THE CHALLENGES ASSOCIATED WITH DIGITAL EDUCATION IN HIGHER MILITARY EDUCATIONAL SETTINGS

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Abstract: In the context of a digitized society, educational activities transcend conventional spaces. Generation Z, the cohort to which today's students belong, differs substantially from previous generations. Within this framework, characterized by the lens of technology and easy access to information, digital education is considered a cornerstone in educating the human resources of the future. Building upon these premises, the objective of this endeavor is to identify the main challenges encountered in the domain of military university education. Additionally, utilizing the method of content analysis, this article aims to delineate an accurate portrayal of the current state of challenges in the field of digital education and to present future perspectives in addressing these challenges.

Keywords: education, digitisation, infrastracture, Military, defence

1. Introduction

In an era marked by rapid and profound technological transformations, the relevance of digital education becomes undeniable. The accelerated development of technology and the emergence of advanced systems, including artificial intelligence applications, necessitate continuous adaptation of human skills. Generation Z, raised in the digital environment, brings new challenges and requirements, challenging traditional pedagogical methods. These changes require a reevaluation of the educational system, which must embrace and integrate digital technologies to remain relevant and efficient.

Digital education has become an integral part of higher education in Romania. Its implementation not only enables students to adapt to new technological advancements but also contributes to the modernization and innovation of the educational process. By incorporating digital technologies into teaching, the educational system can become more appealing and relevant to students' needs, thereby fostering continuous learning and the development of essential skills required for the contemporary job market.

However, the development of the conventional pedagogical system towards a higher level involves a variety of challenges, manifested through changes in infrastructure, teaching staff, and students. Against the backdrop of these transformations and challenges, this article aims to achieve two main objectives:

• Presenting the current image of the educational system in relation to the first category of transformations imposed by digital education, namely infrastructure.

• Analyzing future trends regarding the European response and, based on this, the national response at the infrastructure level. Furthermore, considering the lack of specialized

literature focused on this area, an analysis of the movements and approach of the largest and most renowned higher education institutions in Romania, especially the military ones, will be presented.

The directives of the *European Commission's Digital Education Action Plan* for 2021-2027, launched in 2020, will be presented alongside *Romania's Education Digitalization Strategy* (2021) and the strategies of various academic institutions, including the University of Medicine and Pharmacy in Timișoara, „Babeș-Bolyai" University, University of Bucharest, „Nicolae Bălcescu" Land Forces Academy, „Henry Coandă" Air Forces Academy, „Mircea cel Bătrân" Naval Academy, „Ferdinand I" Military Technical Academy, and "Carol I" National Defense University.

2. Analysis of the current infrastructure in relation to digital education in higher education

The European Commission strongly advocates for the necessity of digitizing education and emphasizes that „The EU should ambitiously address the opportunities and challenges of digital transformation in education and training." (European Commission, 2020:11). Consequently, at the European level, a strategic priority titled „*Fostering the development of a high-performing digital education ecosystem*" (European Commission, 2020:11), has been established, aiming to develop the necessary infrastructure for digital education in educational institutions. Within this framework, four main directions regarding infrastructure are defined: **technological resources, connectivity, open educational resources, and cybersecurity.** Based on these European directives launched in 2020, Romania developed the *Digitalization of Education Strategy* in 2021, with the objective of developing the digital ecosystem during the period 2021-2027.

In terms of **technology resources**, there is not a balanced balance between devices and users. According to data provided by the National Institute of Statistics for the period 2019-2020, in higher education in Romania, the level of coverage with personal computers is only 19.8% , and of these, only 19% are connected to the internet. The higher education system comprises 90 institutions with a total of 543,299 students and 26,429 teaching staff, with a total of 112,951 computers. According to the European Commission's Digital Economy and Society Index report, Romania ranks 26th out of 27 EU Member States in terms of digitisation. However, in terms of **connectivity**, the country ranks 11th in Europe. This is mainly due to the widespread use of high-speed broadband services and the widespread availability of high-capacity fixed networks, especially in urban areas (Ministry of Education and Research – Romania, 2021:56).

