

Digital collaboration in Higher Education: Vulnerabilities and Challenges in E-Learning During Covid-19 pandemic*

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Abstract

Digital industry influences the educational environment and encourages students to get actively involved, take part but also collaborate in this major change to overcome internal and external vulnerabilities in the learning process. Academia researchers are analyzing the vulnerabilities of this new digital revolution and trying to secure the online environment in higher education. Over the years, as innovations and investments in the digital space have grown considerably, so have opportunities for universities by allowing students to learn in their rhythm. This research seeks a detailed analysis of the most important tools that support digital collaboration among students given the current situation of online education in the COVID's context-19 pandemic. The tools that support digital collaboration among students facilitate communication in the current situation, increasing the opportunities for academia to interact with as many users as possible. Educators, students and administrators of online educational platforms need a sustainable basis for adopting a change in education. For educators, the availability of a real-time understanding is needed to increase student performance. For students, receiving information about their performance relative to their peers or their progress relative to their personal goals can be motivating and encouraging.

Keywords: Digital Collaboration, Challenges, Online, Higher Education, COVID-19

Introduction

Digital technology has achieved unprecedented growth in many industry fields. Technological drivers like machine to machine communication, blockchain, cryptocurrencies have conducted to new collaboration opportunities for parties involved. Over the last years, we see mounting pressure and acceleration on the digital transformation. (Hess, et al., 2016; Ustundag, and Cevikcan, 2017; Schweer and Sahl 2017). We stay today face to face with a new connected world, where important attention is given in the usage of Internet of Things (IoT), mobility and cloud solution. Institutions are trying to adapt their infrastructure through technological solutions so they can provide better services to clients, as storing personalized information online, order prioritization, online customer service, or transactions through mobile access.

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Digital technology has also created niches for the higher education system by developing the best educational platforms. Already we are seeing free and paid digital content, digital courseware, Small Private Online Courses (SPOC), and Massive Open Online Courses (MOOC). Higher education adopted the digital approach because there is an urgent need to bridge the gaps in digital literacy of individuals, and in using digital technologies for communication between individuals and institutions. Digital higher education development in developing countries in our days represents a lever that can create economic outcomes and determine new prospects for future generations. The new wave of digitalization in the current educational environment is on the rise in Europe and beyond. European countries with the highest rate of digital skills are moving away from the approach of digital education as a separate optional or compulsory subject in schools, instead integrating it transdisciplinary in the vast majority of fields of study. Widespread digitized education disseminates through various platforms give rise to new opportunities for learning and gaining new digital skills and competencies necessary for employment, education and training, self-development, and participation in society.

Reorienting universities towards digitized education impose the necessary measures to analyze digital techniques used, respectively those that support the education and training systems. Improvement initiatives in education and technological changes have certainly influenced the new directions in society, creating structures that have the ability to empower digitalization in industries (Diaconescu, et al., 2019). Technological changes reshape the material, human, and social dimensions and offer solutions when society is facing the biggest challenges caused by COVID-19 pandemic. The COVID-19 pandemic brings to light another national emergency. During the quarantine period, the educational system had to adapt to a new reality emphasizing the need to invest in technology, resources, training, so that each individual has access to education. Also was consider teacher training, increase their ability to transmit information and educate, keeping alive the interest of students to participate and learn from home. For an act of quality education, it will also be necessary to develop appropriate content for the online environment and distance learning (Diaconescu, et al., 2020).

Measures to prevent the emergence of new outbreaks have forced schools, universities, adult education centers and other educational institutions to suspend all face-to-face learning offerings. During pandemic COVID-19 higher education has reorienting his strategy and force universities towards digitized education by imposing necessary measures to analyze digital techniques used, those that support education and training systems. Consequently, all these changes had a remarkable influence on the educational environment, respectively it was a beneficial road to adapt the teaching/learning methods focusing on creative techniques and innovative technologies. More precisely exists a tacit cooperative acceptance from each university that recognizes these days the importance and advantages provided by digitized education. Now digitized education is transforming the way people work, learn, train, make sense of their world and have fun in a digitalized, networked and knowledge-based society. (Punie, 2007) The advantage brought by digitized education is that it disseminates timely information through various platforms and encourages students to experiment with new learning means, developing them new digital skills and competencies that are necessary for self-development but also good employment in market work.

