Expanding Online Professional Learning in the Post-COVID Era: The Potential of the Universal Design for Learning Framework

Younsung Kim & Larisa Olesova



Teaching and learning in higher education have dramatically changed during the COVID-19 pandemic. The global health crisis has forced faculty to experiment with virtual teaching in a short amount of time, and students were compelled to learn online. While online instruction during COVID-19 is considered contingent-based virtual instruction, it would be most likely that online courses would be part of the instruction modalities in the post-COVID era. In this article, we document the process of creating an asynchronous online course swiftly, guided by the Universal Design for Learning (UDL) framework. It sheds light on the value of the UDL to expedite the scale-up of online professional learning while sustaining student interaction and engagement.

Introduction

The COVID-19 pandemic led higher education to establish virtual classrooms quickly. In the wake of the global health crisis and the need to continue learning, emergent online instruction created the opportunity to shift higher education from in-person classrooms to a boundless digital realm (Adedoyin & Soykan, 2020; Hodges et al., 2020; Zimmerman, 2020). The shift may continue. A recent survey of students who took emergent virtual instruction during the pandemic indicated they would more likely choose fully online courses or blend them with in-person classes in future semesters (McKenzie, 2021). This situation requires a critical assessment of how to best utilize remote instruction methods without sacrificing learning quality in online education. Indeed, concerns were raised that the rapid transition to online teaching in 2020 would acquiesce to tailored learning outcomes and diminished course quality compared to in-person instruction (Adedoyin & Soykan, 2020; Johnson et al., 2020). With the outlook of online learning being part of

instructional modalities after the pandemic, some universities have started to seriously consider the mission to restore learning and refine online education (Lockee, 2021; McKenzie, 2021).

Prior research suggests that online learning success is associated with instructional design. In many cases, instructors perform in an automatic, intuitive manner and do not know and cannot verbalize accurately what they do or how they do it, which underscores the need to plan and design learning in a more thoughtfully structured way (Hannum, 2012). Despite the criticism against the rigid and time-consuming processes (Gordon & Zemke, 2002, Hannum, 2005, 2012), the traditional instructional design approach is valuable for instructors who are new to online teaching. It has also been instrumental in creating "emergency teaching" during the pandemic. Acknowledging emergency teaching is far from well-designed online learning (Hodges et al., 2020), scholars have explored how the instructional design process can support students in adapting to emergency virtual learning (Biwer et al., 2021, Green et al., 2020) and what the current pandemic online learning experiment means for the future (Weir, 2021). Research indicates the power of instructional design processes that could uplift the quality of online education.

This article aims to explore if the learning design approach can swiftly create an online course without losing student interaction and engagement. Universal Design for Learning (UDL) is a research-based learning design framework that underscores teaching and learning to meet diverse students' needs. It aims to support a broad range of learners who engage in learning and achieve mastery in different ways through multiple means of engagement, multiple means of representation, and multiple means of action/expression (Evmenova, 2018; Meyer et al., 2014). The principles promote flexibility in learning, drawing on an analytics-based understanding of learners to support student learning.

Relying on a case of applying the UDL principles to an upper-level environmental policy course, we offer evidence that this approach led to greater student interactions and high-level engagement in learning materials during the entire semester. The findings provide a deeper understanding of when to alter assignment delivery mode by following the UDL principles. The case also offers insight into refining and expanding online learning in higher education, facing high-level uncertainty after the pandemic. As online learning is capable of much more than emergent virtual instruction during the pandemic, higher education may consider the UDL more proactively to integrate online education as part of instructional modalities while expediting the pace of developing online and blended courses.

Supporting Literature

Universal Design for Learning

Universal Design for Learning (UDL) is a scientifically-based framework for developing curricula that support a broad range of learners. It admits learner diversity as a function of human variability since learners would engage in learning and achieve mastery in different ways (Evmenova, 2018; Meyer et al., 2014). The framework was introduced by the Center for Applied Special Technology (CAST) in the 1990s (Edyburn, 2013), and it underscores the need to design courses that are accessible to students with and without special needs (Rao et al., 2015). UDL forms a redundancy effect and allows for clarity and easier comprehension of instruction (Rose et al., 2005).

Implementation of UDL is hinged upon three principles. The first principle is to use multiple means of engagement. To do so, teachers would need to motivate students, foster collaboration and community, and facilitate personal skills and strategies for self-regulation in online courses. During the pandemic, research finds that students are mostly less motivated compared to the situation before the crisis started, implying the potential benefit of the UDL-based learning environments (Biwer et al., 2021; Son et al., 2020). Second, UDL relies on multiple means of representation. That means teachers present learning content with various formats like text, audio, or video. Additional simulations, interactive websites, or synchronous sessions can elicit greater representation (Evemenova, 2018). The third principle is multiple means of action/expression. Under this principle, teachers need to allow students to demonstrate what they know in multiple ways (CAST, 2018; Rose & Meyer, 2002). As such, students would obtain options to take part in discussions using text, video, etc. Assignments and projects would end under flexible schedules and students can receive feedback

on their assignments multiple times. These three principles enrich any learning environment and ensure the success of all learners.

