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Article

Advances and challenges of Artificial Intelligence in the university context: An empirical study

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Abstract: This study aims to predict whether university students will make efficient use of Artificial Intelligence (AI) in the coming years, using a statistical analysis that predicts the outcome of a binary dependent variable (in this case, the efficient use of AI). Several independent variables, such as digital skills management or the use of Chat GPT, are considered.The results obtained allow us to know that inefficient use is linked to the lack of digital skills or age, among other factors, whereas Social Sciences students have the least probability of using Chat GPT efficiently, and the youngest students are the ones who make the worst use of AI.

Keywords: Artificial Intelligence; digital skills; higher education; personalization of learning; efficient use

1. Introduction

Artificial Intelligence (AI) is becoming a transformative element in higher education, being highly influenced by the development of information technologies information and communication (Alajmi et al., 2020), with a significant impact on the teaching, research and university management and administration. Allows you to personalize learning, improve administrative efficiency and redefine key roles such as admissions and student services and is generating debates on its application in higher education, but also poses challenges, such as need for clear policies, training and skills development, integration technological and evaluation and accreditation in contexts where AI is central.

In this sense, UNESCO (United Nations Organization for Education, Science and Culture) emphasizes the importance of directing technology so that do not direct us, increasing student autonomy and expanding options pedagogical.

Based on a humanistic vision, it suggests key steps for the regulation other tools of Generative AI, understood as a type of artificial intelligence that you can create new ideas and content, such as conversations, stories, images, videos and music, which include the obligation to protect data privacy and establishing an age limit for independent conversations with platforms of this AI. This means that to guide the proper use of the tools in education and research, proposes a human-agent approach appropriate to the age for ethical validation processes and pedagogical design (UNESCO, 2024).

The European Teaching Digital Competence Framework (DigCompEdu) provides a general framework of reference to support the development of cyber capabilities in Europe specific to education. Based on this, the final report of the expert group of the Commission on artificial intelligence and data in education and training,

describes the emerging competencies of educational agents and directors of educational centers teaching for the ethical use of AI and data, and proposes a set of categories on what educational agents and organizations working in this field need know and what they need to be able to do to use AI and data in an ethical way. These four ethical considerations are: capacity for action, in terms of whether it is a person competent in new technologies who is in charge of its development; equity social, since the distribution of rights, responsibilities, resources and power must be done fairly; humanity, because we must respect others and try empathize; and, finally, justified choice, with collaborative decision making (European Commission, 2022).

Similarly, the Report on AI in Universities: Challenges and Opportunities, also highlights the following critical factors (Pedreño, 2024):

1) It is necessary to adequately train teachers and administrators in the effective use and ethics of AI tools, since the lack of knowledge and adequate training in this technology could limit its effective implementation.

2) The growing gap between institutions with access to advanced AI tools and those that do not have it can leave some universities behind in Investigation and development.

3) The integration of AI into university administrative operations requires not only advanced technology, but also a cultural and organizational change.

4) AI in the educational environment raises ethical concerns, especially as regarding the privacy of student and faculty data.

5) AI implementation shows an uneven geographic distribution, with regions left behind (Europe, sub-Saharan Africa, parts of Central Asia and South and Latin America), which can amplify existing educational gaps in those areas.

6) There is a great diversity of university challenges that include the establishment of clear policies on the use of AI, training and skills development, technological integration, personalization of teaching and evaluation and accreditation in contexts where AI plays a central role.

7) Europe is a leader in AI recommendations and regulations.

8) Concrete measures are essential to face these challenges, such as strengthening internal skills, establish clear guidelines for AI adoption and encourage its investigation and proper use.

However, despite these challenges, in Spain the youth unemployment rate for The year 2023 stood at 28.6%, significantly higher than the average unemployment youth in the European Union, which was 14.9% during the same period. This indicates that The youth unemployment rate in Spain is almost double the European Union average (Ministry of Labor and Social Economy, 2024), so AI is becoming a key element to connect higher education with constantly changing needs evolution of the labor market.

