

New Perspectives in the Implementation of Smart-Technologies in Higher Education

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ABSTRACT

The digital environment, through its characteristic tools, contributes substantially to shaping the personality and creativity of students in university education. This paper deals with research into the development trends of higher education by application of smart-technologies as a tool with high innovative and intellectual strengths for training qualitative real skills of the students in the didactic process. Finally, it can be concluded that the application and development of smart technologies is a central point of an advanced educational strategy to develop an efficient and sustainable learning style that correlates different operational concepts for maintaining high academic standards, according to the requirements from our modern society.

Keywords: *digital technology, higher engineering education, smart-technologies, educational technology*

1. INTRODUCTION

The information society involves the intensive use of information and communication technologies in all social fields, with significant economic and social impact.

The accelerated dynamics of social changes, but especially the depth of these changes, impose restructuring directions and educational reality aimed at aligning the instructional-educational objectives with the concrete requirements of the super-technological society.

The importance of the activities of introducing the Information and Communication Technologies (ICTs) can now be explained from the perspective of the transformations in society, science and economy, determined by the increase of competition, by the technical progress and, above all, by the exponential development of the information technologies, in which the emphasis is placed on the development of intangible resources, inventions, and know-how. The new social organization, developed especially at the virtual level, has increasingly visible effects in the sphere of economic decisions, competition in various markets and the global economy.

One of the main directions of social development, based on the synthesis of educational, scientific, technological, industrial and other practices, are the smart technologies (in accordance with the English abbreviation: S-self-directed, M-motivated, A-adaptive, R-resource-enriched, T-technology) [1]. Significant growth of smart devices, smart systems and smart technologies has helped define an emerging research area called "smart learning", which offered students new approaches, learning technologies, learning processes and learning strategies to optimize allocation. resources and benefits obtained [2].

The introduction of smart technologies is not a simple event but involves coherent processes, structures, resources, and by applying specific models and

management tools. Also, it can be noted that these technologies represent the material and technological basis for the progress of modern society, and have as objective the formation of new axiological and normative forms of organizing social interaction at different levels through specific information channels [3].

In order to respond to the broad spectrum of needs and multilateral preferences of modern society, a society open to profound changes on multiple levels, smart technology presents a number of particularities due to the cultural specificity, the level of education development, the level of economy and the level of research.

Especially in the last decades, there is a phenomenal increase in the interest in the implementation of smart technologies, as a way to obtain the growth of society.

In the current context, characterized by an accelerated transition period, dominated by complex and profound transformations in all fields of activity, the introduction of smart technologies is reflected first and foremost in the high rhythms of society's development. This causes a fundamental change in the educational model, when new visions emerge, which lead to effects on quality and efficiency in higher education. As these steps never have a closing point, enrolling on an uninterrupted spiral of success in modern science requires the continuous improvement of the educational process, especially at axiological and educational levels. Currently, on the international market, there are many companies that offer various smart technologies, extremely expensive, addressing social needs - from the labor market and

working conditions, up to education, health, and community development, to increase the quality of life.

The implementation of smart technology is the result of a complex set of relations between companies, universities, research institutes and other support structures. The application of multidimensional experiences, with different materializations and effects, from the international sphere, can provide a favorable framework for the development of smart technologies in higher education, which will be a benchmark for modern society, for people.

The purpose of this study is to examine the concept of 'smart-technologies' and to elucidate notable trends in its conceptual development.

2. RESEARCH METHODOLOGY

In this study, a set of questions was proposed:

Defining smart technology, with its main components?

What is the relationship between smart technology and the major axes educational in higher education?

What is the potential of smart technologies in improving the educational process in smart learning environments from higher education?

What are the modern strategies to implement smart technologies in smart learning environments from higher education?

What trends are present in higher education discussions on smart technologies in the last decade?

What are the main obstacles to the implementation of smart technologies in smart learning environments from higher education?

What is the relationship between the concept of smart university and smart community?