Implementing UDL is possible in in-person, hybrid, or online learning environments, and online learning can particularly maximize the flexibility of forming UDL-based courses with greater creativity. Various assistive and instructional technologies have made it easier and more efficient to create the redundancy effect by multiple means of engagement, representation of content, and action/expression (Dell et al., 2015). Studies show that videos and narrated presentations (King-Sears et al., 2015), video games (e.g., Marino et al., 2014), and computer-based reading programs (Hall et al., 2015) are exemplary tools to facilitate UDL-based course development. Technologies also help teachers establish flexible assessments in recognition of variability in students' abilities, needs, and preferences (Robinson & Wizer, 2016).

The UDL implementation can also be accelerated by modeling guidelines and checkpoints and when teachers are trained to thoughtfully integrate UDL methods in their lesson designs. Nine guidelines and thirty-one checkpoints were developed with the aid of research-based best educational practices (CAST, 2011; Israel et al., 2014; refer to Appendix 1). Evmenova (2018) suggested that those practices and checkpoints are instrumental in creating UDL-based learning environments in asynchronous online courses, emphasizing the role that faculty training plays in incorporating UDL principles into lesson plans.

UDL is centered around flexibility. Flexibility learning design can sustain students' motivation for learning throughout the entire learning stage. Prior research indicates that students' learning intents are different. These differences usually lead to student preferences for engaging in surface or deep learning through course activities and learning tasks (Johnson et al., 2017; Maina et al., 2012). When enhancing flexibility in learning environments, students can focus on how students approach their learning and what they prefer to know and understand in the subject area (Means et al., 2009). To this end, instructors can ask students to share their feedback about the course assignments or rely on learning analytic mechanisms for necessary modifications. Those approaches would enable instructors to capture student learning strategies, tactics, preferred practices, or patterns systematically and to utilize data and information constructively. For instance, web-based learning analytics allows instructors to understand students' online behavior patterns like posting frequencies or lengths of their posts and use the information in planning, designing, and encouraging online discussions and peer interactions.

Instructional Design Process

Context and Learner Analysis

This section will explain the process of converting the environmental policy course from face-to-face to its asynchronous online delivery, relying on the UDL framework. The course was delivered to a public university in the mid-Atlantic region of the United States. The university has a diverse student body and culture from highly engaging and vibrant student communities. The university is committed to impactful, transformative learning experiences concerning online learning and teaching. During the COVID-19 crisis, the university leadership has committed to offering emergency-based online courses with the full support of the in-house instructional designer team. Since students come from 130 countries and 50 states, the diverse demographic data seem to hint at the potentially hidden demands for high-quality online education during the post-Covid period.

The environmental policy course is required for environmental science and environmental studies students. With the rapidly rising interest in climate change and sustainability, the course draws students from diverse academic disciplines, including communication, engineering, management, etc. The course provides an overview of various environmental policy and sustainability issues, covering biodiversity loss, climate change, pollution, energy transition, and environmental justice.

The in-person course has utilized an active learning pedagogical approach in which students are empowered to do more than just listen to learn as well as engage in reading, writing, and discussing the problem-solving tasks (Bonwell &

Eison, 1991). As part of the active learning strategy, a role-playing activity was included to have students contemplate the true notion of environmental justice. The activity mirrored real-world politics, inducing deep learning of structural injustice and policies designed to address the issue systematically. Student feedback indicates the active learning approach, including in-class discussions and the role-play simulation, as a vital element of learning.

The course conversion to online platforms was planned and offered in 2016. Thirty-six students registered for the first asynchronous online course. Students were primarily full-time between 20-29 years old. One of the third students majored in environmental science and sustainability studies (66.7%). Students also came from public and international affairs (22.2%), global affairs (5%), and other majors (5%). Female students (69.4%) were more than two-thirds of male students (30.6%).

The following sections present the information on the instructional design process with the ADDIE Model. The ADDIE approach was used since it allowed for a more organized workload for both instructors and learners (Allen & Sites, 2012). The sections of the Design, Development, and Evaluation phases were described in order.

Design

Multiple means of engagement

The course was offered on the asynchronous online platform Blackboard Learning Management System (LMS). Facilitation in online courses is the central strategy to motivate students and engage them in deep learning (Evmenova, 2018). In the first half (seven weeks) of the online course, the design approach relied on an individual/reflection mode where everyone has access to each one's assignments. Under this individual/reflection mode, individual reflection was prioritized over group discussions. This way made it easier for the instructor to track each student's learning progress. Feedback or comments on students' reflections was a primary facilitation tactic, and online discussions were also added to give students a sense of the learning community. Establishing a collaborative community of inquiry is known to be essential for building social presence, which refers to the ability to perceive others in an online environment as "real." Prior research has shown that when social presence is combined with appropriate teaching presence such as instructional design, facility of the course and activities, and direct instruction, the result can be a high level of cognitive presence learning to fruitful critical inquiry (Garrison et al., 2000; Garrison, 2017)

Survey to provide options for sustaining efforts and persistence

Multiple means of engagement provide options for sustaining effort and persistence. Fostering collaboration and community is a strategy to sustain students' motivations in online courses. Teachers are encouraged to incorporate technology in the UDL design cycle to enrich any learning environment and ensure the success of all learners (Castleberry & Evers, 2010, Coyne et al., 2012, Lock et al., 2016; Rao & Meo, 2016).

