ANALYSING DIGITAL TOOLS FOR TECHNICAL UNIVERSITIES

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Abstract

The COVID-19 global pandemic proved a powerful catalyst for many changes in all aspects of society, which was faced with either adapting to the online medium in order to compensate for social distancing, or with grinding to a halt. Most of the activities which could move online did so, throwing many industries and individuals into a medium which until then was considered appropriate mainly for entertainment.

And while e-Learning as a concept has existed for some time and has been researched extensively, there are many areas of education where it is less suited to replace traditional learning paradigms. One such area is Engineering, where the hands-on characteristics of laboratory work, as well as the more traditional approach to the teaching methodologies, make the shift to online-only learning a challenge.

The purpose of this paper is to present part of the research that the ACADIGIA consortium, a multi-national association of technical higher education institutions, has performed in order to achieve its stated goal of accelerating digital readiness for adopting online tools for fully distanced, as well as blended learning scenarios. This research included an extensive analysis of the digital tools that can be used in various educational settings.

Introduction

There is little doubt that the effects of the COVID-19 global pandemic will be seen for decades to come. From long-lasting societal changes to national and international policy shifts, the far-reaching health emergency has touched almost all aspects of our daily lives.

Education is not an exception, with face-to-face learning sessions representing in most cases an unacceptable risk. Thankfully, distance learning has long past the experimental phase, and provided a solid starting point for the transition to online-only teaching and learning.

However, like everything else, e-Learning needed to adapt in order to accommodate the growing number and variety of actors involved: students, educators, academia, policy makers.

There have always been issues with the large-scale adoption of distance learning, like the lack of proper documentation and support, the need for training, or the rigors of pedagogical constraints (Mozelius & Rydell, 2017).

The COVID-19 pandemic has had a different but significant impact on higher education institutions in Europe and this impact was analysed at European Union level (EU Report, 2021) but also at different national levels. The pandemic has changed the way the education is being delivered (in terms of campus closures and the shift to online learning) and highlighted the importance of digital technologies readiness in universities.

In this study we analyse the different impact of the digital technologies' readiness in technical universities in Portugal, Romania, Spain, Ireland, Italy and Greece. This paper is based on the analysis performed in the ACADIGIA Erasmus+ project.

The **Erasmus+ project titled ACADIGIA - Accelerating aCAdemia's DIGItal readiness for online and blended Augmented teaching** is an initiative reuniting partners from 6 European countries with the objective of developing an accelerated model that allows Polytechnic Institutes and other technical HEIs to embrace the digital transformation in education, and promote blended and distance learning. In order to achieve this objective, the project aims to transform educators from target institutions into mentors who will animate and support groups of assisted practitioners, organized in expanding peer-to-peer networks.

The training program to be developed requires a special methodology and corresponding content, containing:

- Frameworks and Compendium – Compiling guidelines from the most recent and relevant frameworks about online and blended learning

- Tool guides – Tutorials and guide materials for becoming proficient users of the most popular open and easily available online pedagogic tools
- Capacitation Programs – A complete training kit to transform the academia staff into highly qualified mentors for digital teaching methods
- Acceleration model – A detailed model to outline an accelerated implementation, accompanied by policy recommendations

This paper focuses on the methodology for choosing and analyzing the appropriate online tools previously mentioned, as well as some of the results of this analysis.

Starting from existing studies (Reimers, Schleicher, Saavedra, & Tuominen, 2020), a list of tools was compiled which included Learning Management Systems, communication and assessment tools, as well as other auxiliary applications which could be used in online learning. Contributions from the partner institutions were also added.

One of the first outputs of the ACADIGIA project was a set of National Reports that each partner compiled according to the response of the specific country to the COVID-19 initial restrictions. These reports, as well as the personal experiences of the project team members were used to filter the proposed list of tools to a final list of 12, which were assigned to the partner teams (two each).

Other factors in choosing the final tools were considered. According to the research performed, pedagogical competences for remote teaching, followed by technical competences, were the main skills identified as necessary to implement distance learning. At the same time, the teachers also highlighted the difficulty in transforming their materials from face-to-face classes into distance learning. Assessment was the most difficult issue to address in distance learning during school closures due to lack of trust in online systems. This difficulty mainly showed that teachers needed training in e-learning strategies to be able to efficiently implement online assessment strategies (Peres, Silva, & Silva, 2021).

The **12 chosen pedagogical tools** were as follows:

- Microsoft Teams
- Zoom
- Blackboard
- Moodle
- Google Classroom
- Skype
- Cisco Webex
- Microsoft Forms
- Digital Whiteboard
- Kahoot
- Kaltura
- Jupyter Notebook

Each of the partners was allocated two of these tools and received the task of creating an analysis report based on a template. The report needed to include:

- Introduction
- Tool evaluation & testing
- Functionalities supporting blended learning
- Additional tool resources

Additionally, the tools evaluation & testing sections include:

- Supporting professional engagement
- Supporting digital resources, supporting teaching & learning
- Supporting the empowerment of learners
- Facilitating learners' digital competence

Aside from the resulting report (in document form), each tool was finally complemented with a video and a presentation-style document (PowerPoint) tutorial.