RoEduNet, as a member of the European Research and Education Network GEANT, ranks among the top three networks of its kind in Europe. With a robust data communications infrastructure, including a 100 Gbps backbone, RoEduNet interconnects universities, student campuses, research centers, schools, and highschools throughout Romania. Additionally, a dark fiber connection has been established with VIX Vienna, one of the two relevant data centers in Europe, with two capacities of 100 Gbps each. One of these capacities is dedicated to the research platform in Măgurele, directly connected to CERN Geneva, while the other is dedicated to education. Any initiative to expand connectivity within Romania's educational

system will build upon the infrastructure and expertise already developed by the National Education and Research Network Management Agency, which administers the RoEduNet network (Ministry of Education and Research – Romania, 2021:72).

In the context of Romania's strategy for digitalization, there is not a detailed perspective offered on Open Educational Resources (OER) in higher education. Instead, only the Online Learning Center (http://training.ise.ro) is mentioned. However, the strategy does highlight platforms and websites developed by the Ministry of Education within various nationally or European-funded programs, dedicated to pre-university education (such as www.subiecte.edu.ro, www.manuale.edu.ro, www.didactic.ro, etc.). Nevertheless, there are currently numerous open educational resources dedicated to university students, such as *E-nformatio*n, the *National Digital Library*, and other similar platforms developed by higher education institutions in the country (Ministry of Education and Research – Romania, 2021:80-83).

Additionally, it is essential to note that the implementation of digitalization in education and the intensification of distance communication are accompanied by specific cybersecurity risks. These risks are often exacerbated by insufficient awareness of online threats and educational infrastructures that are not yet mature in terms of cybersecurity. Several significant challenges face most educational institutions and units:

• Decentralization of IT: Many educational entities manage their own IT systems, which are highly diverse and tailored to each entity's specific requirements. This diversity and widespread distribution of networks make implementing security policies challenging.

• BYOD culture (bring your own device): Many users bring their own devices into the educational environment, increasing the complexity of security management as these devices may have different security levels or be vulnerable to cyber attacks.

• Use of open networks: In the educational environment, there are often open WiFi networks that are vulnerable to cyber attacks because they are not protected by adequate security methods.

• Internal threats: Internal threats are one of the most common concerns in cybersecurity. These can be initiated by individuals within the organization and may involve attacks such as phishing emails or the transfer of sensitive information to personal or insecure devices (Ministry of Education and Research – Romania, 2021:85-92).

In conclusion, at this moment, Romania's image from the perspective of the four strategic directions is satisfactory only regarding connectivity, with deficiencies persisting in other aspects. However, *The Digitalization of Education Strategy in Romania* is not limited to just an assessment of the current national situation; it also provides a vision for the improvements Romania intends to implement in the future.

2. The national response regarding infrastructure in digital education within higher education.

The educational infrastructure concerning technological resources will be updated by equipping at least 13 practice, didactic, and university research laboratories annually, reaching a total of 91 laboratories by the end of 2027. This will facilitate the development of advanced competencies in digital and technological domains. Emphasis will be placed on

modernizing university facilities to improve and expand the skills necessary in the labor market, particularly in ICT, biotechnology, nanotechnology, artificial intelligence, robotics, automation through RPA, the Internet of Things (IoT), blockchain, autonomous transport, virtual reality, and 3D and 4D printing.

3D virtual laboratories and virtual reality (VR) environments will enable students to conduct experiments in a safe setting, providing the opportunity to observe, study, demonstrate, verify, and measure the outcomes of analyzed phenomena. Through these virtual experiments, students will be able to recreate real-life scenarios, regardless of the associated complexity or risks. These processes can be repeated until a thorough understanding is achieved, and the platforms will be designed to be engaging and user-friendly. The development of virtual laboratories will adhere to both pedagogical requirements and educational curricula, as well as to specific recommendations, standards, and norms for designing digital educational content (Ministry of Education and Research – Romania, 2021:63-64).