Relying on the UDL principle, an online survey was executed at the end of the semester. The survey intended to identify whether students were content with the first learning design strategy. The survey was optional, and students were asked to share overall satisfaction with the online course delivery mode. Students were also asked to indicate their preference toward individual/reflection versus group/discussion mode in assignments and online discussions. The survey could inform any demands for small variations of learning tactics during the remaining half of the course. In particular, it could provide a confirmed perspective on how to experiment with the role-playing activity and its corresponding assignment, the stakeholder position paper. Students wrote individual stakeholder papers per stakeholder roles assigned in the in-person format. The papers were instrumental in preparing actual class hearings. The role-playing and stakeholder position paper could be virtually designed in two options: (1) Assignment Type I - Individual/Refection and (2) Assignment Type 2 - Group/Discussion. Table 1 outlines the two assignment options for student interactions.

Table 2

Assignment Options for the Stakeholder Position Paper Delivery

	Assignment Format		
Individual vs. Group Work	Reflection vs. Discussion	Final Assignment Combination	
Assignment Type 1	Individual	Reflection	Individual/Reflection
Assignment Type 2	Group	Discussion	Group/Discussion

* Individual/Reflection versus Group/Discussion

Twenty-five students (69.4%) completed the mid-term survey. Out of twenty-five students, 22 students (88%) indicated that they liked the first half of the fully asynchronous online course. Almost all students (96%) indicated that the course helped them learn about environmental policy. When we asked how we could improve the course later in the second half, 14 students (56%) said no further course improvements were needed. Other remaining students (44%) suggested slight reductions in required readings and enhanced peer-to-peer interactions. Some students suggested required comments on peers' reflection posts that they completed during the first half of the course since peer commenting on online discussions could provide opportunities for more interactions with their classmates. They seemed to miss more real interactions they could have had in traditional in-person instruction.

Development

Relying on students' feedback, we decided to choose a Group/Discussion mode, Assignment Type 2, for stakeholder position paper assignment and online-based Environmental Justice (EJ) case hearing (Table 1). We adopted the collaborative format because fostering collaboration and community is a critical element for enhancing engagement in the UDL-based environments and establishing social presence (Evmenova, 2018; Garrison et al., 2000; Garrison, 2017). While not all students wanted more interactions, still nearly half of students preferred more interactions. Additionally, this discussion-based approach would be closer to the in-person delivery format, fostering students' better understanding of the environmental justice-related complexities and the need to consider diverse stakeholder perspectives. The EJ case was discussing whether or not to locate pollution facilities in a minority community where disproportionate health burdens were observed.

We also added one online discussion where students responded to instructional question prompts. Therefore, the second half of the course converted into a fully collaborative design, including several collaborative assignments (i.e., collaborative paper writing, peer reviews, and online discussion).

Reformatting Stakeholder Paper

The environmental justice case-based stakeholder position paper provided a unique opportunity to experience realworld politics in placing pollution facilities in communities of color or low income. Students in the in-person mode were randomly assigned to one stakeholder and asked to write an individualistic position paper. Students then convened in class to discuss and debate the case in groups, representing assigned stakeholders. The individual stakeholder position paper served as a vehicle for students to organize their ideas before the hearing.

Figure 1

Stakeholder Position Paper Assignment Design in Face-to-Face Class



Students were similarly assigned into stakeholder groups in redesigning the assignment in the online mode. They were then asked to post position-based opinions, advocating their assigned roles. On a discussion forum, six groups were created. Students were then invited to post their contributions to their group discussion threads. After all students in a group shared their opinions, a group member volunteered to develop the group's collaborative position paper by synthesizing information. Group-based position papers were posted on the Discussion Board, and all students can access other groups' papers. Each group participated in further peer-review discussions to provide critique and comments on other groups' stakeholder papers.

Figure 2





Evaluation

Student Participation, Interaction, and Engagement

We used the Blackboard learning analytics to explore students' interaction and engagement levels after group and discussion-based assignments, and a collaborative design approach was taken in the second half. The Blackboard learning analytics data provides critical information about students' online behavior on technology-enhanced platforms (Becker, 2013; Harindranathan & Folkestead, 2019). We tracked students' participation, levels of interaction, and engagement.

We examined the number of hours students spent online during the first half of the course when the individual/reflection mode was used to measure students' participation. Then, we compared the numbers with the hours they spent in the second half of the group/discussion mode. The results revealed that students were more active during the second half and spent more time (n=711.23) when compared with the first half (n=546.76). Each student spent more time reading other students' posts and the course content during the second half of the course. Table 3 shows the total and average time students spent online. The table also indicates which weekdays were more and less active.

Table 3

	Total Time	Average Time	Highest Active Day	Lowest Active Day
Week 1-7	546.76 hrs	14.78 hrs	Tuesday: 266.77 hrs	Saturday: 18.57 hrs
Week 8-14	711.23 hrs	19.22 hrs	Tuesday: 278.19 hrs	Saturday: 41.45 hrs

Amount of Time Students Spent Online (n=36)

* Time calculation is in hours.

