Artificial intelligence: threat or asset to academic integrity? A bibliometric analysis

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Received 4 September 2023
Revised 29 October 2023
5 December 2023
27 December 2023
Accepted 27 December 2023

Abstract

Purpose – This study aims to address a systematic literature review (SLR) using bibliometrics on the relationship between academic integrity and artificial intelligence (AI), to bridge the scattering of literature on this topic, given the challenge and opportunity for the educational and academic community.

Design/methodology/approach – This review highlights the enormous social influence of COVID-19 by mapping the extensive yet distinct and fragmented literature in AI and academic integrity fields. Based on 163 publications from the Web of Science, this paper offers a framework summarising the balance between AI and academic integrity.

Findings – With the rapid advancement of technology, AI tools have exponentially developed that threaten to destroy students' academic integrity in higher education. Despite this significant interest, there is a dearth of academic literature on how AI can help in academic integrity. Therefore, this paper distinguishes two significant thematical patterns: academic integrity and negative predictors of academic integrity.

Practical implications – This study also presents several contributions by showing that tools associated with AI can act as detectors of students who plagiarise. That is, they can be useful in identifying students with fraudulent behaviour. Therefore, it will require a combined effort of public, private academic and educational institutions and the society with affordable policies.

The authors are grateful to the journal's anonymous referees for their extremely useful suggestions to improve the quality of the paper. The authors gratefully acknowledge financial support from National Funds of the FCT – Portuguese Foundation for Science and Technology within the project UIDB/04007/2020, UIDB/05105/2020, UIDB/04630/2020, UI/BD/151029/2021, UIDB/04011/2020 (https://doi.org/10.54499/UIDB/04011/2020), UIDB/04630/2022 and by CEECINST/00127/2018/CP1501/CT0010.

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Conflict of interest statement: The authors declare that there exists no competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

Data availability: All data generated or analysed during this study are included in this article.

Ethical declaration: Not Applicate.

Kybernetes

0368-492X
DOI 10.1108/K-09-2023-1666

Originality/value – This study proposes a new, innovative framework summarising the balance between AI and academic integrity.

Keywords Artificial intelligence, Academic integrity, Plagiarism, Dishonesty, Students

Paper type Literature review

1. Introduction

Technology plays an increasingly important role in education and is considered one of the ways to innovate in this field. However, for the transformation of education to occur, it must provide stimuli for students to be endowed with a critical vision sustained by dialogue and ethics. This role has been exponentiated by the pandemic, which forced most educational institutions to shift their educational practices to digital platforms almost overnight to ensure continuous student learning, where the variable factors related to educational technologies, ease of use, accessibility and funding meant that the process was more challenging for some than others. However, even the most agile and well-prepared educational institutions faced a hurdle during distance learning regarding integrity in assessing students online (Khan *et al.*, 2022).

Artificial intelligence (AI) presents many possibilities and challenges. Used ethically and responsibly, it can help solve many problems and improve people's lives. However, it is essential to ensure its use is governed by ethical and responsible principles, avoiding risks and negative impacts on society. AI is gaining ground in society, especially in the field of education. With the development of technology, it is possible to use computer systems to simulate human intelligence, thus creating new forms of teaching and learning (Martins and Viana, 2022). The use of AI in education also involves ethical and security issues. It is necessary to guarantee student information protection and technology use by ethical principles and human values. AI can be a powerful tool for improving education quality if used responsibly and ethically. However, using AI in academic writing presents opportunities and limitations (Kasneci *et al.*, 2023).

AI is currently developing more rapidly, which has already had a major impact on the services provided by higher education (Popenici and Kerr, 2017). The use of AI-based technologies can support education in several dimensions. For example, these technologies can play a key role in creating and implementing adaptive learning environments designed to suit each student's unique learning needs and preferences and provide the necessary tools for data analysis and personalisation (Marengo *et al.*, 2023). An adaptive learning environment is considered a critical requirement for improving the quality of learning and user performance during the learning process (Marengo *et al.*, 2023). When discussing academic integrity in higher education, it is important not to neglect the power of AI tools, which to Ramírez-Noriega *et al.* (2018) has positive and negative aspects when used by students. Since AI is one of the key constructs of the study presented here, it is important to provide some definitions of it. Thus, Tambe *et al.* (2019) considered that AI is a broad class of technologies that allow a computer to perform tasks without requiring human cognition, even in decision-making; Stanley and Aggarwal (2019) argued that AI is the development of systems computer systems for performing tasks that require intelligence and aims to make machines smarter; Paesano (2021) argued that AI is systems with intelligent behaviour for the execution of actions with autonomy to achieve specific goals. Gamage *et al.* (2022), meanwhile, argued that AI tools are intellectual mechanisms for managing personalised learning when it comes to their use in educational settings and is an auxiliary means of accomplishing students' tasks (Ramírez-Noriega *et al.*, 2018). This is one of the positive aspects. On the other hand, these instruments are facilitators of plagiarism (Ramírez-Noriega *et al.*, 2018), misconduct (Abd-Elaal *et al.*, 2022), cheating (Alessio and Messinger, 2021), that jeopardise academic integrity (Amrane-Cooper *et al.*, 2021).

Despite the numerous literature on academic integrity and the use of AI instruments, some gaps persist in the literature on this topic. For example, Gamage *et al.* (2022) advocated writing more research on ethical issues and AI tools; Ahsan *et al.* (2022) understood that more

research is needed on AI and cheating detection; Abd-Elaal *et al.* (2022) argued that more studies on AI increase academic confidence; for Blau and Eshet-Alkalai (2017), more research is needed in HEIs on what drives young people to engage in ethical misconduct. Additionally, the literature on this topic is scattered and systematic literature reviews (SLRs) are too narrowly focused on a specific subtopic or context, where: (1) Gamage *et al.* (2022) presented a on the same subtopic but from the perspective of HEIs; forms of cheating and its detection by AI; (3) Zhao *et al.* (2022) have embarked on the perception of the effects of peer cheating; (4) Surahman and Wang (2022) investigated the different forms of academic dishonesty in students in online learning; (5) Devine and Chin (2018), Eaton and Edino (2018), Holden *et al.* (2021), Maryon *et al.* (2022), Mulisa and Ebessa (2021), Stoesz and Eaton (2022) have produced SLRs on academic integrity at different levels of higher education and areas; (7) Awasthi (2019) displayed the state of the art on the contributory factors to plagiarism and De Maio *et al.* (2019) on the same subtopic but from the perspective of HEIs; (8) Cutri *et al.* (2021) reviewed academic integrity only in doctoral students in Australia; (9) McCabe *et al.* (2006) presented a survey on business graduates.

