2

Analysis of an Artificial Intelligence Training Program in University Students: Perspectives and Horizons[1]

PhD Alejandro López-García
Universidad de Murcia, Spain
aloga@um.es
https://orcid.org/0000-0002-7665-57890

PhD José María Campillo-Ferrer
Universidad de Murcia, Spain
jmcf2@um.es
https://orcid.org/0000-0001-8570-3749

PhD María Victoria Zaragoza-Vidal
Universidad de Murcia, Spain
mariavictoria.zaragoza@um.es
https://orcid.org/0000-0002-6175-3239

PhD Pedro Miralles-Sánchez
Universidad de Murcia, Spain
pedro.miralless@um.es
https://orcid.org/0000-0002-2436-3012

Abstract
Artificial intelligence (AI) is an emerging technology that is playing a decisive role in education, transforming the way teaching and learning takes place. Personalization of learning, virtual assistance systems, task automation, skills

1. This work has been carried out within the period of the research projects "History Lab for European Civic Engagement" (2020-1-ES01-KA226-HE-095430), funded by the ERASMUS+ KA226 programme, and "La enseñanza y el aprendizaje de competencias históricas en Bachillerato: un reto para lograr una ciudadanía crítica y democrática" (PID2020-113453RB-100), funded by the Agencia Estatal de Investigación de España, to be developed by the DICSO research group of the University of Murcia. These organisations are thanked for their financial contribution to this study.

development and content creation are some of the numerous possibilities. However, they should be supported by innovative approaches that give an active role to e-learners. The general objective of this study was to analyze the effectiveness of a teacher training program at the university level that implements AI technologies to teach social sciences content in early childhood and primary education. To this end, a quantitative method was used, specifically a descriptive pre-experimental one-group pretest-posttest design. The research was carried out with 187 students from two Spanish universities in the Bachelor's Degree in Early Childhood and Primary Education. The training program consisted in the development and planning of 18 pedagogical situations in the field of social sciences, mediated by numerous AI tools. The results show a significant improvement in the learners' perceptions after the training program was implemented, highlighting its usefulness in improving teaching and learning processes, particularly the creation of more effective and personalized teaching plans.

Keywords: Artificial Intelligence, computer science, perception, social sciences, training methods.

2.1. Introduction

The emerging advancement of technology has found its zenith in artificial intelligence (AI) systems. AI is changing the way we live, work, interact and, inevitably, the way we educate and study (Norman-Acevedo, 2023). Thus, faced with the obvious need arising from the current technological evolution, official bodies such as UNESCO (2023) point to the challenge of developing innovative educational practices that are able to meet the challenge posed by education today, and consequently achieve the goals proposed in the 2030 Agenda. The Beijing Consensus (2019) already pointed out the need to introduce new teaching models by bringing together AI and education, as this symbiosis can be beneficial for both students and teachers. It was also pointed out that AI can help education to be more inclusive, equitable, personalized and open, which is why these official documents underline the need to update education systems, so that value is placed, for example, on the achievement of Sustainable Development Goal (SDG) 4 - aimed at education, which refers to ensuring inclusive, equitable and quality education, in addition to promoting lifelong learning opportunities for people.

Some authors have highlighted the need to explore the current university model due to the high degree of digitalization of society, as well as the constant improvement and updating of infrastructures, and the emergence of new technological tools (Tapalova & Zhiyenbayeva, 2022). A critical reconceptualization would contribute to improving the quality of the educational process, as it would allow for a better personalization of learning, enabling the content and pace of the process to be adapted to the needs and preferences of learners (Wild & Schulze, 2021; Mir et al., 2022).