Following Kim et al. (2016), we also measured students' level of interaction by analyzing the frequency of their posts on discussion boards (Kim et al., 2016). The level of engagement was analyzed by the length of students' posts on the discussion board (Kim et al., 2016). We compared the data for interaction and engagement before and after the midterm survey by running descriptive statistics.

We also examined differences between students' interactions and engagement in online discussions, collaborative group paper writing, and peer reviews. There were two online discussions, the first discussion was in the 3rd week, and the second discussion was in the 11th week. Both online discussion board activities required students to respond to prompts and comment on peers' posts. The collaborative stakeholder position paper is another design element for group-based discussion.

Figure 3 below shows the combined average results for two online discussions, the average for peer reviews, and the collaborative paper writing. The results revealed that there was a difference between the two online discussions. The average number of posts per student in the second online discussion was higher than the first one (see Figure 3). In addition, the results revealed that students posted more during their discussions on writing a collaborative stakeholder position paper than they did during the peer review. Also, students interacted more when they worked in small groups with collaborative and creative tasks such as writing a paper (see Figure 3).

Figure 3

Students' Interaction Level by the Type of Assignments in the Course (n=36)



Figure 4 below shows the differences in student engagement across two online discussions, peer review activity and collaborative paper discussions, and the lengths of each student's posts were measured. The results revealed that students were more engaged in the first online discussion with the average number of words per student (n=1,728) than in the second online discussion (n=1,059). The decreased engagement may relate to additional collaborative activities during the second half of the course, such as stakeholder paper discussions. We compared differences between students' levels of engagement in online discussions, peer review activities, and collaborative paper discussions. We found that students' engagement levels increased in collaborative paper discussions (n=1,639), indicating that the UDL approach helped sustain student engagement throughout the semester.

Figure 4



Students' Level of Engagement by the Type of Activity in the Course (n=36)

Course Evaluation

As part of faculty performance evaluation, the university conducts student evaluations to measure the course quality and teaching effectiveness at the end of each semester. Students participate in the survey voluntarily and anonymously. The course evaluation survey allowed us to assess students' satisfaction with the course quality and teaching effectiveness. Twenty-three students (63.8%) completed the institutional course evaluation survey. The survey contained 16 questions using a 1-5 Likert scale regarding course organization and planning, communication and faculty/student interaction, assignments, exams, grading, course delivery, and overall course and teaching rating. The survey also asked to answer the two open-ended questions. The questions are, "what aspects of the course and how it was taught helped you learn?" and "what modifications do you suggest if the course is taught next time?"

The evaluation analysis revealed that students rated teaching effectiveness (M=4.64; SD=0.65) and course quality (M=4.43; SD=0.79), reflecting students' overall satisfaction with the course. The high evaluation scores combined with the analysis of Learning Management Analytics indicated the course conversion from a face-to-face to an asynchronous online course was successful. Students shared their satisfaction with assignment types, indicating that assignments generally helped them learn the materials (M= 4.68; SD=0.57). Concerning the instructor's facilitation role, students answered that the course instructor encouraged students to be actively involved in the material through discussion (M=4.78; SD=0.52). Students also stated that course requirements and expectations were clear (M=4.87; SD=0.34), the course was well organized (M=4.91; SD=0.29), and the grading policy was clear (M=4.78; SD=0.42). Some students shared their qualitative comments about the online delivery mode. For instance, one student said:

I enjoyed the independence of this course. The material allowed me to either explore the topic further or do what I needed for the course. However, it kept students interested in the topic fully emerged. I had a great experience and learned a lot in this class.

Another student noted that *"this semester is the first time I have taken an online class, and I surprisingly enjoyed it."* Students' positive feedback evidenced that the UDL approach would make it easier for inexperienced instructors to convert a face-to-face course to an asynchronous online one. Students could benefit from the approach.

Discussion

We explored the practical case of applying a UDL framework to build an interactive asynchronous online course on environmental policy for undergraduate students. The UDL's multiple means of engagement guidelines helped create a learning environment to respect students' diverse learning styles. The case provides a confirmation that the ULD approach can be instrumental in creating a fully online course from an in-person one, disregarding the concern of low interaction and engagement.

Our case contributes to the growing field of instructional design in three ways. First, this case overview evidences the value of UDL techniques in asynchronous online courses. Despite the rise of online learning in higher education, faculty resistance is still high due to the overall learning quality concerns, potentially downplaying the positive aspects of online learning and teaching (Allen & Seaman, 2013; Keengwe & Kidd, 2010; Lloyd et al., 2012). Emergent virtual instruction during the pandemic has also augmented concerns over the overall quality of online learning (Adedoyin & Soykan, 2020; Hodges et al., 2020).

