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**Article**

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Amfiteatru Economic

**Provided in Cooperation with:**

The Bucharest University of Economic Studies

*Suggested Citation:* Zaharia, Rodica Milena (2024) : Challenges for competence-oriented education in the context of the development of artificial intelligence systems, Amfiteatru Economic, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 26, Iss. 65, pp. 6-11, <https://doi.org/10.24818/EA/2024/65/6>

This Version is available at:

<https://hdl.handle.net/10419/281806>

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# Challenges for Competence-Oriented Education in the Context of the Development of Artificial Intelligence Systems

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**Please cite this article as:**

Zaharia, R. M., 2023. Challenges for Competence-Oriented Education in the Context of the Development of Artificial Intelligence systems. *Amfiteatru Economic*, 26(65), pp. 6-11.

**DOI:** <https://doi.org/10.24818/EA/2024/65/6>

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The debates about the challenges launched to the educational process by Artificial Intelligence systems are more acute than ever. On one hand, education, in general, must be that process that ensures the skills that allow the creation of Artificial Intelligence. Algorithms, chatbots, learning machines were created as a result of knowledge, skills and abilities acquired through education. They will continue to be the result of the creativity, inventiveness and daring of those who are educated in this spirit, of those who are cultivated with these skills. "Working" with Artificial Intelligence systems also requires knowledge, skills and abilities that the entire educational system must provide. Operating with Artificial Intelligence systems needs not only specific skills, but also their permanent adaptation as Artificial Intelligence systems become more complex and more performant.

Academic research is intended not only to identify the challenges that education faces and will face with the development of Artificial Intelligence systems, but also to find solutions, to propose measures to manage the consequences of the penetration of Artificial Intelligence into life of society.

The importance of education seems even more evident in ensuring the balance between the advantages and disadvantages generated by Artificial Intelligence. Artificial Intelligence is a tool that education, as a complex process of developing and substantiating knowledge, skills and abilities, can use in building critical thinking, in accelerating scientific discoveries, in strengthening the ethical spirit. The temptations generated by Artificial Intelligence, which can lead to the opposite of this fundamental goal, can be corrected through the educational process. Ultimately, we must be careful that through education, Artificial Intelligence does not turn from a blessing into a curse.

In the *Amfiteatru Economic Journal*, no. 65/2024, you will find articles that respond to the challenges of education in the context of Artificial Intelligence and that improve the specialized literature in the field, such as:

The article *The development of educational competences for Romanian students in the context of the evolution of data science and Artificial Intelligence* explores key academic competencies and professional skills in data science in the context of the development of Artificial Intelligence, highlighting their importance in the business environment. Using the "2022 Stack Overflow Annual Developer Survey" dataset and machine learning methods such as principal component analysis, K-means clustering, and logistic regression, this study looks at professional skills in data science. This research looks at the distribution of jobs in the field, the level of experience, the languages and analysis programs used, the support offered by companies and the dynamics of data science teams, as well as at the impact that Artificial Intelligence is having on the field, providing a comprehensive

understanding of the impact of academic training on career opportunities in data science, contributing to the development of the profile of a qualified specialist in this field. The research also provides relevant directions and recommendations for enhancing the skills required in data science, in order to outline a skilled profile and to meet the demands of the business environment in a world dominated by data analytics and Artificial Intelligence.

Starting from the idea that technological changes have also created challenges, including a gap between the skills available and the skills needed in the use of Artificial Intelligence technologies, the article *Identifying sufficient and necessary competencies in the effective use of Artificial Intelligence technologies* aims to analyze the relationships between employee skills and effectiveness in using Artificial Intelligence tools, to highlight the set of skills essential to effective interaction with Artificial Intelligence technology. An online questionnaire was completed by 209 employees from Romania, the data analysis being carried out on the basis of two advanced techniques: structural equation modeling and analysis of necessary conditions, using the SmartPLS v4 program. The results suggest a significant association between employee competencies and the effectiveness of using Artificial Intelligence tools, optimism and inventiveness positively mediating this relationship. The article outlines the significant implications for organizations, for the formal and non-formal education system, as well as research directions on the managerial implications of using Artificial Intelligence tools.

