <li>. Counseling of students</li> <li>. Online class using social media</li> <li>. Online teaching</li> </ul>	1, 2
Garajek, S.	4/2/20	<ul style="list-style-type: none"> <li>. Heavy faculty workload</li> <li>. Anxiety</li> <li>. Grief/Devastation</li> </ul>	<ul style="list-style-type: none"> <li>. Remote Work</li> <li>. Develop plans and anticipate challenges</li> <li>. Transition to 100% remote learning</li> <li>. Empower student success</li> </ul>	1, 2
Coilado-Burrell, R.; Escudero-Vilaplana, V.; Villanueva-	8/25/20	<ul style="list-style-type: none"> <li>. Lack of knowledge about quality and quantity of Apps related to COVID19</li> <li>. Poor monitoring of infection transmission</li> </ul>	<ul style="list-style-type: none"> <li>. Use Apps on the smartphone to monitor infections</li> </ul>	1, 2, 3

Bueno, C.; Herranz- Alonso, A.; Sanjurojo- Saez, M.				
Devitt, A., Bray, A., & Chorcora, E.	7/8/20	<ul style="list-style-type: none"> <li>. COVID Impact on Faculty Reviews</li> <li>. Lack of resources</li> <li>. Lack of training</li> <li>. Travel/Conference Restrictions</li> <li>. Increased time for class preparation</li> </ul>	<ul style="list-style-type: none"> <li>. Statement re: COVID Impact on faculty work-load and changes to courses</li> <li>. Seek help from the Office of Faculty Development</li> <li>. Obtain faculty mentors</li> <li>. Develop Reopening plans</li> <li>. Technology workshops</li> </ul>	1
Kushwaha, A.	8/2/20	<ul style="list-style-type: none"> <li>. Time management</li> <li>. Scanning documents</li> <li>. Lack of Cloud space</li> <li>. Linguistic challenges</li> <li>. Lack of inspiration</li> </ul>	<ul style="list-style-type: none"> <li>. Develop checklists</li> <li>. Keep notes in one location</li> <li>. Documents requiring Digitize signatures</li> <li>. Expand space as needed</li> <li>. Communicate with diverse students</li> <li>. Inspirational talks</li> </ul>	1
Snelling, J. & Fingal, D.	3/16/20	<ul style="list-style-type: none"> <li>. Digital inequity</li> <li>. Lack of training</li> <li>. Time management</li> <li>. Attrition</li> </ul>	<ul style="list-style-type: none"> <li>. Provide devices and hot spots</li> <li>. Prepare step-by-step guides on how to use, access online learning platform and tools</li> <li>. Develop daily schedule</li> <li>. Increase Advising</li> </ul>	1, 2, 3
Flaherty, C.  Mickey, E.	4/21/20`  9/4/20	<ul style="list-style-type: none"> <li>. Women's poor time management</li> <li>. Supports</li> </ul>	<ul style="list-style-type: none"> <li>. Boundaries</li> <li>. Reasonable Schedules</li> <li>. Personalized experiences</li> <li>. Access to and integration of multiple Apps</li> </ul>	1, 2, 3

Lashley, M.; Acevedo, M.; Cotner, S. & Lortie, C.	9/25/20	<ul style="list-style-type: none"> <li>. Impact of fear on what and how we teach</li> <li>. Emergency remote teaching</li> <li>. Inclusive teaching</li> <li>. Child and elder care</li> <li>. Job loss</li> </ul>	<ul style="list-style-type: none"> <li>. Regular check-ins with Students</li> <li>. Synchronous and asynchronous class time for students with children or caring for elderly parents</li> </ul>	1, 2
Mandak, K.	4/6/20	<ul style="list-style-type: none"> <li>. Supports for adults with communication needs</li> </ul>	<ul style="list-style-type: none"> <li>. Guides and resources</li> <li>. Communication Boards</li> <li>. Health Passports</li> <li>. Multimodal techniques for communicating</li> </ul>	1, 2, 3
Soni, V.	6/18/20	<ul style="list-style-type: none"> <li>. Need to bridge learner-educator gap</li> <li>. Poor internet service</li> </ul>	<ul style="list-style-type: none"> <li>. Use Google meet for STEM laboratory practices</li> </ul>	1, 2, 3
UNESCO	5/15 20	<ul style="list-style-type: none"> <li>. Inclusion</li> <li>. Need for new learning/teaching methodologies</li> <li>. Need for eSkills</li> <li>. Collaborative research</li> <li>. Academic support</li> </ul>	<ul style="list-style-type: none"> <li>. Zero rate Internet service</li> <li>. Content specialists</li> <li>. eTech development</li> <li>. Innovations to prevent dropouts</li> <li>. Hybrid learning</li> </ul>	1, 2, 3
Valenzuela, J.  Lederman, D.	4/23/20  3/25.2620	<ul style="list-style-type: none"> <li>. Consistent student engagement</li> </ul>	<ul style="list-style-type: none"> <li>. Virtual breakout rooms for storytelling, turn and talk jigsaws</li> <li>. Use of interactive and dynamic slides</li> <li>. Social engagement</li> </ul>	1, 2, 3
ISTE	4/7/20	<ul style="list-style-type: none"> <li>. Social-emotional challenges</li> </ul>	<ul style="list-style-type: none"> <li>. Check-in regularly</li> <li>. Balance asynchronous and synchronous activity</li> <li>. Facilitate group collaboration</li> <li>. Show sympathy</li> <li>. Address special needs of students</li> </ul>	1, 2, 3

### 3.2 UDL-congruent Apps for enhancing teaching and learning

Ten of the articles reviewed yielded 27 Apps that could help address COVID-19-related teaching and learning needs in higher education. Eleven (11) of these Apps addressed three student-focused needs: engagement, creativity and imagination, and science. Seven (7) of these student-focused Apps were fully congruent with the three major UDL principles; four (4) Apps were minimally congruent. Fifteen (15) Apps addressed the teacher-focused need for

support and learning management systems. Eight (8) of these articles were fully congruent with UDL principles; seven (7) were minimally congruent with UDL principles. See Table 2.