Results

The resulting tool reports were adapted alongside the 6 national reports into a Compendium, which will be available on the project website (ACADIGIA Project official website, 2022).

Meanwhile, the short text tutorials, as well as the video instructions, are already available in the dedicated section on the website (ACADIGIA Results, 2022):

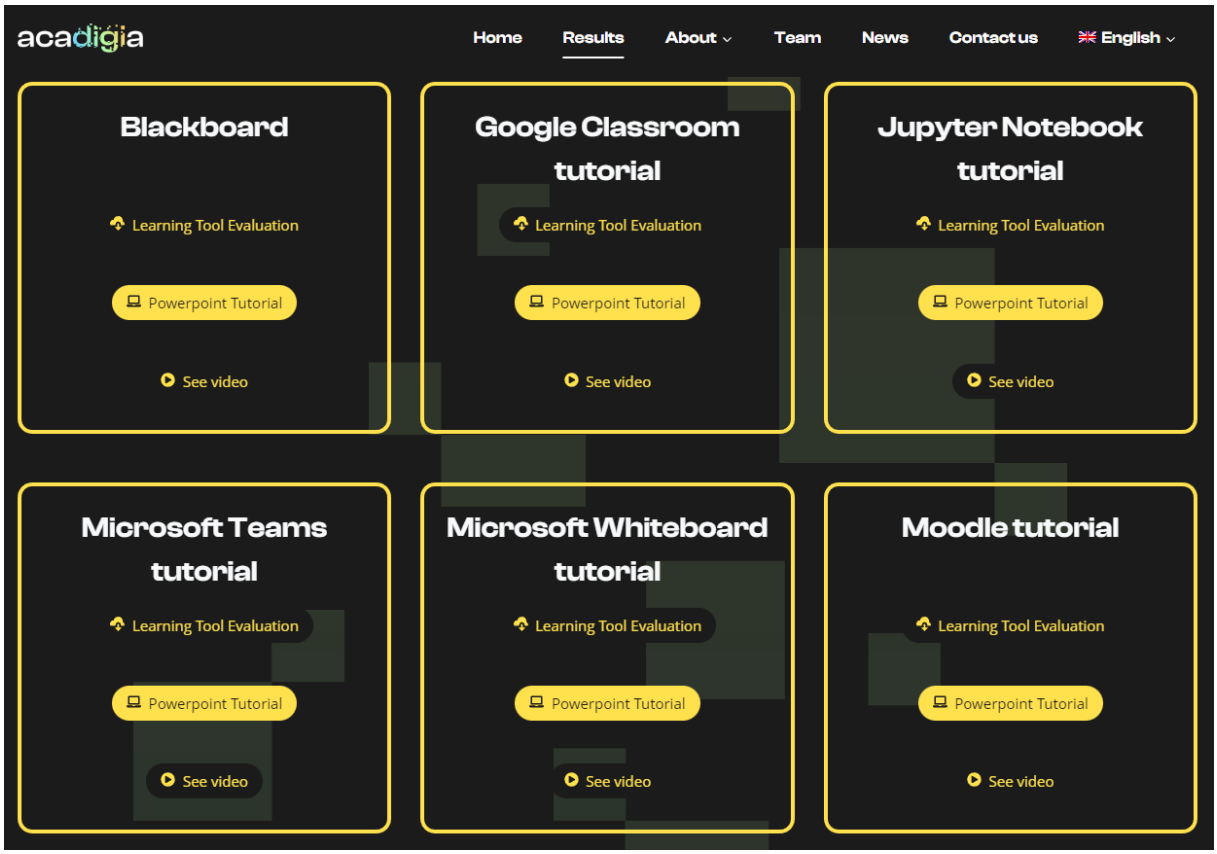

Figure 1. ACADIGIA Website - Results section

A summary of the findings of these reports is presented in Table 1. Comparison of the tools analyzedTable 1. It compares the characteristics, strengths and weaknesses of each tool, allowing a quick decision in choosing one of the solutions presented according the individual needs of most educational scenarios.