In the context of higher education, some universities are offering training to implement AI with their students, even if it is complementary to other subjects. Some researchers such as Lee (2021) state the need for an educational program for students who are not specialized in the subject to train students in the appropriate use of this new technology. This AI literacy, in turn, has favored a positive ethical perception of AI, showing that its use in the classroom has obtained satisfactory results, which points to the need to implement an education that goes beyond theoretical classes limited to the transmission of theoretical knowledge. Likewise, Xiao & Yi (2020) agree on the need for an educational reform that develops new methodologies based on personalized training, highlighting those based on AI, and proposing a design for this type of training.

In this sense, the effects of AI and inclusive online practices on crucial factors such as student performance, motivation, satisfaction, and engagement are complex issues that require further study for the development of AI-driven systems. In relation to these issues, Ouyang et al. (2022) examined the effects and implications of AI-based approaches described in previous research between 2011 and 2020, and concluded that AI-enabled learning boosted student engagement and attention and improved academic performance. However, further research is needed on how AI resources influence student satisfaction, since, as suggested by Rodway and Schepman (2023), higher education institutions need to consider the effects of these technologies on student comfort, course satisfaction and support to minimize a hypothetical decrease in course satisfaction due to their possible adoption. For example, the correlation between student satisfaction and the level of progression in a given module, unit or

course, or the effectiveness of AI tools such as intelligent tutoring systems in web-based approaches deserve to be further examined in future studies. Indeed, in the United States, intelligent tutoring systems using AI are being included to assist in problem solving and provide more personalized education. It has also been used by faculty members to improve the governance of academic affairs (Wang et al. 2021).

The enormous applicability that is beginning to be elucidated around AI systems is thus appreciable. In addition to the possibilities of AI in education, some studies have also focused on analyzing university students' ethical awareness of these tools. In fact, the demand for AI ethics education is defined as a need not only for university education, but also for the other stages of the education system, since, as the coexistence with new AI techniques increases, the urgency of establishing AI ethics education becomes more and more apparent (Hong, 2021).

This chapter shows an approach to the knowledge of AI systems through the implementation and evaluation of a training program that is analyzed from the point of view of future teachers. Perspectives and horizons merge to further shed light on the usefulness of this emerging and promising line of work.

2.2. Objectives

The general objective of this study was to analyse the perception of the effectiveness of an AI program for teaching social science content at the university level. In order to provide an adequate response, the following specific objectives were set:

- To compare the degree of perception about learning, satisfaction, applicability of AI and its limitations, globally and according to gender.
- To analyze the degree of consistency between the previous perception of learning, satisfaction, applicability of resources and their limitations, globally and according to gender.
- To analyze the degree of consistency between subsequent perceptions of learning, satisfaction, applicability of resources and the difficulties in the application of AI, globally and according to gender.

2.3. Method

Design and participants of the research

This research was based on a quantitative method, specifically on a pre-experimental design of one group with a pretest-posttest (McMillan & Schumacher, 2005). The total number of participants in this research was 187 university students of the Degree in Early Childhood Education and Degree in Primary Education from two Spanish universities located in the Region of Murcia, one public and one private. To constitute the sample, a non-probabilistic, accidental or chance sampling procedure was used, thus six groups of intact students were selected, of whom 145 were female and 42 were male.

Description of the teacher training program

This study was implemented during the first term of the 2023/2024 academic year (September-December). The contents of the subjects where the program was carried out were based on the reflective analysis of the cultural and evolutionary phenomena that characterize the current development of contemporary societies. Specifically, the training program was based on 18 curricular learning situations in which students had to respond critically to relevant social problems by analysing primary sources (readings, photographs, interviews, institutional documents) and secondary sources (articles, biographies, documentaries), as well as using different AI tools to carry out activities based on chatbots, avatar design, generation of presentations, posters and infographics, and the creation of online courses, videos and web pages (Figure 2.1). Likewise, with the help of AI, the students designed online questionnaires to check the extent to which they had assimilated the contents previously worked on in the program, which took the form of gamified tasks such as Kahoot, Educaplay and Plickers. All activities were implemented in small groups, presented in the classroom and defended in a shared discussion.