It becomes all too perceptible that students call academic integrity into question with the use of AI tools, which justifies the motivation for conducting the study presented here. Since AI has the potential to expand thoughts, which poses similar risks to misconduct practices that navigate outside academic integrity, students assume that AI-assisted writing is of their own making. This study aims to develop an SLR, using bibliometrics, on the relationship between academic integrity and AI, to bridge the scattered literature on this topic, given the challenge and opportunity for the educational and academic community. Furthermore, this mapping is essential to understanding the limits/borders of the intersection between AI and academic integrity in higher education, as suggested by Peters *et al.* (2022), given the incredible development of AI tools. The results returned that the use of models and strategies to prevent harmful practices and a good relationship between the student and their peers, are positive predictors of academic integrity. In contrast, cultural values, achievement of success and peer pressure are negative predictors of this one since they direct students to use AI tools to accomplish their tasks.

Following this Introduction, the Literature Review; followed by Research Methodology, the Results and their Discussion; and finally, the Conclusions and future agenda are presented.

2. Literature review

It is perceived that AI is a challenge for higher education institutions (HEIs) as a whole and faculty members, so the continuous improvement of integrity policies and their dissemination across academia is critical (Möller, 2022), especially when COVID-19 expanded the opportunities for the violation of academic integrity with the use of virtual and remote rooms (Maryon *et al.*, 2022). Therefore, Cowls *et al.* (2021) and Tomašev *et al.* (2020) considered AI a promising tool to contribute to relevant problems in education and society.

In these circumstances, academic integrity is an essential principle based on honesty, accountability, transparency and trust, and academic dishonesty violates these principles. Academic dishonesty can manifest itself in many ways, including plagiarism, inappropriate collaboration, cheating on exams, copyright violations, complicity in academic dishonesty, data fabrication and falsification of bibliographic references, among others (Awasthi, 2019; Kampa *et al.*, 2020; Kaščáková and Kožaríková, 2022; Tabsh *et al.*, 2015). Being aware of the consequence of the negative impacts of academic dishonesty (e.g. Akbar Qaderi and Thomson, 2016; Currie *et al.*, 2017; Eaton and Edino, 2018; Mulisa and Ebessa, 2021; Stoesz and Eaton, 2022) throughout the academic career of the individuals involved, issues related to plagiarism and academic dishonesty have received particular attention in the literature in the last 2 decades (Awasthi, 2019; Ferguson *et al.*, 2022; Guerrero-Dib *et al.*, 2020; McCabe *et al.*, 2001; Tabsh *et al.*, 2017; Tiong *et al.*, 2018; Uzun and Kilis, 2020).

Academic dishonesty has been approached from different perspectives due to the drastic increase (Akbar Qaderi and Thomson, 2016; Hilliger *et al.*, 2022) or the evolution of technology that can detect this type of behaviour (Johnson *et al.*, 2022; Surahman and Wang, 2022). The analysis of predictors such as: (1) sociodemographic characteristics (Birks *et al.*, 2018; Erguvan, 2022; Yang *et al.*, 2017; Zhang *et al.*, 2018); (2) area and level of education (Abdulrahman *et al.*, 2017; Aplin-Snider *et al.*, 2021; Babu *et al.*, 2011; Birks *et al.*, 2018; Brown *et al.*, 2018; Carpenter *et al.*, 2006; Erguvan, 2022; Ottaway *et al.*, 2017; Özcan *et al.*, 2019; Seaton, 2019; Seeland *et al.*, 2022); (3) culture (Abdulrahman *et al.*, 2017; Brown *et al.*, 2018; Farahat, 2022; McCabe *et al.*, 2008); (4) frequency (Awosoga *et al.*, 2021; Eret and Ok, 2014; Farahat, 2022; Guerrero-Dib *et al.*, 2020; Lucky *et al.*, 2019; Tabsh *et al.*, 2015, 2017); (5) institutional characteristics (Brimble and Stevenson-Clarke, 2005; Burgason *et al.*, 2019; Gallant, 2007; Guerrero-Dib *et al.*, 2020; Luck *et al.*, 2022); (6) the role of the academic staff (Aplin-Snider *et al.*, 2021; Bloomfield *et al.*, 2021; DiPaulo, 2022; Keener *et al.*, 2019; Teodorescu and Andrei, 2009), (7) psychological factors (Miller *et al.*, 2017; Stephens, 2017; Surahman and Wang, 2022; Zinchenko *et al.*, 2021); and (8) impact of AI (Abd-Elaal *et al.*, 2022). Additionally, learning, tests and online learning have significantly proliferated, and the COVID-19 pandemic accelerated this process (Beck, 2014; Dixon *et al.*, 2021; Eret and Ok, 2014; Guangul *et al.*, 2020; Gudiño Paredes *et al.*, 2021; Harper, 2006; Hilliger *et al.*, 2022; Holden *et al.*, 2021; Tsai, 2016).