For university and doctoral education, digital certificates will be stored on blockchain, covering documents such as university degrees, postgraduate degrees, doctoral degrees, and micro-credentials (which attest to participation in modules or courses at other institutions or countries). This system offers numerous advantages: enhancing the integrity of certificates through digitization, improving the confidentiality of personal data, increasing transparency in the educational process, ensuring more precise accuracy in presenting the skills and competencies portfolio, facilitating the portability and mobility of documents for further studies or employment, and promoting the personalization of educational pathways (Ministry of Education and Research – Romania, 2021:64).

Connectivity within educational institutions in Romania must be aligned with efforts to modernize the educational infrastructure to create optimal conditions that enable students to develop the skills necessary for the 21st century. Although connectivity in Romanian university spaces is currently adequate, future digital education projects and the introduction of advanced educational technologies require continuous updates to connectivity to support these reforms. The European Commission emphasizes the importance of sharing educational materials online and, implicitly, the development of Open Educational Resources (OER). The digitization strategy includes, among its priorities, the "Creation of Open Educational Resources (OER)" (European Commission, 2020:14-15). According to the action plan in the digitization strategy for the period 2021-2023, it is planned to "Create learning centers at each university where OER resources will be available as educational support" (Ministry of Education and Research – Romania, 2021:84). However, unlike other priorities of the strategy, the subject of OER is addressed more generally and briefly, without clearly defined objectives. Nonetheless, the topic of OER is treated with much more seriousness and detail in the context of pre-university education.

The implementation of innovative solutions in education, such as smart laboratories and advanced e-learning systems, requires rigorous information security management, in accordance with data protection legislation, ensuring secure access and performance monitoring. It is essential to develop effective mechanisms to attract IT specialists from the private sector to collaborate with schools and universities in Romania, in roles such as

network administrators, or to create regional call centers that provide support for managing these infrastructures. In the field of cybersecurity, three priority directions stand out (Ministry of Education and Research – Romania, 2021:85-88):

1. Implementation of equipment for network security
2. Protection against fraud
3. Training of new specialists in cybersecurity

Pornind de la recomandările și strategiile elaborate la nivel european și de către Based on the recommendations and strategies developed at the European level and by the Ministry of Education, higher education institutions in Romania have initiated efforts to strengthen infrastructure, thereby facilitating the digitalization of education, with the primary goal of transcending the traditional level of the educational system.

3. The response of higher education institutions regarding infrastructure in the context of digital education

The „Victor Babeș" University of Medicine and Pharmacy (UMF) in Timișoara will expand its facilities by constructing a new, modern study center dedicated to students and faculty in the commune of Ghiroda, located near the city of Timișoara. The investment, estimated at 25,000,000 euros, involves the launch of a tender on the SEAP platform for the design and execution of the necessary works. The project will be situated on a site measuring 21,000 square meters, and will involve the construction of a structure that will accommodate two amphitheaters, ten seminar rooms, a conference center, an anthropological museum, and an exhibition center. Furthermore, the design will incorporate offices for faculty and scientific staff, two study and discussion rooms, as well as a variety of annexes. The project also includes the construction of a building for educational purposes and a building for accommodation units, along with a gymnasium and sports fields (Agerpres, 2022).

The „Babeș-Bolyai" University (UBB) aims to address most of the current challenges related to digitalization by 2027, committing to become "perfectly adapted and integrated into the digital landscape of society." In this context, the university is developing six strategic directions and operational programs:

1. Education and research
2. Improvement of decision-making processes and administrative simplification through digitalization
3. Digital integration
4. Information and communications technology direction
5. Relationship with the IT business environment
6. UBB Green

Specifically, in the aim of digitalizing education, UBB plans to achieve the following objectives: building authentic databases, migrating to online platforms, perfecting existing digital systems, creating a "red button" feedback system, implementing a system to facilitate access to OER, ensuring high cybersecurity standards, publishing a monthly newsletter, and other similar initiatives (Babes-Bolyai University, 2021).