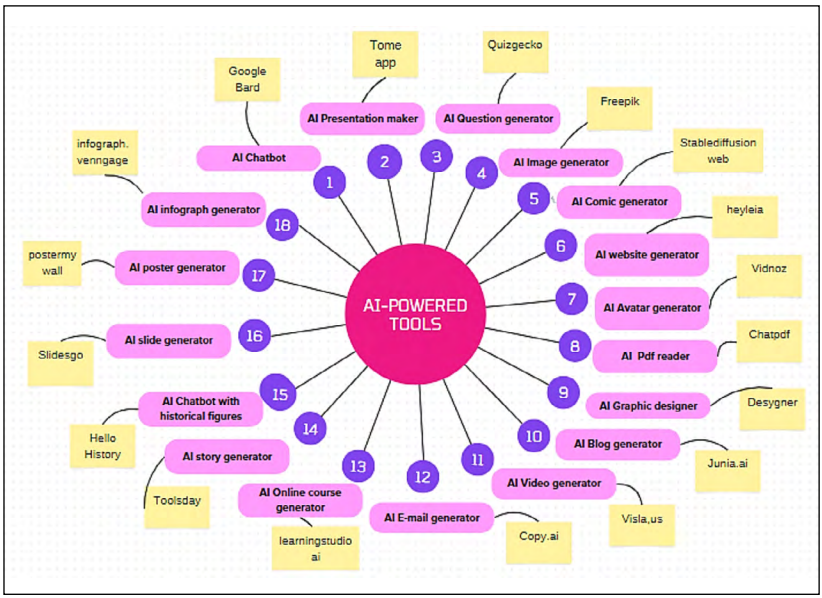

Figure 2.1. List of AI-based resources that were used during the study. Source: developed by author

Data collection tool

An appropriate instrument should record observable data that truly represent the concepts or variables that the researcher has in mind (Hernández et al., 2006). For this research, the instrument "Effectiveness of Artificial Intelligence in a Teacher Training Program" was used. It is an adaptation of the questionnaire designed by Ayuso-del Puerto and Gutiérrez-Esteban (2022). From there, a focus group was held to restructure the blocks and validate the content of the instrument. On this version, the reliability index was calculated, obtaining an alpha value of .929, which left a good degree of internal consistency, with values practically similar to those of its initial version ($\alpha = .930$).

This version of the instrument begins with an instruction section, followed by a section with identification questions. In its central part, the questionnaire is made up of four blocks or groups of questions, presented on a five-point Likert scale, ranging from 1, indicating total disagreement, to 5, indicating total agreement. As for the specific description of the blocks, the first

one contains ten items and aims to determine what students think about the learning process with AI tools. The second block consists of five statements and aims to analyze their overall level of satisfaction. The third block, consisting of five statements, investigates the applicability of the technology. The last block is related to possible difficulties or deficits in working with AI.

2.4. Results

About the Objective 1: To compare the degree of perception about learning, satisfaction, the applicability of AI and its limitations, globally and according to gender: Tables 2.1 and 2.2 present the descriptive results of this first objective, based on an analysis of the indices of central tendency of the blocks of the instrument, so that the self-perceived e-competence in this approach is collected, i.e., the perception of their learning, the satisfaction achieved, the degree of applicability that AI deserves, and the limitations derived from its practice. Only in this way can it be observed whether the applied program had an effect on computational thinking about the mastery of these AI systems.

Table 2.1. Descriptive statistics for the variables referring to self-perceived e-competence in this approach

Blocks of variables	Tests	Participants (n = 187)		
		M	Sd	Md
Learning	Pretest	3.67	.63	3.7
	Posttest	3.94	.80	4
Satisfaction	Pretest	3.48	.61	3.4
	Posttest	3.91	.79	4
Applicability	Pretest	3.15	.67	3.2
	Posttest	3.81	.72	3.8
Limitations	Pretest	3.10	.57	3
	Posttest	3.18	.63	3.2

Source: developed by autor.