3. DISCUSSION

In an emerging knowledge society based on innovation, a knowledge-creating community, oriented towards the progress of collective knowledge, is necessary to exist between students and teachers and implies an appropriate supportive atmosphere and culture. On the other hand, contemporary solutions based on learning can only improve learning outcomes if the surrounding social practices are updated and revised accordingly. It is, therefore, an important objective to develop collective cultural practices, physical learning environments, and institutional routines to support engagement, innovation, and knowledge creation at higher education.

In solving this study, the methods of explanation and comparative analysis were applied, in order to emphasize the specific differences between smart technologies and traditional technologies. Smart education has become a concept that, describing the learning processes in the digital age, presents an important attention worldwide, as with the technological advances, everything can be instrumented, interconnected and intelligently designed.

In literature, there are used several definitions for smart-education [4, 5]. In general, smart education is defined as an interdisciplinary educational system in a smart environment supported by smart technologies, using smart tools and smart devices. In smart education, there are three essential elements: smart environments, smart pedagogy, and smart learner.

Smart education is mainly focused on learners and content rather than devices, using technology to develop conducive environments to increase learners' motivation to learn in open and interconnected environments, marked by diverse informational content. The central objective of smart education is to provide students with knowledge and skills (to learn more effectively, efficiently, flexibly and comfortably) that can meet the challenges of modern society, to improve learner's quality of life long learning. Also, it focuses on contextual learning, personalized and perfect to promote the emergence of learners' intelligence, to engage the student in effective, efficient and meaningful learning and to facilitate their ability to solve problems in intelligent environments. Smart learning environments have a number of characteristics, such as mobility, context awareness, adaptability, interactivity, penetration, perfection, integrity, interoperability and involvement [6, 7].

Smart learning environments need to be tailored to learners, tailored to meet the individual needs of the learner in a wide variety of contexts. From intelligent learning environments new and efficient learning models can be built, by analyzing the data collections of various learners and further extracting valuable learning models [8-10]. A smart educational environment can adapt the ways of presenting information and content of education according to the personal factors and individual preferences of the students [11].

Smart learning environments can provide a fully contextualized learning process to provide learners with learning scenarios in their own living and working environments, allowing the student to demonstrate their skills, bringing added quality to their training. A smart learning environment allows learners to access multiple digital resources and to interact instantly with learning systems anywhere and at any time, and to actively lead to learning clues, tools or suggestions at the right place, at the right time and in the right form [6]. The aim of a smart learning environment is to provide self-learning, self-motivated and personalised services and should include pedagogical strategies.

In the case of smart learning technologies, a number of successful technological requirements are adopted, such as learning management systems [7], high quality and usable smart devices [12], network and sensors, cloud infrastructure [13], devices and data security [14], big data, historical datasets and learning analytics [15].

In smart learning environments big data techniques and learning analysis techniques can be used from the perspective of micro-competences, competencies, macro-competences, in order to synthesize the combination of real-time data and historical data sets to identify contextually significant learning patterns in shaping the

personality and creativity of students in higher education [16]. Smart learning environments acquire content with a certain functionality, which is constantly evolving, which facilitates timely learning, as they can offer different levels of adaptation and precision of the diversified learning conditions for learners through the characteristic tools.

Smart learning environments (which include space, place, time, technology, control and interaction) involve assessing the cultural context and socio-cultural characteristics of formal and informal learning.

It is known that smart learning (formal and informal learning, social and collaborative learning, personalized and situated learning) is defined to be learner-centered, collaborative, flexible, interactive, self-directed and realistic [17], which emerged as a response to the limitations of e-learning [18].

Smart education has the following ten key features [19, 20]: - context-aware; - socially-aware; - interoperable; - seamless connection; - adaptable; - ubiquitous; - whole record; - natural interaction; - high engagement.

The application and development of intelligent learning technologies offers an efficient means to improve automatic assessments (by incorporating automation and artificial intelligence algorithms), and to eliminate the subjectivity of assessments and to result in a uniform classification methodology. Automation gives educators a chance to focus more on teaching and interacting with learners, releasing them from their administrative responsibilities [20]. Analytical analysis systems can be implemented in real-time evaluation based on evidence with intelligent digital systems designed to develop critical thinking and problem solving. All the data from the tracking and management of learning activities offers the choice of support and the sequence of learning activities to allow learners to focus on areas of weakness [20].

