Journal of Education and Learning (EduLearn)
Vol. 18, No. 4, November 2024, pp. 1292~1300
ISSN: 2089-9823 DOI: 10.11591/edulearn.v18i4.21511

The impact of artificial intelligence on research and higher education in Morocco

Ghizlane Moukhliss[1], Khalid Lahyani[2], Ghizlane Diab[3]
[1]Department of Computer Science and Mathematics, Ecole Normale Superieure (ENS) Casablanca, Hassan II University of Casablanca, Casablanca, Morocco
[2]École Nationale Supérieure des Arts et Métiers Casablanca, Hassan II University of Casablanca, Casablanca, Morocco
[3]Faculty of Law, Economics and Social Sciences (FSJESM), Hassan II University of Casablanca, Casablanca, Morocco

Article Info

Article history:

Received Nov 27, 2023
Revised Feb 11, 2024
Accepted Feb 28, 2024

Keywords:

Artificial intelligence
Higher education
Impact
Morocco
Student performance

ABSTRACT

Artificial intelligence (AI) has revolutionized various fields, including research and higher education. Thanks to its innovative applications, it has changed traditional teaching methods. This article aims to explore the impact of AI on these domains in Moroccan universities, focusing on its transformative influence, benefits, challenges, and future prospects. By analyzing current literature, case studies, and expert opinions, we elucidate how AI has enhanced research methodologies, empowered educators and students, and fostered innovation in academia. In addition, we discuss ethical considerations and potential concerns associated with the increasing integration of AI. Finally, we highlight the future prospects and opportunities offered by AI for research and higher education in Morocco.

Corresponding Author:

Ghizlane Moukhliss
Department of Computer Science and Mathematics, Ecole Normale Superieure (ENS) Casablanca
Hassan II University of Casablanca
Route d'El Jadida Km 9, 50069, Casablanca, Morocco
Email: ghizlane.moukhliss@gmail.com

1. INTRODUCTION

The emergence of artificial intelligence has triggered a veritable revolution in all areas of society [1]. From medicine [2] to industry [3], from finance [4] to agriculture [5], and from education [6] to scientific research [7], AI has profoundly transformed the way we approach the problems and challenges of the modern world. Remarkable progress in machine learning and natural language comprehension has elevated artificial intelligence (AI) to a pivotal role in facilitating decision-making, automating tasks, and optimizing operational processes.

In the academic world, AI has become ubiquitous at all levels [8], from primary to higher education [9], in all disciplines including health sciences, language teaching, mathematics education, engineering, translation teaching, mobile learning and nursing pain education. Using Morocco as a case study, traditional education and research systems have shortcomings that limit the full realisation of the country's academic and scientific potential. Thus, the integration of AI in education and research could catalyse significant advances in terms of efficiency, personalisation of learning and development of new research perspectives [10]. In this context, this article aims to discuss the impacts of using AI in higher education and scientific research. We examine how AI is being used to improve pedagogical methods, adapt to students' needs, and create new learning opportunities. We also discuss the challenges as well as the prospects and opportunities offered by AI for research and higher education. After this introduction, the rest of the paper is structured as follows:

section 2 presents the literature review. Section 3 describes the research methodology. The results and discussion are presented in section 4. Finally, section 5 concludes the manuscript.

2. LITERATURE REVIEW

Over the past 5 years, the use of AI in higher education has grown rapidly [11]. Against this backdrop, several and various research studies [12] have been carried out to investigate the benefits and shortcomings of AI for higher education and research. Some researchers have carried out systematic reviews in specific specialties. In relation to the health sciences, Schwartz *et al*. [13] investigated the use of AI in medical education by examining machine learning best practices for assessing surgical expertise in virtual reality simulation. Mustapha [14] have studied the impact of AI on the teaching process in translation engineering. Shukla *et al*. [15] have carried out a bibliometric analysis of 30 years' use of AI in engineering. Hwang *et al*. [16] have conducted a study on the hot topics of AI research in mobile learning. Liang *et al*. [17] have carried out a bibliographical analysis and systematic review of the roles and research areas of AI in language teaching. Hwang *et al*. [18] have specifically analyzed the roles and trends of AI research in mathematics education. Harmon *et al*. [19] conducted an in-depth study on the use of AI and virtual reality in nursing education.

In addition, the results of the recent study [20] on the use of AI in higher education from 2016 to 2022 showed "that in 2021 and 2022, the number of publications in the field of AI in education increased by almost two to three times compared with previous years". While the study [21] revealed an evolution of AI in higher education based on an analysis of scientific production indexed in the Scopus and Web of Science bibliographic databases, and which deals with the use of AI in higher education. On the other hand, Richter *et al*. [22] have focused on applications of AI in higher education to reveal four main uses: i) profiling and predicting academic success [23]; ii) assessment [24], [25]; iii) adaptive systems and personalization; and iv) intelligent tutoring systems [26].