The results show that the block of variables in which the difference before and after the application of the program is most evident is the one related to applicability, with the highest grouped median appearing in the posttests (3.8). Moreover, the best rated block is the one related to learning, with grouped medians being close to 4 points. According to the gender of the participants, the results improve in posttests in all blocks and for both male and female participants, as can be observed in Table 2.2.

Table 2.2. Descriptive statistics for the variables referring to self-perceived e-competence in this approach according to the gender of the participants

Blocks of variables	Tests	Participants (n=187)					
		Men n = 42			Women n = 145		
		M	Sd	Md	M	Sd	Md
Learning	Pretest	3.74	.23	4	3.64	.93	4
	Posttest	3.89	1.05	4	3.97	1.01	4
Satisfaction	Pretest	3.61	.17	4	3.44	.92	4
	Posttest	3.89	1.02	4	3.92	.99	4
Applicability	Pretest	3.33	.85	4	3.10	.98	3
	Posttest	3.76	.94	4	3.83	1.02	4
Limitations	Pretest	3.14	.61	3	3.13	.98	3
	Posttest	3.23	1.19	3	3.16	1.10	3

Source: developed by author

The block of variables in which the best results are obtained in both subgroups is the one linked to learning through AI, since the grouped mean of the responses in the posttest are closer to 4 (agree) in the subgroup of female participants, followed by the block related to satisfaction, also with grouped means close to 4 in both subgroups.

The higher rated results for male participants shown in the table above are reinforced by similar findings from the non-parametric Mann-Whitney tests on applicability, as they indicate that male students consider AI resources to be significantly more effec-

tive in their studies, as well as in the development of e-projects (U = 2083.5; p < .001; U = 2375; p < .029). In addition, the participants' ratings were significantly higher regarding the satisfaction obtained by using these tools, particularly when designing new online projects or searching for more information on AI. Specifically, there is a significant difference in these two variables between the mean scores of male and female students (U = 2395.5; p < .023; U = 2403.5; p < .028), which shows that the use of AI resources promoted a change in attitude, especially among male students.

About the Objective 2: To analyze the degree of consistency between the previous perception of learning, satisfaction, applicability of resources and their limitations, globally and according to gender: In order to meet this objective, Spearman's rho correlation coefficient was calculated, which is used to analyze ordinal variables. During the process, the mean values of each item were obtained, and then a categorized grouping was established, by blocks, in order to be able to carry out a transformation into discrete variables that would allow us to analyze the degree of consistency between the variables of each construct of the questionnaire. At this point, it is necessary to highlight the contribution of several authors (Monroy & Maquilón, 2015), who estimate that this coefficient can range between -1 (negative perfect relationship) and 1 (positive perfect relationship), with a value close to 0 meaning an absence of relationship. Table 2.3 presents the index of relationships found between the variables Learning, Satisfaction, Applicability and Limitations, before the implementation of the AI program.

Table 2.3. Relationship between pre-program learning, satisfaction, applicability and limitations, at a global level

Correlations at a global level Spearman's Rho		Learning	Satisfaction	Applicability	Limitations
Learning	C. correlation	1.000	.703**	.531**	.226**
	Sig. (bilateral)	.	<.001	<.001	.002
	N	186	186	184	185

Satisfaction	C. correlation	.703**	1.000	.641**	.128
	Sig. (bilateral)	<.001	.	<.001	.082
	N	186	187	185	186
Applicability	C. correlation	.531**	.641**	1.000	.142
	Sig. (bilateral)	<.001	<.001	.	.055
	N	184	185	185	184
Limitations	C. correlation	.226**	.128	.142	1,000
	Sig. (bilateral)	.002	.082	.055	.
	N	185	186	184	186

