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### Article

## The social impact of using artificial intelligence in education

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## THE SOCIAL IMPACT OF USING ARTIFICIAL INTELLIGENCE IN EDUCATION

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### Abstract

Artificial intelligence currently represents one of the most talked about topics, considering the need for sustainable economic growth at a global level. When it comes to education, artificial intelligence is aimed at enhancing systems, ways of learning, as well as at the results of learning, on the one hand, and training the youth so as to accordingly satisfy the requirements of their future jobs, on the other hand. In this context, research on higher education in Romania was conducted, which analysed the students' opinion on the social impact of using artificial intelligence in education. As a consequence of performing an opinion poll, answers were collected online from students from prestigious Romanian universities. The data registered for the mentioned objective was processed by applying three statistical and econometric logistic regression models. The results of the first binary logistic model show the respondents' opinions on the need and importance of enhancing the learning experience by using artificial intelligence in education, considering their gender and level of education. Also, with respect to the two characteristics considered the most significant to the objective of the paper, the following two multinomial logistic models have been developed. The results highlight the way in which the use of artificial intelligence in education influences, on the one hand, the graduates' prospect for a job and, on the other hand, the society as a whole.

**Keywords:** artificial intelligence, education, logistic model, multinomial model, learning experience, job prospects, society

**JEL Classification:** C20, D83, I23, J21, L86

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**Introduction**

The process of sustainable economic development visibly occurs in recent years. This includes a component that has been increasingly addressed after 2010, artificial intelligence (AI). In this context, a worldwide manifestation was observed of a global race aimed at developing, acquiring and funding technologies for artificial intelligence. This leads to substantial sustainable growth of advanced and emerging economies. Artificial intelligence (AI) has rapidly developed a significant potential that has visibly occurred in various disciplines and in many sectors of the economy (Farchy and Denis, 2020).

The use of artificial intelligence in education was aimed at the process of enhancing the learning environments and levels, as well as the results of learning. Simultaneously, its use is also aimed at saving the working time of both students and professors. Concurrently, it should be emphasised that artificial intelligence has had an impact on parents' capacity of involvement in children's education (Mou, 2019).

The involvement of artificial intelligence in education is stimulated by its adequate potential through the tools and platforms created in favour of both teachers and students. Furthermore, the artificial intelligence technologies significantly improve the students' way of learning on the one hand, and lead to an increased access and greater efficiency of education, on the other hand. The automated learning process through the use of artificial intelligence technologies has the ability to customise the learning content. This context allows teachers to properly evaluate students, thus having the possibility to meet their needs and elevate their performance level. Additionally, the capacity of artificial intelligence to improve online training should be noted. As a result, professors get help with finalising the automation process for routine tasks, modernising the grading process, and offering immediate feedback to students. Therefore, students get help with better understanding of concepts, on the one hand, at their own pace, and, on the other hand, at a higher rate of individualisation (Mou, 2019).

The originality and novelty of this study consist in the selection of questions and variables included in the questionnaire of the online survey and in the results obtained. The respondents' profile is highlighted through two variables (gender and level of education) that constitute basic characteristics used in emphasising the impact of AI in education. Simultaneously, in the specialty literature, similar studies, that encompass young students' opinion on the role and impact of artificial intelligence tools used in education - are totally limited.

The added value of this study also consists in the use of logistic regression models that are aimed at the interdependencies and impact of AI on the learning experience, on graduates' employment prospects and on the way it transforms society.

This paper is structured in four sections, introduction excluded. After the introduction, there is an emphasis on the specialists' and other interested parties' points of view. The next section includes a detailed presentation of the methodology of the research performed, emphasising on the aspects related to applying the logistic regression models. Performed on the basis of the research results, the results and discussions section is followed by the conclusions, which show the interdependency and impact of using AI in education has on the labour market and on society as a whole. With its content, this paper adds to the studies performed so far concerning the usefulness of AI in education, thus forming the premises for elaborating and applying development strategies in the field.

### **1. Review of scientific literature**

Specialists consider that artificial intelligence (AI) should not be defined in a simplistic manner. Therefore, it represents a set of technological instruments that confer human-like abilities to machines, from senses, to the capacity to understand, learn, and even create. AI influences not only people's lives, their health and education, but also the economy and society as a whole, in an overwhelming way and rhythm (Goralski and Tan, 2020; Moreno-Guerrero et al., 2020; Pelau, Ene and Pop, 2021). AI tools interact with impressive volumes of data, offering people a better and safer life, helping them to enhance their businesses and to contribute to the sustained development of the world's economies. Does AI offer real, new opportunities, or rather does it generate new threats for mankind? According to the 2020 Eurobarometer regarding the attitude of EU citizens to digitalisation, the views on the benefits and use of digital technologies are rather contradictory, EU citizens having both positive and negative views, with significant differences amongst groups. For example, women, elders, less educated people and those who live in childless households self-evaluate their digital skills at a lower level. There are significant differences between countries as well, such as in Italy and Hungary, people's confidence in their own digital skills is lower, while in Spain, Estonia, or the UK they are polar opposites from this perspective (European Union – Eurobarometer, 2020).

One of the fields in which AI has a significant presence is the education market, and the key to this success is the fact that the learning process has been updated due to the introduction and use of some intelligent training tools (Moreno-Guerrero et al., 2020; Moonpreneur, 2023). However, the role of the teacher continues to be essential (Cope, Kalantzis and Sears, 2020).

Over time, it has been proven that the use of AI tools in the education and learning process has a contradictory character also, besides the numerous advantages, there are also some less desired effects. Therefore, among the positive aspects of using AI in education, we mention the following: increasing accessibility to the learning process and its efficiency, the possibility to customise learning, the benefit of additional training, increasing the youth's motivation and involvement in the learning process, identifying and addressing deficiencies, weaknesses related to knowledge and skills; the possibility to organise and easily access information; easier access to education for persons with special needs; using interactive learning methods and real-time feedback; swift update of the information content; learning through simulations of real-life situations; bridging the gap when it comes to the students' socio-economic situations, geographic location, age or gender (Sullins, Craig and Hu, 2015; Luckin et al., 2016; Hinojo-Lucena et al., 2019; Cukurova, Kent and Luckin, 2019; Ufarte Ruiz and Manfredi Sánchez, 2019; Wang and Wang, 2019; Knox, 2020; Xiao and Yi, 2020; Chatterjee and Bhattacharjee, 2020; Van Der Niet and Bleakley, 2020; Felea et al., 2021; Moonpreneur, 2023). Not lastly, an important advantage is the reduction of costs as well as the boost in academic performance (Ahmad et al., 2022; Moonpreneur, 2023; Kamalov, Santandreu Calonge and Gurrib, 2023). Conversely, specialists in the field also mention some negative aspects, such as: the loss of jobs for professors whose tasks were replaced by AI; high costs; lack of human contact, of emotional bonds; lack of clear regulations and instructions for using AI tools in the learning process; the possibility of inequalities, discriminations in the learning-evaluation process; insufficient measures to guarantee private data; the dependency on modern technology to access AI tools in the learning process; managing the limitations of digital systems (data volume, number of users, response time,

etc.) but also moral, ethical concerns (Fahimirad, 2018; Moonpreneur, 2023; Ahmad et al., 2023). Furthermore, Lai et al. (2023) mention another less desired aspect of using AI learning systems: the fact that the long term effects of this process on the mental and physical state of users of smart learning systems are not sufficiently known. They emphasised the negative correlation between the use of AI in education, on the one hand, and the youth's social adaptability and family support, on the other.