Against this sentiment, some scholars suggested that better learning outcomes in asynchronous online courses could be possible in courses with a high faculty teaching presence and social presence, and peer collaboration, as opposed to a student learning independently by watching videos or reading materials (Arbaugh & Benbunan-Fich, 2006; Arbaugh et al., 2010; Daspit & D'Souza, 2012; Garrison et al., 2000; Garrison 2017). Consistent with this research line, our findings indicate that students prefer more frequent and meaningful interactions, and a UDL approach could help student expectations for online courses be met. Flexibility in the design approach could allow different assignment formats, group cooperative or individual reflective, to be interchangeably altered to ensure learning outcomes are accomplished regardless of course delivery mode, face-to-face or online (Braun, 2008; Rovai & Jordan, 2004; Topper, 2007; Dickinson & Gronseth, 2020).

Second, this case sheds light on the varying degrees of student interactions, which need to be factored in for online course design. Both individual discussions and group work can foster student interactions. However, discussion-oriented collaborative assignments may facilitate more significant and purposeful student interactions than the other

types of assignment formats (Table 3). The UDL approach can make it easier to engineer high-quality student interaction in asynchronous online courses. Instructors would then be more beneficial if they had a more advanced understanding of online course design, such as learning elements development and modification beyond the simple course architecture set-up. Due to the disciplinary nature, some advanced practicum courses in political science, public policy, and international affairs may need such understanding to a greater degree. If the highest student interactions are woven into asynchronous online courses' well-designed architecture, subject-specific learning outcomes such as collaborative learning skills could be more likely invigorated (Bowen, 2013; Emerson & Gerlak, 2016). The benefits of a UDL could then be reaped more substantially in those disciplines where student interaction is essential to be taken in place regardless of the course delivery format, either in-person or online.

Practical Implication

Adding to the instructional practice contributions, this case adds a practical tip for implementing the UDL approach. As an illustrative suggestion, Table 3 shows how instructors can apply the UDL approach in their courses. The instructional mode change can be portrayed with a two-by-two matrix with the two factors, student engagement level and student preference for peer-to-peer interactions. Instructors can form the four different assignment modes when the student engagement factor is crossed with student preference for peer-to-peer interactions. As a rule of thumb, if students favor more interactions and their engagement level remains high, instructors can choose group-based, discussion-focused assignments. Conversely, when students' preference for peer-to-peer interactions is low, and students are engaged in discussion activities at a low capacity, instructors can adopt individual-based, reflection-oriented assignments. Table 4 shows four possible assignment types in the UDL learning environments.

Table 4

Instructor's Choice for Assignment Mode*

		Student engagement level	
Low	High		
Student preference for peer-to-peer interactions	Low	Individual/Reflection	Group/Reflection
	High	Individual/Discussion	Group/Discussion

* Depending on Student Engagement Level and Student Preference over Peer-to-Peer Interactions

Limitations of the design approach

However, it should be acknowledged that the benefits of a UDL could not be universally applicable for all online course conversions and designs. Some faculty may assume that the UDL approach could improve the overall course quality at a minimum, and indeed, changes would not matter ultimately. Some others also argue that the UDL approach creates unnecessary steps requiring substantial time and resources for the instructional mode change. Future examination would benefit from investigating such claims in empirical settings.

Also, the implementation of the UDL in this case study was limited to exploring the roles of representation and action/expression on students' satisfaction in the online course delivery. Future studies can expand how representation and action strategies can be changed when the courses are converted from in-person to online.

Limitations of the research

In addition, researchers and practitioners may investigate how flexibility in changing assignment formats per student engagement level and student preference for peer-to-peer interactions can affect students' learning performance. We encourage some questions that address, but are not limited to, the following specific questions: To what extent does it cause the satisfaction of learning? Or does it create havoc due to restructuring the primary assignments in the middle of the course? Also, it would be interesting to know if enhanced student interactions and engagement are qualitatively different in synchronous and asynchronous discussion. It seems natural to accept verbal conversation that happens in a face-to-face or synchronous online course is substantively different from written conversations in an asynchronous online mode (Kilpatrick et al., 2021). However, it could also be possible to observe students' careful approaches to lay out their own perspectives and more constructively consider others' perspectives when flexibility of action and representation is given in an asynchronous online course. By answering those questions in an experimental setting, one can gain a more nuanced understanding of the UDL framework, which can foster designing online courses in consideration of quality.

Conclusion

Learning and teaching in higher education have dramatically changed over the past year during the COVID-19 pandemic. The global health crisis has forced faculty to experiment with virtual teaching in a short amount of time without full preparation, and adequate training (Johnson et al., 2020; Lockee, 2021; McKenzie, 2021), and students were compelled to learn purely online or in a hybrid format of courses. Even though online courses during COVID-19 are close to contingent-based virtual instruction (Adedoyin & Soykan, 2020), it is most likely that online courses will be part of the instruction modalities in higher education during the post-COVID era (McKenzie, 2021). This facet emphasizes the need to reflect and consider how to refine online courses and expand them in a timely manner.

