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# Digital Transformation in Higher Education: A Focus on Croatia

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## Abstract

*The COVID-19 pandemic has underscored the pivotal role of digital transformation in education. Despite pre-existing efforts, the pandemic highlighted the urgency of embracing digital technologies in teaching and learning. The e-Universities project by Croatian Academic and Research Network - CARNET aims to catalyze this transformation by investing in crucial areas such as network infrastructure, equipment, cybersecurity, institutional digital maturity and teacher competencies. Through this project, the goal is to enhance the quality and accessibility of higher education across Croatia by fostering a digitally mature environment. Research presented in this paper emphasizes the pivotal role of systematic approach in driving successful technology adoption and it is a part of a large-scale needs analysis.*

*However, as this was an initial, qualitative, study, it provides much needed bottom-up information by employing a semi-structured interview format as the primary research instrument. A total of 25 online interviews were conducted, encompassing participants from diverse scientific fields, including interdisciplinary and artistic disciplines. The sample pool consisted of educational and administrative staff from notable Croatian universities: University Josip Juraj Strossmayer of Osijek, University of Zagreb, University of Rijeka, and University of Zadar. The participants ensured comprehensive insights into the impacts of digital technology across academic and administrative domains. The research spanned four key themes: digital technology integration in educational and administrative processes, digital teaching materials, digital equipment and support services, and digital competencies.*

*The research will help create a roadmap for strategic decision-making, emphasizing collaboration, digital competency education, and innovative teaching approaches. By addressing educators' needs and recognizing disciplinary distinctions, a future-ready education landscape can be cultivated, ensuring Croatia's higher education system remains competitive and adaptable in the digital era.*

## Keywords

digital transformation, higher education, digital maturity, Croatia

## 1. Introduction

One could argue that the COVID 19 pandemic has transformed the way digital technologies are perceived in all domains of human life, education notwithstanding revealing that digital transformation is not only necessary, but also a *conditio sine qua non* for education at present times. However, in Croatia, as elsewhere, the processes of digital transformation in education had been taking place long before COVID-19. Namely, it was in 1991 when the Croatian Academic and Research Network was founded as a project of the then Ministry of Science and Technology and became the first and only provider of Internet services in Croatia. Four years later, the Government of the Republic of Croatia passed the Decree on the establishment of the CARNET institution for the purpose of innovating the education system and encouraging the progress of individuals and society as a whole with the help of digital technology.

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## 2. e-Universities Project

Since 2022 CARNET has been implementing the e-Universities project with the aim of digital transformation of higher education in the Republic of Croatia by improving the digital teaching infrastructure, introducing digital teaching tools, and strengthening digital competences of the management staff, IT staff, teachers and librarians for work in a digital environment. As part of the project, significant investments will be directed towards several crucial areas. This includes enhancing network and computer infrastructure, procuring essential equipment along with related services, and undertaking vital cyber security initiatives. Furthermore, the project encompasses the enhancement of the existing IT system and the integration of applications within the higher education sector. Moreover, the initiative aims to bolster the competencies of teaching staff in navigating the digital learning environment through educational support and tailored programs. Additionally, a key aspect involves the professional development of expert personnel. The overarching objective of the e-Universities project is to increase the quality and accessibility of higher education by reinforcing the adaptability and innovation of public institutions. This is to be achieved by facilitating investments in digital teaching infrastructure. The specific goal is to lay the foundation for sustained digital transformation in higher education institutions across Croatia. Through strategic investments in digital infrastructure and the provision of educational support, educators will be empowered to create impactful digital content. Continuous research into digital technology's applications in education and administrative processes, combined with experimental modular education initiatives, will contribute to enhancing teacher competencies and overall digital maturity across higher education institutions throughout Croatia. The project is scheduled to last from March 2022 to December 2025.

### 2.1. Research background

Numerous studies have addressed teachers' problems in accepting new technologies, focusing mainly on how to use technology and only lately on its integration into the teaching and learning process. Studies show that successful implementation of educational technologies depends largely on the attitudes of educators and that their attitude is a major enabling/disabling factor in the adoption of technology [1, 2, 3, 4]. Educators' acquisition of digital competence is elaborately shaped through the convergence of individual and institutional determinants. The achievement of favorable outcomes in the implementation of novel educational methodologies is notably contingent upon the manifestation of intrinsic motivation among teachers [5]. This motivation encompasses the eagerness to actively participate in professional development initiatives oriented towards fostering innovation and effectively translate acquired knowledge into practical classroom applications. Educators, like professionals in any field, require certain conditions and resources to effectively engage in innovative practices. An array of external challenges can obstruct their capability to do so [6].