The use of AI has effects and consequences on the labour market. It is widely accepted that a rise in the use of AI will lead to a remodelling of the workforce (Mann Levesque, 2018; Dumitru and Halpern, 2023). The structure and type of jobs are in a continuous dynamic, accelerated by the spectacular development of AI tools, which leads to some jobs becoming obsolete, jobs requiring tasks taken over by machines, in parallel with the occurrence of new ones. Consequently, the workforce will have to adapt to new requirements in the labour market, and education systems and AI applications in education will take on the role of performing this transition more easily and with new tools (Mann Levesque, 2018; Dumitru and Halpern, 2023). AI is increasing its importance in the workplace (Dellermann et al., 2018; Sowa, Przegalinska and Ciechanowski, 2021; Füller et al., 2022), changing its role from executor to leader, with the possibility of reducing employees' promotion chances (Yam et al., 2022; Tsai et al., 2022). AI tools applied in education (including lifelong training) can ensure long-term competitiveness for future employees on the labour market, employees being motivated to train in order to acquire the skills to work with AI (Ciarli et al., 2021). The use of these tools comes, however, with some risks. Mann Levesque (2018) mentions the risk of deepening the gaps, discrepancies, and inequalities that already exist between the educational results of youth depending on race, ethnicity, or income. Frequently, access to quality education comes easier for youth from families with a better financial standing or from a better residential setting. AI can deepen the mismatch between the skills and knowledge of the workforce with the competencies required by new technologies (Acemoglu and Restrepo, 2019), with people often perceiving AI as a threat to their jobs, generating fear of unemployment and job insecurity (Brougham and Haar, 2020; Dodel and Mesch, 2020). Other studies on the effects of the use of AI on the labour market aim at reducing employment and wages (Acemoglu and Restrepo, 2020), increasing labour productivity, reducing bargaining power, and changing the length of the work schedule (Huang and Sharif, 2017; Koch, Manuylov and Smolka, 2021), as well as the influence of AI on workplace learning, more prominent for older employees, women and those with a lower level of education, for those with less work experience and autonomy (Li et al., 2023).

The specialty literature presented has emphasised the motivation at the basis of formulating and performing the research in this article, as premises for conceiving and applying development strategies in education.

## **2. Research methodology**

The general scope of this research is represented by the analysis of Romanian students' views on the social impact of using artificial intelligence in education. Its accomplishment was aimed at three main objectives:

- analysing the impact of using artificial intelligence in education on the improvement of the learning experience;

- the way in which the use of artificial intelligence in education influences the graduates' prospect for a job;
- the way in which the use of artificial intelligence in education influences society as a whole.

The data included in this analysis was collected through an opinion poll performed on the basis of a questionnaire filled in online on the *isondaje.ro* platform. The 606 students (Bachelor's and Masters' degree) who have answered the questionnaire questions come from prestigious universities in Romania (Bucharest University of Economic Studies, University Politehnica of Bucharest, University of Bucharest, "Ștefan cel Mare" University of Suceava, "Alexandru Ioan Cuza" University of Iași, "Constantin Brâncuși" University of Târgu Jiu, University of Craiova, University of Oradea, Babeș-Bolyai University of Cluj, the Western University of Timișoara). Sample size was determined on the basis of the probability function argument ( $z$ ), variance ( $s^2$ ) and margin of error ( $\Delta\bar{x}$ ), thus:  $(z^2 \cdot s^2) / \Delta\bar{x}^2$ . The data collection period lasted one semester, in the period February-June 2023.

The test contained five questions, two of which targeted the characteristics of the respondents (gender and education level), and three resulted from the objectives of the study. These three questions were: "Do you think the use of artificial intelligence in education has improved your learning experience?"; "How do you think the use of artificial intelligence in education will affect employment prospects?"; "How do you think the use of artificial intelligence in education will affect society as a whole?" and the answers were presented in table no. 1.

In order to define respondents' profiles, two factorial variables were used in their processing, which constitute their main characteristics: gender (GEN) and level of education (EDLV) as well as three outcome variables which are aimed at the students' opinions regarding: improvement of the learning experience through the use of artificial intelligence in education (AIILE) and the way in which the use of artificial intelligence in education influences on the one hand the graduates' prospect for a job (EMPT) and, on the other hand, the society as a whole (AIEAS). Table no. 1 presents the identifiers and significance of the variables that shall be subsequently used on the models applied.

As a consequence of studying the results of the main studies in the specialty literature and considering the variables presented, the following hypotheses were formulated:

- Hypothesis 1: There is interdependency between the improvement of the learning experience and the use of artificial intelligence in education.
- Hypothesis 2: There is interdependency between the use of artificial intelligence in education and graduates' prospect for a job.
- Hypothesis 3: There is interdependency between the use of artificial intelligence in education and the development of society.

Additionally, in the case of the three hypotheses there was the aim to study whether there are significant differences amongst students' opinions depending on gender and stage of their education process, basically creating a profile for them.