The framework of intelligent pedagogy involves differentiated instruction based on classes, collaborative learning based on groups, personalized learning based on individual and generative learning based on mass. Through other intelligent technologies, such as cloud computing, learning analysis, big data, Internet of things (IoT), wearable technology, etc., the emergence of intelligent education is promoted, which increases the quality and efficiency in the educational process, contributing to the training of the students' professional competencies, increasing the performances and obtaining the successful results.

The wearable technology can integrate location information, exercise logbook, interaction with social media and visual reality tools in learning to create the didactic situation system in digital media for creating electronic portfolios, leading to increased quality and efficiency in the educational process, and contributing at the same time when training the professional skills of the students, increasing the performances and obtaining the successful results [20, 21]. Modern intelligent

education can only be implemented in a new intelligent university, characterized by new educational, research performance, which allow the development of a person, a group, the whole society and finding solutions to their problems from the social, political, economic environment [16, 22]. The smart university, through the educational structures and the educational ideology, offers many advantages and could be deepened and extended and thus contribute to the development of the students in a complete way (emotional, intellectual and physical). On the other hand, it is known that the concept of intelligent learning communities includes the requirements of a smart community defined as a geographical area ranging in size from a neighborhood to a multicounty region within which citizens, organizations, and governing institutions deploy an NICT to transform their region in significant and fundamental ways [23].

4. CONCLUSION

In conclusion, the concept of smart university based on smart learning, smart research, and a smart continuous education is capable to support local university policies suitable to better integrate the students into the community and society and to put into play the construction of a new culture at the center of a smart university and its cultural principles. A smart university that uses appropriate modern tools, which favors the educational process, must follow a high quality, and be able to take into account the different cultures and subcultures of students, academics and managers. In modern society, it is a great challenge for educators, the concrete and appropriate way to integrate the data of different scenarios in smart cities and to build intelligent data-centered education to provide a seamless learning experience and personalized services for students.

REFERENCES

- [1] I.B. Ardashkin, A.Yu. Chmykhlo, M.A. Makienko, M.A. Khaldeeva, Smart-technologies in higher engineering education: modern application trends. In Proceedings of the International Conference on Research Paradigms Transformation in Social Sciences (RPTSS 2018), The European Proceedings of Social & Behavioural Sciences, 2018, pp. 57-64. DOI: 10.15405/epsbs.2018.12.8.
- [2] K. Budhrani, Y. Ji, J.H. Lim, Unpacking conceptual elements of smart learning in the Korean scholarly discourse, Smart Learn. Environ., 2018, vol. 5, no. 23, pp. 1-26. DOI: 10.1186/s40561-018-0069-7.

