EMBRACING DIGITAL TRANSFORMATION OF ACADEMIC LEARNING DURING AND POST COVID PANDEMIC ENVIRONMENT

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ABSTRACT
This study examines the major challenges in digital transformation of learning content and how to overcome those obstacles for smooth delivery of classes in fully online mode in the post COVID pandemic environment. It has been found that among other factors the logistic supports such as availability of learning tools, equipment, and software, etc., which is crucial for successful online learning delivery, plays an important role in effective digital transformation of learning content. Especially the digital divide among the student population is a major challenge as it hinders the availability of learning tools, equipment, and software for students. Instructors' extra work load can also be a significant issue. Another important factor to ensure effective online learning is its quality. The design and development of improved online courses must be based on the criteria of online learning quality standards. Also, the active communication and interaction between instructors and students in class is an important factor. Finally, the collaboration among faculty members, administrators, and e-learning technologists play vital role in the success of the digital transformation of academic learning process.
Keywords: Digital transformation of academic learning, Post COVID-19 pandemic online learning,

INTRODUCTION

This study examines the challenges in digital transformation of academic learning content and recommends how to overcome those obstacles for effective delivery of successful classes in fully online mode in post COVID pandemic environment. On January 30, 2020, the World Health Organization (WHO) declared a public health emergency of international concern because of global COVID pandemic (Wu, 2021) that quickly spread around the world with no country left untouched. Consequently, most of the countries around the world established quarantine and lockdown measures with a direct impact on people's work, education, mobility, freedom, health, economy, and social life (Pe´rez-VillalobosID, 2021). The emergence COVID-19 pandemic with its unprecedented challenge for every segment of the society has drastically affected all spheres of everyday life including the education. The educational institutions were forced to disrupt the education of 89% of students, which is more than 1.5 billion students of all ages in 188 countries (UNESCO, 2020). The educational institutions canceled in-person classes and regular on-campus activities immediately. Thus, the pandemic forced millions of students and instructors in higher education all over the world to move to new formats of instruction and learning on an emergency basis. In addition to disrupted regular academic delivery methods, all kinds of on-campus events including conferences, workshops, sports activities had been suspended or canceled as faculty, administrators, and staffs were compelled to work remotely. In that context, the only solution to continue the academic process was the transition of in-person classes to online using learning platforms and other digital technologies. Without adequate preparation 220 million college students' education had to transferred from in-person to online learning using around the world (Pe´rez-VillalobosID, 2021, Wu, 2021).

DIGITAL TRANSFORMATION OF ACADEMIC LEARNING DURING COVID

Although most higher education institutions actively had the online learning environment before the pandemic, the main challenge was the sudden implementation of online learning delivery mode irrespective of faculty and students' lack of ability and/or willingness to conduct classes online. Different factors, especially the limitation of available technology for transition of in-person classes to online classes in short time was a significant challenge in smooth delivery of online learning. The situation was more challenging for the lab-intensive classes, where hands-on learning requires students and instructors' in-person presence in the on-campus labs where all tools, equipment, and software were already set-up to provide students real physical learning experience (Gonzalez et al., 2020, Tropea1 & Rango, 2020).

Actions Taken in the Beginning of Pandemic

To continue the learning process in sudden unprecedented situation, following steps were taken by the educational institutions (Nogales-Delgado et al., 2020):

- Cancel all in-person class activities, replacing it by online learning, eventually for rest of the 2019–2020 academic year.
- Provide online training to instructors and students for online classes.
- Provide students opt-out for Pass/Fail rather than latter grade.
- Give students the opportunity to withdraw from their class at late semester without any financial or grade penalty.
- Adapt online setting for meeting, advising, workshop, seminar, conferences, etc.
- Ensure full online library service for students, faculty members and researchers.

Learning Delivery Method

As shown in Table 1, there are three main modes of learning delivery – in-person, hybrid, and fully online. The fully online mode can be sub-categorized into asynchronous and synchronous modes. During the beginning of COVID pandemic, all classes offered fully online synchronous and asynchronous mode with very few exceptions of hybrid mode. The selection of online learning mode depended on the course content and knowledge of the subject matter that the students require to learn. Combination of synchronous and asynchronous online mode was also applied, if it fits better for a course in a specific program such as engineering and technology (Pregowska et al., 2021).