Table no. 1. Types, coding, and significances of the variables included in the analysis

| Variables        |                 | Type              | Coding and meaning of the answers |  |
|------------------|-----------------|-------------------|-----------------------------------|--|
| Output variables | AIILE           | NOMINAL<br>BINARY | YES                               | using artificial intelligence in education will improve learning experience  |
|                  |                 |                   | NOT                               | using artificial intelligence in education will not improve learning experience  |
|                  | EMPT            | ORDINAL           | SIGOPP                            | the use of artificial intelligence in education will create significant opportunities on employment                          |
|                  |                 |                   | MEDIMP                            | the use of artificial intelligence in education will have a medium positive impact on employment                             |
|                  |                 |                   | NOIMP                             | the use of artificial intelligence in education will not have a significant impact on employment                             |
|                  | AIEAS           | NOMINAL           | MESF                              | the use of artificial intelligence in education will create a more educated and skilled workforce                            |
|                  |                 |                   | IAEO                              | the use of artificial intelligence in education will increase inequality in access to education and employment opportunities |
|                  |                 |                   | JLED                              | the use of artificial intelligence in education will lead to job losses and economic disruption                              |
|                  | Input variables | GEN               | NOMINAL<br>BINARY                 | FEMALE   |
| MALE             |                 |                   |                                   | Male respondents   |
| EDLV             |                 | NOMINAL           | BY1                               | First year of undergraduate studies  |
|                  |                 |                   | BY2                               | Second year of undergraduate studies   |
|                  |                 |                   | BY3                               | Third year of undergraduate studies  |
|                  |                 |                   | MY1                               | First year of university master's studies  |
|                  |                 |                   | MY2                               | Second year of university master's studies   |

The achievement of the objectives presented was performed as a consequence of a statistical and econometric processing based on the logistic regression model.

For the analysis of the results and the identification of the quantitative and qualitative connections between the respondents' opinions, besides statistical analyses, we identified and used logistic regression models, with  $n$  factorial variables, in the form:

$$\ln(odds) = \ln(k) + \sum_{i=1}^n \ln(OR_i) = a + \sum_{i=1}^n B_i \cdot x_i \tag{1}$$

where  $odds = \frac{p}{1-p}$  represents the opportunity for the event to take place, whose likelihood

ratio is  $p$ , and  $OR_k = \frac{odds_k}{odds_{baza}}$  is Odds Ratio.

Under these conditions, the  $odds$  value; to opt for a certain statement expressing a certain standpoint of respondents, depending on the factorial variables is:

$$odds_i = e^{\ln(k) + \sum_{i=1}^n \ln(OR_i)} = e^{a + \sum_{i=1}^n B_i \cdot x} \tag{2}$$

On this basis (equations no. (1) and (2)), in order to analyse students' opinions on the social impact of using artificial intelligence in education, we developed three regression models, one of which being a binary logistic model and the other two being multinominal logistic

models. The binary logistic model aims to inform students' opinions on the enhancement of the learning experience by using artificial intelligence in education (AILE), and multinomial models are aimed at students' opinions on the way in which the use of artificial intelligence in education influences graduates' prospects for employment (EMPT), on the one hand, and their opinions on the way in which artificial intelligence in education will affect society as a whole, on the other hand (AIEAS). Each of these contains two factorial variables: GEN variable (respondents' gender) and EDLV variable (respondents' level of education).

The fact that data collection was performed by using an application specialised in surveys (isondaje.ro) has allowed for the processing and analysis of data with the help of the SPSS software.

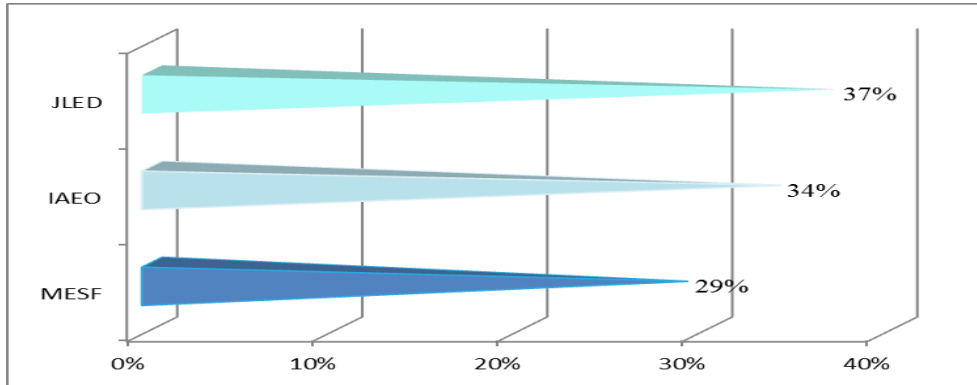
### **3. Results and discussions**

The data processing and analysis began with the two characteristics defining respondents' profile: gender and level of education. Therefore, the sample structure on the basis of respondents' gender is as follows: 49.01% male students and 51.99% female students, similar to the school population structure at university level, according to data supplied by the National Institute of Statistics (National Institute of Statistics, 2023). Concurrently, the sample structure when it comes to the education level (Bachelor's or Master's degree) is as follows: 21.4% of the total number of respondents are in their first year of Bachelor's studies, 13.5% in their second year of Bachelor's studies, 21.9% in their third year of Bachelor's studies, 20.8% in their first year of Master's studies, 22.4% in their second year of Master's studies. Next, three questions were extracted from the questionnaire, which were significant for the achievement of the research objectives. The first question has binary answers (Yes, No): "Do you consider that the use of artificial intelligence in education has improved your learning experience?". The answers were structured in 60.8% students who consider that the use of artificial intelligence in education has improved the learning experience and 39.2% students who gave a negative answer. The second question extracted from the questionnaire, which is included in the processing: "How do you think the use of artificial intelligence in education will impact employment prospects?" has three possible answers: "It will create significant opportunities" (SIGOPP), "It will have a medium positive impact" (MEDIMP), "It will not have a significant impact" (NOIMP).

The structure of students' opinions on the impact of using artificial intelligence in education on employment prospects shows that most students (59%) believe that artificial intelligence will have a medium positive impact on employment prospects. With a 35% difference from the maximum percentage, we find the respondents who said that artificial intelligence will create significant opportunities for employment prospects. Only 16% of the total respondents consider that artificial intelligence used in education will not have a significant impact on employment prospects. The third question extracted from the questionnaire is: "How do you think the use of artificial intelligence in education will affect society as a whole?" and it also has three possible answers: "It will create a more educated and skilled workforce" (MESF), "It will increase inequality when it comes to the access to education and to the employment opportunities" (IAEO), "It will lead to the loss of jobs and economic disturbances" (JLED). The students' answers to this topic are not very optimistic, although they reflect reality (Figure no. 1). Most students (37%) consider that the use of artificial intelligence in education



leads to the loss of jobs and to economic disturbances affecting society, as a whole. 34% of the respondents consider that artificial intelligence in education will increase inequality when it comes to the access to education and to the employment opportunities. Only 29% of the total number of respondents consider that the use of artificial intelligence in education will create a more educated and skilled workforce. With slight variations, it is notable that respondents' views are quite uniformly distributed across the three possible answers.



**Figure no. 1. Structure of students' opinions on the impact of using artificial intelligence in education on society**

Considering the variables and hypotheses presented, three logistic regression models have been applied.