Trough this paper the author explains the concept of collaboration in education and how its evolution will revolutionize the way students will explore practice workshops with the help of online tools. Beside the importance of collaboration in higher education between educators and students upon online platform it is shown how fragile is the online environment. Besides concerns for introducing all learning materials in the online curriculum, student enrollment, or student training and teachers, universities have also considered identifying the best cyber security systems to protect users' identities or prepare for cyber attacks. In this paper are highlighted some vulnerabilities in the online environment in higher education. Also, there are included collaboration challenges in the higher education and are explain some digital tools for develop students' skills based on projects. There are in questions information about how higher education is a valuable testing ground for the latest collaborative technology and how the use of digital solutions stimulates better collaboration for higher education and explore the many applications of technology in today's learning environment.

Digital collaboration in Higher Education

There was a time when technology was seen as an additional tool to traditional learning methods, but now technology is a vital component in education. While the term "educational technology" has existed for several decades, in recent years there have been changes in technology-based education systems that have brought a wave of change in higher education practices.

Innovative teaching approaches, such as virtual classrooms, online education and blended learning programs, have opened the door to unlimited opportunities for both students and educators. The digital transformation of education

is accelerated by the rapid advancement of new technologies such as artificial intelligence, robotics, cloud computing and blockchain technologies. Like the major technological advances in the past, digital transformation affects how people live, interact, study and work. Grimoni, Belico dos Reis, and Tori (1998) describe the success of using multimedia for their existing electrical engineering on-campus students. Kondo and Ishijima (1999) presents a distance learning system for engineering education via the Internet, using multimedia technologies and mathematical tools for a course in control engineering (Ariadurai and Manohanthan 2008). Strenger et al., (2017) explain how digital, virtual and e-learning elements will allow students to strengthen their intercultural competences while working on real engineering and technical problems, in online courses where they can conduct experiments, analyze and interpret their results in international teams (Renzulli, 2015). Lieberman and Cheung (2007) discuss the development of remote-controlled laboratory exercises for their distance laser and fiber-optics engineering technology programmer. To address problems inherent in hands-on laboratories and teaching such laboratories at a distance, many institutions now use computer simulations as an inexpensive way to expose more students to the power of real laboratories without them having to incur the burden of costs associated with time and travel. Simulation software enables delivery of laboratory facilities to the front door of students' homes (Gorrell, 1992). Constant software upgrades have also resulted in aggregate improvements in distance education for engineering students. Internet-based simulations can be used flexibly by students anytime, anywhere. According to Alhalabi et al., (2004), however, although simulations can serve important purposes, in some cases, such simulations are an inadequate substitute for real, hands-on laboratory experiences. Although simulation serves the purpose of initial experimentation, these authors opined that it cannot provide the same range of possibilities that manipulating physical material does. In some fields, such as electrical and mechanical engineering, actual experiences with real physical elements are necessary.

Coşkun et al., (2019) in their recent article describe an important part of the tasks in the preparation for Industry 4.0 is the adaption of the higher education to the requirements of this vision, in particular the engineering education. In the research paper they introduce a road map consisting of three pillars describing the changes/enhancements to be conducted in the areas of curriculum development, lab concept, and student club activities.