Table 1. Learning Delivery Modes

Delivery Mode	Class Meeting Method	
In-Person	Meet 100% in-person on-campus physical class room	
Hybrid	Meeting in-person physically in class room, but significant percentage of the class content delivered online	
Fully Online	Asynchronous	Synchronous
	Meet from anywhere, anytime	Meet from anywhere, but in a specific time

Deployment of Technology

The online learning platforms, applications software and tools were being used to continue the classes during pandemic. Zoom, Skype, Microsoft Team, Web Ex and other video conferencing platforms became the new classroom for collaborations between instructor and students. Learning management platforms such as Canvas, Blackboard, Adobe Connect, Google Drive, Google Workspace, etc. were used for course content delivery (Nworie, 2021). As shown in Figure 1, students benefitted from fully online learning in different ways.
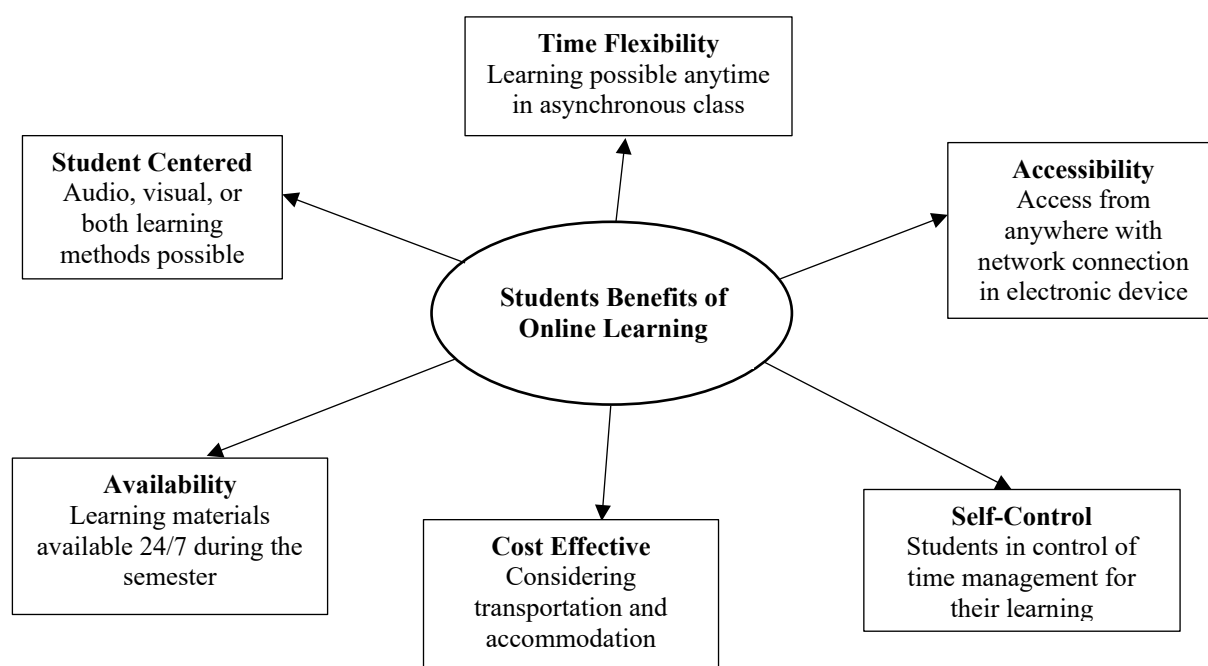

Figure 1. Benefits of fully online learning from students' perspective

Obstacles to Achieve Learning Objectives Online
There are the obstacles that created barriers preventing the achievement of effective quality learning objectives using the e-learning system, especially for the first few semesters during COVID-19 pandemic (Bashitialshaaer et al., 2021). The general concern regarding the complete implementation of online learning, especially in lab-intensive classes, was the sudden development of the pandemic events with little room to maneuver, with the limited availability of technology and tools. The smooth transformation to online learning delivery mode was challenging because of faculty and students' prior expertise and experience with online learning, and the nature of the class that requires logistic support (Nogales-Delgado et al. 2020). A significant challenge to successful online learning with feasible learning technologies has been access to labs, studios, and other specialized learning environments for hands-on experiences (Nworie, 2021). Thus, the fundamental issues that mainly affected the successful transformation of learning to online delivery mode was the lack of preparedness, which highlights on two critical factors: 1) *Logistic support* - the availability of learning tools, equipment, and software to meet learning objectives of the course, 2) *Faculty and students' preparedness* based on their level of prior experience and expertise with e-learning systems.