The first model resulting from data analysis and processing evaluates the students' answers on the improvement of the learning experience through the use of artificial intelligence in education (AIILE). The model includes two explanatory categorical variables: the binary variable GEN and the multinomial variable EDLV, the bases being the variables GEN\_MALE (male students' opinions) and EDLV\_MY2 (the opinions of the second year of Master's students). The model characteristics are presented in Table no. 2.

**Table no. 2. Characteristics of the binominal binary logistic model according to students' opinions on the improvement of the learning experience through the use of artificial intelligence in education**

| Hosmer & Lemeshow Test |        | Chi-square =2.265 |    |       | df=4   | Sig.=0.587 |       |            |       |
|------------------------|--------|-------------------|----|-------|--------|------------|-------|------------|-------|
| Variables              | B      | Wald              | df | Sig.  | Exp(B) | AIILE      |       |            |       |
| GEN(FEMALE)            | .108   | 4.445             | 1  | 0.035 | 1.115  | oddsMALE   |       | oddsFEMALE |       |
| EDLV                   |        | 9.537             | 4  | 0.049 |        | NOT        | YES   | NOT        | YES   |
| EDLV(BY1)              | .452   | 7.035             | 1  | 0.008 | 1.571  | 0.285      | 3.505 | 0.318      | 3.145 |
| EDLV(BY2)              | .346   | 3.025             | 1  | 0.082 | 1.414  | 0.257      | 3.895 | 0.286      | 3.495 |
| EDLV(BY3)              | .322   | 2.857             | 1  | 0.091 | 1.380  | 0.251      | 3.990 | 0.279      | 3.580 |
| EDLV(MY1)              | .383   | 5.502             | 1  | 0.019 | 1.467  | 0.266      | 3.753 | 0.297      | 3.367 |
| Constant               | -1.706 | 8.423             | 1  | 0.004 | 0.182  | 0.182      | 5.506 | 0.202      | 4.940 |

Note: Reference Category: Last (GEN\_MALE and ELDV\_MY2)

The values of the Hosmer & Lemeshow test (the Goodness of fit) lead to the acceptance of the null hypothesis: the chosen model fits the data well. Considering the values of the Wald statistics and the level of significance Sig., corresponding to the EDLV(BY2) and EDLV(BY3) variables, we can state that the parameters of the explanatory variables are statistically significant (for a significance level of 5%, respectively 10%), according to the hypotheses developed and presented in the methodology section. By analysing the results obtained (Table no. 2), we see the greatest value of *odds* is registered in the case of male students in their second year of Master's studies.

$$odds_{YES\_MALE\_MY2} = 1/odds_{NOT\_MALE\_MY2} = 1/e^{(-1.706)} = 5.506 \quad (3)$$

It is then closely followed by the female students in the same year of studies:

$$odds_{YES\_FEMALE\_MY2} = 1/odds_{NOT\_MALE\_MY2} = 1/e^{(-1.706+0.108)} = 4.940 \quad (4)$$

The results obtained, including from equations (3) and (4), emphasise the fact that the most convinced students of the positive role of artificial intelligence in education in enhancing the learning experience are students in their last year of Master's degree studies, as well as the ones in the last year of their Bachelor's degree studies, therefore, students in the final years of each cycle of studies. In their case, the *odds* values highlight the fact that the chances of agreeing with the statement that the use of artificial intelligence in education has improved the learning experience are 3.99 times greater in the case of male students and 3.58 times greater in the case of female students, compared to the chances of negating this statement. In contrast, the ratio among the students' genders related to their opinions about improving the education experience with the use of artificial intelligence, leads to the conclusion that, despite the slight difference, male students are more confident than female students ( $odds_{MALE\_YES}/odds_{FEMALE\_YES}=1.115$ ). On the other hand, both in the case of Bachelor's degree students, as well as in Master's degree students, the chances of stating that the use of artificial intelligence in education will improve the learning experience, compared to rejecting this statement, increase proportionally with the students' promotion to the next year of study. Therefore, for example, for female students, from an odds value of 3.145 for first-year students, to 3.495 for second-year students, up to 3.580 for third-year Bachelor's degree students, which represents a 1.138 times increase. In the case of Master's degree students, the odds value increase is even more significant, from 3.367 for first year students, to 4.940 for second year students, which represents a 1.467 times increase. The results presented are similar to those obtained by Cukurova, Kent and Luckin (2019), Xiao and Yi (2020), or Chatterjee and Bhattacharjee (2020).

The second model analyses students' opinions on the way in which the use of artificial intelligence in education influences the graduates' prospect for a job (EMPT). In this model, amongst the possible answers, the third statement was chosen as a basis: the use of artificial intelligence in education will not have a significant impact on the employment prospects (NOIMP). The characteristics of the logistic multinomial model AIEAS are presented in table no. 3.

Considering the values of the Wald statistics and the level of significance (Sig.), except for SIGOPP\_EDLV\_MY1 and MEDIMP\_EDLV\_MY1 coefficients for which the confidence level is at least 90% (Sig.<0.1), in the case of the others the confidence level is 95%

(Sig.<0.05), as well as LHR values, the conclusion is that, on the one hand, the introduction of explanatory variables brings more information, and on the other hand, considering the confidence levels presented, the model coefficients are statistically significant.

**Table no. 3. Characteristics of the multinomial logistic model for the analysis of students’ opinions on the influence of artificial intelligence in education on graduates’ prospects for employment**