This case informs the value of the approach by applying a UDL framework to designing an asynchronous course online. In questioning and preparing a "new normal" for courses and program delivery in higher education, the UDL approach could lift students' experience in online courses regardless of discipline. UDL allows planning flexibility in the curricular design, recognizing that learners are varied in their learning preferences and capabilities, motivational characteristics, and environmental constraints (Dickinson & Gronseth, 2020). It also recognizes that program and course developments are under time and budget pressures, and entirely fixed learning modules and formative evaluation methods would not be necessary (Costly & Lange, 2018, Kilpatric et al., 2021). Rather, the UDL approach can foster community and collaboration, making online learning more conducive beyond information transmission (Evmenova, 2018; Garrison et al., 2000; Garrison, 2017).

The pandemic seems to edge toward its end, but higher education leadership still faces uncertainties of course delivery mode and may wonder about how to move forward with online education. The UDL framework can be more extensively employed to ensure the various means of engagement, representation, and action and expression in fully online courses or blended courses. Doing so can expand the benefits of higher education to the unreached student population and scale up online professional learning in the post-pandemic era.

References

- Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: The challenges and opportunities. Interactive Learning Environments. <u>https://doi.org/10.1080/10494820.2020.1813180</u>
- Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States.* Sloan Consortium.
- Allen, M. W., & Sites, R. (2012). *Leaving ADDIE for SAM: An agile model for developing the best learning experiences.* American Society for Training and Development.
- Arbaugh, J. B., & Benbunan-Fich, R. (2006). An investigation of epistemological and social dimensions of teaching in online learning environments. *Academy of Management Learning & Education*, 5(4), 435-447. <u>https://doi.org/10.5465/AMLE.2006.23473204</u>
- Arbaugh, J. B., Desai, A. B., Rau, B. L., & Sridhar, B. S. (2010). A review of research on online and blended learning in the management discipline: 1994-2009. *Organization Management Journal*, 7(1), 39-55.

https://doi.org/10.1057/omj.2010.5

- Becker, B. (2013). Learning analytics: Insights into the natural learning behavior of our students. *Behavioral and Social Sciences Librarian*, 32(1), 63–67. <u>https://doi.org/10.1080/01639269.2013.751804</u>
- Biwer, F., Wiradhany, W., oude Egbrink, M., Hospers, H., Wasenitz, S., Jansen, W., & de Bruin, A. (1AD, January 1). Changes and adaptations: How university students self-regulate their online learning during the COVID-19 pandemic. *Frontiers in Psychology*. <u>https://www.frontiersin.org/articles/10.3389/fpsyg.2021.642593/full</u>
- Bonwell, Charles, C.& Eison, J. A. (1991). Active learning: Creating excitement in the classroom. ASHE-ERIC Higher Education Reports. <u>https://eric.ed.gov/?id=ED336049</u>
- Bowen, W. G. (2013). Higher Education in the Digital Age. Princeton University Press. https://doi.org/10.1111/bjet.12109
- Braun, T. (2008). Making a choice: The perceptions and attitudes of online graduate students. *Journal of Technology* and Teacher Education, 16(1), 63–92. <u>https://www.learntechlib.org/index.cfm?</u> <u>fuseaction=Reader.ViewAbstract&paper_id=21874</u>
- CAST (2011). Universal Design for Learning Guidelines version 2.0. Wakefield, MA: CAST Professional Publishing. https://udlguidelines.cast.org/binaries/content/assets/udlguidelines/udlg-v2-0/udlg_graphicorganizer_v2-0.pdf
- CAST (2018). Universal Design for Learning Guidelines version 2.2. Wakefield, MA: CAST Professional Publishing. http://udlguidelines.cast.org
- Castleberry, G. T., & Evers, R. B. (2010). Incorporating technology into the modern language classroom. *Intervention in School and Clinic*, 45(3), 201-205. <u>https://doi.org/10.1177/1053451209349535</u>
- Costly, J., & Lange, C. (2018). The moderating effects of group work on the relationship between motivation and cognitive load. *International Review of Research in Open and Distributed Learning*, 19(1), 68-90. https://doi.org/10.19173/irrodl.v19i1.3325
- Coyne, P., Pisha, B., Dalton, B., Zeph, L. A., & Smith, N. C. (2012). Literacy by design: A universal design for learning approach for students with significant intellectual disabilities. *Remedial and Special Education*, 33, 162–172. <u>https://doi.org/10.1177/0741932510381651</u>
- Daspit, J., & D'Souza, D. E. (2012). Using the community of inquiry framework to introduce wiki environments in blended learning pedagogies: Evidence from a business capstone course. Academy of Management Learning and Education, 11(4), 666-683. <u>https://doi.org/10.5465/amle.2010.01.54</u>
- Dell, C. A., Dell, T. F., & Blackwell, T. L. (2015). Applying universal design for learning in online courses: Pedagogical and practical considerations. *The Journal of Educators Online*, 13, 166–192. <u>https://doi.org/10.9743/jeo.2015.2.1</u>
- Dickinson, K. J., & Gronseth, S. L. (2020). Application of Universal Design for Learning (UDL) principles to surgical education during the COVID-19 pandemic: UDL for surgical education during COVID-19. *Journal of Surgical Education*. 77(5), 1008-1012. <u>https://doi.org/10.1016/j.jsurg.2020.06.005</u>
- Edyburn, D. L. (2013). Critical issues in advancing the special education technology evidence base. *Exceptional Children*, 80(1), 7-24. <u>https://doi.org/10.1177/001440291308000107</u>
- Emerson, K. & Gerlak, A. K. (2016). Teaching collaborative governance online: Aligning collaborative instruction with online learning platforms, *Journal of Public Affairs Education*, 22(3), 327-344. <u>https://doi.org/10.1080/15236803.2016.12002251</u>
- Evmenova, A (2018). Preparing teachers to use Universal Design for Learning to support diverse learners. *Journal of Online Learning Research*, 4(2), 147-171. <u>https://www.learntechlib.org/primary/p/181969/</u>

Garrison, D. R. (2017). E-Learning in the 21st century: A framework for research and practice (3rd ed.). Routledge.