Logistic Support for Online Learning

Availability of Learning Tools, Equipment, and Software
There are a variety of learning tools available to overcome the challenges of online class development. Using those tools, the learning contents of in-person classes were transformed in digital delivery mode on an emergency basis after the COVID-19 outbreak (Gonzalez et al., 2020). The digital learning content delivered in learning management platforms using devices such as laptop, tablet, smartphone, desktop, or Virtual Reality goggles. All these devices, tools, and software made online learning delivery increasingly viable and accessible to the students for learning and to the instructors for instruction (Pregowska et al., 2021). However, the adequate availability of those tools required for specific classes, especially in lab intensive undergraduate classes, was not guaranteed during the beginning of unprecedented COVID situation (Nogales-Delgado et al., 2020).

Students' Digital Dividedness
Many students were unprepared for online classes that require technology and tools to fulfill the learning objectives of their course. One of the main challenges students faced was the lack of logistic support such as inadequate internet connections, hardware and software compatibility, lack of knowledge and expertise of installing and using those technologies and tools for their learning purposes. Students who were consequently unable to afford those technology, were being left behind academically without the access to those resources (Bassett, 2020). The lack of access to digital devices and internet with sufficient bandwidth highlighted the serious issue of ***digital divide*** in the student population. Depending on where they are living, having secure high-speed internet connection is significantly important for students' quick and timely access to their course content and materials in class. They must have secured network connection, especially during the exams, lab assignments, and live class (Bashitialshaaer et al., 2021). A study shows that 65% of instructors and 77% administrators of higher academic institutions reported that students without access to required learning technologies or to internet connections with adequate bandwidth, are deprived from effective learning opportunities (Nworie, 2021).

A study on students in engineering programs shows that students' unequal access to technology resources, which represents *digital divide,* plays a significant role in their success in online learning. The students' socio-economic background affects the inequality of access to digital devices and technology required for online classes. About 30% of students with lower-income backgrounds did not have the necessary tools and equipment for online learning (Goncharova & Zaitseva, 2020). In another study, 41.3% of the engineering students reported that the internet speed was the major online problem they have faced in their using e-learning platform (Alkhalil et al., 2021). The internet connectivity and other technology constraints were significant concern for students access to the e-learning platforms, especially during live online synchronous classes. Many students do not have the infrastructure nor adequate connectivity in their homes or off-campus. Students from more vulnerable demography face greater challenge of access to the required tools, equipment, and necessary connectivity for online classes (Pe´rez-VillalobosID, 2021).

Instructors' Work Load
In terms of instructors, the lack of individual approach, lack of their control on the digital transformation of some hands-on learning activities, such as lab and project work, into an online learning platform increased their workload to design and develop effective digital instructions. In addition, during the COVID pandemic many instructors did not have the logistic support of tools and technology needed for their class that created significantly extra workload for them. The instructors indicate three levels of support that they would like to get from their academic

institutions: 1) Organizational with more autonomy, 2) Material with computer equipment and services, and 3) Communication (Goncharova & Zaitseva, 2020).

Faculty and Students' Preparedness
Prior Experience and Expertise with E-Learning
Instructor and students' prior experience and expertise with developing online classes using e-learning management tools and equipment play an important role in designing and developing effective online learning delivery. A study in engineering programs shows that the less digitally competent instructors are, the more unwilling they are to shift to new online learning delivery modes (Goncharova & Zaitseva, 2020). During COVID-19, both instructors and students, especially with no or minimal experiences, have to adapt to the new online learning environment with online training, webinars, or tutorials on learning management systems (Nogales-Delgado et al. 2020).