**. The correlation is significant at 0.01 (bilateral).
Source: developed by autor.

As is shown in Table 2.3, there is a positive and significant relationship between the mean perception on Block I, which deals with perceived learning with AI, and Block II, related to students' satisfaction with their previous experience with this technology ($r = .70$; $p < .001$). Although less strongly, the learning variable also correlates with the block III variable, related to the applicability of AI, in this global analysis ($r = .53$; $p < .001$). There is also a statistically significant positive relationship between Block II (satisfaction) and Block III (applicability) ($r = .64$; $p < .001$). These findings are justified by the contribution of some authors, who indicate that a positive correlation higher than .50 (Cohen, 1988) and .70 (Mateo, 2009) is considered strong. Therefore, there is strong consistency between three of the four variables in which the previous perception of the research participants was analysed, with no relationship with Block IV, related to the limitations of AI. Table 2.4 shows the relationships found between the average degree of perception of these four variables according to gender, in order to contrast their degree of consistency before the implementation of the AI training program.

Table 2.4. Relationship between pre-program learning, satisfaction, applicability and limitations, according to sex

Correlations according to sex Spearman's Rho			Learning	Satisfaction	Applicability	Limitations
Male	Learning	C. correlation	1.000	.574**	.462**	.411**
		Sig. (bilateral)	.	<.001	.002	.007
		N	42	42	42	42
	Satisfaction	C. correlation	.574**	1.000	.564**	.127
		Sig. (bilateral)	<.001	.	<.001	.424
		N	42	42	42	42
	Applicability	C. correlation	.462**	.564**	1.000	-.022
		Sig. (bilateral)	.002	<.001	.	.890
		N	42	42	42	42
	Limitations	C. correlation	.411**	.127	-.022	1.000
		Sig. (bilateral)	.007	.424	.890	.
		N	42	42	42	42
Female	Learning	C. correlation	1.000	.727**	.545**	.179*
		Sig. (bilateral)	.	<.001	<.001	.032
		N	144	144	142	143
	Satisfaction	C. correlation	.727**	1.000	.647**	.139
		Sig. (bilateral)	<.001	.	<.001	.096
		N	144	145	143	144
	Applicability	C. correlation	.545**	.647**	1.000	.199*
		Sig. (bilateral)	<.001	<.001	.	.018
		N	142	143	143	142
	Limitations	C. correlation	.179*	.139	.199*	1.000
		Sig. (bilateral)	.032	.096	.018	.
		N	143	144	142	144

* The correlation is significant at 0.05 (bilateral).
** The correlation is significant at 0.01 (bilateral).
Source: developed by author.

The results corroborate the existence of differences in the degree of consistency between men and women. For the variable related to the limitations derived from the use of AI, no relationship was found. However, this was not the case for the other variables. In the male group, the learning variable correlated positively and significantly with the satisfaction variable (r=.57; p<.001). The latter, in turn, did the same with the applicability variable (r=.56; p<.001). With regard to the analysis of the average perception of women, there was a higher degree of consistency, with a positive and significant correlation between the variables learning and satisfaction (r=.73; p<.001), learning and applicability (r=.54; p<.001), and satisfaction and applicability (r=.65; p<.001). These results allow us to assert that, in the female group, the number of significant correlations is somewhat higher (three) than in the case of boys (two), and these relationships have a higher degree of consistency according to the aforementioned authors (Cohen, 1988; Mateo, 2009).

About the Objective 3: To analyze the degree of consistency between subsequent perceptions of learning, satisfaction, applicability of resources and the difficulties in the application of AI, globally and according to gender: To answer this objective, Spearman's rho correlation coefficient, derived from the grouped mean values of each construct, was recalculated. Table 2.5 shows the relationships found between blocks after the implementation of the AI training program.