3. RESEARCH METHOD

To investigate the impact of AI on research and higher education in Morocco, we employed a mixed-methods approach, comprising both surveys and data analysis to holistically capture the impact of AI on higher education and research in Morocco. This methodology was designed to gather insights from educators and students across various universities in Morocco. This section presents the survey design, data collection and data analysis method.

3.1. Survey design

3.1.1. Teacher survey

We administered a structured questionnaire to university teachers across different universities in Morocco. The survey instrument was designed to elicit responses regarding their experiences, perceptions, and observations regarding the integration of AI in teaching, research, and administrative processes within the higher education sector. The survey also probed for insights into challenges and opportunities stemming from AI adoption.

3.1.2. Student survey

A separate survey was conducted among students from different universities of Morocco. This survey focused on students' perspectives on how AI technologies have influenced their learning experiences, including any perceived benefits or challenges. Additionally, we sought feedback on their interactions with AI-driven educational tools and platforms.

3.2. Data collection

The surveys were distributed electronically to the selected participants. The various universities in Morocco were targeted. Respondents were given ample time to complete the questionnaires.

3.3. Data analysis

Collected data were analyzed using statistical software to derive quantitative insights from the surveys. Descriptive statistics, including frequency distributions and averages, were calculated to summarize the responses. Additionally, qualitative responses were subjected to thematic analysis to identify common themes and patterns in university teachers' and students' open-ended comments.

4. FINDINGS AND DISCUSSION

4.1. Teacher survey

In this study, 52% of respondent teachers are female, while 47.7% are male. Figure 1 illustrates the number of participant. More than 38% of teachers are a little familiar with AI tools. Indeed 29% are moderately familiar with AI and 10% are not at all familiar with AI tools. Figure 2 provides a visual representation of these results.

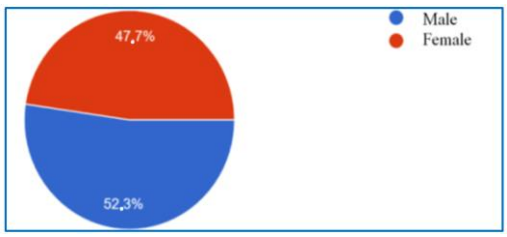

Figure 1. Number of participant teachers

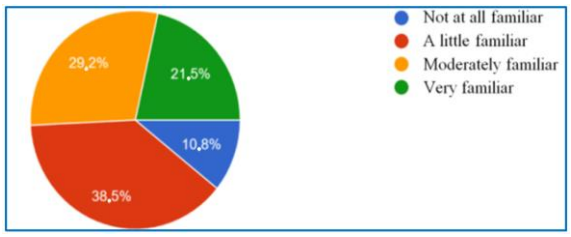

Figure 2. How familiar are teachers with AI tools

As shown in Figure 3, AI is used in a few courses in 53% of institutions. However, AI is not used at all in 35% of educational institutions. More than 67% of teachers have used AI-based tools in their teaching or research. However, as depicted in Figure 4, 33% of the respondents have never used AI-based tools in their teaching or research. Teachers already used an AI tools in teaching and research. Figure 5 lists examples of these uses. Like, to provide translations and check language, detect plagiarism or fraud and create or adapt teaching materials (e.g., lesson plans, course notes, exam questions, scenarios, and video clips).