Although plagiarism detection proves to be a challenge and many traditional tools remain insufficient to detect contract fraud (Alin, 2020; Royal *et al.*, 2018), the existing literature presents several solutions to try to cancel or mitigate academic dishonesty. For example, Surahman and Wang (2022) highlighted the role of technology considering integrating into pedagogical activities the use of plagiarism-checking software, multi-AI in a learning management system, computer adaptive testing and also online supervision. Conducting orientation and ethics programs and workshops on academic integrity, academic writing and reference styles were also proposed to help discourage plagiarism in academic writing among students and the academic community (Awasthi, 2019; Cutri *et al.*, 2021; Kampa *et al.*, 2020; Surahman and Wang, 2022). Along the same line, the creation and implementation of an academic integrity code, with a clear definition of the consequences in the case of academic misconduct, were one of the suggested solutions and is associated with lower levels of academic dishonesty (Keener *et al.*, 2019; McCabe *et al.*, 2001, 2002; Tabsh *et al.*, 2015). The challenge also falls to professors, who will be the main agents of change in transforming the problem of academic dishonesty into a possibility of positive student development (Stephens and Wangaard, 2016).

On the other hand, it should be noted that "the future seems uncertain, but one thing is certain: AI is here to stay in various fields and, in Education in particular, its force has been established in recent years as robust and solid and the trend is not to slow down" (U-World, 2021, online), not only for the advantages provided by AI but mainly for the risks and challenges it brings to the education system. The risks and challenges of AI implicitly require an ethical reflection at a time when the issues of privacy, disruption and security gain more relevance among peers because, as argued by Albuquerque and Bentinho (2008), society, in general, is always expecting all organisations to be guided by ethical principles and values. AI, therefore, poses ethical challenges, as these tools use algorithms to operationalise cognitive tasks previously performed by individuals (Piteira *et al.*, 2019) and is associated with the risk of lacking credibility, which requires the adoption of integrity codes (da Costa Felipe, 2017; Gómez *et al.*, 2008), which includes higher education institutions (HEIs).

A recent survey stated that ". . . artificial intelligence is already here, and as educators, we have a responsibility to ensure we are taking an ethical approach about how it can be used for teaching, learning, and assessment." AI and academic integrity: The ethics of teaching and learning with algorithmic writing technologies.

3. Methodology

The methodology adopted was mixed (quantitative and qualitative) since the SLR presented here is based on scientific mapping, bibliometry (quantitative) followed by content analysis (qualitative), as defined by several authors (Connor and Voos, 1981; Wasserman and Faust, 1994; Powell *et al.*, 1996; White and McCain, 1998; Quinlan *et al.*, 2008). This type of study enables the identification, assessment and analysis of content in specific areas and systematisation of concepts, theories and practices (Rowley and Slack, 2004). In other words, bibliometric literature analysis on a specific topic means more than a mere compilation of scientific documents and their theoretical and practical contributions and implications since it includes critical added value by providing a synopsis of the literature on the topic under study and the identification of gaps not yet filled and future research clues; that is, its main objective is to enable the advancement of scientific knowledge in that same topic (Mentzer and Kahn, 1995); this objective is achieved by identifying patterns of subtopics, authors, scientific journals, citations, cocitations, keywords, among others (Donthu *et al.*, 2021; Prasad and Tata, 2005; Treinta *et al.*, 2014); conceptual content (Seuring and Mu, 2008); and dimensions of analysis (Pedro *et al.*, 2018). For Kraus *et al.* (2021), bibliometric analysis is smart. Under these circumstances, the bibliometry presented here had as its unit of analysis the empirical and review scientific articles grouped by their objectives and hardcore (Grácio, 2016). Additionally, the methodological procedures pointed out by Tranfield *et al.* (2003) were adopted in this study and they are: the planning, the development; and the presentation of the results. Recent research has emphasised the importance of these procedures and the added and critical value of these reviews (e.g. Fan *et al.*, 2022; Gusenbauer and Haddaway, 2020; Lim *et al.*, 2022; Palmatier *et al.*, 2018; Snyder, 2019).

"Bibliometric analysis of a specific research area implies adopting a methodic, structured strategy to select the documents for inclusion in the systematisation of the literature" (Rodrigues *et al.*, 2022, p. 4). Thus, the keywords to be used in the method of searching for and detailing documents must be defined, as well as the eligibility criteria for scientific articles (Bandara *et al.*, 2011), because the circumscription of this literature search is crucial to obtaining a link between the main topic and the subtopics; also, in a later stage, its descriptive analysis should be carried out (Treinta *et al.*, 2014).

In this context, the method of enquiry and detailing was carried out on 14 February 2023, with the following research protocol: (1) Use of the online database ISI (Web of Science) for the research, as this is internationally recognised as relevant and pertinent and provides all the bibliographic information on scientific articles, in addition to the fact that using only this database is associated with its prestige in terms of peer review (e.g. Geissdoerfer *et al.*, 2017) and has been used in previous research (e.g. Bastos *et al.*, 2021; Golan *et al.*, 2020; Rodrigues *et al.*, 2022). The choice to only use this database is further reinforced by the fact that it contains thousands of academic publications and provides bibliographic information about them, including authors, affiliations and citations, as referenced by Rodrigues and Franco (2022), The use of WoS was also associated with the nonsimilarity of the structures of the tag fields with Scopus, when it comes to merging them when exporting the data (Echchakoui, 2020), for example, WoS considers the citations of an article as "Times Cited" and Scopus as "Cited By"; Zyoud *et al.* (2017) postulated that WoS is the most reliable in high-impact scientific studies; (2) Only scientific articles were selected; (3) use of the Boolean operators "and" and "or". Table 1 shows the search criteria based on the protocol.

The protocol referenced in Table 1 shows that Boolean operators ("AND" and "OR") and the search topic (TOPIC) were used to retrieve the publications, to outline the search strategy, i.e. the search string; scientific areas, language and document type were also scanned as inclusion criteria. After applying the criteria described in Table 1, 504 articles (WoS) were obtained. This database was imported into the Raayan software, which ". . . was developed specifically to expedite the initial screening of abstracts and titles using a process of semi-automation . . ." (Ouzzani *et al.*, 2016, p. 3), i.e. Raayan uses text mining to assist the reviewer

Items	Critérios
Time horizon	Without chronological filter
Online databases	ISI (Web of Science – WoS)
Language	English
Keywords	"artificial intelligence" and "academic integrity" or "academic misconduct" or "academic dishonesty" (Topic)
Seriation by search category	Computer Science Interdisciplinarity Applications; Education Scientific Disciplines; Education and Educational Research; Information Science Library Science
Seriation by document type	Articles and Review
Software used	Raayan, Rbibliometrix and VosViewer

Table 1.
Search criterion

Source(s): Author's own work

in screening articles for inclusion or noninclusion in systematic reviews (Olofsson *et al.*, 2017). This software has been used in several systematic health literature reviews (e.g. Gao *et al.*, 2023; Lauritzen *et al.*, 2023; Vieira *et al.*, 2023), so it is a novelty in educational research. Therefore, Raayan was used to apply the defined eligibility criterion. This criterion considers eligible articles containing the words AI, computer and integrity in the title and/or abstract, the results of which are presented in Figure 1.