| Likelihood Ratio Test (LHR) |           | Chi-square=19.267 |                |       | df=10 | Sig.=0.037 |           |        |           |       |       |
|-----------------------------|-----------|-------------------|----------------|-------|-------|------------|-----------|--------|-----------|-------|-------|
| EMPP <sup>a</sup>           |           | B                 | Wald           | df    | Sig.  | Exp(B)     | MALE      |        | FEMALE    |       |       |
|                             |           |                   |                |       |       |            | log (odd) | odd    | log (odd) | odd   |       |
| SIGOPP                      | Intercept | 0.741             | 4.598          | 1     | .032  |            |           |        |           |       |       |
|                             | GEN       | Female            | -.188          | 4.019 | 1     | .045       | 1.334     |        |           |       |       |
|                             |           | Male              | 0 <sup>b</sup> |       | 0     |            |           |        |           |       |       |
|                             | EDLV      | BY1               | -.293          | 5.169 | 1     | .023       | .746      | 0.448  | 1.565     | 0.260 | 1.297 |
|                             |           | BY2               | -.462          | 6.465 | 1     | .011       | .630      | 0.279  | 1.322     | 0.091 | 1.096 |
|                             |           | BY3               | .263           | 5.024 | 1     | .025       | 1.301     | 1.004  | 2.729     | 0.816 | 2.261 |
|                             |           | MY1               | -.289          | 3.291 | 1     | .070       | .169      | 0.452  | 1.572     | 0.264 | 1.303 |
| MY2                         |           | 0                 |                | 0     |       |            | 0.741     | 2.098  | 0.553     | 1.739 |       |
| MEDIMP                      | Intercept | 0.978             | 3.910          | 1     | .048  |            |           |        |           |       |       |
|                             | GEN       | Female            | .153           | 4.350 | 1     | .037       | 1.451     |        |           |       |       |
|                             |           | Male              | 0 <sup>b</sup> |       | 0     |            |           |        |           |       |       |
|                             | EDLV      | BY1               | -.944          | 3.380 | 1     | .066       | .389      | 0.034  | 1.034     | 0.186 | 1.205 |
|                             |           | BY2               | -1.038         | 4.135 | 1     | .042       | .354      | -0.060 | 0.942     | 0.093 | 1.097 |
|                             |           | BY3               | -0.815         | 4.956 | 1     | .026       | .443      | 0.163  | 1.177     | 0.316 | 1.371 |
|                             |           | MY1               | -0.779         | 3.260 | 1     | .071       | .459      | 0.199  | 1.220     | 0.352 | 1.421 |
| MY2                         |           | 0                 |                | 0     |       |            | 0.978     | 2.659  | 1.131     | 3.097 |       |

Note: a. The reference category is: NOIMP; b. This parameter is set to zero because it is redundant.

The analysis of students’ opinions on the way in which the use of artificial intelligence in education will influence graduates’ prospects for employment emphasises a series of particularities from the point of view of the level and year of study, as well as from the point of view of their gender. Therefore, the greatest value of *odds* with respect to ensuring significant employment opportunities (SIGOPP) is registered in the case of male third-year Bachelor’s students (5).

$$odds_{SIGOPP\_BY3\_MALE} = e^{(0.741+0.0+0.263)} = 2.729 \tag{5}$$

it is then closely followed by the female students in the same year of studies (6), for which:

$$odds_{SIGOPP\_BY3\_FEMALE} = e^{(0.741-0.188+0.263)} = 2.261 \tag{6}$$

This means that, for third year Bachelor’s degree students, the chances of considering that the use of artificial intelligence in education offers significant opportunities for employment are 2.729 times greater than the pessimistic point of view (NOIMP), of male students, respectively 2.261 times greater for female students. Comparing the two values, it results that male students are more optimistic ( $odds_{SIGOPP\_MALE}/odds_{SIGOPP\_FEMALE} = 1.207$ ). Additionally, significant values of odds were registered in the case of second-year Master’s degree

students, respectively 2.098 for male students and 1.731 for female students. The second-year Bachelor's degree students exhibit the least expectations concerning significant opportunities for employment, for which the odds values are 1.322, in the case of male students and 1.096, for female students. When it comes to the opinion according to which the use of artificial intelligence in education will have a medium positive impact on the students' employment prospects (MEDIMP), the greatest values of odds are registered in the case of second-year Master's degree students, respectively 2.659 for male students and 3.097 for female students and the lowest values of odds belong to second-year Bachelor's degree students, respectively 0.942 for male students and 1.097 for female students. Unlike those who consider that the use of artificial intelligence in education offers significant employment prospects, in the case of those with medium opinion, the ratios between the genders are reversed, here  $\text{odds}_{\text{MEDIMP\_MALE}}/\text{odds}_{\text{MEDIMP\_FEMALE}}=0.859$ . Overall, considering both the maximum values of odds, as well as the ratios between the students' opinions depending on their education cycle, it results that third year Bachelor's students are the most optimistic about the impact of using artificial intelligence in education on providing significant opportunities for employment, which is emphasised by the values of ratios between the  $\text{odds}_{\text{SIGOPP\_MALE\_BY3}}/\text{odds}_{\text{SIGOPP\_MALE\_MY2}}=1.301$ , respectively between the  $\text{odds}_{\text{SIGOPP\_MALE\_BY3}}/\text{odds}_{\text{MEDIMP\_MALE\_MY2}}=1.027$ , as well as between the  $\text{odds}_{\text{SIGOPP\_MALE\_BY3}}/\text{odds}_{\text{MEDIMP\_MALE\_BY3}}=2.318$ . With respect to the influence of students' gender on their opinion regarding the impact of artificial intelligence in education on the employment prospects, it resulted that female Bachelor's degree students are less optimistic, the majority of odds values pertaining to the opinion about the medium impact on employment prospects (MEDIMP) being greater than the results of odds aimed at the existence of significant opportunities for employment (SIGOPP). When it comes to Master's degree students, the greatest value of odds pertains to female second-year Master's degree students (3.097), which emphasises that their dominant opinions suggest a medium positive impact on employment prospects. These conclusions are also highlighted by the ratios of odds values between genders, which emphasise the more reserved opinions of female students. The results of the second model are similar to those obtained by Mann Levesque (2018) or Ciarli et al. (2021).

The third model estimates student's opinions regarding the way in which the use of artificial intelligence in education will influence society, as a whole (AIEAS). In the AIEAS model, from the possible answers, the first statement was chosen as the basis: the use of artificial intelligence in education will create a more educated and skilled workforce (MESF). The characteristics of the AIEAS logistic multinomial model are presented in Table no. 4.

Testing the statistical significances of the coefficient values for the AIEAS model was performed with the Wald test. Taking into account the values of the significance level (Sig.), the coefficients of the variables IAEO\_EDLV\_MY1, JLED\_Intercept and JLED\_FEMALE are statistically significant for the confidence level of at least 90% (Sig.<0.1), and the other coefficients are statistically significant for the 95% confidence level (Sig.<0.05).