Table 1. Comparison of the tools analyzed

Tool	Characteristics	Strengths	Weaknesses
Microsoft Teams	Synchronous videoconferencing, communication and collaboration platform that combines chat, video conferencing, file storage, and workplace application integration.	Rich feature set including video conferencing and file sharing. Multiple forms of chat are possible, with potential to create various different teams and breakout rooms. Full integration with Microsoft Office 365.	Some incompatibility with operating systems other than Microsoft Windows. Limits on the length of meetings and number of participants if using the free version.
Zoom	Synchronous videoconferencing, communication and collaboration platform that combines chat, video conferencing, file storage,	Rich feature set including video conferencing, waiting room, file sharing, recording of meetings, etc.	Maximum number of participants and meeting time limits for free version.

	and workplace application integration.	Possible to create different breakout rooms.	
Blackboard	Collaborative teaching and learning platform designed to provide educators, administrators, and learners with an open, robust, secure platform to create and deliver personalized learning environments.	Widespread adoption by many HEIs and educational institutions worldwide. Intuitive and easy to use interface with complex file management. Creation of quizzes, exams and other multi-media content is possible.	Paid version only with no free version available. Dedicated technology expertise within the HEI needed to set up and maintain Blackboard.
Moodle	Collaborative teaching and learning platform designed to provide educators, administrators, and learners with an open, robust, secure and free platform to create and deliver personalized learning environments	Widespread adoption by many HEIs and educational institutions worldwide. The platform is free and open source.	Dedicated technology expertise within the HEI needed to set up and maintain Moodle.
Google Classroom	Suite of classroom tools provided by Google containing tools designed to help educators manage, measure, and enrich learning experiences.	Widespread use of Google Classroom by schools and HEIs. Simple, easy, and inituitave to use the tools.	Lacking in some features compared to other platforms such as Blackboard and Moodle. Not as common in HEIs, and mainly seen as a high school platform.
Skype	Synchronous videoconferencing, communication and collaboration platform that combines chat, video conferencing, file storage, and workplace application integration.	Calls between Skype and landlines/mobile phones is possible. Skype has both free and paid versions. Allows file exchange, video calling, voice calling and chat, and various forms of group calls.	Skype lacks some of the features available in the other platforms such as Zoom and Blackboard. Seen as somewhat outdated and surpassed by Zoom and Microsoft Teams.
Webex	Synchronous videoconferencing, communication and collaboration platform that combines chat, video conferencing, file storage, and workplace application integration.	Easy to set up and use, with a paid version available. The platform has a wide variety of features available similar to other platforms.	The platform is not as widely used in HEIs and schools as other platforms. There are some potential issues with non-Webex users to connect via audio.
Microsoft forms	Microsoft Forms allows creation of a variety of forms, surveys and quizzes. It also allows the user to invite others to respond using a web browser or mobile device, see real-time results as they're submitted, use built-in analytics to evaluate responses, and export results to Excel for additional analysis or grading.	Microsoft Forms is simple and intuative to use, as well as being free and widely used. There is a huge variety of support available and a strong community of users.	Microsoft Forms is sometimes seen as too simple and lacking in functionality when compared with other platforms. Microsoft Forms is not as widely used as some

			other collaborative learning platforms.
Digital Whiteboard	Digital Whiteboard is a simple and intuative interactive digital whiteboard.	The platform is free, intuitave and easy to use. The platform integrates with other pedagogic tools.	Digital Whiteboard is lacking in functionality when compared with other platforms. Not as widely used as some other collaborative learning platforms.
Kahoot	Kahoot is a game-based learning platform that makes it easy to create, share and play learning games or trivia quizzes.	Kahoot is highly creative and results in high levels of student engagement. The platform has been gaining wide use in HEIs over the past few years.	There is a learning curve for both student and teacher to learn all functions of the system and platform. Although it is gaining popularity, Kahoot is not as widely used as some other platforms.
Kaltura	A multimedia management platform integrated into Aula Global which allows the user to create, edit and manage interactive videos and incorporate them into courses.	Possible to record interactive video assignments, assessments and tutorials. The platform is gaining wider use within HEIs over the past years.	Although gaining popularity, the platform is not as widely used as some other learning platforms. Kaltura requires some technoval knowledge and steep learning curve for both student and teacher.
Jupyter Notebook	Web-based interactive development environment designed specifically for notebooks, code, and other technical data.	A modular design allows for a highly flexible interface allows users to configure and arrange workflows in data science, scientific computing, computational journalism, and machine learning.	Jupyter is a speciality platform focussing on computer science and engineering students. As such, the platform is not widely used by HEIs and outside the computer science and engineering fields.

Conclusions

The purpose of the ACADIGIA Project is to accelerate digital readiness of Polytechnic HEIs towards the sustainable and effective adoption of online and blended teaching and learning approaches. In order to achieve this objective, part of the efforts were focused on analyzing a list of digital tools that educators could use in their work with students, especially in the Polytechnic Higher Education Institutions.

This paper detailed the process of creating the list of potential candidates, the criteria by which the final tools were selected, the methodology of analysis as well as a short description of the findings. The study performed provides critical information about different digital education tools and the use scenarios for technical, engineering higher education. It has become clear that a critical analysis from technological, educational perspective of any educational tools is the first and important step to be performed by any university teacher, academic administrator and this report is resource that has proved its usefulness. As it is based on the first-hand experiences of a mix of university

teachers, academic managers, educational support, and technical developers the report is a diagram of the last 2 years, during COVID-19 time, and so it should be used only as indicator of fully online education as it reflects that period, but it provides clear indication and evidences for other types of education – hybrid, hyflex, or blended learning.

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