It is perceived that 163 articles will be the object of bibliometric analysis, through Rbibliometrix and VosViewer. Firstly, the Rbibliometrix (Aria and Cuccurullo, 2017) processes all data on serial publications for analysis (163 articles). From this processing, several results can be extracted (e.g. on authors, number of publications, networks, couplings, authors' impact and citations per year, among others) (Ekundayo and Okoh, 2018), through publication similarity standardisation procedures (Aria and Cuccurullo, 2017). This software can analyse and map bibliographic data simultaneously (Derviş, 2019). Then, using VosViewer, the research flows (clusters) were identified for constructing and visualising bibliometric networks of cocitations (van Eck and Waltman, 2010). It also provides the design and visualisation of the mapping of the most cited and cocited authors by researchers in the 163 selected articles, identifying the clusters and networks of cocitation references (van Eck

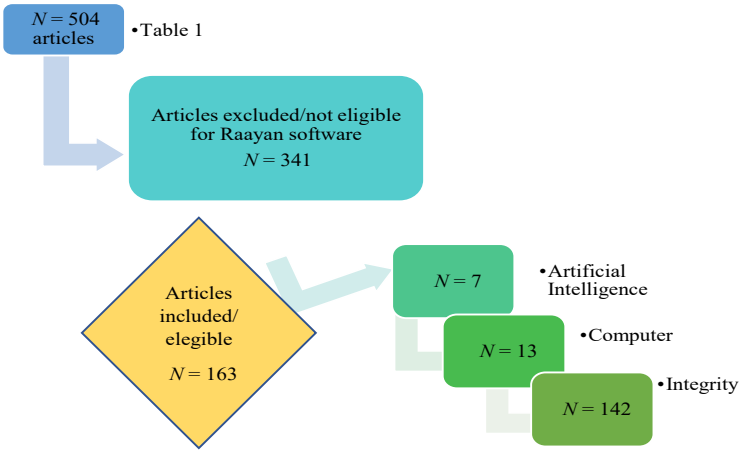


Figure 1.
Selection of articles eligible for bibliometric

Source(s): Author's own work

and Waltman, 2010; Waltman *et al.*, 2010), for checking the frequency with which two documents are cited. Thus, the cocitation analysis focuses on the frequency with which two documents are cited and the weight of the cocitations they have when they are cited by an additional document (Small, 1973) since the visualisation of topographic network maps through a coincidence matrix allows grouping by coauthorship and co-occurrence (van Eck and Waltman, 2010), i.e. it enables the perception that subsists in academia about a research area (Gmür, 2003) and the clustering by cocitation of the scientific literature on the same (Jeong *et al.*, 2014). Finally, content analysis is shown on the 163 articles to enrich the bibliometry presented (Spens and Kovács, 2006; Seuring and Gold, 2012), which includes some subjectivity due to its qualitative nature, but this does not refute the validity of its inferences or its rigour (Becker *et al.*, 2012), as a structured and systematic approach was adopted as recommended by Tranfield *et al.* (2003) and Seuring and Gold (2012).

4. Presentation and discussion of the bibliometric results

Using RBibliometrix, we obtained the general characterisation of the selected database ($N = 163$), including 14 SLR articles and 149 empirical articles (Table 2).

Between 1999 and 2023, 163 articles were published by 443 authors on academic integrity and its relationship with AI instruments; a level of network collaboration of 3.14 is also verified.

About the temporal evolution of publications, Figure 2 is presented.

Description	Results
Main information about data	
Timespan	1999:2023
Sources (Journals, Books, etc.)	78
Documents	163
Average years from publication	5.33
Average citations per document	15.21
Average citations per year per doc	2,047
References	4,818
Document types	
Article	146
Article; early access	4
Review	13
Document contents	
Keywords Plus (ID)	215
Author's Keywords (DE)	415
Authors	
Authors	443
Author appearances	473
Authors of single-authored documents	26
Authors of multiauthored documents	417
Authors collaboration	
Single-authored documents	27
Documents per author	0.361
Authors per document	2.77
Coauthors per documents	2.96
Collaboration Index	3.14