Table 2.5. Relationship between post-program learning, satisfaction, applicability and limitations, at a global level

Correlations at a global level Spearman's Rho		Learning	Satisfaction	Applicability	Limitations
Learning	C. correlation	1.000	.778**	.697**	.178*
	Sig. (bilateral)	.	<.001	<.001	.018
	N	180	178	178	177
Satisfaction	C. correlation	.778**	1.000	.752**	.206**
	Sig. (bilateral)	<.001	.	<.001	.006
	N	178	183	181	180

Applicability	C. correlation	.697**	.752**	1.000	.261**
	Sig. (bilateral)	<.001	<.001	.	<.001
	N	178	181	185	182
Limitations	C. correlation	.178*	.206**	.261**	1.000
	Sig. (bilateral)	.018	.006	<.001	.
	N	177	180	182	184

* The correlation is significant at 0.05 (bilateral).
** The correlation is significant at 0.01 (bilateral).
Source: developed by autor

Finally, Table 2.6 shows the relationships found according to sex in the average degree of perception of each of the blocks, after the application of the AI training program.

Table 2.6. Relationship between post-programme learning, satisfaction, applicability and limitations, according to sex

Correlations according to sex Spearman's Rho			Learning	Satisfaction	Applicability	Limitations
Male	Learning	C. correlation	1.000	.819**	.800**	.225
		Sig. (bilateral)	.	<.001	<.001	.157
		N	41	41	40	41
	Satisfaction	C. correlation	.819**	1.000	.774**	.123
		Sig. (bilateral)	<.001	.	<.001	.438
		N	41	42	41	42
	Applicability	C. correlation	.800**	.774**	1.000	.253
		Sig. (bilateral)	<.001	<.001	.	.111
		N	40	41	41	41
	Limitations	C. correlation	.225	.123	.253	1.000
		Sig. (bilateral)	.157	.438	.111	.
		N	41	42	41	42

Female	Learning	C. correlation	1.000	.766**	.663**	.168*
		Sig. (bilateral)	.	<.001	<.001	.050
		N	139	137	138	136
	Satisfaction	C. correlation	.766**	1.000	.748**	.225**
		Sig. (bilateral)	<.001	.	<.001	.008
		N	137	141	140	138
	Applicability	C. correlation	.663**	.748**	1.000	.269**
		Sig. (bilateral)	<.001	<.001	.	.001
		N	138	140	144	141
	Limitations	C. correlation	.168*	.225**	.269**	1.000
		Sig. (bilateral)	.050	.008	.001	.
		N	136	138	141	142

* The correlation is significant at 0.05 (bilateral).
** The correlation is significant at 0.01 (bilateral).
Source: developed by author.

As is shown in Table 2.5, the overall results obtained show the existence of a statistically significant positive relationship between the learning variable and the variables satisfaction ($r = .78$; $p<.001$) and applicability ($r = .70$; $p < .001$). Similarly, the variable related to student satisfaction also presents a relationship of this level with the applicability variable ($r = .75$; $p < .001$), taking into account for all three cases the condition of exceeding .70 proposed by Mateo (2009) for a relationship to be considered statistically strong. In turn, according to the rho coefficient derived from Table 2.6, in the male sex there is a very positive and significant association between the block related to learning and the block that shows student satisfaction ($r = .82$, $p < .001$), as well as between learning and the AI applicability block ($r = .80$; $p < .001$). Similarly, there is also a statistically significant positive interdependence relationship between satisfaction with AI and its applicability ($r = .77$; $p < .001$), and all these relationships can be considered strong (Mateo, 2009). Despite remaining strong, these consistency relationships are slightly weaker in the female group, where the learning variable correlates positively with the satisfaction variable ($r = .77$; $p < .001$)

and with the applicability variable ($r = .66$; $p < .001$), while the satisfaction and applicability variables also have a high interdependence relationship with each other ($r = .75$; $p < .001$), in a statistically significant way in all these cases.

2.5. Discussion and Conclusions

AI is being implemented in new learning scenarios, adding value to complex issues in higher education and also introducing new challenges and demands for better, more advanced and motivating educational systems.