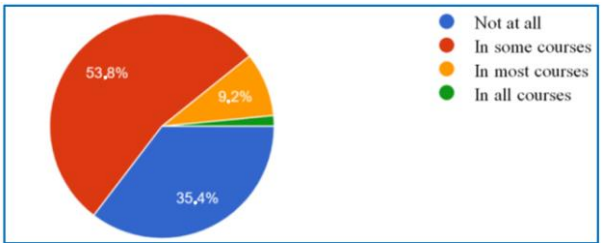

Figure 3. Use of AI in educational institutions

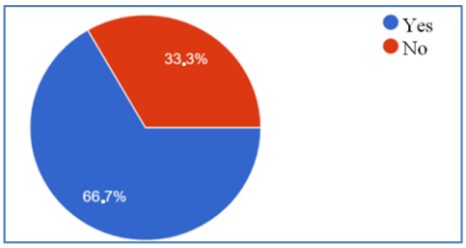

Figure 4. Use of AI-based tools in teaching

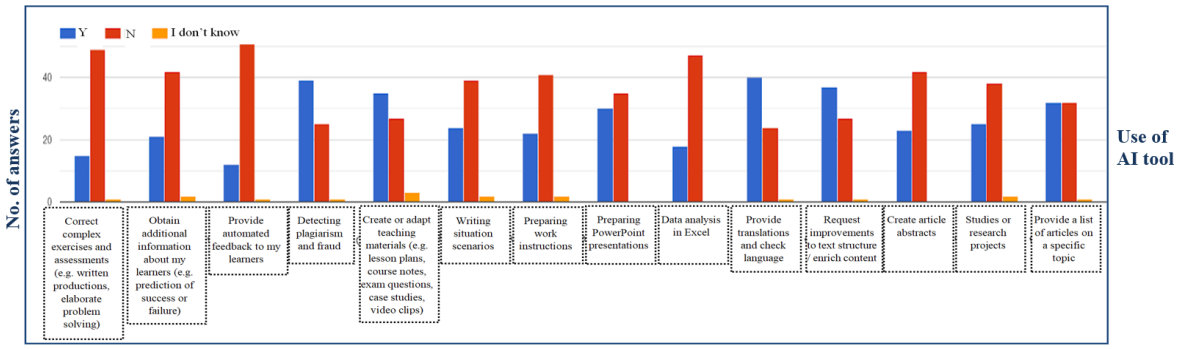

Figure 5. Use of an AI tool

70% of teachers are able to use a computer or mobile device (cell phone, tablet) independently. They can also learn to use new AI tools relatively easily. Figure 6 shows a graphical representation of AI literacy in learning. If offered, teachers will use an AI tool mainly to create or adapt teaching materials (e.g. lesson plans, course notes, exam questions, case studies, video clips), then to detect plagiarism or cheating and to detect AI-generated texts with generative tools. Figure 7 shows the interest in using AI in education.

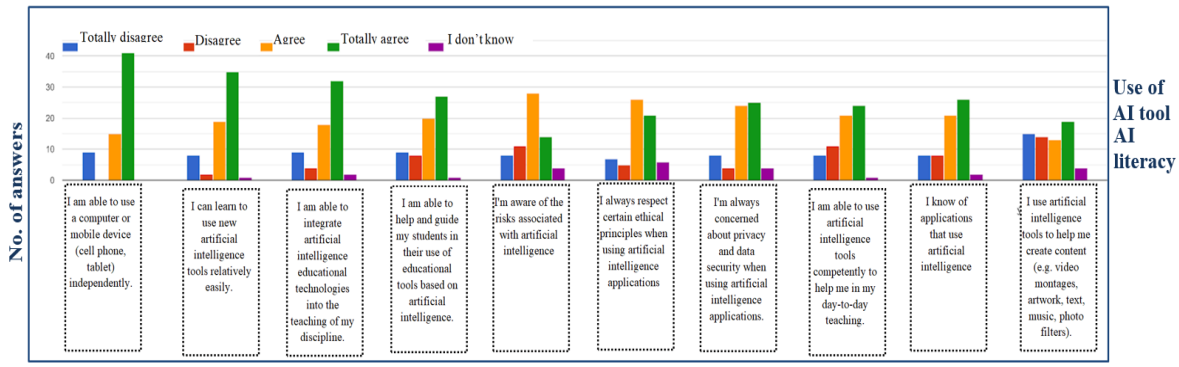

Figure 6. AI literacy in education

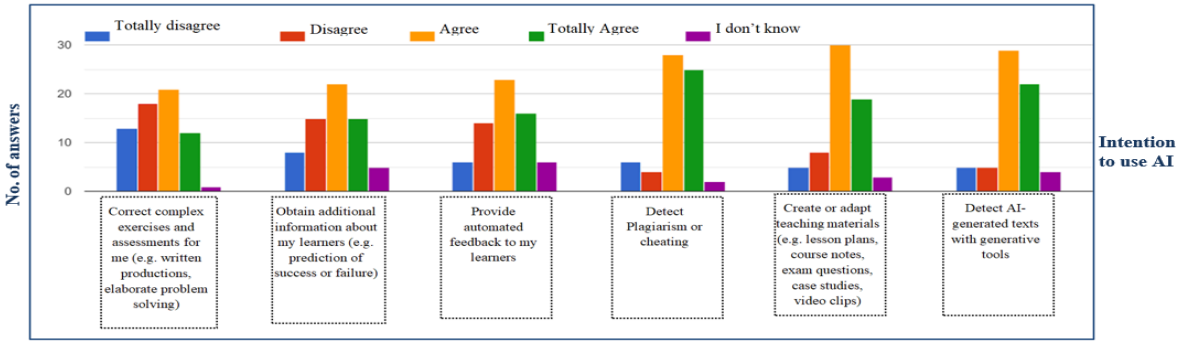

Figure 7. Intention to use AI in teaching

With regard to the anxiety linked to AI in higher education, 53% of teachers are apprehensive about using an AI tool for teaching. They will be also afraid of not using an AI tool correctly (42%), as shown in Figure 8. In this context, the results of the study [27] show that teachers express a degree of anxiety about the impact of AI on social life.