However, in this paper we argue that, in addition to this individually-oriented perspective, systematic support and systematic transformation also play a major role in the digitalisation processes as many of these experiences are collective and thereby should be approached at all levels – top-down, communally (in forms of communities of practice) and individually [7]. CARNET and the e-Schools team from the Faculty of Informatics, University of Zagreb, during the project e-Schools developed the notion of *digital maturity* applying it to educational context [8, 9]. The concept has also served as an analytical tool for measuring digital transformation of educational institutions and focused on different aspects of institutional digital development, namely – digital management, teaching and learning competences, professional development, institutional digital culture and infrastructure – themes which are to a larger extent covered in the research presented in this paper.

## **2.2. Methodology**

This study is a part of a larger needs-analysis study that consisted of qualitative research in the forms of semi-structured interviews (presented here), quantitative study and focus groups. In this paper we will focus on the first part of the study – interviews conducted at the beginning of the whole-scale research.

The interview protocol encompassed four main themes focusing on the integration of digital technology in educational and management processes. The first theme explored the integration of digital technologies within teaching and institutional workflows. This involved investigating how digital tools were used to enhance successful learning and teaching processes as well as efficiency. The second theme delved into the realm of digital teaching materials, analyzing their design, delivery, and impact on learning outcomes. The third theme centered around digital equipment and support services, aiming to comprehend the role of technological infrastructure in facilitating successful implementation. Lastly, the fourth theme centered on digital competencies, scrutinizing the skills required for proficient application of digital tools in various contexts.

A total of 25 online interviews were conducted, engaging participants from diverse scientific fields, with interdisciplinary and artistic disciplines included. The pool of participants consisted of educational and management staff from four Croatian universities: University Josip Juraj Strossmayer of Osijek, University of Zagreb, University of Rijeka, and University of Zadar. This diverse representation ensured a comprehensive exploration of the impact of digital technology across various academic and administrative domains.

## **2.3. Results**

### **2.3.1. Support and Equipment Needs in Digital Education**

The landscape of digital education has brought to light a range of essential requirements, all contributing to the pursuit of a more streamlined and effective approach. One noticeable need pertains to the quest for a unified methodology. Instructors currently operate on diverse platforms and Learning Management Systems (LMS), revealing the absence of established standards for incorporating digital technologies into teaching. This reveals a demand for software solutions that not only facilitate administrative tasks but also cater to subject-specific needs. Corresponding education about these tools is also recognized as crucial.

An equally pressing concern revolves around the provision of necessary equipment, particularly within classrooms and for hybrid teaching scenarios. Vital hardware includes dual screens, intelligent cameras, microphones, sound systems, lecture recording facilities, and specialized licenses. Alongside this, both technical and human support are deemed essential, while some instructors rely on their own equipment. However, a significant inconsistency in the level of technical support among faculties is apparent. Certain faculties boast e-learning committees, while most lack such institutional backing.

Addressing these needs, a significant proportion of educators underline the urgency of swift and efficient technical support, a service often found wanting. Additionally, the notion of establishing multimedia support centers at the faculty level emerges as a suggestion to enhance learning and teaching experiences. Expanding beyond technicalities, the desire to network with colleagues from other institutions teaching similar courses surfaces as an imperative for knowledge sharing and experiential enrichment. Lastly, the need for regulating digital culture emerges. The scarcity of such regulation elicits frustration due to perpetual exposure to digital stimuli, constant emails, messages—24/7 availability—a predicament mirroring that encountered in school settings.

### **2.3.2. Educational Needs**

The imperative for education across various domains is evident, encompassing a multitude of aspects in the realm of digital transformation. Areas requiring additional education include lecture recording, assistive technology, professional engagement, digital resources and materials, teaching and learning methodologies, assessment strategies, empowerment of students, and the development of students' digital competencies.

A strong consensus resonates that the responsibility for this education lies with the educators themselves. It is acknowledged that correctly applied digital technology (DT) positively impacts student engagement. However, the correct integration of DT should be considered an integral part of pedagogical consideration, rather than an isolated endeavor.

Furthermore, there is a high demand for the creation of highly sophisticated educational materials. This involves incorporating gamification elements within the materials, as well as integrating user interfaces to enhance user experience. An expressed need for pedagogical and methodological skills development pertaining to digital technology integration is also evident.