The **University of Bucharest (UB)** is implementing the "*Digital Transformation Strategy of the University of Bucharest*" for the period 2022-2027, focused on three main

areas: Education, Research, and Administration. This strategy aims to streamline the educational system through a series of specific objectives:

• Adoption of state-of-the-art information and communication technologies to ensure the infrastructure necessary for modern and efficient education.

• Improvement of the quality of educational services through the use of IT&C-supported methods, thus optimizing the teaching and learning process.

• Revision and updating of study programs to include emerging technologies and professions, ensuring the relevance and timeliness of the university curriculum.

• Collaboration with university partners and the IT&C industry to facilitate bidirectional exchange of knowledge and resources, developing programs and outcomes beneficial for students, participants, the university, and partners.

Through these initiatives, UB aims to significantly improve the quality and efficiency of educational processes, consolidating its position in the modern academic and digital landscape (University of Bucharest, 2022).

As part of the "*Grants for the Digitalization of Universities*" program funded through the National Recovery and Resilience Plan (PNRR), the **"Alexandru Ioan Cuza" University (UAIC)** in Iași has secured funding of over 8 million euros for the digitalization of the institution. The aim of this project is to ensure the necessary resources in the field of Information and Communication Technology (ICT) in line with technological progress and new technologies available on the market, through investments in the modernization of digital infrastructure. Additionally, a series of IT services will be modernized and implemented within the university by 2025. The project will create an institutional framework for developing the digital skills of members of the academic community, by updating, developing, and providing training programs in basic and advanced digital skills. Furthermore, IT and communication services will be developed, modernized, and updated to facilitate access to the academic environment and improve the quality of educational and research services by 2025. The project will be implemented over a period of 39 months, with a total value of 40,265,619.21 lei (Alexandru-Ioan Cuza University of Iasi, 2022).

The **"Nicolae Bălcescu" Land Forces Academy (AFT)** in Sibiu continues its digitalization initiative as part of its institutional strategy through the project „*DigitalArmyAcademy: Integrating Digitalized Educational Processes in the Land Forces Academy.*" This project, funded with over 13,417,837.86 lei through the "*Grants for the Digitalization of Universities*" program within PNRR, aims to modernize educational infrastructure and enhance the advanced digital skills of both faculty and military students, in line with European standards for digital competencies. The project aims to:

• Establish a data center;

• Implement IT solutions for digitalizing educational relationships and processes with students;

• Upgrade ten laboratories with state-of-the-art hardware and software equipment, promoting innovative methods of digital teaching and learning (Nicolae Bălcescu Land Forces Academy: https://www.armyacademy.ro/ev_2022_09_23.php).

According to the „*Digitalization Strategy of the Air Force Academy*" **(AFAHC)**, this institution possesses multiple strengths in the field of digitalization. Students demonstrate

advanced competencies in information technology, and the academy efficiently utilizes an e-learning platform. The management of AFAHC actively supports the digital transformation process and collaborates with international universities on projects related to the digitalization of military higher education institutions. Additionally, the academy benefits from experts in IT&C and internal methodologies and regulations that facilitate the development and use of digital tools.

During the period 2021-2025, AFAHC has established a strategy for the development of digital education infrastructure, which includes 11 objectives, among which are:

• Modernizing and updating infrastructure, as well as connectivity of digital equipment.

• Creating high-quality digital educational content.

• Automating processes and activities within the information system.

• Implementing modern technologies such as artificial intelligence, virtual reality, and augmented reality in the educational process (Henry Coandă Air Force Academy, 2022:66-8).

While the **Naval Academy "Mircea cel Bătrân" (ANMB)** does not publicly disclose its digitalization strategy, its "*Strategic Plan for Institutional Development*" is available, outlining six fundamental objectives for the period 2021-2025. Within the objective of "*Consolidating the culture of quality and ensuring excellence in education*," various action directions related to the digitalization of education from an infrastructure perspective are outlined, such as:

• Improving the digitalization of the educational and training process by updating teaching materials and using interactive digital resources and online learning.