Furthermore, with the exponential growth of the importance of AI in the field professional, the urgent need to train a greater number of people in this field. This demand is reflected in the labor market, where Jobs related to AI and machine learning are among the highest expansion. However, it is alarming that only 22% of AI experts are women, which reveals a significant gender gap in this industry. Between 2018 and 2022, an increase in the offer of AI courses has been observed, doubling to exceed six thousand, counting only those taught in English (Pedreño, 2024).

The Report "Jobs of Tomorrow: Large Language Models and Jobs" (World Economic Forum, 2023), quantify four types of effects of AI on the market employment taking into account a horizon of a decade:

Automation: Jobs with a high probability of being replaced by AI.

Increased productivity: Jobs that may use AI in a complementary way and, therefore, increase the productivity levels of workers.

Little to no effect: Jobs that will not be affected in the coming years by AI

Creation: These are new jobs that will be created as a result of the expansion of AI.

Related to this aspect, **Figure 1**, the vertical axis indicates the potential of exposure of jobs, with potential growth scores in the box the top scores, the low potential scores in the center box, and the automation in the box below. The horizontal axis indicates the expected net growth of jobs over the next five years, measured as the percentage change expected in the employment of labor. The most immediate conclusion of the graph is the positive association between increased employment and growth and negative association between the automation of employment and growth. On the contrary, jobs with lower exposure potential have much lower expected growth (World Economic Forum, 2023).

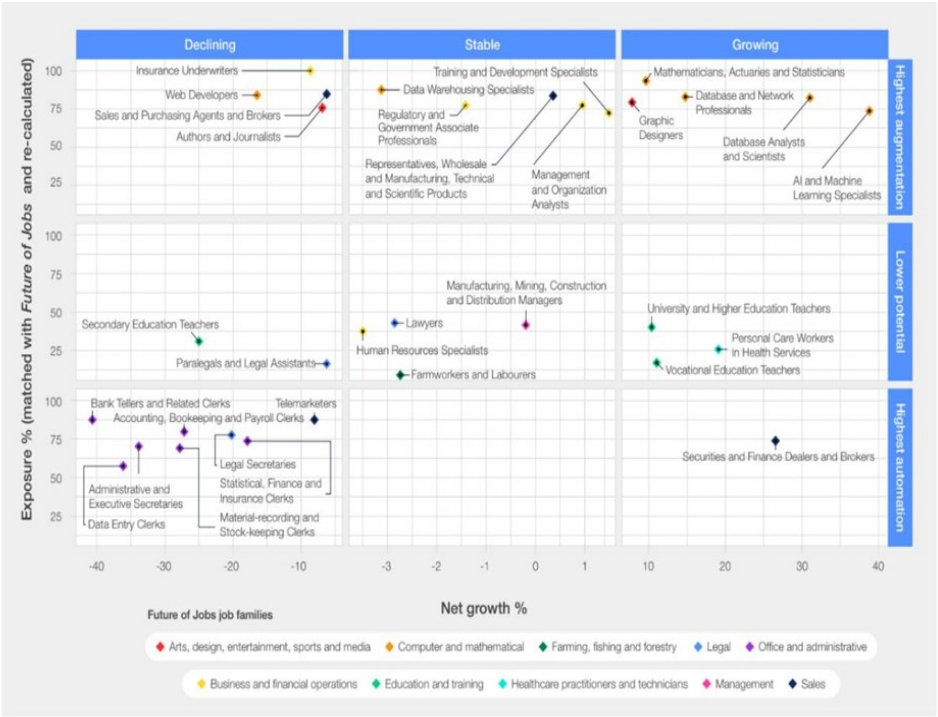

Figure 1. Employment exposure potential vs. growth potential.

In the same way, higher education institutions in Spain are dedicating significant effort to expand its repertoire of intelligence programs artificial. In this situation, it is crucial that these universities be pioneers, adjusting and expanding their study plans to cover not only technological aspects, but also to promote a multidisciplinary approach and the fusion of knowledge from different fields. We must not forget the importance of key skills for the age of intelligence artificial, such as creativity, critical analysis, effective communication, and the ability to leadership since as AI expands,

a reconfiguration is expected of the competencies and skills necessary in the workplace. critical thinking or AI-related competencies will become increasingly important for the employability and adaptation to technological change.