The paper *Challenges of Artificial Intelligence on the learning process in Higher Education* had as its objective the identification of the skills necessary for the digital learning environment specific to Romanian higher education, skills intended to encourage the adoption of Artificial Intelligence technologies by students as beneficiaries of the educational act. Using the structural equation model applied to an original set of data collected on the basis of a questionnaire addressed to undergraduate students in higher economic education, the research results emphasize that the intention to adopt applications that use Artificial Intelligence, among students, directly depends of constructs such as: perceived usefulness, attitude towards these technologies, perceived hedonic value, expected performance, or degree of compatibility, while the interactivity of the applications also has an important but indirect influence.

The research *Exploring university students' perceptions of generative Artificial Intelligence in education* focused on a certain form of Artificial Intelligence, namely the generative one, which facilitates the acquisition (generation) of content in all its forms (text, image, video, audio, programming codes, etc.), thus having a crucial role in education, enabling the personalization of educational content and facilitating the learning process. The article starts from the conceptual delimitations regarding Artificial Intelligence and the ways of using it in education, its advantages and limits, showing that the adoption of generative Artificial Intelligence applications, such as ChatGPT, in economic higher education, is a topic too little addressed in the literature. Then, adopting exploratory research, carried out on a sample of 364 undergraduate and master students of the Faculty of Business and Tourism within the Bucharest University of Economic Studies, their perception regarding these applications was analyzed. The research results indicated a high level of awareness and interest in content generation models and highlighted the fact that users who have favorable perceptions of the quality of content generated by such applications believe that their integration into academic endeavors can stimulate creativity and can improve employment prospects.

The social impact of Artificial Intelligence was the starting point of the article *The social impact of using Artificial Intelligence in education* which, starting from the data collected through a survey from the students of some prestigious universities in Romania and processed by applying three statistical-econometric logistic regression models, revealed interesting results. The results of the first binary logistic model reflect the respondents' views on the need and on the importance of improving the learning experience through the use of Artificial Intelligence in education, taking into account their gender and their level of education. Also, in relation to the two characteristics considered the most significant for the research objective, the following multinomial logistic models were developed. The findings show that the use of Artificial Intelligence in education influences, on the one hand, graduates' employment prospects and, on the other hand, society as a whole.

Starting from a theory increasingly used in the literature, the Unified Theory of Acceptance and Use of Technology (UTAUT), the article *Exploring the antecedents of Artificial Intelligence Products' usage. The case of business students* investigates the extent to which extent facilitating conditions (those means that users consider necessary to use for a certain technology) and other predictors (perceived risk and lack of trust in technology, gender, education, income, technology proficiency and equipment used to access the Internet) influence the use of Artificial Intelligence Products (AIPs) in general and for educational purposes. Data from a sample of 450 Romanian business students were examined using principal component analysis and logistic regression. Facilitating conditions showed a direct (positive) effect on the dependent variables, and the combination "perceived risk-perceived lack of trust in technology" showed an inverse (negative) effect on the dependent variable. This study advances theory by exploring the actual use of AIPs for educational purposes, developing the UTAUT model by isolating facilitating conditions and using descriptive variables as predictors. Also, the study expands the empirical evidence related to UTAUT regarding the acceptance and use of technology in Romania and formulates practical recommendations for universities, as current and potential providers of AIPs, to make the educational process more efficient.

The article *Artificial Intelligence adoption in the workplace and its impact on the upskilling and reskilling strategies* presents the results of an ethnographic research aimed at identifying the impact of the adoption of Artificial Intelligence in the workplace on the requirements related to professional knowledge and skills and, based on these, the impact on the upskilling and reskilling strategies. The research covers three areas of activity, namely: information technology, education and scientific research. A relevant conclusion of this research is the need to study the competence requirements from multiple perspectives, not only from the perspective of technological innovation. The research originality mainly consists in the way in which the concept of the level of upskilling/reskilling importance is defined and applied, based on professional knowledge and skills development requirements. By using the assessed level of upskilling/reskilling importance, strategies and related actions may be defined and undertaken.