**Table 2:** *Apps for Enhancing Teaching-Learning During the COVID-19 Pandemic*

<b>Author/Date</b>	<b>Need</b>	<b>App</b>	<b>Price</b>	<b>UDL Congruence</b>
Devitt, Bray, & Chorcora (2020); Osmanski (2020)	Engagement	<i>Zoom</i>	Free K-12	1
		<i>Asana</i>	Free Subscription 10.99 per month and up	1, 2, 3
Coy (2020)	Engagement	<i>Google Meet</i>	Some free subscriptions or \$6 per month	1, 2, 3
Dickinson & Gronseth (2020)	Engagement	<i>Microsoft Teams</i>	Part of MO subscriptions \$5 per month	1, 2, 3
Devitt, Bray & Chorcora (2020); Coy (2020)	Engagement	<i>Facebook</i>	Free	1, 2, 3
		<i>You tube</i>	Free	1, 2, 3
		<i>WebX Meetings</i>	Customized Costs start at \$150 per year	1, 2, 3
Cho (2021)	Engagement	<i>Whats App</i>	Free	1
Lee (2020)	Creativity and Imagination	<i>Doodle Matic</i>	\$29.99	1
Govindarajan & Srivastava (2020); Lee (2020); Dickinson & Gronseth (2020)	Augmented reality in science	<i>Vividbooks</i>	Free for Parents Full package \$700 or by subject	1, 2, 3
Osmanski (2020)	Augmented reality in science	<i>Science 360</i>	Free online	1

Osmanski (2020)	Teaching Support	<i>Hippo Campus Math Science</i>	\$39 per month & up	1
Coy (2020)	Teaching Support	<i>Google Forms</i>	Free	1
Kushwaha (2020)	Teaching Support	<i>Evernote</i>	Basic Free 14.99 per month Business Premium \$60 per year	1
		<i>TED-ED</i>	Free Initially - Starts at \$20	1, 2, 3
		<i>Slido</i>	Free	1
Coy (2020)	Teaching Support	<i>Screencastify</i>	Free 5-minute limit \$49 per year	1
		<i>Belouga</i>	Free-Subscription or \$14 per month	1
		<i>Khan Academy</i>	Free	1, 2, 3
		<i>Nearpod</i>	Free Basic	1
		<i>Microsoft Office Tools</i>	\$5.67 per month and up	1, 2, 3
Noor, Isa & Mazhar (2020)	Teaching Support	<i>Google Classroom</i>	Free	1, 2, 3
Dickinson & Gronseth (2020)	Teaching Support	<i>Flipgrid</i>	Free	1, 2, 3
Dickinson & Gronseth (2020)	Learning Management Systems (LMS)	<i>Blackboard</i>	Priced by school or class	1, 2, 3
		<i>Canvas</i>	Priced by school or class	1, 2, 3
		<i>Moodle</i>	Free Trial	1, 2, 3



## **4 Conclusion**

The challenges to higher education that are surfacing as a result of COVID-19 require flexible solutions that can address the unique demands that the pandemic has created for faculty and students. These demands cover a broad spectrum ranging from social-emotional and instructional needs to environmental and technological needs. The current research project identified teaching/learning strategies and Apps with the potential to meet these needs and decrease the negative impacts of COVID-19 on the higher education environment. The potential of the strategies and Apps presented for ameliorating pandemic-related needs and impacts was evidenced in their congruence with the major principles of UDL. For faculty, UDL provides a guided framework that enables them to make learning accessible to all students. For students, adherence to UDL principles removes barriers to learning by expanding the ways information is communicated, the ways learners are supported and motivated, and the ways learning is assessed. All of the teaching/learning strategies and Apps were congruent with at least one of the three major UDL principles. However, more of the teaching/learning strategies as opposed to the Apps were congruent with all three UDL principles (i.e. fully congruent). Specifically, 61% of the teaching/learning strategies were fully congruent while 55% of the Apps were fully congruent. The pressure to transition, virtually overnight, to remote teaching and learning placed an unexpected and undue burden on institutions of higher education resulting in a lower degree of full UDL compliance for Apps. In response to COVID-19, several Apps were created or enhanced, but without sufficient time for the research and development (R&D) that would have assured full congruence with UDL, adequate technological support for faculty, and universal accessibility for diverse students. Teaching/learning strategies were more UDL-congruent than the Apps, but they too fell short of 100% UDL congruence. Faculty lack of knowledge, inexperience, and unease with eLearning is most likely explanations for this nonideal situation. Further research should take place in the near future to re-assess the UDL-congruence of both teaching/learning strategies and Apps.

## **5 Declarations**

### **5.1 Competing Interests**

The author certifies that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

### **5.2 Publisher's Note**

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