2. Theoretical framework

The notion of artificial intelligence is not recent; according to Cristianini (2016) it was coined in 1956 thanks to McCarthy, who followed Turing's line of thought (1950), who had already contemplated the possibility of providing machines with comparable reasoning and thinking to the humans. The computer, using the principles of artificial intelligence, can react to the way a student is responding to tests and can modify a strategy for testing so that their learning becomes efficient (Barker, 1986).

In the 1990s, the popularity of the Internet and the growth of digital data fueled the development of artificial intelligence, which made it possible to collect large amounts of information to train machine learning algorithms. In the following decades of 2000 and 2010, artificial intelligence experienced extraordinary growth, driven by technological advances such as cloud computing and deep learning.

Cloud computing has allowed researchers and companies access to large computing capacity at affordable prices, thus facilitating the management of enormous volumes of information. On the other hand, deep learning has been key in the formation of algorithms for pattern recognition and independent learning, achieving significant progress in fields such as image recognition, human language analysis and robotics.

With the step of time and technological advancement, the conception of AI has expanded and transformed. Today, AI is understood as those computer systems that can emulate human processes such as learning, adaptation, creation, self-correction. and data management to carry out complex operations (Popenici and Kerr, 2017). At the educational level, and, especially in Higher Education, the rapid growth of called Information and Communication Technologies (ICT) and, in parallel, AI have generated highly relevant educational applications, such as the analysis of learning data for improve educational decision making, the creation of personalized educational materials and the identification of learning problems.

As such, AI has the potential to revolutionize education by providing more personalized, accessible and effective for all students. That is, AI is changing the way knowledge is created and shared, improving the efficiency of course creation online and distance learning. Additionally, it is used to create high-quality educational content. quality that can be adapted to the needs of each student individually.

Now, it is essential that university professors stay up to date on the recent trends and progress in the field of AI and it is crucial that they prepare students to manage the tools and technologies associated with it, which will facilitate the incorporation of these concepts into their teaching and will equip them for the demands of the environment professional. Therefore, university teachers must have technological skills, including competence in the use of digital tools for the design and delivery of their lessons, as well as the ability to apply artificial intelligence and other advanced technologies within the educational context.

As for the students, it is essential that a critical evaluation of the information

obtained from artificial intelligence, critical thinking being essential.

In short, AI is becoming an essential tool in higher education, not only for its ability to improve customization and efficiency, but also for its potential to transform interdisciplinary research and collaboration (González-González, 2023).

If used effectively, artificial intelligence has the potential to improve education significantly, making it more accessible to everyone, hence the interest of this research, which tries to predict the efficient use of AI by students.

Universities that manage to incorporate and apply artificial intelligence effectively in their educational programs and institutional management will find themselves in an advantageous position to prepare their students for the future and to stay up to date with technological developments.

3. Methodology

The methodology followed to carry out this research is quantitative and It is based on a binary logistic regression (RL) carried out with SPSS (program computer statistician for social science research and developed by IBM).

This type of methodology is used because it allows a mixture of categorical and quantitative variables to be introduced as predictor variables of the response (effect variable or dependent variable). In this case, the dependent variable (efficient use of AI in education), which is the one we wish to model, is categorical and dichotomous and its choice is due to the research of authors such as Albarran (2023), for whom the use of AI in education should improve its effectiveness and efficiency, as it can be personalized and better adapted to the personal needings; Also according to UNESCO (2023), AI has sufficient potential to address most of the current problems in education, and help achieve goal 4, of sustainable development, which is to guarantee inclusive, equitable and quality education, as well as promote lifelong learning opportunities.

Regarding the predictor variables, which can influence the use of AI by students, after a review of the scarce scientific literature based on the student profile (Cataldi and Dominighini, 2019; Oyarvide et al., 2024), can be classified into the following:

- Gender
- Age
- Type of Studies
- Digital Skills Management
- Use of Chat GPT
- Affective Level with Chat GPT

With these variables, an online survey was carried out for two months to a group of students from a university in Madrid, who were studying different degrees and whose age range was between 17 and 25 years, and whose analysis allowed us to propose an RL with which express the probability that the efficient use of AI will occur as a function of certain variables, which are presumed relevant or influential (explanatory and independent variables).