The role of educators in shaping skills, in the context of the expansion of Artificial Intelligence, is particularly important. Three studies focus on this aspect: **(i)** *AI in education: next-gen teacher perspectives* which mentions the fact that the progress made by Artificial Intelligence at the world level leads UNESCO, through the Beijing Consensus, to recommend in 2019 to governments the inclusion of Artificial Intelligence in educational policies and processes. The research analyzes the factors that influence the behavioral intention to use Artificial Intelligence from the training stage of future from the training

stage of future primary and secondary teachers in Romania. Through quantitative exploratory research, carried out on a sample of 270 students from the Faculty of Education, Social Sciences and Psychology, the subjects' interaction with Artificial Intelligence and the intention to integrate Artificial Intelligence in education were investigated, using binary logistic regression. The analysis shows that, among the six variables of the model, "confidence in one's ability to use Artificial Intelligence" and "perception of a greater number of advantages" have a positive and significant impact on the willingness to use Artificial Intelligence in the educational process, more than 'previous use', 'level of knowledge' or 'student requirements'. These results are of particular importance for the revision of teacher education programs and the development of educational policies that increase future teachers' confidence in the ability to use Artificial Intelligence, eliminating fears or misconceptions about Artificial Intelligence in education. (ii) *Artificial Intelligence and the modelling of teachers' competencies* explores educators' perspective on their own role in shaping skills and presents educators' perceived challenges and key measures in the context of expanding Artificial Intelligence. Thus, teachers' positive attitudes toward Artificial Intelligence significantly influence cognitive, fundamental, and educational management competencies. The research highlights key challenges to integrate Artificial Intelligence into education, including the imperative of professional development for educators and ensuring equitable access to educational resources and technology. The study advocates for initiatives to bridge the digital divide and integrate Artificial Intelligence education into school curricula. (iii) *Quantitative evaluation of willingness to use Artificial Intelligence within business and economic academic environment* analyzes the state of information, use and availability of use of Artificial Intelligence in the economic and business university environment, according to Romanian teaching staff opinions. The research aims to identify the advantages, disadvantages and how Artificial Intelligence is used on the teachers' personal initiative in research, teaching, and evaluation activities. The results of the study identify the aspects that can optimize the processes of education - research, teaching, evaluation and learning to meet the increased dynamics of the use of Artificial Intelligence in the economic academic environment in Romania. Also, the advantages associated with the use of Artificial Intelligence systems and the solutions proposed to maximize the benefits brought by Artificial Intelligence in research, teaching, evaluation activities in the opinion of teachers are highlighted.

Two other articles investigate aspects of student perceptions of the use of Artificial Intelligence. (i) *Generation z students' perceptions on the abilities, skills and competencies required in the age of Artificial Intelligence systems* analyzes one of the most challenging generations in relation to the use of new technologies. A total of 352 questionnaires were validated from students who graduated from full-time bachelor's programs in a Romanian faculty. The data were processed using the statistical program SPSS 17.0, the viability tests and subsequent analyzes involving Cronbach Alpha coefficient, principal components analysis, respectively correlational analysis. The conclusions of the article offer a new perspective on the structure of skills, abilities and competencies needed in the digital society and propose solutions to improve the educational process, by adapting academic programs to the demands of the digital society. (ii) *Students' perceptions of the use of Artificial Intelligence in educational services* investigates Serbian students' conceptions of the use of new technologies in education. The research represents the first implementation of an eight-factor instrument, modeled as a reflexive-formative hierarchical construct. Thus, all eight factors contribute positively and significantly to the use of Artificial Intelligence in

education from the students' perspective. The biggest contribution could be attributed to factors stemming from the weaknesses of traditional education, such as: sentiment analysis in education, personalized learning and student performance prediction, and the smallest contribution could be attributed to factors related to privacy concerns with on the use of Artificial Intelligence and control: classroom monitoring, visual analysis, and student grading and assessment.