A well-planned online class experience is meaningfully different from online classes designed in emergency basis in middle of the semester in response to a crisis like COVID-19 (Hodges et al., 2020). Usually, it requires six to nine months to design, prepare and develop an online class. When COVID pandemic first outbreak, instructors had to have their online classes ready in weeks, if not days. Many instructors, especially with no or minimal experience or expertise of online learning delivery fell back to the trial-and-error situation. Although they feel more comfortable in teaching the same or similar course online in the following semesters, but it was very difficult and stressful for them for the first time. Consequently, they were then more focused in providing the instructional service rather than in the students' learning as they tended to struggle in transforming their course content digitization. The stress of having to familiarize with new technology and use it in innovative ways replacing their familiar practices of instruction under the pressure against time was overwhelming for instructors without experience and expertise. While those inexperience instructors were more challenged by the drastic change in their instructional method, the instructors with experience and expertise in online instruction carried out this transition more easily and smoothly because they had already used the e-learning management platform before this unexpected COVID pandemic (Pe´rez-VillalobosID, 2021).

ADDRESSING THE CHALLENGESS IN POST COVID DIGITALIZATION OF ACADEMIC LEARNING
Well-designed online courses using emerging technology have been found as effective as in-person traditional classroom instruction. The benefits gained from online instructional delivery strategies during unexpected emergency COVID situations can lead to wider applications in post COVID learning delivery. Therefore, those innovative strategies can be applied as regular instructional practices in post COVID academic environment. With a thoughtful and creative approach, the courses designs can be planned, improved, and best delivered online (Nworie, 2021). For that purpose, as shown in Figure 2, following issues need to be addressed:
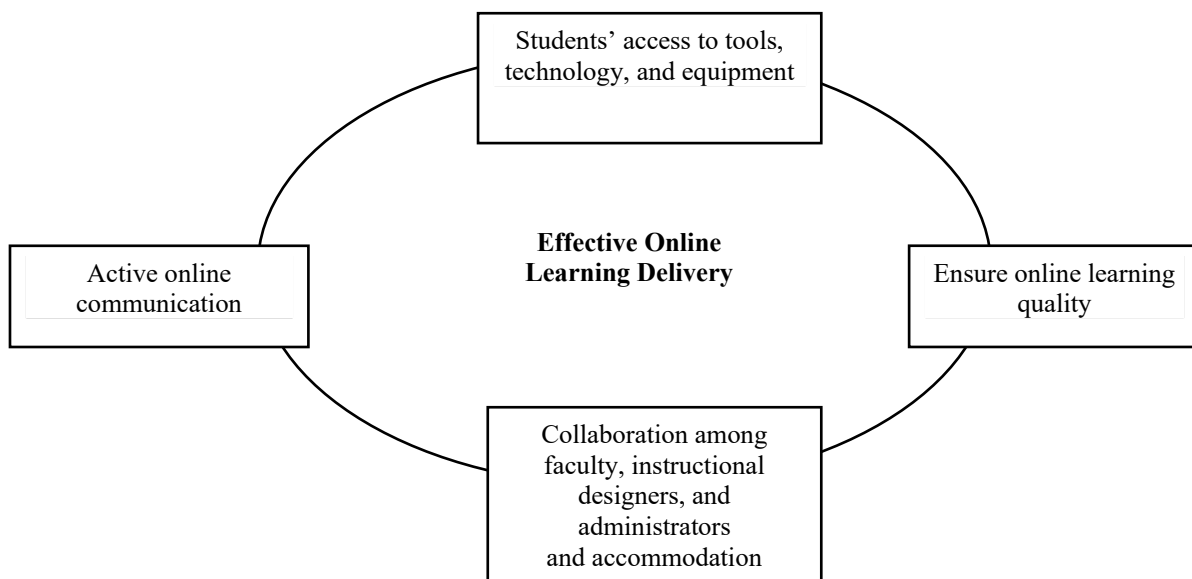

Figure 2. Addressing the challenges in digitalization of academic learning

Students' Access to Tools, Technology, and Equipment
From the online learning experience during COVID, it can be suggested that although there is a significant difference between in-person experience and online experience in learning, especially in hands-on lab classes (Cuschieri & Agius, 2020), with proper access to the tools, technology and equipment, the unique experience of traditional in-person lab sessions can be offered to lab-intensive classes fulfilling the learning objectives. In synchronous or asynchronous online learning classes, well-developed digital simulations, video with learning content, augmented and virtual reality, interactive learning applications, etc. could be used to ensure the learning experience of in-person lab-based classes. For that purpose, academic institutions may consider to providing students with:
1) Remote access to their virtual computer labs
2) Free license to software application
3) Simulated labs environment

Also, for students with disadvantage background with lack of required technical resources, institutions may provide them learning materials and other resources through USB drives, e-books, etc. combining with printed learning materials (Nworie, 2021).

