

# Implications of modern digital technologies in higher education

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**Abstract** — This article offers new insight into a set of issues related to modern digital technologies in higher education. Also, there are analyzed their impact and some specific aspects of the dynamic interaction between them in today's context of higher education. The impact of the Fourth Industrial Revolution (4IR) on the mission of higher education from universities is also explored. Modern digital technologies in higher education are a necessity in the current student-centered education system, focusing on the level of development of its potential, to develop an efficient, sustainable learning style that correlates different operational concepts for maintaining high academic standards.

**Keywords** — digital technology, eLearning, higher education, methodology, modern educational technology, quality education

## I. INTRODUCTION

The history of education at all levels with various arrangements across the basic levels, its philosophy, as a multifaceted and integrated process, is in direct connection with the development of information and communication technologies that offer the basis for social growth and prosperity [1-3].

The modern philosophy of education in all its diversity and complexity expressed in the "tradition - innovation" system, has taken a central role and significantly contributed to innovation and value creation providing strong motors for the economic, social, and academic sectors.

Higher education institutions and policy dynamics of expansion and differentiation of higher education systems differ across time, between countries and political regimes, with complex socioeconomic fluctuations and strong implications in all areas. Whatever the era, the higher education institutions have the same fundamental functions, to offer a high quality of education using appropriate teaching strategies to transfer the latest knowledge through exploratory research and training [4-6].

Higher education as a complex long-term process in a permanent dynamic requires institutions to put a huge amount of effort and vision into teaching, research, and innovation, based on optimal management, critical thinking, cognitive flexibility and competition to fulfill their roles in society.

Modern innovations in higher education influences the activity of students in different ways, principally in terms of access, use, competence, diversity, and quality education.

In recent decades, digitalization is one of the most visible, complex, and profound phenomena between science and

practice, due to its higher flexibility in all aspects of the educational system and the socio-economic structures [7].

Advancements in information and communications technology (ICT) are mainly reflected in new approaches with the concrete requirements to teaching, learning, and research, or knowledge generation and knowledge transfer, to accelerate, amplify, and expand the impact of teaching practices [8, 9].

ICT in the global information society encourages and supports responsible creativity and innovative research at high-quality standards contributing to visible changes in the competitiveness of companies and nations [9].

ICT allows the elimination of the barriers in time, space, and quality in the modern university education system, specific to an information society. The global culture dominated by ICT technology has a mass character and outlines a new learning model. The practical milestones of personal multilateral development are understood as permanent training and recycling, much easier to assimilate thanks to the new technologies existing in ICT.

On the other hand, ICT is a powerful tool that can support holistic development processes that generate long-term educational, social and human benefits, by creating a trained workforce and a competitive economy. The academic leaders, professors, instructors, and researchers, but also the students use the ICT on a large scale, but also at a high, complex level.

The Fourth Industrial Revolution (4IR) is a concept that captures the idea of the confluence of new technologies and trends such as artificial intelligence (AI), biotechnologies and nanomaterials, as soon as their cumulative impact on our world [10, 11].

Deeper transformations in physical (e.g., intelligent robot systems, autonomous drones, autonomous vehicles, 3-D printing, and smart sensing systems), digital (e.g., the internet of things (IoT), next-gen cybersecurity, virtual reality, advanced analytics, big data, digital twin simulation, blockchains, services, data and even people) and biological (e.g., synthetic biology, individual genetic make-up, and 3-D bio-printing) technologies are key factors in integrated processes of today's life for social development and economic competitiveness [12].

The Fourth Industrial Revolution changes the global landscape of manufacturing competition and can help raise the global level of economic development. Also, it can have a positive impact on the quality of the world population for

excellence, prosperity and personal development. On the other hand, the 4IR contains its own set of risks according to their contextual needs and circumstances [12].

Higher education in the 4IR facilitates the development and implementation of smart education methodologies and technology based on high-tech T-shaped skills for both high-tech start-ups and innovative methodologies at each level, in all aspects of teaching and research [12]. All these factors have implications on adaptable learning programmes, learning experience, and lifelong learning attitude in a challenging society and technology trends in the way of acquiring information and knowledge.

To remain globally competitive the institutions of higher education need to reinvent the approaches to learning and collaboration, to provide authentic learning experiences using the right tools, to be aware of how students use educational technologies and to implement modern technologies into the process of education, training, and communication, and to adapt learning experiences to meet the students need.