**Table no. 4. Characteristics of the AIEAS logistic multinominal model for the analysis of student’s opinions regarding the way in which the use of artificial intelligence in education will influence society, as a whole**

| Likelihood Ratio Test (LHR) |           | Chi-square=18,646 |                |       |      | d <sub>r</sub> =10 |          | Sig.=0,045 |          |        |       |
|-----------------------------|-----------|-------------------|----------------|-------|------|--------------------|----------|------------|----------|--------|-------|
| AIEAS <sup>a</sup>          |           | B                 | Wald           | df    | Sig. | Exp(B)             | MALE     |            | FEMALE   |        |       |
|                             |           |                   |                |       |      |                    | log(odd) | odd        | log(odd) | odd    |       |
| IAEO                        | Intercept | .227              | 8.284          | 1     | .004 |                    |          |            |          |        |       |
|                             | GEN       | Female            | -.131          | 4.176 | 1    | .041               | 0.87     |            |          |        |       |
|                             |           | Male              | 0 <sup>b</sup> |       | 0    |                    |          |            |          |        |       |
|                             | EDLV      | BY1               | -.307          | 4.653 | 1    | .031               | 0.735    | -0.080     | 0.923    | -0.211 | 0.810 |
|                             |           | BY2               | -.464          | 7.033 | 1    | .008               | 0.629    | -0.236     | 0.790    | -0.367 | 0.693 |
|                             |           | BY3               | -.693          | 4.135 | 1    | .042               | 0.500    | -0.466     | 0.627    | -0.597 | 0.550 |
|                             |           | MY1               | -.356          | 3.148 | 1    | .076               | 0.700    | -0.129     | 0.879    | -0.260 | 0.771 |
| MY2                         |           | 0                 |                | 0     |      | 1.000              | 0.227    | 1.255      | 0.096    | 1.101  |       |
| JLED                        | Intercept | .306              | 2.986          | 1     | .084 |                    |          |            |          |        |       |
|                             | GEN       | Female            | .266           | 3.537 | 1    | .060               | 1.30     |            |          |        |       |
|                             |           | Male              | 0 <sup>b</sup> |       | 0    |                    |          |            |          |        |       |
|                             | EDLV      | BY1               | -.522          | 4.891 | 1    | .027               | 0.59     | -0.215     | 0.806    | 0.051  | 1.052 |
|                             |           | BY2               | -.252          | 4.445 | 1    | .035               | 0.77     | 0.055      | 1.056    | 0.320  | 1.378 |
|                             |           | BY3               | .067           | 3.910 | 1    | .048               | 1.07     | 0.374      | 1.453    | 0.639  | 1.895 |
|                             |           | MY1               | -.199          | 5.803 | 1    | .016               | 0.81     | 0.107      | 1.113    | 0.373  | 1.452 |
| MY2                         |           | 0                 |                | 0     |      |                    | 0.306    | 1.359      | 0.572    | 1.772  |       |

Note: a. The reference category is: MESF. b. This parameter is set to zero because it is redundant

A first conclusion resulting from the analysis of students’ opinions regarding the way in which the use of artificial intelligence in education will affect society as a whole is that the highest value of odds is registered in the case of female students in their third year of Bachelor’s studies, who consider that the effect with the highest chances of occurrence is job loss:

$$odds_{JLDE\_FEMALE\_BY3} = e^{(0.306+0.266+0.067)} = 1.895 \tag{7}$$

This means that, according to the result no. (7), from their point of view, by using artificial intelligence in education, the chance of losing jobs is 1.895 times higher than the one of creating a more educated and more skilled workforce, which is shown through  $odd_{JLED\_FEMALE\_BY3}/odd_{IAEO\_FEMALE\_BY3}=3.445$  times greater, than the chance of increasing the inequality when it comes to the access to education and to the employment opportunities.

Second year Master’s degree students also have a similar standpoint. In this case as well, the highest values of odds are also registered in the case of female students (8):

$$odds_{JLDE\_FEMALE\_MY2} = e^{(0.306+0.266+0.0)} = 1.772 \tag{8}$$

Under these conditions, the ratio of odds values between genders regarding possible losses of jobs caused by the use of artificial intelligence in education is  $\text{odd}_{\text{ILED\_FEMALE}}/\text{odd}_{\text{IAEO\_MALE}}=1.304$ , which means that female population is more fearful of the job loss than the male one. Furthermore, it should be pointed out that the fear of job loss is increasing as the students approach the last years of studies, therefore approaching the moment of entering the labour market. For example, for male Bachelor's degree students, the odds values for first-year students increase from 0.806 to 1.056 for second-year students and up to 1.453 for third-year Bachelor's degree students. The same situation is registered in the case of Master's degree students, the odds value in the case of male first year students is 1.113 (greater value than in the case of first year and second year Bachelor's degree students) and in the case of second year Master's degree students it is 1.359. Regarding student opinions on the statement that the use of artificial intelligence in education will lead to an increase in inequality when it comes to the access to education and to the employment opportunities (IAEO), the ratios with the MESF statement (the use of artificial intelligence in education will create a more educated and skilled workforce) chosen as a basis are reversed. Therefore, except for second year Master's degree students for which the values of  $\text{odd}_{\text{IAEO}}$  are greater than one (1.255 for male students and 1.101 for female students), in all other cases the registered values are less than one. The lowest values of  $\text{odd}_{\text{IAEO}}$  were registered in the case of third-year Bachelor's degree students, of 0.672, in the case of male students, and 0.355, for female students. This means that the odds of considering the use of artificial intelligence in education will create a more educated and skilled workforce (MESF), compared to the one related to the increase in inequality when it comes to the access to education and to the employment opportunities (IAEO), is 1.594 for male students ( $1/\text{odd}_{\text{IAEO\_MALE\_BY3}}=1/0.627$ ) and 1.817 for female students ( $1/\text{odd}_{\text{IAEO\_FEMALE\_BY3}}=1/0.355$ ). The results of the third model are similar to those obtained by Mann Levesque (2018), Brougham and Haar (2020), or Ciarli et al. (2021).

## **Conclusions**

The research performed an analysis of the opinions of students from prestigious universities in Romania on the social impact caused by the use of artificial intelligence in education. An opinion poll was developed and respondents were required to fill out a questionnaire online, but, in order to accomplish the mentioned objective, only a few questions deemed significant in this sense were selected. Considering two significant characteristics of respondents (gender and level of education) and three variables of interest for expressing the impact of using artificial intelligence in education (aimed at improving the learning experience, employment prospects and changes to the society) three logistic regression models were applied.

The results obtained by applying a binary logistic model, referring to the respondents' opinions on the improvement of the learning experience through the use of artificial intelligence in education, highlighted that, as the students are in higher years of study of the bachelor's and master's cycles, compared to those in the first year, the greater the chance of improving the learning experience through the use of artificial intelligence. At the same time, the most convinced of the positive effect of artificial intelligence on the improvement of the learning experience are the male students in the last year of the master's degree, followed by those in the third year of the bachelor's degree. Female students are less confident than male students, regardless of education level. Regarding the students' opinions on the employment

prospects of the graduates, as a result of the use of artificial intelligence in education, they were analysed using a multinomial regression model. The conclusion was that female students in their third year of Bachelor's studies and second year of Master's degree studies consider that the chance of losing jobs is 1.895 times higher than that of creating a more educated and more skilled workforce. Concurrently, this chance is 3.445 times greater than that of increasing inequality when it comes to the access to education and to employment opportunities. The fear of losing a job increases in intensity as students approach the last years of studies, the odds values increase from less than one in the first year of studies, to more than one in the last year of studies. The exceptions are second year Master's degree students, the odds in their case being much lower than that of creating a more educated and skilled workforce. From the analysis of odd-ratios it results that, according to respondents' views, the use of artificial intelligence in education will, first of all, lead to the loss of jobs and, only secondly, to creating a more educated and skilled workforce.