Therefore, the objective of this analysis will be to predict whether there will be efficient use of AI by students based on the predictor variables, obtaining a mathematical formula that can be used to calculate the probability of the event studied in a new student. in function of the values of the different variables included in the

model.

Table 1 shows a summary with the number of cases introduced in the analysis: 109, the selected for analysis; 108 and those excluded or lost cases: 1, for having some unanswered question.

Table 1. Case processing summary.

Cases		**Sample**	**Percentage**
Selected cases	Included in the analysis	108	99.1
	Lost cases	1	0.9
	Total	109	100.0
Unselected cases		0	0.0
Total		109	100.0

For its part, **Table 2** specifies the coding of the dependent variable (which must be dichotomous), in this case the efficient use of the GPT chat (YES = 0; NO = 1).

Table 2. Dependent variable coding.

Original value	**Internal Value**
YES = 1	0
NO = 2	1

The following table (**Table 3**) shows the coding used in the independent variables, in this case four variables, also indicating the absolute frequency of each worth.

Table 3. Coding of independent variables (categorical).

Variable Encodings		**Frequency**	**Parameter Encoding**	
			(1)	(2)
On an Affective Level with Chat GPT	I feel good	31	1.000	0.000
	I feel regular	27	0.000	1.000
	I feel bad	50	0.000	0.000
Skills Management Digitales	good	44	1.000	0.000
	regular	30	0.000	1.000
	bad	34	0.000	0.000
Use of Chat GPT	professionall	39	1.000	0.000
	personal	31	0.000	1.000
	academician	38	0.000	0.000
ype of Studies	social	36	1.000	0.000
	health	38	0.000	1.000
	technical	34	0.000	0.000

4. Results

The following results have been achieved, which we distribute in blocks: Initial block: in which the likelihood of the model is calculated.

Table 4 allows evaluating the fit of the regression model (up to this point, with a

single parameter in the equation), comparing the predicted values with the observed values. By default, a probability cut-off point of 0.5 has been used to classify students; This means that those students for whom the equation with a single parameter calculates a probability <0.5 are classified as "they do make efficient use", while if the resulting probability is ÿ 0.5 they are classified as "they do not make efficient use". "efficient". In this first step the model has correctly classified 64.8% of the cases, and no student who "does make efficient use" has been correctly classified.

Table 4. Leaderboard[b].

Observed			Predicted		
			efficient use of AI		Correct Percentage
			Yes	No	
Paso 0	efficient use of AI	Yes	0	38	0.0
		No	0	70	100.0
	Overall Percentage				64.8

a. The constant is included in the model.
b. The cut-off value is 0.500.

Finally, **Table 5** presents the estimated parameter (B), its standard error, its significance statistics with the Wald test, which is a statistic that follows a Chi square law with 1 degree of freedom and the estimate of the exponent of B, which indicates the strength of the relationship, how much the further away it is from 1, the stronger the relationship. In the regression equation it only appears, in this first block, the constant, leaving out the rest of the variables.

Table 5. Variables in the equation.

		B	Standard Error	Wald	gl	Sig.	Exp(B)
Step 0	Constant	0.611	0.201	9.192	1	0.002	1.842

Final block: provides information on the fit of the model with these estimates.

Table 6 shows a Chi Square test that evaluates the null hypothesis that the coefficients (ÿ) of all terms (except the constant) included in the model are zero. If the significance is less than 0.05 indicates that the model helps explain the event, that is, the independent variables explain the dependent variable.

Table 6. Omnibus tests of model coefficients.

		Chi-square	Degrees of freedom	Next
Step 1	Passed	12,444	10	0.256
	Block	12,444	10	0.256
	Model	12,444	10	0.256

Three inputs emerge: Step, Block and Model:

- The first row (Step) is the one corresponding to the change in likelihood (of -2LL) between successive steps in the construction of the model, contrasting the H0 that the coefficients of the variables added in the last step are zero. The probability of

the results observed in the study, given the parameter estimates, is what is known as likelihood; but since this is a small number (usually less than one) -2LL is used ("minus two times the natural logarithm of the likelihood").