Ensure Online Learning Quality
The post-COVID-19 era offers an opportunity to ensure the effective online learning experience improving the quality of online learning for students. The design and development of improved online courses can be based on the criteria of online learning quality standards such as the *Quality Matters,* which establish benchmarking tools, checklists, and rubrics of online classes. Especially, instructors who are new to online learning can be benefitted from *Quality Matters* that measures the quality of online learning.

Active Online Communication
The interactive communication is more crucial in the hands-on lab-based classes in engineering and technology programs that mainly focus on developing rigorous technical expertise, often significantly focused on the development of engineering and technology skills, and the sophisticated complex problem-solving curricula where teamwork and communication skills are required to prepare students for the real-world workplace. To address this issue, instructors can use the discussion board in the e-learning platform as well as other communication platforms such as Zoom, Microsoft Teams, Google Suite, etc. for communication and collaboration among students in class. Using those platforms, students can share and get feedback on the progress of their group projects reducing the risk of failure (Schefer-Wenzl & Miladinovic, 2020). While before pandemic many instructors and students were not prepared or experienced with using those platforms for educational purposes, but now they are at least familiar with those, and some of them are become expert.

Collaboration among Faculty, Instructional Designers, and Administrators
In the post-COVID-19 environment, instructors in collaboration with instructional designers, e-learning technology staffs, and administrators of their academic institution, can identify and implement the learning technologies that best suit in development of their online class fulfilling students' learning objectives. To offer lab-intensive classes online, instructions need to classify and assess the inadequacy in technology, tools, and equipment that they had during their pre-pandemic learning technology infrastructure. With administrative support and collaboration to have the required technologies to design those online classes, instructors can develop effective hands-on lab-based classes. Faculty, administrators, and instructional designers all have to intended to adopt the innovative tools and technology for the effective learning process. In collaboration with the instructional designers and necessary support from the administrators, the instructors can apply their experience to transform the traditional classroom instruction to the digital form for effective synchronous and asynchronous online learning in post pandemic environment (Nworie, 2021).

CONCLUSION
E-learning has been adopted globally as the alternative learning delivery strategy during the COVID-19 quarantine time (Fawaz & Samaha, 2021). The sudden digital transformation of academic learning during covid pandemic environment created a variety of challenging experiences for students, and instructors had to adjust the delivery mode of their course curriculum for students' learning accordingly. However, even with such challenges, online learning environments have been an effective alternative to higher education institutions during the COVID-19. Not many institutions or faculty and students were prepared for entire transition of in-person classes to complete online classes in short notice. As a result, they faced challenges to deliver the learning content effectively online meeting the objectives of their course as curriculum. In particular, the mandated social isolation impacted the undergraduate courses that were designed to in-person class instructions, group project interactions, lab-intensive, and field studies for real world experience beyond the virtual world (Humphrey & Wiles, 2021).

Instructors and students, who had not no experience of online learning and many of them previously did not consider online learning as authentic as in-person learning, have had online learning experience during COVID. Institutions with minimal experience of online learning had to deliver a large number of online courses on an emergency basis. This experience can serve as an opportunity for the faculty to develop effective online classes and for the students to develop their collaborative skills, self-discipline, time management as well as resilience in learning environment (Cuschieri & Agius, 2020). The lessons learned during COVID can serve to improve instructors' instructional methods and students' learning achievements in future online learning. Instructors should embrace cutting-edge technology and deliver their instruction integrating it paying careful attention to students' experiences to make their online learning effective (Alkhalil et al., 2021).

In the post-pandemic environment, as the higher education institutions are moving forward to digital transformation of learning process; the faculty, administrators, and e-learning technologists play vital roles in the success of this process. More faculty are now seeking technology solutions to develop their online classes. They are willing to incorporate tools, apps, and other technology into their online class delivery to provide a better and successful digital learning environment for students (Malvitz, 2021).

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