Using the same research methodology, namely the bibliometric analysis, three other articles carry out a review of the specialized academic literature for different objectives. **(i)** *A systematic analysis of new approaches to digital economic education based on the use of AI technologies* presents a systematic evaluation of a number of 60 scientific articles, with the aim of studying how to approach, in recent years, the specific concepts of digital economic education, based on Artificial Intelligence, how to use Artificial Intelligence applications in digital economic education, all these with the aim of identifying critical success factors and challenges facing this field. The results obtained highlighted the trend according to which most researchers define digital education as a form of technology use with the aim of building the necessary support for educational activities, positioning Artificial Intelligence and its various applications as essential elements of current digital education, with fundamental potential in revolutionizing economic processes. It has been noted that the widespread use of digital education platforms based on Artificial Intelligence is influenced by the technology, its superior characteristics from the perspective of the ability to coherently correlate teaching/learning processes, the confidence generated at the level of teachers and learners regarding the results obtained as a result of the adoption of these digital education platforms based on Artificial Intelligence and cultural factors, in parallel with a permanent confrontation with numerous challenges related to the resistance of users to change, digital skills, accessibility of systems, as well as financial issues. Based on this research endeavour, a model system of correlations and elements has been developed, specifically for the digital economic education based on Artificial Intelligence, bringing together both success factors and specific challenges. **(ii)** *Artificial Intelligence and competency-based education: a bibliometric analysis* set out to identify emerging trends, challenges and opportunities generated by the intersection of Artificial Intelligence and Competency-Based Education. The research was carried out through the bibliometric analysis of 1028 articles included in the Web of Science database and based on the reports provided by the biblioshiny application, the graphical interface of the bibliometrix R package. The results included quantitative analysis of scientific production, collaborations, co-citations, as well as the evolution and thematic map of the field. The research revealed an annual growth of 8.43% in publications, accelerating after 2017, and global engagement, with the US and China leading the way. The thematic analyzes showed the evolution of the field, from technological foundations to an interdisciplinary approach, highlighting including the influences of global events, such as COVID-19. The study confirmed the deep interaction between Artificial Intelligence and Competency-Based Education, demonstrating the potential, complexity and need for collaborative and interdisciplinary approaches. **(iii)** *Redesign of accounting education to meet the challenges of artificial intelligence - a literature review* underlines the impact of artificial intelligence on the accounting profession, in the sense of redefining the role and place that accounting specialists occupy within economic entities. The systematic literature review aims to highlight and summarize the main challenges regarding the impact that artificial intelligence and other related technologies have on accounting professionals and the skills they need to develop or acquire. At the same time, the aim was to outline concrete solutions

through which accounting professionals can be supported in their efforts to adapt to the new requirements of the labor market imposed by the evolution of disruptive technologies.

The paper *Artificial Intelligence in business education: benefits and tools* looks at how Artificial Intelligence can support educational activities, the key drivers and tools used in business education. Survey data, collected from 254 learners, were analyzed using multivariate binary logistic regression. Two research questions were formulated to verify whether Artificial Intelligence supports educational activities and to identify Artificial Intelligence tools that support educational activities for business. The results show that respondents appreciate artificial intelligence because it helps teachers with administrative tasks, allows for personalization of learning plans and saves time. However, learners are not familiar with most of the benefits offered by artificial intelligence tools, with the exception of computer vision, edge computing, and chatbots. The paper emphasizes the importance of expanding the use of artificial intelligence in education, with the aim of familiarizing students with these technologies and exploiting technology's potential in the context of business education.

We hope that all these articles will increase the interest of both academics and practitioners, as students, also, in finding answers for their questions regarding the role of Artificial Intelligence in education. Also, we are optimistic that these articles will inspire for further researches, as the topic of Artificial Intelligence in relationship to education seems to be at the beginning of the journey.

**Associate Editor,  
Rodica Milena Zaharia**