Source(s): Author's own work

Table 2. Compiled data

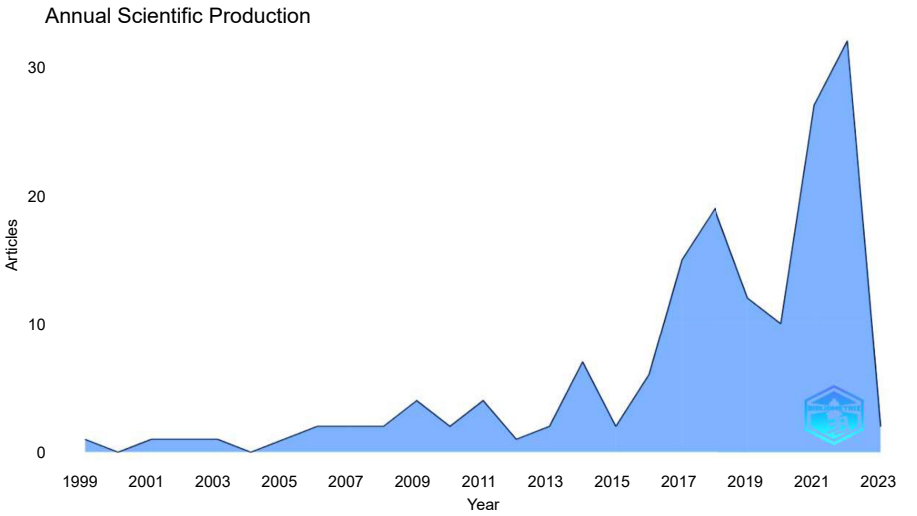


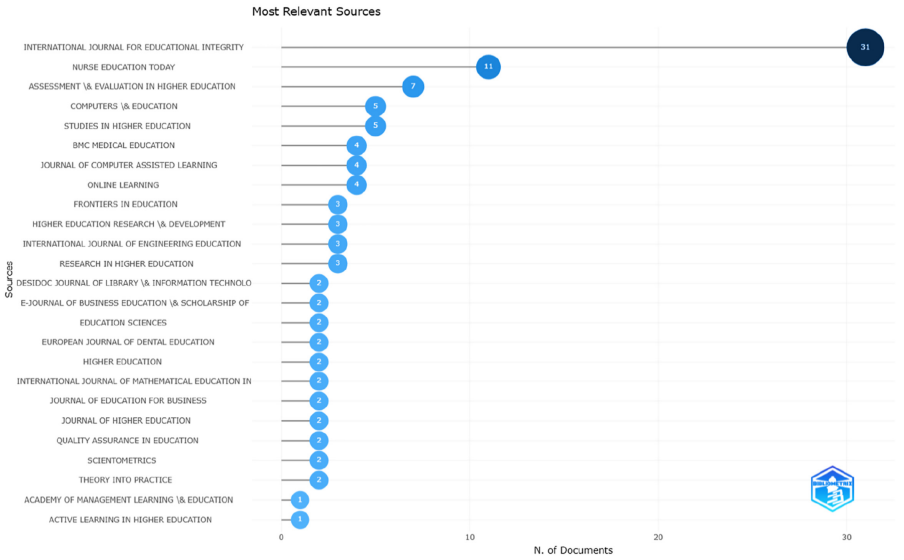
Figure 2.
Evolution of publications per year

Source(s): Figure by authors from Rbibliometrix

Figure 2 shows that publications skyrocketed in 2017 (17 articles) and peaked in 2022 (34 articles). Additionally, 123 articles were published between 2017 and 2023, representing 75% of the database. During this period 13 SLRs were published (Ahsan *et al.*, 2022; Awasthi, 2019; Cutri *et al.*, 2021; De Maio *et al.*, 2019; Devine and Chin, 2018; Eaton and Edino, 2018; Gamage *et al.*, 2022; Hilliger *et al.*, 2022; Holden *et al.*, 2021; Maryon *et al.*, 2022; Mulisa and Ebessa, 2021; Stoesz and Yudintseva, 2018; Surahman and Wang, 2022; Zhao *et al.*, 2022). Most of these reviews were published after the pandemic because, as Maryon *et al.* (2022) argued, the pandemic expanded the opportunity for violation of academic integrity as teaching shifted to independent, virtual and remote settings. It was still found that these reviews were cited 128 times by other authors, where the most cited author (22 citations) was Awasthi (2019). This author concluded that there is a lot of literature on plagiarism and academic misconduct, which means that its users are aware of academic integrity and the contributing factors to its persistence are lack of sensitivity and writing skills of students, advancement of technology, so there is a need to adopt zero tolerance strategies for plagiarism.

As shown in Figure 3, the most relevant source of the 163 articles under analysis, the *International Journal for Educational Integrity* stands out, with 31 publications between 2016 and 2022; this journal has an impact factor of 0.75 (Q1) and an h-index of 13. Examples of publications in this journal include the thematic analysis of Eaton and Edino (2018) on educational integrity in Canada from 1992 to 2017. These authors concluded that research on this topic needs to be matured and that technology includes useful tools; another study published in this journal noted that the promotion of academic integrity could occur in an online format and face-to-face sessions because the inclusion of these practices in teaching approaches increase students' skills and knowledge about it, change behaviours and result in more tremendous success for them in the long term (Stoesz and Yudintseva, 2018); already the survey of Chala (2021) on cheating targeting students in Ethiopia, was compelling in showing that cheating is rampant and that students are tolerant of unethical behaviour, prompting a review of policies on academic integrity in higher education.

Table 3 shows the Top 25 most cited authors.



Source(s): Author's own work

Figure 3.
Most relevant sources

Author(s)	Citations
Brimble and Stevenson-Clarke (2005)	134
Karim *et al.* (2009)	94
McCabe *et al.* (2001)	90
McCabe *et al.* (2008)	89
Gullifer and Tyson (2014)	79
Guangul *et al.* (2020)	74
Carpenter *et al.* (2006)	63
Park *et al.* (2013)	54
Chapman and Lindner (2016)	51
Lancaster and Cotarlan (2021)	49
Teodorescu and Andrei (2009)	49
Alessio *et al.* (2017)	46
Sotiriadou *et al.* (2020)	41
Eret and Ok (2014)	41
Miller *et al.* (2011)	41
Elzubeir and Rizk (2003)	41
Rowland *et al.* (2018)	39
Harper (2006)	39
Daffin and Jones (2018)	37
Newton (2016)	35
Azulay Chertok *et al.* (2014)	32
Beck (2014)	32
Akçapınar (2015)	31
Reedy *et al.* (2021)	30
Foltýnek and Králíková (2018)	30

Source(s): Author's own work

Table 3.
Citations WoS (top 25)

From the analysis of Table 3, we highlight the authors Brimble and Stevenson-Clarke (2005) with 134 citations and *"the survey aimed to determine the prevalence of academic misconduct and to investigate the extent to which perceptions of dishonesty are shared between students and staff, as preliminary steps toward developing effective strategies to deal with the academic dishonesty/misconduct problem. Results indicate a higher tolerance for academic misconduct by students in comparison to staff, particularly concerning falsification of research results and plagiarism, as well as considerable underestimation by staff of the prevalence of virtually all forms of student academic misconduct"* (Brimble and Stevenson-Clarke, 2005, p. 19). The study of Karim *et al.* (2009), with 94 citations, investigated the extent to which students at a public university in Malaysia engage in such unethical behaviour and its relationship with the Big Five personality model; the results of factor analyses confirmed and refined the reliability of the scales for both the big five personality variables and unethical Internet behaviours as conceptualised through the internet Triggered Academic Dishonesty (ITADS). Further, they indicated that personality traits such as agreeableness, conscientiousness and emotional stability are significantly and negatively correlated with unethical Internet behaviours in college students.