A general conclusion is that respondents who are in their final years of Bachelor's and/or Master's degree studies are much more aware of the impact of using artificial intelligence in education. Male students are more optimistic, both with respect to the chance of improving the learning experience, as well as to the significant and medium effect of using AI in education on the employment prospects. With regard to female students' answers, a more reserved attitude is formed as for the positive impact of using artificial intelligence in education.

The research results offer an overview of the perception of young students enrolled in higher education institutions in Romania on the multiple influences the use of AI has on education. The research results can be starting points in designing the implementation of artificial intelligence in student-oriented education, in becoming aware of skills in order to elevate them, and in creating a positive attitude in the context of sustainable development.

The research limits are represented, on the one hand, by the fact that the research was performed only at the level of university students, and, on the other hand, by the variables presented. Expanding the research could also include other categories of people from the field of education (i.e., professors) as well as other levels of education.

As it appears from other studies mentioned (Moonpreneur, 2023), the applicability of the research results is useful not only at the academic level. Students' perception on the impact of artificial intelligence on education is also important for future workplaces in the direction of their efficiency. At the same time, artificial intelligence is also important for the transition, training, and adaptation of young graduates to the requirements of future jobs, in the development and application of specialised work training programs.

Highlighting the usefulness of artificial intelligence in the process of assessing, smart guidance, developing the level of knowledge at global level, of learning and perfecting at any level of education, of adapting the demand to the offer of skills, represent many perspectives of expansion for future research studies, which would analyse other institutions and fields of activity.

### References

- Acemoglu, D. and Restrepo, P., 2019. Artificial intelligence, automation, and work. In: A. Agrawal, J. Gans and A. Goldfarb eds., 2019. *The Economics of Artificial Intelligence: An Agenda*. Chicago, IL, USA: University of Chicago Press, pp. 197-236.

- Acemoglu, D. and Restrepo, P., 2020. Robots and Jobs: Evidence from US Labor Markets. *Journal of Political Economy*, [e-journal] 128(6), pp. 2188-2244. <https://doi.org/10.1086/705716>.
- Ahmad, S.F., Alam, M.M., Rahmat, M.K., Mubarik, M.S. and Hyder, S.I., 2022. Academic and Administrative Role of Artificial Intelligence in Education. *Sustainability*, 14(3), article no. 1101. <https://doi.org/10.3390/su14031101>.
- Ahmad, S.F., Han, H., Alam, M.M., Rehmat, M.K., Irshad, M., Arraño-Muñoz, M. and Ariza-Montes, A., 2023. Impact of artificial intelligence on human loss in decision making, laziness and safety in education. *Humanities and Social Sciences Communications*, [e-journal] 10, article no. 311. <https://doi.org/10.1057/s41599-023-01787-8>.
- Brougham, D. and Haar, J., 2020. Technological disruption and employment: The influence on job insecurity and turnover intentions: A multi-country study. *Technological Forecasting and Social Change*, [e-journal] 161, article no. 120276. <https://doi.org/10.1016/j.techfore.2020.120276>.
- Chatterjee, S. and Bhattacharjee, K.K., 2020. Adoption of artificial intelligence in higher education: A quantitative analysis using structural equation modelling. *Education and Information Technologies*, [e-journal] 25(5), pp. 3443-3463. <https://doi.org/10.1007/s10639-020-10159-7>.
- Ciarli, T., Kenney, M., Massini, S. and Piscitello, L., 2021. Digital technologies, innovation, and skills: Emerging trajectories and challenges. *Research Policy*, [e-journal] 50(7), article no. 104289. <https://doi.org/10.1016/j.respol.2021.104289>.
- Cope, B., Kalantzis, M. and Searsmith, D., 2020. Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. *Educational Philosophy and Theory*, [e-journal] 53(12), pp. 1229-1245. <https://doi.org/10.1080/00131857.2020.1728732>.
- Cukurova, M., Kent, C. and Luckin, R., 2019. Artificial intelligence and multimodal data in the service of human decision-making: A case study in debate tutoring. *British Journal of Educational Technology*, [e-journal] 50(6), pp. 3032–3046. <https://doi.org/10.1111/bjet.12829>.
- Dellermann, D., Lipusch, N., Ebel, P. and Leimeister, J.M., 2018. Design principles for a hybrid intelligence decision support system for business model validation. *Electronic Markets*, [e-journal] 29(3), pp. 423-441. <https://doi.org/10.1007/s12525-018-0309-2>.
- Dodel, M. and Mesch, G.S., 2020. Perceptions about the impact of automation in the workplace. *Informaiton, Communication & Society*, [e-journal] 23(5), pp. 665-680. <https://doi.org/10.1080/1369118X.2020.1716043>.
- Dumitru, D. and Halpern, D.F., 2023. Critical Thinking: Creating Job-Proof Skills for the Future of Work. *Journal of Intelligence*, [e-journal] 11(10), article no. 194. <https://doi.org/10.3390/jintelligence11100194>.
- European Union – Eurobarometer, 2020. *Attitudes towards the Impact of Digitalisation on Daily Lives*. [online]. Available at: <<https://europa.eu/eurobarometer/surveys/detail/2228>> [Accessed 12 august 2023].
- Fahimirad, M., 2018. A Review on Application of Artificial Intelligence in Teaching and Learning in Educational Contexts. *International Journal of Learning and Development*, [e-journal] 8(4), pp. 106-118. <https://doi.org/10.5296/ijld.v8i4.14057>.