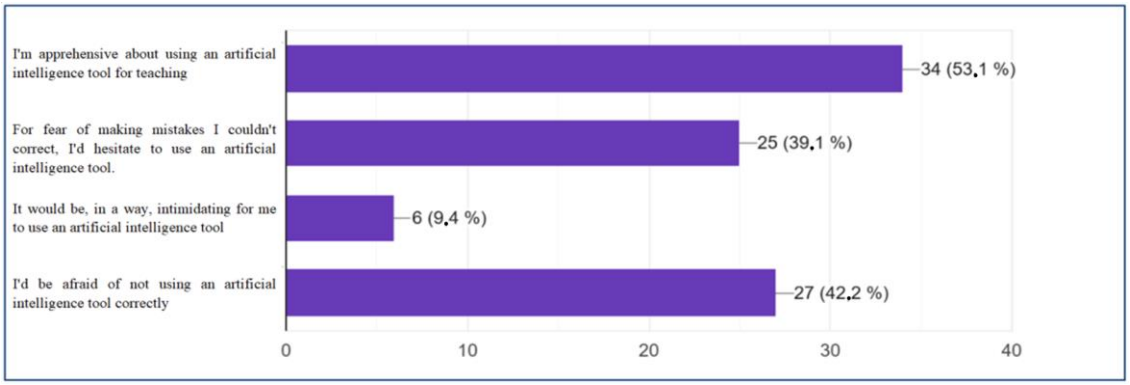

Figure 8. Anxiety about AI in education

Figure 9 shows that teachers ready to make efforts to use AI in teaching. More than 64% believe it would be easy to learn how to use an AI tool. In addition, 55% affirm they would clearly understand their role as a teacher in the use of an AI tool. On the one hand, as seen in Figure 10, more than 92% of teachers affirmed that the behavioral intention of actors in Moroccan higher education institutions can influence the adoption of AI. On the other hand, as shown in Figure 11, over than 95% of respondents confirmed that generative AI tools can never replace the physical presence and personality of a teacher in the classroom.

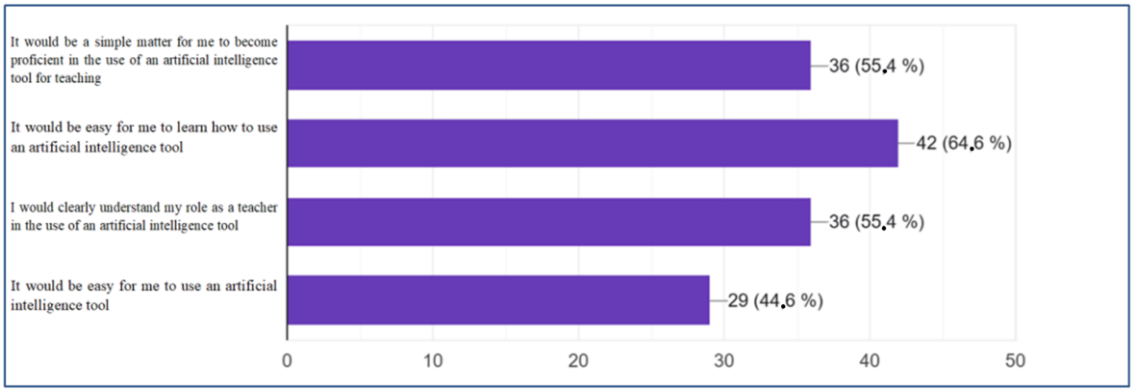

Figure 9. Perceived effort to use AI in teaching

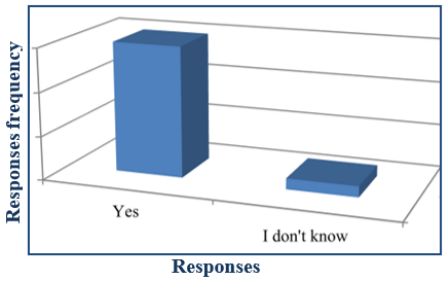

Figure 10. Can the behavioral intent of actors in Moroccan higher education institutions influence AI adoption?

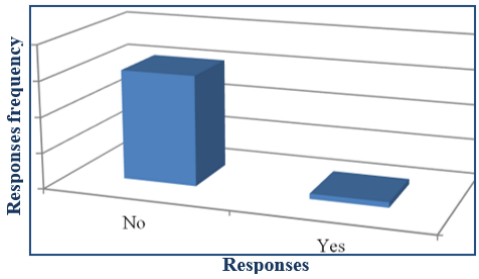

Figure 11. Can generative AI tools replace the presence and personality of a teacher in the classroom?

Figure 12 shows that 97% of teachers need additional training to make better use of AI in their field. In addition, the majority of teachers (91%) believe that AI has influenced or improved the quality of their research activities to varying degrees (Figure 13).

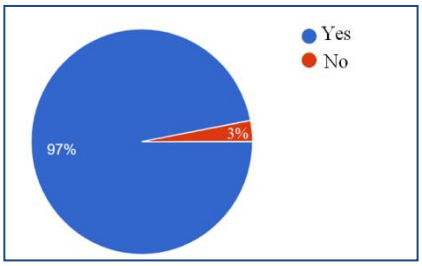

Figure 12. Need for training

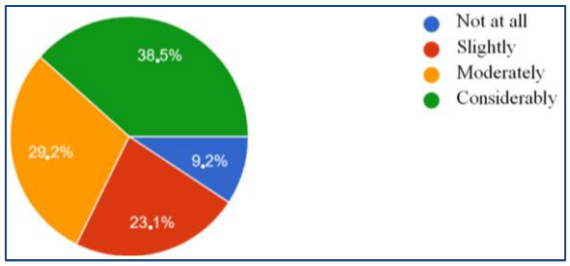

Figure 13. To what extent do you think AI has influenced or improved the quality of your research activities?