• Increasing the objectivity of assessment processes through the gradual adoption of digital assessment technologies.

• Developing a portfolio of online courses supported by the ADL platform (including courses under the ESDC), to capitalize on institutional potential.

• Transitioning to an electronic library (Mircea cel Bătrân Naval Academy, 2020:7-9).

The mentioned objectives are supported and funded by the project "*Digitalization of the Naval Academy's Infrastructure*" within the PNRR, with a value of 13,071,215 lei (Mircea cel Bătrân Naval Academy, 2022). In 2023, ANMB inaugurated a specialized laboratory, equipped according to international standards, dedicated to the fields of Voyage Planning and Execution, Electronic and Integrated Navigation. This laboratory aims to provide high-quality professional training to all personnel of the institution (Mircea cel Bătrân Naval Academy: https://www.anmb.ro/DigiANMB/events01.html).

The **"Ferdinand I" Military Technical Academy (ATM)** is developing the „*Strategic Plan of the Academy*" for the 2024-2029 term, with only the operational plans for the digitalization of the institution for the previous academic years 2023-2024 being made public. The operational plan for the digitalization of the institution is correlated with the digitalization strategies of the Ministry of National Defense, establishing two main guidelines: the digitalization of educational and research processes; the digitalization of administrative processes.

Within the first guideline, ATM aims to achieve the following objectives:

• Expansion of ATM's virtual library and integration with other university libraries.

• Ensuring online access to the book collection for all academy members.

• Maintenance and utilization of online training platforms in the educational process.

• Completion of the acquisition and operationalization of a new mobile data center.

• Ensuring secure and continuous access to data required for education and research (Ferdinand I Technical Military Academy, 2023: 1-3).

To achieve these objectives, UNAp has obtained funding amounting to 12,867,266.61 lei through the PNRR, aiming to overhaul the institution into a contemporary establishment aligned with the tenets of digital education. From 2022 to 2025, UNAp plans to modernize the digital infrastructure of 12 departments and three laboratories, facilitating the cultivation
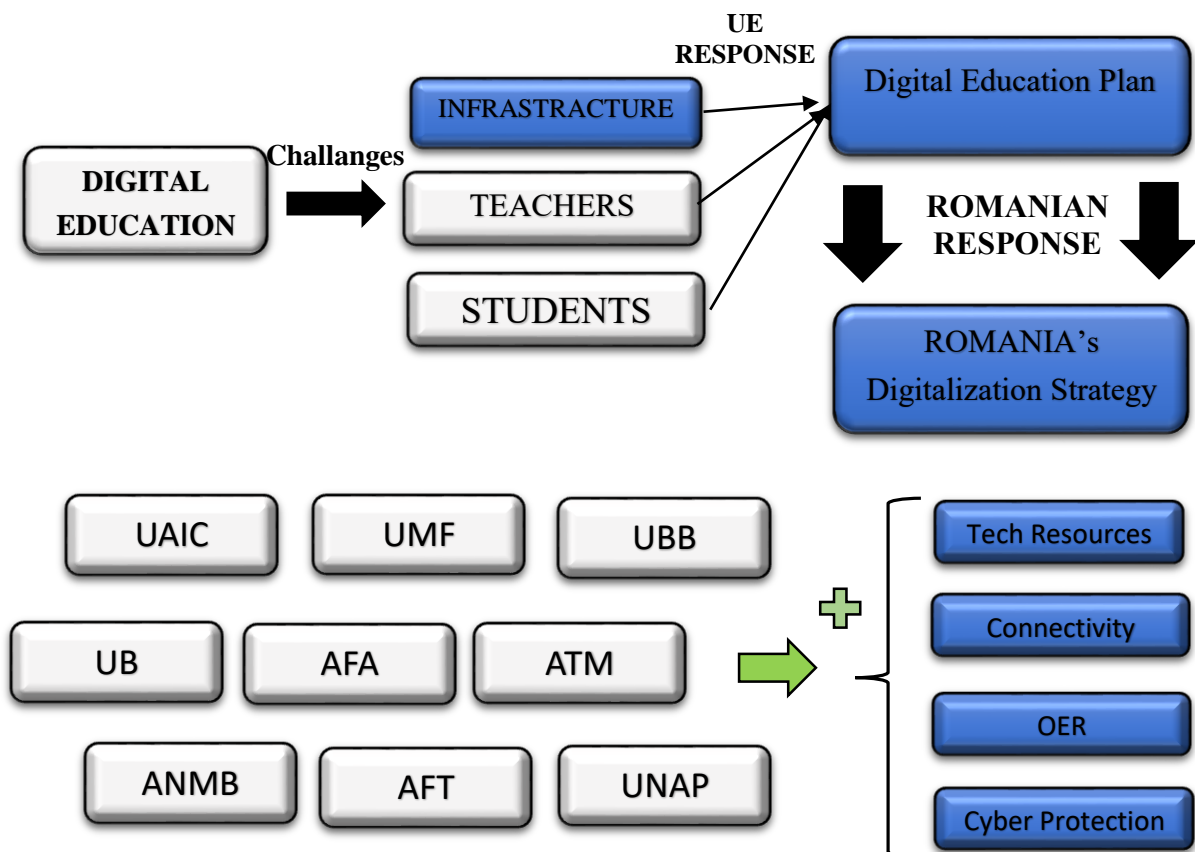