- Farchy, J. and Denis, J., 2020. *Artificial intelligence*. [online] Available at: <<https://EconPapers.repec.org/RePEc:hal:journl:halshs-04006773>> [Accessed 22 July 2023].
- Felea, M., Bucur, M., Negruțiu, C., Nițu, M. and Stoica, D.A., 2021. Wearable Technology Adoption Among Romanian Students: A Structural Model Based on TAM. *Amfiteatru Economic*, [e-journal] 23(57), pp. 376-391. <https://doi.org/10.24818/EA/2021/57/376>.
- Füller, J., Hutter, K., Wahl, J., Bilgram, V. and Tekic, Z., 2022. How AI revolutionizes innovation management – Perceptions and implementation preferences of AI-based innovators. *Technological Forecasting and Social Change*, [e-journal] 178, article no. 121598. <https://doi.org/10.1016/j.techfore.2022.121598>.
- Goralski, M.A. and Tan, T.K., 2020. Artificial intelligence and sustainable development. *International Journal of Management Education*, [e-journal] 18(1), article no. 100330. <https://doi.org/10.1016/j.ijme.2019.100330>.
- Hinojo-Lucena, F.-J., Díaz, I.A., Reche, M.P.C. and Romero-Rodríguez, J.-M., 2019. Artificial Intelligence in Higher Education: A Bibliometric Study on its Impact in the Scientific Literature. *Education Sciences*, [e-journal] 9(1), article no. 51. <https://doi.org/10.3390/educsci9010051>.
- Huang, Y. and Sharif, N., 2017. From ‘labour dividend’ to ‘robot dividend’: Technological change and workers’ power in South China. *Agrarian South: Journal of Political Economy*, [e-journal] 6(1), pp. 53-78. <https://doi.org/10.1177/2277976017721284>.
- Kamalov, F., Santandreu Calonge, D. and Gurrib, I., 2023. New Era of Artificial Intelligence in Education: Towards a Sustainable Multifaceted Revolution. *Sustainability*, [e-journal] 15(16), article no. 12451. <https://doi.org/10.3390/su151612451>.
- Knox, J., 2020. Artificial intelligence and education in China. *Learning Media Technology*, [e-journal] 45(3), pp. 298-311. <https://doi.org/10.1080/17439884.2020.1754236>.
- Koch, M., Manuylov, I. and Smolka, M., 2021. Robots and firms. *Economic Journal*, 131, pp. 2553-2584.
- Lai, T., Xie, C., Ruan, M., Wang, Z., Lu, H. and Fu, S., 2023. Influence of artificial intelligence in education on adolescents’ social adaptability: The mediatory role of social support. *PLoS ONE*, [e-journal] 18(3), article no. e0283170. <https://doi.org/10.1371/journal.pone.0283170>.
- Li, C., Zhang, Y., Niu, X., Chen, F. and Zhou, H., 2023. Does Artificial Intelligence Promote or Inhibit On-the-Job Learning? Human Reactions to AI at Work. *Systems*, [e-journal] 11(3) article no. 114. <https://doi.org/10.3390/systems11030114>.
- Luckin, R., Holmes, W., Griffiths, M. and Forcier, L.B., 2016. *Intelligence Unleashed: An Argument for AI in Education*. London, UK: Pearson Education.
- Mann Levesque, E., 2018. *The Role of AI in Education and the Changing US Workforce*, *Brookings*. [online]. Available at: <<https://www.brookings.edu/articles/the-role-of-ai-in-education-and-the-changing-u-s-workforce/>> [Accessed 12 September 2023].
- Moonpreneur, 2023. *AI’s Negative and Positive Impact on Education Industry*. [online]. Available at: <<https://moonpreneur.com/blog/ai-negative-and-positive-impact-on-education-industry/>> [Accessed 5 September 2023].

- Moreno-Guerrero, A.-J., López-Belmonte, J., Marín-Marín, J.-A. and Soler-Costa, R., 2020. Scientific Development of Educational Artificial Intelligence in Web of Science. *Future Internet*, [e-journal]12(8), article no. 124. <https://doi.org/10.3390/fi12080124>.
- Mou, X., 2019. *Artificial Intelligence, No 32652. World Bank Publications - Reports, The World Bank Group*. [online] Available at: <<https://EconPapers.repec.org/RePEc:wbk:wbooper:32652>> [Accessed 22 July 2023].
- National Institute of Statistics, 2023. *Tempo online database*. [online]. Available at: <<http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>> [Accessed 30 June 2023].
- Pelau, C., Ene, I. and Pop, M.I., 2021. The Impact of Artificial Intelligence on Consumers' Identity and Human Skills. *Amfiteatru Economic*, [e-journal] 23(56), pp. 33-45. <https://doi.org/10.24818/EA/2021/56/33>.
- Sowa, K., Przegalinska, A. and Ciechanowski, L., 2021. Cobots in knowledge work-AI collaboration in managerial professions. *Journal of Business Research*, [e-journal]125, pp. 135-142. <https://doi.org/10.1016/j.jbusres.2020.11.038>.
- Sullins, J., Craig, S.D. and Hu, X., 2015. Exploring the effectiveness of a novel feedback mechanism within an intelligent tutoring system. *International Journal of Learning Technology*, [e-journal]10(3), pp. 220-236. <https://doi.org/10.1504/IJLT.2015.072358>.
- Tsai, C.-Y., Marshall, J.D., Choudhury, A., Serban, A., Hou, Y.T.-Y., Jung, M.F., Dionne, S.D. and Yammarino, F.J., 2022. Human-robot collaboration: A multilevel and integrated leadership framework. *The Leadership Quarterly*, [e-journal] 33(1), article no. 101594. <https://doi.org/10.1016/j.leaqua.2021.101594>.
- Ufarte Ruiz, M. J. and Manfredi Sánchez, J. L., 2019. Algorithms and bots applied to journalism. The case of Narrativa Inteligencia Artificial: structure, production and informative quality. *Doxa Comunicación*, [e-journal] 29, pp. 213-233. <https://doi.org/10.31921/doxacom.n29a11>.
- Van Der Niet, A. and Bleakley, A., 2020. Where Medical Education Meets Artificial Intelligence: "Does Technology Care?". *Medical Education*, [e-journal] 55(1), article no. 30-36. <https://doi.org/10.1111/medu.14131>.
- Wang, Y.-Y. and Wang, Y.-S., 2019. Development and validation of an artificial intelligence anxiety scale: An initial application in predicting motivated learning behavior. *Interactive Learning Environments*, [e-journal] 30(4), pp. 619-634. <https://doi.org/10.1080/10494820.2019.1674887>.
- Xiao, M. and Yi, H., 2020. Building an efficient artificial intelligence model for personalized training in colleges and universities. *Computer Applications in Engineering Education*, [e-journal] 29(2), pp. 350-358. <https://doi.org/10.1002/cae.22235>.
- Yam, K.C., Goh, E.-Y., Fehr, R., Lee, R., Soh, H. and Gray, K., 2022. When your boss is a robot: Workers are more spiteful to robot supervisors that seem more human. *Journal of Experimental Social Psychology*, [e-journal] 102, article no. 104360. <https://doi.org/10.1016/j.jesp.2022.104360>.