Digital collaboration in e-learning

In January 2018, an Action Plan for Digital Education was drafted and disseminated at the level of the European Union, which mainly considers education and training to be the best investments in the future of Europe, with an important role in creating a European identity, starting from common cultures and values. Attempts to imagine the future of education often highlight new technologies - omnipresent computing devices, flexible classroom models and innovative visual screens. The existential factor that shapes the future of higher education is something that people cannot touch or see: "great data and analysis." Undoubtedly, important analyzes and data have an important role to play in the future of higher education, especially collaboration through technology. Educators, students and administrators need a good collaboration to fortify the foundation and adopting change. For educators, the availability of a real-time understanding of student performance, including students at risk, can be a significant help in planning teaching activities. For students, receiving information about their performance in relation to their colleagues or about their progress in relation to their personal goals may be motivating and encouraging. (Siemens and Long, 2011)

Collaboration through technology changes the trajectory of traditional education as we know it. We have already seen how the Internet has radically changed the classical approach to learning in classrooms, introducing digital resources and providing a wealth of up-to-date knowledge that supports teachers and students. Through connectivity, we open up a new world of global learning: classrooms include students from all over the world, and collaboration between experts exposes valuable knowledge to provide new learning experiences. The captivating world of video creates opportunities for students not only to explore new areas with ease, but also to collaborate with others in engaging and fascinating ways.

Digital collaboration vulnerabilities in e-learning

According with the current situation presented above engineering graduates face multiple changing demands on their competencies. Engineering students must have good communication skills, collaboration, information networks, feedback and reception, teamwork, and even in some cases cultural understanding. Innovating engineering universities have become a necessity in a globalized world, especially for newly established universities looking for a more competitive market place.

Thereby taking into account the opinions of other researchers the intensity of the technological boom in education starts from the premise that today's students are the first generation of digital natives, who have grown up using technology since birth. They are also early adopters of the latest technological advances and demand access to the latest technology in everything they do. We are also seeing a growing demand for experienced technology professionals in the modern workplace. Adopting an active status through the use of the Internet and social networks or the use of smartphones and other mobile devices, modern students expect a more collaborative and interactive learning environment.

Starting from this premise, taking into account the requirements of the new generations of students, the educational institutions did their best to introduce new friendly and easily accessible interfaces for online learning. Although students' adaptation to the online environment has come naturally, it is also a vulnerable field that is at increased risk of cyber attacks. Universities and classrooms around the world have had to stop face-to-face meetings due to the COVID-19 pandemic. Shortly after the schools urgently started to move to distance learning, it was noticed that the parties involved were not prepared for the type of full-time digital education. Not all students or teachers had the necessary technology, laptops, stable internet connection, creating a general panic that students will be left behind with learning. Moreover, many educational institutions have not implemented adequate cybersecurity measures, putting online classrooms at increased risk of cyber attacks. Or there have been several types of threats - phishing pages and emails related to online learning platforms and video conferencing applications, threats disguised as the same applications and distributed denial of service (DDoS) attacks affecting the education industry. DDoS attacks have affected the educational resources of the following online educational platforms:

- Coursera – represent an online learning platform that offers a wide range of open online courses, certificates and even diploma programs.
- Blackboard – provides a virtual learning environment in which educators can build fully digital courses or create additional activities to complete personal training.
- Google Meet – offer a video communication service, which can be used to host meetings and online classes
- Moodle – the most popular learning management system (LMS) in the world, used by educators to build online courses, host classes and create activities.
- Zoom – a highly popular online collaboration tool that provides free video conferencing capabilities.
- Google Classroom – a web service designed specifically for educators to host classes, generate assignments and track students' progress.
- edX – a provider of open online courses available to users worldwide.

The report of Kaspersky DDoS Intelligence System identify various threats in two platforms Moodle and Zoom. From January to June 2020, the platform most commonly used as a lure was Zoom, with 5% of the users that encountered various threats encountering them via files that contained the name Zoom. The second most common platform used as a lure was Moodle. By far the most common threats encountered in 2020 were downloaders and adware, which were encountered in 98.77% of the total registered infection attempts. Various classes of trojans followed adware.