Participants have advocated for the development of concise, targeted education formats. These could take the form of succinct, interactive webinars lasting around 45 minutes. It is suggested that these sessions be accompanied by clear, concise written instructions and be scheduled at times that do not conflict with other commitments. Such sessions should occur once or twice annually. Lastly, the clamor for succinct, interactive, and creative education is echoed, involving project-based learning approaches. This approach emphasizes the need for practical engagement to effectively grasp the nuances of digital transformation in education.

### **2.3.3. Recording Lectures**

The practice of recording educational sessions remains a rarity, with even fewer instances of public sharing. One prevailing argument for this limited engagement is the perceived subpar quality of such recordings. In light of these challenges, a prevalent need emerges for the establishment of recording standards—comprehensive guidelines dictating the principles of recording classroom sessions and the desired attributes of resulting recordings. As a participant from the Faculty of Electrical Engineering and Computing (FER) succinctly articulates, the aspiration for standardization and clarity within the realm of digital technology-based teaching is akin to having an "IKEA manual" that universally guides the execution of various instructional formats and administrative processes. Presently, the spectrum of possibilities for implementation is notably broad, leading to divergent outcomes. This diversity in approaches, from choice of software to instructional methodology, underscores the requirement for defined benchmarks.

A consensus among many participants underscores the pressing necessity for adequately equipped recording studios and classroom tools tailored to hy-flex teaching scenarios. The demand is pronounced for contemporary learning spaces outfitted with versatile equipment to facilitate hybrid teaching—a method that combines in-person and remote instruction. This pivotal requirement stems from the collective aspiration to foster high-quality recordings, ensuring effective pedagogy in the ever-evolving landscape of digital education.

It is recognized that responsible educators diligently strive to optimize the quality of recorded content, while others may limit their efforts due to the general nature of instructions provided. Notably, exemplary European universities employ standardized formats in their instructional recordings, regardless of subject matter or presenter. These institutions employ uniform components such as splash intros, green screen presentations, and dynamic camera angles, yielding a presentation that emanates professionalism and quality.

### **2.3.4. The Importance of Formal Recognition**

There exists a compelling need for the introduction of a system for evaluating digital educational competences as part of professional development. This demand is rooted in the pervasive desire for enhancement in digital competencies across virtually all disciplines, with particular emphasis on the domains of teaching and learning, student empowerment, and the use of digital resources. However, these endeavors are not currently accorded due formal recognition. Individuals underscore that the

creation of digital educational materials does not receive comparable acknowledgment in the context of career progression, thereby compounding the issue.

### **2.3.5. Assistive Technologies**

While there's a notable lack of familiarity with assistive technologies, there is also a strong inclination towards seeking education in this direction. In general, there appears to be a deficiency in awareness about students with special needs, despite some pockets of good practice at individual institutions. Noteworthy examples include disability support offices that cater to all students with disabilities, ensuring effective communication with instructors and recommending necessary adjustments for individual students. For instance, such an office at the University of Rijeka procures essential assistive technologies and adapts learning materials to accommodate specific learning needs.

### **2.3.6. Students**

While there is a consensus that technology streamlines educational and professional processes—accelerating tasks, enabling easier access, fostering customization, and enhancing communication—participants also highlight its potential to render students more passive. Simultaneously, they express concerns about technology promoting poor reading habits and cultivating spoon-feeding-like solutions, such as PowerPoint presentations. Notably, participants note that students frequently underutilize the capabilities for resource exploration, sometimes engaging in unethical practices like plagiarism.

Resistance among students towards online learning has been observed, particularly after the implementation of Covid-related measures. Students exhibit greater engagement when working in groups, revealing a preference for collaborative approaches. Consequently, the educational value of implementing digital technology holds more weight than the technology itself, contributing significantly to student engagement.

For a couple of respondents stressed that for some students, the use of digital technology amplifies their engagement; however, for those with lower motivation and self-discipline, technology often yields counterproductive outcomes. The impact of technology is not uniform across all students, further underscoring the need for personalized approaches in integrating digital tools into education.