- [3] I. Lyapina, E. Sotnikova, O. Lebedeva, T. Makarova, N. Skvortsova. Smart technologies: perspectives of usage in higher education, *Int. J. Educ. Manag.*, 2019, vol. 33, no. 3, pp. 454-461. <https://doi.org/10.1108/IJEM-08-2018-0257>.
- [4] M. Coccoli, A. Guercio, P. Maresca, L. Stanganelli, Smarter Universities: a vision for the fast changing digital era. *J Visual Lang. Comput.* 2018, vol. 25, pp. 1003–1011.
- [5] J. Daniel, Making sense of MOOCs: musings in a maze of myth, paradox and possibility. *Journal of Interactive Media in Education*, 2012, vol. 3, p. Art. 18. DOI: 10.5334/2012-18.
- [6] B. Gros, The design of smart educational environments, *Gros Smart Learning Environments*, 2016, vol. 3, pp. 1-15. DOI: 10.1186/s40561-016-0039-x.
- [7] V. Tikhomirov, N. Dneprovskaya, E. Yankovskaya, in *Smart Education and Smart e-Learning*, ed. by V.L. Uskov, R.J. Howlett, L.C. Jain. Three dimensions of smart education, vol 41 (Springer, Cham, Switzerland, 2015), pp. 47-56. DOI: 10.1007/978-3-319-19875-0_5.
- [8] Ș. Țălu, D Sobola, N. Papež, “Analysis and recommendations for education process of experts in the field of scanning probe microscopy,” *DEStech Transactions on Social Science, Education and Human Science*, p. 5-9, 2017. *Proceedings AETMS 2017 (2017 4th International Conference on Advanced Education Technology and Management Science*, September 17-18, 2017, Shenzhen, China).
- [9] Ș. Țălu, D. Sobola, R.S. Dallaev, “Micro-courses for education to scanning probe microscopy,” *Advances in Economics, Business and Management Research (AEBMR)*, vol. 81, p. 546-549, 2019. DOI: mtde-19.2019.109. *Proceedings of the 1st International Scientific Conference "Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth" (MTDE 2019)*, April 14-15, 2019, Yekaterinburg, Russia.
- [10] Ș. Țălu, Implications of modern digital technologies in higher education. *Advances in Economics, Business and Management Research (AEBMR)*, 2019, vol. 105, p. 554-557. DOI: 10.2991/iscde-19.2019.107. *Proceedings of the 1st International Scientific and Practical Conference on Digital Economy (ISCDE 2019)*, November 7-8, 2019, Chelyabinsk, Russia.
- [11] Z.T. Zhu, Yu Ming-Hua, P. Riezebos, A research framework of smart education. *Smart Learn. Environ.*, 2016, vol. 3, article 4. DOI: 10.1186/s40561-016-0026-2.
- [12] S.J.H. Yang, T. Okamoto, S.S. Tseng, Context-aware and ubiquitous learning (guest editorial). *Educational Technology & Society*, 2008, vol. 11, no. 2, pp. 1–2.
- [13] R. Raghunath, C. Anker, A. Nortcliffe, Are academics ready for smart learning? *Br. J. Educ. Technol.*, 2018, vol. 49, no. 1, pp. 182–197. DOI: 10.1111/bjjet.12532.
- [14] C. Gordon, Addressing security risks for mobile devices: what higher education leaders should know (Dissertation) (Theses, Dissertations, and Student Research, Educational Administration, 2015). Retrieved from <https://digitalcommons.unl.edu/cehsedaddiss/248>.
- [15] N.S. Kinshuk, I.L. Chen, S.W. Cheng, Chew, Evolution is not enough: Revolutionizing current learning environments to smart learning environments. *International Journal of Artificial Intelligence in Education*, 2016, vol. 26, no. 2, pp. 561–581. DOI: 10.1007/s40593-016-0108-x.
- [16] J.M. Spector, Conceptualizing the emerging field of smart learning environments. *Smart Learn. Environ.*, 2014, vol. 1, no. 1, pp. 1–10.
- [17] M. Sung, A study of adults’ perception and needs for smart learning. *Procedia Soc. Behav. Sci.*, 2015, vol. 191, pp. 115–120.
- [18] K.-S. Noh, S.-H. Ju, J.-T. Jung, An exploratory study on concept and realization conditions of smart learning. *J. Digit. Converg.*, 2011, vol. 9, pp. 79–88.
- [19] E. Shoikova, R. Nikolov, E. Kovatcheva, Conceptualising of smart education, “E+E”, 2017, vol. 3-4, pp. 29-37.
- [20] A. Nuzzaci, L. La Vecchia, A Smart university for a smart city, *International Journal of Digital Literacy and Digital Competence*, 2012, vol. 3, no. 4, pp. 16-32. DOI: 10.4018/jdlde.2012100102.
- [21] G. Piccoli, R. Ahmad, B. Ives, Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS quarterly*, 2001, pp. 401–426.

- [22] V.L. Uskov, J.P. Bakken, A. Pandey, U. Singh, M. Yalamanchili, A. Penumatsa, Smart university taxonomy: features, components, systems. In: Uskov V., Howlett R., Jain L. (Eds.) *Smart Education and e-Learning 2016. Smart Innovation, Systems and Technologies*, vol 59. Springer, Cham.
- [23] A. Coe, G. Paquet, G. Paquet, J. Roy, E-Governance and Smart Communities: A Social Learning Challenge, *Soc. Sci. Comput. Rev.*, 2001, vol. 19, pp. 80-93. DOI: 10.1177/089443930101900107.