To sum up, the participants summarized the challenges facing the adoption of AI in higher education and research in Morocco in the lack of training, the lack of mastery of tools as well as ethical challenges. There are other challenges, gaps and even limits to AI mentioned Hagendorff and Wezel [28]. Faced with these challenges, teachers put forward some recommendations on how to overcome them, namely, programming targeted training for teachers, students and administrative staff, developing a public policy to support the use of AI in higher education. This has also been proposed and recommended in a number of studies [29].

4.2. Student survey

As shown in Figure 14, in this study, 54.1% of respondents are female, while 45.9% are male. Figure 15 illustrates that the majority of participants in the study are Ph.D. students (44%) and bachelor students (40%). More than 40% are moderately familiar with AI tools. Indeed, more than 32% of students are a little familiar with AI tools as presented in Figure 16. However, Figure 17 illustrates thar ChatGPT is the most popular tool for students (85%), then Midjourney (6.22%), next Bard (4.53%), then OpenAI (2.50%). Related to AI tools use, 151 students have used it to "Obtain additional information", 124 to "Provide translations and check language", 103 to "Request improvements to text structure" as presented in Figure 18.

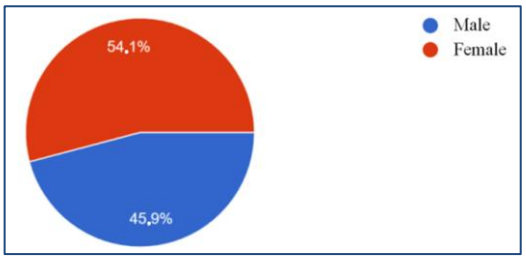

Figure 14. Number of participants to the study

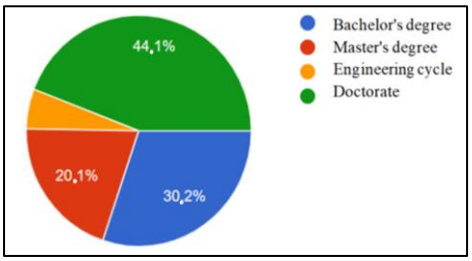

Figure 15. Education level

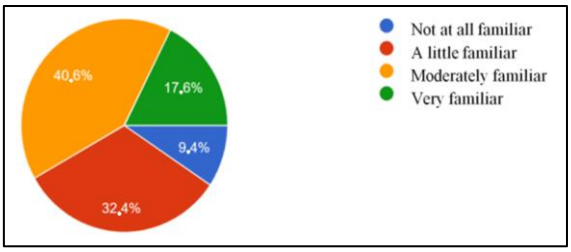

Figure 16. How familiar are students with AI tools

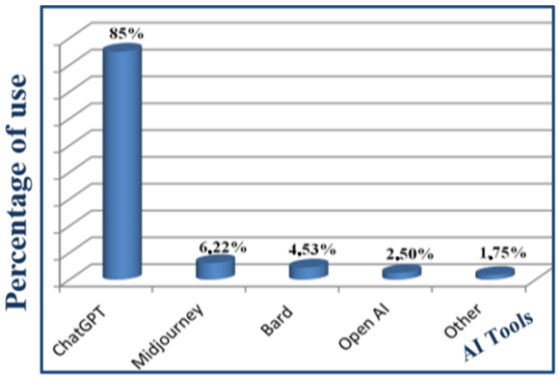

Figure 17. AI tools that students are familiar with

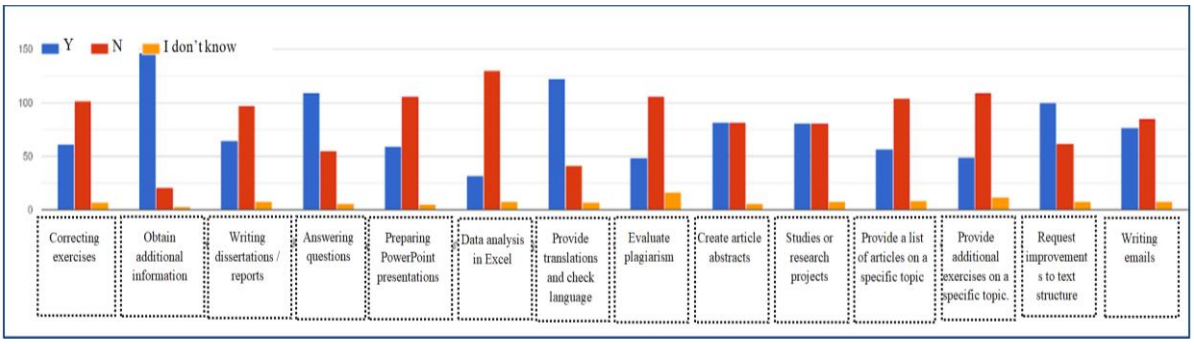

Figure 18. Different uses of AI tools

The participants claim that the primary benefit of AI in education is improving the quality of learning (75%) as shown graphically in Figure 19. Followed by learning assistant available 24/7, then increasing learning efficiency. In the context of perceived performance of AI in education, as shown in Figure 20, students confirmed that first it would be useful to use an AI tool in their studies and/or research. Second, they would complete their tasks faster if they used an AI tool. And finally, their productivity would increase if they used an AI tool. Other benefits were cited by higher education students in Asia and Africa in a recent study [30].

Figure 19. The benefits of AI in education

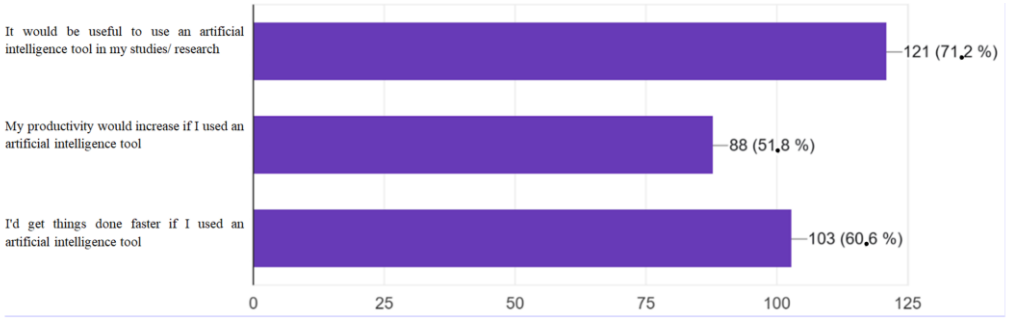

Figure 20. Perceived performance of AI in education

Figure 21 illustrates that only 17.3% have seen improvements in their research and study activities due to AI tools. They listed, improved performance, time savings, speed (data collection) and efficiency, translation assistance, language learning, helps get rid of repetitive tasks, article summaries, finding solutions to exercises, knowledge development. While 82% did not notice any improvement.