Professors in higher education, well trained professionally and methodically, have the continuous task of reviewing, aligning, adopting, identifying new tools and technological educational resources adapted to students' learning styles, with standards regardless of the format of the course (online/distance, hybrid and face-to-face courses). Furthermore, professors in higher education are those who guide, stimulate, and lead with competence and prestige, creative spirit and increased efficiency the process of education and training of the students and can influence, satisfactorily, its learning and results, attitudes and the interests, aspirations and professional orientations of the students through their behaviors and attitudes, through their empathy and relationships with them. As well as, the professors, taking into account the logic of learning, triggers and maintains the interest of the students, their curiosity and their natural desire for the activity of learning and discovery, guiding the activity of organizing and integrating the collected data, of the updated knowledge to apply them to solve the given problems. In the modern pedagogical conception, the professor involved in instructional-formative activities has competences such as: communicative, informational, teleological, instrumental, decisive and appreciative.

## II. MODERN EDUCATIONAL TECHNOLOGIES

Modern educational technology theory is a general concept with more connected specific concepts, which refers to the theory and practice of optimizing teaching with the latest scientific-educational theory to exploit fully the potential of information technology (IT) [13].

Some relevant educational theories were explored, discussed and implemented in education from different countries beginning with the 20<sup>th</sup> century (such as behaviorism, cognitivism, constructivism and multiple intelligence) [6]. In all these theories are proposed a wider range of ways to learn, strive, cultivate and improve the enthusiasm, self-efficacy, competence, critical thinking, complex problem solving, collaboration and initiative of

students in the learning process in order to obtain students with adequate levels of individual authentic skills.

Students are encouraged to develop their own scientific, research potential, through exploration, innovation, design, and collaboration in personalized ways in a better correlation between higher education and the labor market.

Flexible learning routes, bridges to change the course of educational training impose a high degree of flexibility and adaptability of the university system, which simultaneously characterize structures (institutions, faculties, groups), but also persons (professors, instructors, teachers, students, and parents), to respond appropriately to the new changes in the current society.

Nowadays, the students can use the modern educational technologies to search for information related to their needs in the following ways:

a) Local area networks, internet and intranets connection and round the clock internet connectivity. The Internet has revolutionized the communication process through new online work possibilities, addressing new ways of reading and writing with minimal visual and auditory cues [14-16].

In this cyberspace characterized by the lack of borders, dynamism, and anonymity, the communication is fluid in time, and the subjective feeling of the interpersonal space replaces the importance of the geographical space. People can chat online with almost anyone individually or with multiple partners simultaneously. Besides, digital conversations can be saved and reviewed later.

The Internet promote and facilitate the exchange of information and knowledge-discovery or data-mining systems among people and applications contributing to scaling-up successful projects. Interactive learning offers easy multi-domain and multi-task accessibility, for efficient use of information, both longitudinally and cross-sectionally, through the use of databases, search engines, specialized websites, and scientific portals.

Innovative secure software applications, through online platforms or websites, virtual libraries and online encyclopedias, can enable students and teachers information sharing that meets standards of quality, integrity, and accuracy. Students can easily access online databases, extra study material, resources (such as interactive lessons and video tutorials), and open resources in security conditions before or after the class period.

Discussion and commentary forums on various topics proposed by community members (professors, instructors, teachers and students) allow for the presentation of new ideas and perspectives in common education, projects, and programs.

The forum can be an effervescent hub for those interested in the development of sustainable and high-quality projects carried out in partnership with professors and students to capitalize on their potential in design-research-innovation. Forum participants inspire other members to get involved, apply critical thinking, and generate community discussions that enhance communication skills and foster a sense of

community among students. At the same time, collaborative problem solving is encouraged, in innovative new contexts, which determines authentic learning processes, and which appreciates and encourages the progress made, connecting participants and with society.

The community members (professors, instructors, teachers) involved in the forum have the opportunity to guide effectively and to intervene in a timely, intelligent manner in the interactions with students. At the same time, the forum discussions were recorded, the students have time to reflect and build relevant answers to the topics addressed.

Psychologically, students may manifest themselves with different reactions to text-based discussions. Some may find it frustrating to have to type the whole message, in front who possess superior keyboarding skill (eye/hand coordination) and have an undeniable advantage. Ironically, students with writer skills may be introverted people. Therefore, those who have divergent discussions, are ignored or interrupted during class discussions often have the opportunity to use an expressive opportunity and will post stronger messages in discussion forums.