- The second row (Block) is the change in -2LL between successive input blocks during model construction. If, as is usual in practice, the variables in a single block, the Chi Square of the Block is the same as the Chi Square of the Model.
- The third row (Model) is the difference between the value of -2LL for the model only with the constant and the value of -2LL for the current model. In this case, since there is only one covariate introduced in the model (in addition to the constant), a single block and a single step, the three values coincide. The statistical significance (0.256) tells us that the model with the new variables introduced improves the fit significantly with compared to what we had.

Below, **Table 7** provides three measures that constitute a summary of the models, complementary to the previous one, to globally evaluate its validity: the first is the value of -2LL and the other two are Coefficients of Determination (R2), which express the proportion (as per one) of the variation explained by the model.

A perfect model would have a very small -2LL value (ideally zero) and an R^2 close to one (ideally one).

The determination coefficients indicate that only 10% or 15% of the variation of the dependent variable is explained by the variables included in the model, and should improve when variables that are more explanatory of the result are included or by doing more iterations. The higher the R^2, the more explanatory the model is, that is, the variables independents explain the dependent variable.

Table 7. Summary of the models.

Step	Logarithm of Likelihood -2LL	Cox and Snell square R	R square Nagelkerke
1	127,651a	0.109	0.150

The process has needed four cycles to correctly estimate the constant term, because the variation of -2LL between the third and fourth loop has changed by less than the set criterion by the program (0.001).

Tables 8 and **9** show a global fit test of the model known as the test of Hosmer and Lemeshow, which measures a specific aspect of model validity: calibration (degree in which the predicted probability coincides with the observed one).

Table 8. Hosmer and Lemeshow test.

	Chi-square	Degrees of freedom	Next
Step 1	7.590	7	0.370

This is another test to evaluate the goodness of fit of a logistic regression model.

It is based on the idea that if the fit is good, a high value of the predicted probability (p) will be associated with outcome 1 of the dependent binomial variable, while a low value of p (close to zero) will correspond in the most of the time—with the result 0.

Table 9. Contingency table for the hosmer and lemeshow test.

Contingency Table for the Hosmer and Lemeshow Test						
		efficient use of AI = yes		efficient use of AI = no		Total
		Observed	Expected	Observed	Expected	
Step 1	1	9	7.629	2	3.371	11
	2	4	5.431	7	5.569	11
	3	3	5.159	9	6.841	12
	4	7	4.826	5	7.174	12
	5	4	4.047	7	6.953	11
	6	2	3.623	10	8.377	12
	7	2	2.688	10	9.312	12
	8	3	2.104	8	8.896	11
	9	4	2.494	12	13.506	16

An alternative way to evaluate the regression equation and the model obtained is to construct a 2 × 2 table classifying all individuals in the sample according to the agreement of the values observed with those predicted or estimated by the model. In this sense, an equation without power of classification would have a specificity, sensitivity and total correct classification equal to 50% (by simple chance). A model can be considered acceptable if both specificity and sensitivity are at a high level, at least 75%. With our model (with a single variable), the classification table obtained is the following (**Table 10**).

Table 10. Leaderboard[a].

Observed			Predicted		
			efficient use of AI		Correct Percentage
			Yes	No	
Step 1	efficient use of AI	Yes	31	7	81.5
		No	5	65	92.9
	Overall Percentage				70.4

a. The cut-off value is 0.500.

In the classification table we can verify that our model has a specificity high (81.5%) and high sensitivity (92.9%), that is, it is acceptable. Furthermore, the value of overall percentage correctly classified, which indicates the number of cases that the model is capable of of predicting correctly is 70.4%. That is, it is capable of correctly classifying almost 71 cases out of every hundred, and the higher it is, the more times the predicted value coincides with the observed value, so the better the model, the more explanatory, and the independent variables are good predictors of the dependent variable. If the model correctly classifies more than 50% of the cases, the model is accepted. If not, you would have to start over selecting new ones. independent variables.

Finally, **Table 11** indicates the variables that will be left in the equation, their coefficients of regression with its corresponding standard errors, the value of the Wald

statistic to evaluate the null hypothesis, the associated statistical significance, and the value of Exp B.

Table 11. Variables in the equation.