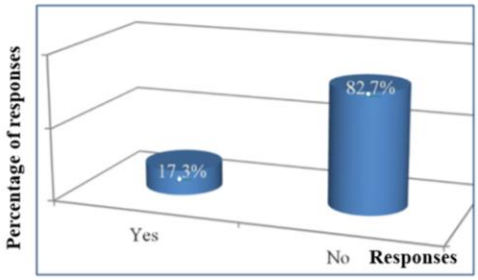

Figure 21. Improvements in research and study

In relation to the main challenges or obstacles to the adoption of AI in higher education, students listed: Lack of training, Fear of plagiarism/fraud, Sharing incorrect information, students will no longer make an effort, favors student laziness, ethical issues, killing student innovation and creativity, irresponsible students and unfamiliar teachers, high cost of AI tools, reducing human intelligence. The respondents mentioned recommendations for improving the integration of AI into research and higher education, namely: program training courses for students and professors, define the ethical framework [31] and rules for the use of AI tools, hosting conferences on AI and higher education for students and teachers, encourage students to use the tools and integrate AI into teaching programs.

5. CONCLUSION

The study reveals a nearly equal distribution of gender among the students' respondents, with 54.1% being female and 45.9% male, indicating a balanced participation of both genders in the survey. In summary, their survey results indicate a widespread awareness and acceptance of AI tools among Moroccan students, with a strong belief in their capacity to improve learning outcomes and streamline academic tasks. These

findings emphasize the significance of further exploring AI integration in educational contexts to harness its full potential for enhancing the educational experience.

For university teachers, the study reveals a nuanced landscape of AI adoption in Moroccan higher education. While there is a notable interest in AI applications, it is accompanied by varying levels of familiarity and recognition of the indispensable role of human educators. The results highlight the need for targeted training and a collective commitment to effectively harness the potential of AI within the educational context. Our research results lay a solid foundation for future research endeavors aimed at optimizing AI integration in Moroccan higher education. These perspectives emphasize the need for a holistic approach that combines technical innovations with pedagogical considerations and ethical safeguards to harness the full potential of AI in the educational landscape.

REFERENCES

[1] R. Gruetzemacher and J. Whittlestone, "The transformative potential of artificial intelligence," *Futures*, vol. 135, p. 102884, Jan. 2022, doi: 10.1016/j.futures.2021.102884.

[2] A. L. Beam, J. M. Drazen, I. S. Kohane, T.-Y. Leong, A. K. Manrai, and E. J. Rubin, "Artificial intelligence in medicine," *New England Journal of Medicine*, vol. 338, no. 13, pp. 1220–1221, 2023, doi: 10.1056/NEJMe2206291.