One of the main benefits that participants highlighted in this study was the driving force of AI for the development of e-projects. In this regard, some authors, such as Klašnja-Milićević & Ivanović (2021), highlight the relevance of AI-based resources for building personalised learning systems that adapt to learners' needs and preferences in digital tasks. In this sense, the creation of inclusive learning pathways through AI training on online platforms, virtual spaces, digital feedback and generative pedagogical content can pave the road to an effective shift towards a more innovative, learner-friendly and web-based education system.

Another advantage reported by the participants was the growth of interest in knowing more about these AI-powered resources. The great attention paid by participants to these online tools in terms of engagement has been examined in previous studies, such as that of Wang et al. (2023), who analyzed how students engage in smart learning and concluded that enhancing students' engagement experiences through AI, as well as implementing learner-oriented approaches, could be successful in terms of participation and interest.

In global terms, this chapter elucidates some parameters that point to the potential that AI seems to have as an influential factor in the self-perception of learning, in satisfaction, and in the applicability of the use of AI tools for teaching social sciences. Likewise, the results also highlight the impact of the teacher training program, demonstrating that, after its application, the parameters analyzed increased notably and the impact on the consistency between variables increased, particularly in the case of the male sex. However, it is striking that the only

variable where there is no relationship of dependence with the perception of learning, with reported satisfaction or with the applicability of AI tools, is in the block derived from the items that address the limitations generated with this technology. This coincides with the fact that this is the variable with the lowest grouped means of the whole instrument, thus it is not surprising that those students who do not feel insecure or intimidated with AI, do not consider the projects addressed in the program to have been difficult, and have not had difficulties remembering the important points, are exactly the same who report learning more, feeling more satisfied, valuing more the applicability of the activities and resources used and, in general, having better results in e-competence and perceived usefulness with AI systems, showing strong consistency between these parameters.

Based on the above, we believe that a clear answer has been given to the stated objectives and that, in the absence of a controlled evaluation, in terms of actual learning, to confirm these findings, the self-perception of performance generation, ease of use, motivation and satisfaction generated engagement or efficiency in the perception of success, point in the right direction. These results are in line with those reported in other studies (Ouyang et al., 2022; Rodway & Schepman, 2023), which, over several years, are examining the effects and implications for learners, concluding an improvement in engagement, attention and perception of learning, although the utmost caution is needed, as AI can have very marked effects on student comfort, satisfaction with the course or bias in terms of perceived interest in the academic course.

In summary, this current e-paradigm should be used as an innovative framework for many educational institutions wishing to explore the capabilities of AI in an attempt to improve higher education in terms of quality (Hooda et al., 2022). There are qualities that AI will never be able to develop to replace a teacher, as the warmth of the relationship with students, empathy towards them, personalized assessments adapted to each student, and the creativity of teachers to create material are and will always be irreplaceable. In this sense, universities must continue to take firm steps towards the formative consolidation of a series of human competences that cannot be developed by AI

systems, such as creativity, the emotional approach or the casuistry that implies adaptability to each person, with their personal circumstances. It would be unreasonable if we were to consider that our students do not use AI to study or carry out academic work, just as it would be illogical for any teacher to forbid these tools. Therefore, teachers must take a critical look at the advantages and disadvantages that underlie these resources and make use of the enormous possibilities that AI certainly seems to offer.

References

Ayuso-del Puerto, D., & Gutiérrez-Esteban, P. (2022). La inteligencia artificial como recurso educativo durante la formación inicial del profesorado. *RIED. Revista Iberoamericana de Educación a Distancia*, *25*(2), 347-358. https://doi.org/10.5944/ried.25.2.32332

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd edition). Lawrence Erlbaum Associates.

Hernández, R., Fernández-Collado, C., & Baptista, P. (2006). *Metodología de la investigación* (4rt ed.). McGraw-Hill.

Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial Intelligence for assessment and feedback to enhance student success in higher education. *Mathematical Problems in Engineering*, 1-19. https://doi.org/10.1155/2022/5215722

Hong, H.J. (2021). A plan to apply Artificial Intelligence ethics education into the elementary moral curriculum. *Korean Elementary Moral Education Society*, *75*, 183-206. https://n9.cl/39wa7

Klašnja-Milićević, A., & Ivanović, M. (2021). E-learning personalization systems and sustainable education. *Sustainability*, *13*(12), 6713. https://doi.org/10.3390/su13126713

Lee, A. (2021). The effect of Artificial Intelligence literacy education on university studens' ethical consciousness of Artificial Intelligence. *Robotics & AI Ethics*, *6*(3), 52-61. https://doi.org/10.22471/ai.2021.6.3.52

Mateo, J. (2009). La investigación ex post facto. In R. Bisquerra (Coord.). *Metodología de la investigación educativa* (pp. 195-230). La Muralla.

McMillan, J. H., & Schumacher, S. (2005). *Investigación educativa* (trad. J. Sánchez) (5ª ed.). Pearson Educación.

Mir, U., Kar, A. K., & Gupta, M. P. (2022). AI-enabled digital identity-inputs for stakeholders and policymakers. *Journal of Science and Technology Policy Management, 13*(3), 514-541. https://doi.org/10.1108/JSTPM-09-2020-0134

Monroy, F., & Maquilón, J. J. (2015). Correlación y regresión. In F. Hernández Pina, J. J. Maquilón, J. D. Cuesta, & T. Izquierdo (Eds.). *Investigación y análisis de datos para la realización de TFG, TFM y tesis doctoral* (pp. 131-156). Compobell.

Norman-Acevedo, E. (2023). La inteligencia artificial en la educación: una herramienta valiosa para los tutores virtuales universitarios y profesores universitarios. *Panorama, 17*(1). https://doi.org/10.15765/pnrm.v17i32.3681

Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial Intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies, 27*(6), 7893-7925. https://doi.org/10.1007/s10639-022-10925-9

Rodway, P., & Schepman, A. (2023). The impact of adopting AI educational technologies on projected course satisfaction in university students. *Computers and Education: Artificial Intelligence, 5*, 100150. https://doi.org/10.1016/j.caeai.2023.100150

Tapalova, O., & Zhiyenbayeva, N. (2022). Artificial Intelligence in education: AIEd for personalised learning pathways. *Electronic Journal of e-Learning, 20*(5), 639-653. https://doi.org/10.34190/ejel.20.5.2597

UNESCO (2023). *La inteligencia artificial en la educación*. https://www.unesco.org/es/digital-education/artificial-intelligence

UNESCO (2019). *International Conference on Artificial Intelligence and Education, Planning Education in the AI Era: Lead the Leap*. Beijing, China. https://unesdoc.unesco.org/ark:/48223/pf0000368303

Wang, R., Li, J., Shi, W., & Li, X. (2021). Application of Artificial Intelligence techniques in operating mode of professors' academic governance in American research universities. Hindawi. *Wirelesss Communications and Mobile Computing*, 1-7. https://doi.org/10.1155/2021/3415125

Wang, S., Wang, H., Jiang, Y., Li, P., & Yang, W. (2023). Understanding students' participation of intelligent teaching: an empirical study considering artificial intelligence usefulness, interactive reward, satisfaction, university support and enjoyment. *Interactive Learning Environments, 31*(9), 5633-5649. https://doi.org/10.1080/10494820.2021.2012813

Wild, S., & Schulze, L. (2021). Re-evaluation of the D21-digital-index assessment instrument for measuring higher-level digital competences. *Studies in Educational Evaluation, 68*(1), 100981. https://doi.org/10.1016/j.stueduc.2021.100981

Xiao, M., & Yi, H. B. (2020). Building an efficient artificial intelligence model for personalized training in colleges and universities. *Computer application in Engineering Education, 29*(2), 350-358. https://doi.org/10.1002/cae.22235