### **2.3.7. Room for Enhancement**

The use of technology for assessment purposes appears somewhat underutilized, except for a few more advanced participants, primarily from technical faculties. Interestingly, among the majority of respondents, the sharing of digital teaching materials is not prevalent, with the exception of some sharing with students. This phenomenon highlights a potential disparity in resource accessibility within the educational landscape. Furthermore, a less pronounced awareness regarding licensing systems and copyright issues is noted, indicating a gap in understanding the legal dimensions of digital resource utilization. This underscores the importance of providing educators with a more comprehensive understanding of intellectual property rights in the digital realm.

Most often, digital educational materials are predominantly associated with the creation of PowerPoint presentations. However, participants themselves acknowledge that this approach can inadvertently foster student passivity as they merely receive ready-made materials without actively engaging in source-searching, thereby diminishing their critical thinking development.

Additionally, a significant gap becomes apparent concerning the absence of comprehensive strategies for hybrid teaching methodologies. This deficiency points toward the need for pedagogical adaptation to the evolving educational landscape, emphasizing the importance of incorporating digital tools in a more strategic and holistic manner.

These observations collectively accentuate the need for a more comprehensive approach to technology integration within education. Bridging these gaps requires fostering a culture of collaboration, bolstering awareness of legal considerations, reimagining digital learning materials creation to encourage active learning, and rethinking pedagogical methods to seamlessly encompass digital tools.

### **2.3.8. Art Academies - The Need for Profound Digital Transformation**

When it comes to art academies, the lack of digital transformation is distinctly evident—spanning equipment, competencies, and emerging trends such as content creation and digital art, albeit in specific, specialized disciplines. An illuminating portrayal of this situation is provided through an insightful interview conducted at the Art Academy in Osijek, which vividly captures the prevailing scenario and its intricacies.

### **2.3.9. Technical Fields**

Responses obtained from institutions such as FER (Faculty of Electrical Engineering and Computing Zagreb), FSB (Faculty of Mechanical Engineering and Naval Architecture), and FOI (Faculty of Organization and Informatics – all from University of Zagreb, highlight a discernible disparity in digital engagement between technical and non-technical scientific fields. Notably, a more robust awareness of digital technology's potential, along with more developed practices in recording and sharing materials, emerges within the realm of technical sciences. This observation gives rise to the hypothesis that technical disciplines are generally more attuned to the possible uses of digital tools, along with a comparatively advanced use of Learning Management Systems (LMS).

## **3. Discussion**

This study sheds light on the pressing need for comprehensive digital transformation in the Croatian higher education landscape. The impacts of the COVID-19 pandemic, coupled with pre-existing trends, have underscored the urgency of embracing digital technologies for effective teaching, learning, and administrative processes.

The research highlights several key areas that warrant attention and strategic intervention. The identified needs for support, equipment, and education underscore the demand for a unified approach in incorporating digital tools. By addressing the requirement for standardized methodologies and offering subject-specific software solutions, educational institutions can foster a consistent and enriched digital learning environment.

Furthermore, the imperative for educational programs aimed at enhancing digital competencies among educators is unmistakable. The acknowledgement that the role of educators is pivotal in not only utilizing but also integrating digital technologies aligns with the evolving pedagogical landscape. The appeal for concise, targeted education formats and project-based learning approaches reflect a commitment to facilitating a seamless transition to digital methodologies.

The study's exploration of recording lectures highlights the need for standardized practices to enhance the quality and engagement of recorded content. It underscores the importance of creating a robust infrastructure for high-quality recordings and a conducive environment for hybrid teaching scenarios.

The research also underscores the importance of recognizing digital competencies as part of professional advancement. The call for the establishment of a formal evaluation system reflects the aspiration for enhancing digital skills across various domains and validates educators' efforts to create digital educational materials.

The insights gleaned from art academies and technical disciplines further enrich our understanding of digital transformation. While the former lacks comprehensive digital integration, the latter demonstrates a relatively advanced utilization of digital tools, emphasizing the need for tailored strategies across diverse academic domains.

## 4. Conclusion

By synthesizing these findings, the research provides a roadmap for informed decision-making and strategic planning. It calls for the cultivation of a collaborative culture, heightened awareness of legal considerations, and innovative approaches to designing digital learning materials that foster active student engagement. Additionally, recognizing the distinct needs of various academic disciplines can inform tailored strategies that bridge gaps and ensure a cohesive digital transformation.

Ultimately, this study emphasizes that the journey toward comprehensive digital transformation in higher education is multifaceted. The identified needs, challenges, and opportunities underscore the imperative for stakeholders to collaborate, adapt, and innovate to ensure a future-ready education landscape in Croatia and beyond.

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