Table 1: Vulnerabilities in online learning platforms / video conferencing applications

	Vulnerabilities	
Online learning platforms / video conferencing applications	Phishing risks	Users who reach these phishing pages are often tricked into clicking on URLs through which malicious programs are downloaded being tricked into entering their login details.
	Riskware	Various files, from browser bars and download managers to remote administration tools, which can perform various actions on your computer without your consent.
	AdWare	Users are assault with unwanted ads.
	Trojan (Backdoor)	Malicious files that allow cybercriminals to do everything from deleting and blocking data to interrupting computer performance.
	Exploit	Piece of code or even some data written by a hacker or malware writer that is designed to take advantage of a bug or vulnerability in an application.

Zoom is by far the most commonly used platform as bait, with 99.5% of users encountering various threats disguised under its name. This is not surprising, given that Zoom has become the most frequently used video

conferencing platform by universities. By February 2020, the platform has added new users (2.22 million) compared to 2019 (1.99 million). Given its immense popularity, it is obvious that in the near future Zoom will be the favorite target for malicious actors. Being a tool powered in the online environment millions of users want to download the application, which inevitably at least one of them will meet with installers or fake configuration files.

Even knowing that vulnerabilities will increase in the next period because of continually usage of online education, the pandemic was a real test for all digital educational resources, none of which, public or private, was designed to cope with such an explosive increase in internet traffic. However, the variety of platforms and tools coordinated by IT developers have allowed everyone to continue their studies.

In the near future, universities will become dependent on their technological infrastructure, so that any resulting attacks and violations can have an even deeper impact on their operations. In addition, there is the potential for digital delivery technologies to be directly targeted, and we have already seen evidence of such attacks, such as vulnerability exploitation, phishing and denial of service, being targeted specifically at online learners and providers.

Digital collaboration challenges in e-learning

Passing the years, as the innovations and investments in the digital space have grown considerably, the opportunities for various universities to collaborate with each other have also increased. Some universities have enjoyed partnerships with the IT industry and allowed shared knowledge and good practice for online environment. Currently, the incentive demand for using the data and the digitization are at the helm of these new-age collaborations, in such a way that the intra-industry and universities partnerships complement each other forming a strong alliance. Given the evolution of the epidemiological situation at the international level and the adoption of legal restrictions to stop the spread of the Covid-19 virus, it has forced higher education institutions to switch to online platforms allowing safe educational activities. Thus, the teaching activities that require the physical presence of students in educational units and institutions have suspended, being configured in online format. Hundreds of digital education tools have been created with the purpose of giving autonomy to the student, improving the administration of academic processes, encouraging collaboration, and facilitating communication between teachers and learners. To embrace digital transformation must be considered several smart applications easy to implement. Smart applications allow task coordination between students and improves projects efficiency, responsiveness, and effectiveness. Coordinate homework tasks for students and synchronize information can be achieved by tools like Edmodo, Socrative, Projeqt, Thinglink, TED-Ed, cK-12, ClassDojo, eduClipper, Storybird, Animoto or Kahoot and offer an optimal modality for individuals to communicate with each other in every moment of the day using text, audio or even video. The advantages provided by smart applications have an important asset in improving students interaction, especially among for those geographically dispersed. In this sense different tools provide screen sharing and video chat for different discussions about the problems encountered in the project.

Table 2: Digital education tools

Digital education tools		
Facilitating communication between teachers and learners		
Engineering Unit Converter App	https://play.google.com/store/apps/details?id=mobile.unitconverter&hl=en	Allows students to easily do conversions and engineering calculations
Finger CAD	http://www.ngcybit.it/iTunesApp/fingercad/	This application gives students the opportunity to design anything they do using computerized CAD operations.
Simple Physics	https://jundroo.com/app/simplephysics/	Students complete various construction challenges using physics. For example, students build structures that should withstand different forces. Students earn points as they learn to use physics concepts to build sustainable structures.
Instructables	https://www.instructables.com/	A site that has teaching tools for engineering and includes projects and lesson plans for teaching engineering with fun and practical activities.
Wolfram Alpha	https://www.wolframalpha.com/	An online database of engineering materials where students and teachers can simply ask engineering questions, and the application will search the database for relevant materials that should answer the question.