Figure 1: The figure depicting the implications of digital education in the higher education system and the European and national response to the infrastructure-related challenge

Source: author's conception

The **National Defense University "Carol I" (UNAp)** conceptualizes digital transformation as a balance between people, technologies, and processes, aiming to create a digitized educational environment by the year 2027. According to the UNAp Digital Transformation Strategy, three guiding principles are outlined regarding the digitalization of education:

• Expansion and consolidation of ICT infrastructure: The university will improve its ICT infrastructure to provide digital access to all students and staff by 2027.

• Development of applications and IT platforms: The university will create integrated portals and digitize workflows by 2027.

• Implementation of emerging technologies in the educational process: The university will integrate emerging technologies into study programs and support research in this field by 2024.

To achieve these objectives, UNAp has obtained funding amounting to 12,867,266.61 lei through the PNRR, aiming to overhaul the institution into a contemporary establishment aligned with the tenets of digital education. From 2022 to 2025, UNAp plans to modernize the digital infrastructure of 12 departments and three laboratories, facilitating the cultivation of digital competencies among 30 faculty members and approximately 500 students (Carol I National Defense University: https://www.unap.ro/index.php/ro/8-noutati/evenimente/388-investitii-masive-pentru-digitalizarea-unap-carol-i).

Conclusions

In conclusion, the importance of digital education is indisputable in shifting from traditional teaching methods to more modern approaches that cater to current societal demands. This approach enables us to redesign the educational experience as interactive, captivating, and relevant to students' needs, thereby equipping them for their future professional lives. By familiarizing them with cutting-edge technology and preparing them for future obstacles, digital education mitigates the risk of them being left behind by technological advancements. However, digital education confronts three distinct sets of challenges that impact infrastructure, instructors, and students.

Regarding infrastructure, the European Commission has established an action plan that served as the basis for the development of a digitization strategy in Romania. At the institutional level, each university analyzed previously has initiated its own digitalization strategies, most through the PNRR (Ministry of Education – Romania: https://www.edu.ro/digitalizare_universitati_PNRR). By accessing European funds, these institutions have begun to implement measures for the digitalization of education, focusing on the four guidelines established by the European Union and the Romanian government: equipping with technological resources, developing connectivity infrastructure, promoting open educational resources, and strengthening cybersecurity. Moving forward, our objective is to employ a similar analytical methodology in addressing other challenges in the realm of digital education.

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