[3] Z. Jan *et al.*, "Artificial intelligence for industry 4.0: systematic review of applications, challenges, and opportunities," *Expert Systems with Applications*, vol. 216, p. 119456, Apr. 2023, doi: 10.1016/j.eswa.2022.119456.

[4] H. Pallathadka, E. H. Ramirez-Asis, T. P. Loli-Poma, K. Kaliyaperumal, R. J. M. Ventayen, and M. Naved, "Applications of artificial intelligence in business management, e-commerce and finance," *Materials Today: Proceedings*, vol. 80, pp. 2610–2613, 2023, doi: 10.1016/j.matpr.2021.06.419.

[5] M. Wakchaure, B. K. Patle, and A. K. Mahindrakar, "Application of AI techniques and robotics in agriculture: A review," *Artificial Intelligence in the Life Sciences*, vol. 3, p. 100057, Dec. 2023, doi: 10.1016/j.ailsci.2023.100057.

[6] N. D. Nguyen, "Exploring the role of AI in education," *London Journal of Social Sciences*, no. 6, pp. 84–95, Sep. 2023, doi: 10.31039/ljss.2023.6.108.

[7] M. Hammad, "The impact of artificial intelligence (AI) programs on writing scientific research," *Annals of Biomedical Engineering*, vol. 51, no. 3, pp. 459–460, Mar. 2023, doi: 10.1007/s10439-023-03140-1.

[8] M. Sullivan, A. Kelly, and P. McLaughlan, "ChatGPT in higher education: considerations for academic integrity and student learning," *Journal of Applied Learning and Teaching*, vol. 6, no. 1, pp. 31–40, Mar. 2023, doi: 10.37074/jalt.2023.6.1.17.

[9] H. Majjate, Y. Bellarhmouch, A. Jeghal, A. Yahyaouy, H. Tairi, and K. A. Zidani, "AI-powered academic guidance and counseling system based on student profile and interests," *Applied System Innovation*, vol. 7, no. 1, p. 6, Dec. 2024, doi: 10.3390/asi7010006.

[10] M. Ghizlane, B. Hicham, and F. H. Reda, "A new model of automatic and continuous online exam monitoring," in *Proceedings - 2019 4th International Conference on Systems of Collaboration, Big Data, Internet of Things and Security, SysCoBIoTS 2019*, Dec. 2019, pp. 1–5, doi: 10.1109/SysCoBIoTS48768.2019.9028027.

[11] H. C. Chu, G. H. Hwang, Y. F. Tu, and K. H. Yang, "Roles and research trends of artificial intelligence in higher education: A systematic review of the top 50 most-cited articles," *Australasian Journal of* Educational Technology, vol. 38, no. 3, pp. 22–42, 2022, doi: 10.14742/ajet.7526.

[12] B. Lainjo and H. Tsmouche, "Impact of artificial intelligence on higher learning institutions," *International Journal of Education, Teaching, and Social Sciences*, vol. 3, no. 2, pp. 96–113, Apr. 2023, doi: 10.47747/ijets.v3i2.1028.

[13] A. Winkler-Schwartz *et al.*, "Artificial intelligence in medical education: best practices using machine learning to assess surgical expertise in virtual reality simulation," *Journal of Surgical Education*, vol. 76, no. 6, pp. 1681–1690, Nov. 2019, doi: 10.1016/j.jsurg.2019.05.015.

[14] D. B. Mustapha, "Impacts de l'intelligence artificielle sur l'enseignement 'en' traduction impacts of artificial intelligence on teaching," *Cahiers de Traduction*, vol. 28, no. 1, pp. 233–245, 2023.

[15] A. K. Shukla, M. Janmaijaya, A. Abraham, and P. K. Muhuri, "Engineering applications of artificial intelligence: a bibliometric analysis of 30 years (1988–2018)," *Engineering Applications of Artificial Intelligence*, vol. 85, pp. 517–532, Oct. 2019, doi: 10.1016/j.engappai.2019.06.010.

[16] G. J. Hwang, Y. F. Tu, and C. J. Lin, "Advancements and hot research topics of artificial intelligence in mobile learning: A review of journal publications from 1995 to 2019," *International Journal of Mobile Learning and Organisation*, vol. 15, no. 4, pp. 427–447, 2021, doi: 10.1504/IJMLO.2021.118444.

[17] J. C. Liang, G. J. Hwang, M. R. A. Chen, and D. Darmawansah, "Roles and research foci of artificial intelligence in language education: an integrated bibliographic analysis and systematic review approach," *Interactive Learning Environments*, vol. 31, no. 7, pp. 4270–4296, Oct. 2023, doi: 10.1080/10494820.2021.1958348.

[18] G. J. Hwang and Y. F. Tu, "Roles and research trends of artificial intelligence in mathematics education: A bibliometric mapping analysis and systematic review," *Mathematics*, vol. 9, no. 6, p. 584, Mar. 2021, doi: 10.3390/math9060584.