No less important are the various indexes of the authors included in this study, for which Table 4 is displayed. Thus, the g-index is calculated from the distribution of citations of publications by an author, resulting in a set of articles ordered in descending order by their number of citations (van Eck and Waltman, 2008). The index Hirsch (h-index) uses the author's most cited articles and the number of citations they have received in other publications (Hirsch, 2005), i.e. it is a metric that measures the productivity and citation impact of an author's publications (Aria and Cuccurullo, 2017), while the m-index is defined as H/n, where h is the index h and n is the number of years since the author's first publication (Aria and Cuccurullo, 2017).

Based on Table 4 it is found that only two authors show indices of 2, specifically: 1) Abdelfatah AS, who first published in 2015 and has 2 publications with 86 citations; 2) Alessio HM, with 2 publications and 60 citations, with 2017 being the year of first publication.

Author	Index H	g	m	Total citations	Nº publications	Year of publication start
Abdallah H	1	1	0.063	86	1	2008
Abdelfatah AS.	2	2	0.222	13	2	2015
Abdulrahman M	1	1	0.143	6	1	2017
Abraham A	1	1	0.333	8	1	2021
Akbulut Y	1	1	0.063	26	1	2008
Akcapinar G	1	1	0.111	30	1	2015
Alcazar JM.	1	1	0.333	12	1	2021
Alessio HM.	2	2	0.286	60	2	2017
Ali MF.	1	1	0.333	4	1	2021
Alin P	1	1	0.25	4	1	2020
AlsalehI S	1	1	0.143	6	1	2017
Amrane-Cooper L	1	1	0.333	1	1	2021
Andrei T	1	1	0.067	49	1	2009
Ankola AV.	1	1	0.071	9	1	2010
Antney J	1	1	0.167	24	1	2018
Apgar C	1	1	0.067	19	1	2009
Aplin-Snider C	1	1	0.333	1	1	2021
Ashokkumar BR.	1	1	0.071	9	1	2010
Asselin ME.	1	1	0.333	3	1	2021
ATchison R	1	1	0.2	2	1	2019

Table 4.
Author impact factor

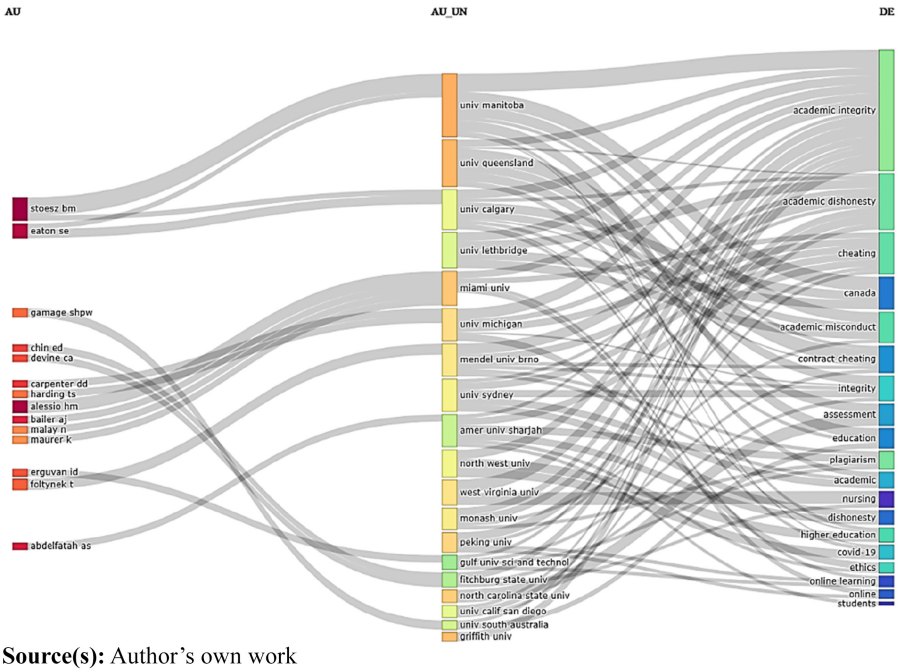
Source(s): Author's own work

The research of Tabsh *et al.* (2015) includes coauthor Abdelfatah AS and compared engineering students' perceptions of the occurrence of academic misconduct in 2002 and a decade later, whose evidence suggests that actions implemented by the institution to improve academic integrity have greater efficacy on in-class examinations than on out-of-class work. In contrast, Alessio *et al.* (2017) argued that the growth of online teaching poses a challenge to lecturers and students about their commitment to academic integrity, leading to the forced development of software to detect cheating, as these practices provide the absence of critical mass and reflection, impact the lecturer's reputation and compromise learning, so this topic should always be proactively addressed.

About the collaboration network between authors, universities and topics Figure 4 is presented.

Figure 4 displays the Sankey Diagram, visualising the prominent authors, their university affiliations and the topics (keywords). In this diagram, the larger the size of the coloured rectangles, the greater the frequency/importance of a given author, university and keyword in the collaboration network. Additionally, the thicknesses of the couplings between these three items vary depending on the number of connections. Under these circumstances, the authors with the highest network participation are Eaton and Edino (2018) and Stoesz and Yudintseva (2018), the institutions are the University of Manitoba (Canada) and Queensland University (Australia), while the constructs are academic integrity, academic dishonesty and cheating.

Finally, the clusters obtained by VosViewer are displayed (see Figure 5). Two clusters (red and green) were obtained, on which a content analysis will be performed. The two clusters were obtained using the criteria inherent in VosViewer, specifically the minimum number of cited citations, in this case, 12, which meant that of the 4,818 references cited, 16 met the minimum of 12 citations.