		B	Standard Error	Wald	Degrees of freedom	Sig.	Exp(B)
Step 1a	Sex	−0.179	0.448	0.159	1	0.690	0.836
	Age	−0.012	0.446	0.001	1	0.979	0.988
	Type of Studies			4.184	2	0.123	
	Type of Studies(1)	−1.038	0.563	3.394	1	0.065	0.354
	Type of Studies(2)	−0.184	0.565	0.106	1	0.745	0.832
	Digital Skills Management			0.004	2	0.998	
	Digital Skills Management (1)	0.014	0.525	0.001	1	0.979	1.014
	Digital Skills Management (2)	−0.021	0.571	0.001	1	0.970	0.979
	Use of Chat GPT			7.999	2	0.018	
	Use of Chat GPT(1)	−1.365Lo m	0.543	6.319	1	0.012	0.255
	Use of Chat GPT(2)	−0.162	0.603	0.072	1	0.788	0.850
	On an Affective Level with Chat GPT			0.686	2	0.710	
	On an Affective Level with Chat GPT(1)	−0.263	0.531	0.246	1	0.620	0.769
	On an Affective Level with Chat GPT(2)	−0.431	0.536	0.648	1	0.421	0.650
	Constant	2.104	1.203	3.057	1	0.080	8.201

a. Variables specified in step 1: Sex, Age, Type of Education, Management of Digital Skills, Use of Chat GPT, Affective Level with Chat GPT.

In general, as seen in this last table, the results that can be obtained from the research problem posed would be the following:

- Students who study Social Sciences are the least likely to make an efficient use of Chat GPT, as evident from the high negative value of *B* for this type of studies.
- The youngest students are the ones who make the worst use of AI.
- The same happens with those students who make professional use of this tool. of AI, as their professionalism may prevent them from analyzing other uses.
- The dependent variable that explains the efficient use of GPT chat is good management of the tool (with $B < 0.05$), the rest less than 0.05, having a negative sign explain a use inefficient, as occurs with the variable corresponding to poor management of digital skills or with age.
- Since the exponent of *B* is close to 1 in almost all the variables, it is indicating that the relationship between them is weak.

In summary, with all the data analyzed we can now create a profile of those students who are going to make efficient use of AI in their training:

They are generally men, aged between 22 and 26 with technical and/or health studies, with GPT chat handling knowledge that you feel good about using as a tool.

This means that new AI training methods must be considered for those young

social studies students with little training in AI who are not comfortable using AI.

4. Discussion

Universities should strive to train students in the proper use of AI as a learning process, so that regardless of the degree studied and previous knowledge about this tool, they leave with a more competent training, which corresponds to the effective use of AI in any scientific field. In addition, it is also important to remember to always make an ethical use of this tool. As with any technological change, training and adaptation to AI will be necessary, but in the short term the benefits of its correct use will be greater than the disadvantages associated with it.

5. Conclusion

Research on the use of artificial intelligence (AI) in education reveals patterns interesting that could inform future strategies to improve the integration of these technologies in the classroom. The findings suggest that Social Sciences students can benefit from a more targeted and contextualized approach when using tools like Chat GPT, which which could involve more specialized training that addresses your needs and applications specific in their fields of study. Furthermore, the results indicate that the most young people may need more structured guidance to make the most of the AI capabilities, possibly due to less exposure or familiarity with these technologies compared to their older counterparts.

Professionalism, while valuable, may limit exploration of alternative applications of AI, suggesting that even experienced users can benefit from a mindset open and experimental towards these tools. The correlation between competent management of tool and the efficient use of Chat GPT highlights the importance of digital competence, which underlines the need for continuous training in digital skills for all students, regardless of your age or field of study.

The data also point to the existence of a specific profile of students who use efficiently AI: predominantly men between 22 and 26 years old, with technical or health and a good understanding of Chat GPT. This profile can serve as a guide for identify those who could act as mentors or facilitators among their peers, helping to close the skills and comfort gap with AI.

In conclusion, it is crucial to promote responsible and conscious use of AI in environments educational. This not only improves learning and content generation, but also prepares students for an increasingly technological future. Implementation of methods innovative teaching methods that adapt to the needs of less fortunate students. familiar with AI is essential to ensure that all students, regardless of their age, gender or discipline of study, can benefit from what AI has to offer.

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