[19] J. Harmon, V. Pitt, P. Summons, and K. J. Inder, "Use of artificial intelligence and virtual reality within clinical simulation for nursing pain education: A scoping review," *Nurse Education Today*, vol. 97, Feb. 2021, doi: 10.1016/j.nedt.2020.104700.

[20] H. Crompton and D. Burke, "Artificial intelligence in higher education: the state of the field," *International Journal of Educational Technology in Higher Education*, vol. 20, no. 1, p. 22, Apr. 2023, doi: 10.1186/s41239-023-00392-8.

[21] F. J. Hinojo-Lucena, I. Aznar-Díaz, M. P. Cáceres-Reche, and J. M. Romero-Rodríguez, "Artificial intelligence in higher education: A bibliometric study on its impact in the scientific literature," *Education Sciences*, vol. 9, no. 1, p. 51, Mar. 2019, doi: 10.3390/educsci9010051.

[22] O. Zawacki-Richter, V. I. Marín, M. Bond, and F. Gouverneur, "Systematic review of research on artificial intelligence applications in higher education – where are the educators?," *International Journal of Educational Technology in Higher Education*, vol. 16, no. 1, p. 39, Dec. 2019, doi: 10.1186/s41239-019-0171-0.

[23] L. Chen, P. Chen, and Z. Lin, "Artificial intelligence in education: a review," *IEEE Access*, vol. 8, pp. 75264–75278, 2020, doi: 10.1109/ACCESS.2020.2988510.

[24] M. Liu, Y. Wang, W. Xu, and L. Liu, "Automated scoring of Chinese engineering students' English essays," *International Journal of Distance Education Technologies*, vol. 15, no. 1, pp. 52–68, Jan. 2017, doi: 10.4018/IJDET.2017010104.

[25] Y. Ma and K. L. Siau, "Artificial intelligence impacts on higher education," *MWAIS 2018 Proceedings*, vol. 42, pp. 1–5, 2018,
[26] V. González-Calatayud, P. Prendes-Espinosa, and R. Roig-Vila, "Artificial intelligence for student assessment: a systematic review," *Applied Sciences (Switzerland)*, vol. 11, no. 12, p. 5467, Jun. 2021, doi: 10.3390/app11125467.
[27] S. Hopcan, G. Türkmen, and E. Polat, "Exploring the artificial intelligence anxiety and machine learning attitudes of teacher candidates," *Education and Information Technologies*, Aug. 2023, doi: 10.1007/s10639-023-12086-9.
[28] T. Hagendorff and K. Wezel, "15 challenges for AI: or what AI (currently) can't do," *AI and Society*, vol. 35, no. 2, pp. 355–365, 2020, doi: 10.1007/s00146-019-00886-y.
[29] B. K. Nagaraj, A. Kalaivani, R. S. Begum, S. Akila, H. K. Sachdev, and N. S. Kumar, "The emerging role of artificial intelligence in STEM higher education: a critical review," *International Research Journal of Multidisciplinary Technovation*, vol. 5, no. 5, pp. 1–19, Aug. 2023, doi: 10.54392/irjmt2351.
[30] M. Ahmad *et al.*, "Awareness, benefits, threats, attitudes, and satisfaction with AI tools among Asian and African higher education staff and students," *Journal of Applied Learning and Teaching*, vol. 7, no. 1, Jan. 2024, doi: 10.37074/jalt.2024.7.1.10.
[31] A. A. Tubella, M. Mora-Cantallops, and J. C. Nieves, "How to teach responsible AI in higher education: challenges and opportunities," *Ethics and Information Technology*, vol. 26, no. 1, p. 3, Mar. 2024, doi: 10.1007/s10676-023-09733-7.

BIOGRAPHIES OF AUTHORS

Ghizlane Moukhliss received her Ph.D. degree in computer science from Hassan II University, Casablanca, Morocco in 2021. Currently, she is a Professor at the Department of Computer Science and Mathematics, Ecole Normale Superieure (ENS) Casablanca, Hassan II University of Casablanca, Morocco. Her research interests include e-learning, electronique ressources, information system security, software engineering, machine learning, and performance of higher education. She can be contacted at email: ghizlane.moukhliss@gmail.com.

Khalid Lahyani received his Ph.D. degree in sociology from Hassan II University, Casablanca, Morocco. He is a professor at École Nationale Supérieure des Arts et Métiers Casablanca, and director of Mohamed Sekkat University Library, Hassan II University of Casablanca. His research interests include sociology, higher education, e-learning, employability and entrepreneurship. He can be contacted at email: khalid.lahyani@gmail.com.

Ghizlane Diab received the Ph.D. degree in management sciences from Hassan II University of Casablanca. Her academically researches focus on human resource management, human resource information system, innovation, strategic management. Her research subject is about the impact of digital transformation on the performance of the human resource function. She can be contacted at email: ghizlane.diab@univh2c.ma.