Source(s): Author's own work

Figure 4.
Collaboration network

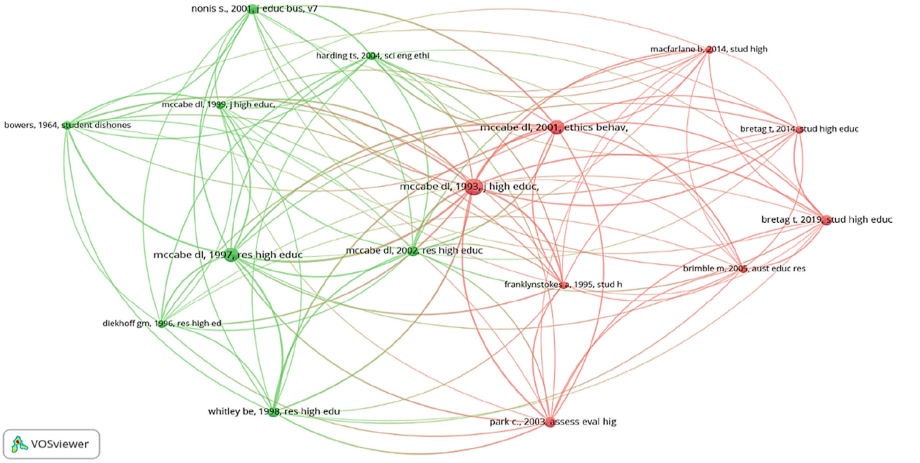


Figure 5.
Cocitation network

Source(s): Author's own work

Figure 5 shows the emerging nodes of cluster 1 and cluster 2, which are the nodes that have a high level of citation in a short period and are marked by scientific strength (red and green). Table 5 presents the composition of the clusters, whose theme is: (1) Cluster 1: Academic integrity, with a weight of total link strength of 376; (2) Cluster 2: Negative predictors of academic integrity, with a weight of total link strength of 376. The empirical articles included in both clusters are mostly quantitative, while the qualitative articles are conceptual. Of the theories used in both clusters, the Theory of Planned Behaviour is advocated (Ajzen, 1991), since the student possesses the ability to self-regulate his/her intentions to commit academic misconduct, and Social Learning Theory, since the environment around the student, his/her peers are predictors of this conduct, are convincing theoretical frameworks to explain behaviours in students of academic misconduct. It should also be noted that the author McCabe has five publications included in the two clusters (McCabe *et al.*, 1999, 2001, 2002; McCabe and Trevino, 1993, 1997).

Cluster 1. Academic integrity includes considerations on students' behaviours towards integrity, the need for preventive models and effective strategies to combat this; the importance of the student–teacher proximity environment in mitigating dishonesty and the involvement of students by universities in issues of academic integrity. Regarding cluster 1, recent research has argued that academic integrity implies the existence of clear guidelines for students on plagiarism and collusion (Amrane-Cooper *et al.*, 2021). Hudd *et al.* (2009) argued that discussions of academic integrity are becoming increasingly important on university campuses, which has led many lecturers to adjust their classroom practices and reduce the occurrence of integrity violations. These arguments go along with the fact that teachers play a crucial role in prevention; it is their duty to report suspected misconduct, but they need tools to improve the culture of academic integrity (Dannhoferová *et al.*, 2022).

Cluster 2. Negative predictors of academic integrity address the themes that direct students to misconduct practices and the need to include technology in the models and preventive strategies of these. On this theme, the meta-analysis conducted by Zhao *et al.* (2022) demonstrated that peers and cultural values impact students' behaviours when it comes to practicing academic dishonesty

Author(s)	Cluster	Weight Citations	Theory	Method	Unit of analysis	Type of article	Objective	Conclusions
McCabe and Trevino (1993)	1	36	Deterrence theory; learning theory	Quantitative	6.096 students from thirty-one US colleges and universities	Empirical	Comparison of differences in the level of academic dishonesty in colleges that do not have honor codes and those that do	Although there are different perceptions, in general, the theory of social learning is assumed to be useful in understanding the behaviour of university students regarding academic dishonesty
McCabe *et al.* (2001)	1	29	Social learning theory	Quantitative	Literature Review	Conceptual	Search for suggestions for managing cheating from the perspective of students and teachers	Identifying strategies that can be integrated into any campus
Park (2003)	1	19		Qualitative	Literature Review	Conceptual	Characterise "the need for institutions in the United Kingdom to strengthen cohesive structures to deal with and prevent plagiarism, on the part of students, betting on prevention based on autonomous systems in robust detection	Reinforcement of the progressive need for UK institutions to develop cohesive frameworks to prevent and identify student plagiarism

(*continued*)

Table 5.
Schematic analysis of clusters

Table 5.

Author(s)	Cluster	Weight Citations	Theory	Method	Unit of analysis	Type of article	Objective	Conclusions
Bretag *et al.* (2019)	1	18		Quantitative	Eight Australian universities	Empirical	Analysis of students' experiences and attitudes related to contract fraud and the respective contextual factors that can impact fraudulent behaviour	Universities have supported the development of teaching and learning environments that strengthen student–faculty relationships and reduce cheating opportunities across curriculum and assessment style
Bretag *et al.* (2014)	1	13		Quantitative	Six Australian universities	Empirical	Enquire about academic integrity awareness and policy to identify how to avoid violation of academic integrity	The opinion of the students indicated that Australian universities should ensure a holistic view, which allows the involvement of students regarding academic integrity
Franklyn-Stokes and Newstead (1995)	1	13		Quantitative	UK	Empirical	Research focuses on data analysis, studies of different academic disciplines, and in different institutions	Students have a very high perception of various types of cheating behaviour

(*continued*)