- Garrison, D. R., Anderson, T, & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, 2, 87-105. <u>https://doi.org/10.1016/S1096-7516(00)00016-6</u>
- Gordon, J., & Zemke, R. (2002). The attack on ISD. *Training*, 37(4), 42-45.
- Green, J. K., Burrow, M. S., & Carvalho, L. (2020). Designing for transition: Supporting teachers and students cope with emergency remote education. *Postdigital Science and Education*, 2, 906–922. <u>https://doi.org/10.1007/s42438-020-00185-6</u>
- Hall, T. E., Cohen, N., Vue, G., & Ganley, P. (2015). Addressing learning disabilities with UDL and technology: Strategic reader. *Learning Disability Quarterly*, 38, 72-83. <u>https://doi.org/10.1177/0731948714544375</u>
- Hannum, W. H. (2005). Instructional systems development: A 30-year retrospective. *Educational Technology*, 45(4), 5-21. <u>http://www.jstor.org/stable/44429217</u>
- Hannum, W. H. (2012). Flexible instructional design: The opposite of doing everything isn't doing nothing. *Educational Technology*, 52(3), 20-29. <u>http://www.jstor.org/stable/44430037</u>
- 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. <u>http://dx.doi.org/10.24059/olj.v23i3.2057</u>
- Hodges, C., Moore, S, Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning, EDUCAUSE. <u>https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning</u>
- Israel, M., Ribuffo, C., & Smith, S. (2014). Universal design for learning: Recommendations for teacher preparation and professional development (Document No. IC-7). <u>http://ceedar.education.ufl.edu/tools/innovation-configurations/</u>
- Johnson, C., Hill, L., Lock, J., Altowairiki, N., Ostrowski, C., da Rosa dos Santos, L., & Liu, Y. (2017). Using Design-Based Research to develop meaningful online discussions in undergraduate field experience courses. *International Review of Research in Open and Distributed Learning*, 18(6), 36-53. <u>https://doi.org/10.19173/irrodl.v18i6.2901</u>
- Johnson, N., Veletsianos, G., & Seaman, J. (2020). U.S. faculty and administrators' experiences and approaches in the early weeks of the COVID-19 pandemic. *Online Learning*, 24(2), 6-21. <u>https://doi.org/10.24059/olj.v24i2.2285</u>
- Keengwe, J., & Kidd, T. T. (2010). Towards best practices in online learning and teaching in higher education. *Journal of Online Learning and Teaching*, 6(2), 533-541. <u>http://jolt.merlot.org/vol6no2/keengwe_0610.htm</u>
- Kilpatrick, J.R., Ehrlich, S, & Bartlett, M. (2021). Learning from COVID-19: Universal Design for Learning implementation prior to and during a pandemic. *Journal of Applied Instructional Design*, 10(1). <u>https://dx.doi.org/10.51869/101jkmbse</u>
- Kim, D., Park, Y., Yoon, M., & Jo, I. H. (2016). Toward evidence-based learning analytics: Using proxy variables to improve asynchronous online discussion environments. *The Internet and Higher Education*, 30, 30-43. <u>https://doi.org/10.1016/j.iheduc.2016.03.002</u>
- King-Sears, M. E., Johnson, T., Berkeley, S., Weiss, M., Peters-Burton, E., Evmenova, A., & Hursh, J. (2015). An exploratory study of universal design for teaching chemistry to students with and without disabilities. *Learning Disabilities Quarterly*, 38, 84-96. <u>https://doi.org/10.1177/0731948714564575</u>
- Lloyd, S. A., Byrne, M. M., & McCoy, T. S. (2012). Faculty-perceived barriers of online education. *MERLOT Journal of Online Learning and Teaching*, 8(1), 1–12. <u>https://jolt.merlot.org/vol8no1/lloyd_0312.pdf</u>