Edmodo	https://new.edmodo.com/	It is a personalized educational tool and aligned with the opportunities brought by technology and the digital environment. Teachers and students are connected in a social network. Teachers can create online collaboration groups, manage and provide educational materials, measure student performance, and communicate with parents, among other functions.
Socrative	https://www.socrative.com/highered/	It is a system that allows teachers to create educational exercises or games that students can solve using mobile devices, whether they are smartphones, laptops or tablets.
Thinglink	https://www.thinglink.com/	Allows educators to create interactive images with music, sounds, text and photos. It offers teachers the opportunity to create learning methodologies that arouse students' curiosity through interactive content that can expand their knowledge.
TED-Ed	https://ed.ted.com/	It is an educational platform that allows the creation of educational lessons in collaboration with teachers, students, generally people who want to expand knowledge and good ideas. This website allows the democratization of access to information, both for teachers and students, both parties having an active participation in the learning process of the others.
cK-12	https://www.ck12.org/student/	This platform has an open source interface that allows the creation and distribution of educational material via the internet, which can be modified and contains videos, audio and interactive exercises.
ClassDojo	https://student.classdojo.com/#/login	It is a tool for improving students' behavior: teachers give their students instant feedback, so that the friendly mood in the classroom is "rewarded" with points, and students have a more receptive attitude to the learning process.
eduClipper	https://explore.participate.com/educlipper	This platform allows teachers and students to share and explore references and educational materials. It also offers teachers the opportunity to organize a virtual class with their students and create a portfolio in which all the work done is stored.
Animoto	https://animoto.com/projects	Animoto is a digital tool that allows to create high quality videos in a short time and from any mobile device, inspiring students and helping to improve academic lessons. The Animoto interface is friendly and practical, allowing teachers to create audiovisual content that adapts to educational needs.

Collaboration challenges in the higher education must be overcome through linked digital tools for develop students' skills based on projects. Projects stimulates better collaboration for higher education and explore the many applications of technology in today's learning environment. For example in educational projects, a major important element that requires creativity exposure is the design project. Most of the time, students receive this task in the final years, after having thoroughly laid the theoretical foundations. However, these projects should be from day one and spread throughout the program to develop skills and encourage active learning. In the current situation, the educational system requires a creative approach regarding digital education that response to global innovative initiatives in higher education.

Discussion and conclusions

In conclusion, the key result of distance education is an increase in digital literacy for both students and teachers. This means that the forms of the learning process should become more diverse, respond to modern needs and take advantage of new technological opportunities. The new vision approved and implemented by universities towards digital education requires the necessary measures to analyze the digital techniques used, respectively those that support education and training systems.

So far are to realize the main vulnerabilities on universities at the surface. These in the next period will try to penetrate the university environment and will increase significantly in the near future. The university has many more things essential to their ability to do business that they now need to protect. The surface of attack that universities now face is multiple scales larger than they were before. Investments in some IT and security infrastructures are needed, as a starting point to allow the transition from physical to virtual. There is much more dependence on IT infrastructure, there is much more dependence on applications. There is still the availability of using online platforms, the reliability of these platforms, all those things that are not necessarily security issues, but are IT issues.

Modern challenges and global problems that require the most attention from the new generation of students will be solved by collaborating with digital tools, developing the skills to create customized learning solutions. The growing popularity of digital services in education will also contribute to the demand for cyber security. Using distance learning as a main education tool, will speed up the importance of digital security and turned from an abstract notion into a necessity in maintaining a normal learning process. Collaboration with industry must take place immediately to introduce digital security lessons for teachers so they can pass on knowledge and skills to students.

Widely digitized education, disseminated through various platforms, gives rise to new learning opportunities and offers new practices for acquiring the digital skills needed for employment, education and training, self-development and participation in society.

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