Students may decide to receive (or not) email notifications about new posts or when the topics they posted have replied. Students can create brainstorm groups together, to plan future goals, to provide new learning, research, and study as a group for future exams.

Choosing correct, dynamic management, appropriate to the educational requirements, the discussion forums can assist students in identifying their strengths and weaknesses to increase their learning experience.

b) Using audiovisual aids and overhead projectors. To make a presentation very impressive, visual images and sounds can transmit much more information compared to words due to fact that images contain two codes: one visual and the other verbal, each stored in different zones in the brain. On the other hand, visuals add interest, facilitate access to a variety of examples, an extra-lingual reference to contexts for interpretation, and redundancy which aids understanding and recall.

Visual aids when the information is complex offer creativity, considerable flexibility of text, image projection and make the presentation interesting by bringing a variety providing significant, concrete ideas and richer experiences. Simple, and clear visual aids (such as pictures, diagrams, tables, charts, graphs, maps, drawings, objects, models, and the like) multiply the audience's level of understanding and strengthening of the material presented, and permit to add impact to a presentation, clarify the message to transfer information and express ideas to others. Audible aids include musical excerpts with various acoustic parameters (duration, intensity, pitch contours, timbre, and rhythm), audio speech excerpts, environmental and sound effects [17].

Sometimes, new models of overhead projectors with a wide number of characteristics extend the range of teaching methods and can be used pretty efficiently in different classroom conditions, contributing to an interactive and high-quality presentation.

c) Digital footprint in the higher education. According to the Wikipedia a digital footprint (or digital shadow) can be defined as: "One's unique set of traceable digital activities, actions, contributions and communications that are manifested on the Internet or on digital devices". Before beginning the teaching activity, professors should develop concrete types of software tools and related professional applications to determine accessibility, as well as to quantify the types of digital fingerprints that Internet users leave behind intentionally or unintentionally, considered as unique data trails [18, 19].

Instructors must apply a clear, solid action plan to educate their students about online activity, to turn the internet into a modern and effective tool for building a positive online virtual identity for students. The internet can be our ally or enemy, through the quality of posts on various topics on social accounts, such as Facebook, Twitter, etc. For all digital accounts, it is preferable for students should set strict confidentiality limits with appropriate authentication (access control, passwords, two-factor authentication) [20].

For proper communication, students must use professional emails for all communications with a strong and professional online identity.

d) Online degrees with the use of ICT. Top academic and research institutions offer different online programs with various applications. Innovative online education platforms offer a flexible, interactive learning experience for instructors and students, based on a comprehensive training plan, through live, mobile or online courses.

Various open education portals worldwide offer online courses, in different languages, so that they become accessible to professors, researchers, teachers, technology developers, and students.

Online courses based on the educational concept in the IT field "learning by doing" offer simulation, visualization, activity creation, evaluation and collaboration tools, facilitating professional teaching and learning. Online courses focus on analytical thinking, problem solving, teamwork, and practical application of skills. These courses are based on rich multimedia content, which includes interactive activities and questionnaires, and offers a variety of learning styles, stimulating the learning process and the accumulation of knowledge for students to obtain qualifications in a certain area, without spending the time required for a traditional diploma [21, 22].

Practical laboratories and simulated activities help the students to consolidate their knowledge and practice it at their own pace and pace. Innovative assessments allow quick feedback to facilitate the verification of skills acquired for certification and a career in the field.

Online certification is an optional first step towards obtaining a standard certification in the socio-economic and educational environment in the country and internationally, which offers well-paid jobs. Among the reasons why students prefer certification are: reliable assessment of skills and knowledge; accelerating professional development and increased credibility in the activity carried out; improves the

CV and LinkedIn profile; enter the data of the participants in the database of the professionals who have this certification.

### III. CONCLUSION

Modern digital educational technologies have a positive impact on university education, but at the same time, it can have negative effects. All participants in the educational process must adopt positive elements and minimize the disadvantages that lead to a decrease in professional success among the students.

We conclude that between the traditional and the contemporary education system, there is a complementary relationship within the general and specialized framework, which confers a conclusive dynamic concerning the use of knowledge, information and of learning methods.

The correct and efficient use of modern digital technologies in higher education is both a necessity and an imperative for maintaining the high academic standards required of a world based on competition and prosperity.

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