- Lockee, B.B. (2021). Online education in the post-COVID era. *Nature Electronics*, 4, 5–6. https://doi.org/10.1038/s41928-020-00534-0
- Maina, M., Craft, B., & Mor, Y. (2012). *The art & science of learning design*. Sense Publishers. https://doi.org/10.1007/978-94-6300-103-8
- Marino, M. T., Gotch, C. M., Israel, M., Vasquez, E., Basham, J. D., & Becht, K. (2014). UDL in the middle school science classroom: Can video games and alternative text heighten engagement and learning for students with learning disabilities? *Learning Disability Quarterly*, 37, 87-99. <u>https://doi.org/10.1177/0731948713503963</u>
- McKenzie, L. (2021, April 27). Students want online learning options post-pandemic. *Inside Higher Ed.* <u>https://www.insidehighered.com/news/2021/04/27/survey-reveals-positive-outlook-online-instruction-post-pandemic</u>
- Means B., Toyama, Y., Murphy, R. Bakia, M., & Jones, K. (2009). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. U.S. Department of Education Report (ED505824). <u>https://eric.ed.gov/?id=ED505824</u>
- Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal design for learning: Theory and practice*. Wakefield, MA: CAST Professional Publishing.
- Ostrowski, C.P., Santos, L.D., Lock, J.V., Altowairiki, N., Hill, S.L., & Johnson, C. (2016). A journey through the development of online environments: Putting UDL theory into practice. *Handbook of Research on Innovative Pedagogies and Technologies for Online Learning in Higher Education*. IGI Global. <u>https://doi.org/ 10.4018/978-1-5225-1851-8.CH010</u>
- Rao, K., Edelen-Smith, P., & Wailehua, C. (2015). Universal design for online courses: Applying principles to pedagogy. Open Learning: The Journal of Open and Distance Learning. 30, 35-52. <u>https://doi.org/10.1080/02680513.2014.991300</u>
- Rao, K., & Meo, G. (2016). Using Universal Design for Learning to design standards-based lessons. SAGE Open, 6(4), 1-12. <u>https://doi.org/10.1177/2158244016680688</u>
- Robinson, D. E., & Wizer, D. R. (2016). Universal Design for Learning and the Quality Matters Guidelines for the design and implementation of online learning events. *International Journal of Technology in Teaching & Learning*, 12, 17-32. <u>https://sicet.org/main/journals/ijtt</u>
- Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal Design for Learning*. The Association for Supervision and Curriculum Development. <u>http://www.ascd.org/publications/books/101042.aspx</u>
- Rose, D. H., Meyer, A., & Hitchcock, C. (2005). *The universally designed classroom: Accessible curriculum and digital technologies.* Harvard Education Press.
- Rovai, A., & Jordan, H. (2004). Blended learning and sense of community: A comparative analysis with traditional and fully online graduate courses. *International Review of Research in Open and Distant Learning*. 5(2), 1-13. <u>https://doi.org/10.19173/irrodl.v5i2.192</u>
- Son, C., Hegde, S., Smith, A., Wang, X., & Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: an interview survey study. *Journal of Medical Internet Research*, 22(9), e21279. <u>https://doi.org/10.2196/21279</u>
- Topper, A. (2007). Are they the same? Comparing instructional quality of online and face-to-face graduate education courses. Assessment and Evaluation in Higher Education, 32(6), 681-691. <u>https://doi.org/10.1080/02602930601117233</u>

Weir, K. (2021). The great distance learning experiment continues, *Monitor on Psychology*, 52(1), 61. <u>https://www.philanthropyroundtable.org/magazine/the-great-distance-learning-experiment/</u>

Zimmerman, J. (2020, March 10). Coronavirus and the great online-learning experiment. *The Chronicle of Higher Education*. <u>https://www.chronicle.com/article/coronavirus-and-the-great-online-learning-experiment/</u>

Appendix 1

UDL Principles, Guidelines, Checkpoints with the Focus of Flexibility in Engagement, Representation, and Action/Expression

Principles	Guidelines	Exemplary Checkpoints
Multiple Means of Engagement	Provide options for recruiting interest	\bullet Optimize individual choice and autonomy \bullet Minimize threats and distractions
	Provide options for sustaining effort and persistence	\bullet Heighten salience of goals and objectives \bullet Foster collaboration and community
	Provide options for self - regulation	• Promote expectations and beliefs that optimize motivation • Develop self-assessment and reflection
Multiple Means of Representation	Provide options for perception	• Offer ways of customizing the display of information • Offer alternatives for auditory or visual information
	Provide options for language, mathematical expressions, symbols	Clarify vocabulary and symbols Illustrate through multiple media
	Provide options for comprehension	 Activate or supply background knowledge Guide information processing, visualization, manipulation
	Provide options for physical action	\bullet Vary the methods for response and navigation \bullet Optimize access to tools and assistive technologies
Multiple Means of Action/Expression	Provide options for expression and communication	• Use multiple means for communication • Blend fluencies with graduated levels of support
	Pride options for executive function	• Guide appropriate goal setting • Enhance capacity for monitoring progress



Younsung Kim

George Mason University

Younsung Kim is an associate professor in the Department of Environmental Science and Policy at George Mason University. Her research interests lie in environmental policy and management, climate governance, business sustainability, and online teaching and learning.



Larisa Olesova

University of Florida

Larisa Olesova is a Clinical Assistant Professor of Educational Technology in the School of Teaching and Learning, at the University of Florida. Prior, Larisa worked as a Senior Instructional Designer for George Mason University. Her research interests are Community of Inquiry, online teaching and learning, and social network analysis.



This content is provided to you freely by EdTech Books.

Access it online or download it at https://edtechbooks.org/jaid_11_2/___expanding_onli.