Author(s)	Cluster	Weight Citations	Theory	Method	Unit of analysis	Type of article	Objective	Conclusions
Brimble and Stevenson-Clarke (2005)	1	12	Neutralising theory; The general theory of crime	Quantitative	4 major universities of Queensland in Australia	Empirical	Characterises the domain of academic misconduct and investigate whether perceptions of dishonesty are shared among students and staff	University administrators need to manage and reduce the level of academic misconduct, to avoid weakening the academic integrity of the Australian tertiary sector
Macfarlane *et al.* (2014)	1	12	Ethical theory; Virtue Theory; Rights theory; espoused theory	Qualitative	115 articles of both Western and Chinese literature	Conceptual	Highlight the main aspects of academic integrity, namely teaching, research and service	Most of the literature on this area is framed with academic misconduct or corruption. However, there must be a focus on identifying ethical and unethical practices
McCabe and Trevino (1997)	2	28	Sex-role socialisation theory; social learning theory; association theory; Deterrence theory; learning theory	Quantitative	9–10 medium to large American universities	Empirical	Investigate the factors that influence cheating to provide viable solutions. that decrease academic dishonesty on the part of university students	The results suggest that cheating is influenced by specific characteristics such as age, gender, student average grade and contextual factors. It is recognised that peer disapproval is one of the most important factors in this process

(*continued*)

Table 5.

Table 5.

Author(s)	Cluster	Weight Citations	Theory	Method	Unit of analysis	Type of article	Objective	Conclusions
Whitley (1998)	2	19	Theory of the trait; theory of planned behaviour	Qualitative	107 articles	Conceptual	Analysing the proportion of college students who cheat, identifying changes in the cheating process over the last few years. Identify factors that can correlate with cheating	Have moderate expectations of success, have cheated in the past, study abroad unstable conditions, maintaining a positive attitude towards cheating, are some of the most determining factors, which lead to cheating
McCabe *et al.* (2002)	2	18	Social learning theory; deterrence theory	Quantitative	21 colleges and universities	Empirical	Investigates the outcomes of the modified honor codes, compared to traditional ones, as the modified honour code is reaching popularity on larger campuses	It turns out that honour codes changed lower evidence of student dishonesty. In this sense, the McCabe and Trevino model seems quite strong
Nonis and Swift (2001)	2	18	Gender role socialisation theory."	Quantitative	Business students from 6 different campuses ($N = 1.051$)	Empirical	It aims to fill a gap between findings related to academic dishonesty and dishonesty in the workplace	Students who believe cheating would be acceptable are more likely to engage in other dishonest behaviour. Furthermore, students with dishonest behaviour are more tolerant of adopting dishonest behaviour in the workplace

(*continued*)

Table 5.

Author(s)	Cluster	Weight Citations	Theory	Method	Unit of analysis	Type of article	Objective	Conclusions
Harding *et al.* (2004)	2	15	Theory of Planned Behaviour	Exploratory survey	Undergraduate engineering students from two technically oriented private universities	Conceptual	Investigate whether engineering students who practice academic dishonesty are more predisposed to unethical behaviour in professional practice	Analysis of the relationship between academic dishonesty in high school and college, with the practice of unethical behaviour in professional life
Bowers (1964)	2	14		Quantitative	Academic students	Empirical	Determining the challenges of academic dishonesty in our higher education and realising its long-term leads to corruption	Inspires comprehensive and systematic efforts to advance in the face of integrity, preventing dishonesty, fostered by advancing technology
Diekhoff *et al.* (1996)	2	13		Quantitative	474 university students	Empirical	Assess the extent of cheating and attitudes towards cheating, identify variables that distinguish cheating from noncheating and analyse changes in chatting attitudes and behaviours	Both cheating and noncheating revealing embarrassment and fear of punishment as being the strongest impediments to promoting cheating. It is noted that the disapproval of friends is considered the least capable of dissuasion
McCabe *et al.* (1999)	2	12		Mixed	31 US colleges and universities, larger study of academic cheating in honour code and noncode institutions	Empirical	Understand the individual and contextual characteristics that influence cheating	Honour codes can create an atmosphere of anxiety and fear, discussions of cheating and other concerns about the honour code rule

Source(s): Author's own work

and cheating; this impact of cultural values had already been argued by Cutri *et al.* (2021). On the other hand, Evans *et al.* (2021) understood that cheaters have the cultural intelligence to avoid sanctions and good emotional intelligence to decide whether to cheat (Ferrer *et al.*, 2020). However, tackling these behaviours should include honour codes, which can provide the framework to reduce the perception and prevalence of cheating (Tatum and Schwartz, 2017). From another perspective, the perception that academic fraud is widespread in higher education affects the credibility of higher education schools, giving rise to doubts about the quality of learning and the preparation of students for their professional lives. As such, academic misconduct is now a common area of investigation, yet higher education schools still seem unable to contain academic fraud, given its prevalence and scope (Ramos *et al.*, 2020), so preventive models must be implemented (Park, 2003) associated with a holistic vision (Bretag *et al.*, 2019). It is clear that Covid-19 has further triggered this imperative, and the urgency of Policies and Procedures, Compliance, Commitment and Resources is palpable (Walsh *et al.*, 2021). This urgency directs to the importance of the use of technologies, as mentioned by Ahsan *et al.* (2022), Awasthi (2019), Mulisa and Ebessa (2021) and detection software (Khalil *et al.*, 2022; Levine and Pazdernik, 2018). In this scenario, Gamage *et al.* (2022) postulated that teaching tools, such as Moodle, are in permanent transformation specifically to incorporate AI, which was corroborated by Surahman and Wang (2022) by concluding that the reduction of academic dishonesty requires the use of plagiarism software and AI in learning systems (Jia and He, 2022; Surahman and Wang, 2022).

This bibliometry showed that there are still gaps in the simultaneous use of AI in the promotion of academic nonintegrity and the detection of these practices since few articles refer to it. However, the scientific mapping and bibliometry presented here provided critical value to the topic, expressed in the value chain shown in Figure 6.

Globally, there is an accelerated development of AI tools, which entails the greatest difficulty in discerning between original work and work carried out by these tools so that academic integrity may be put at risk, i.e. there is a narrow line between these constructs that must be

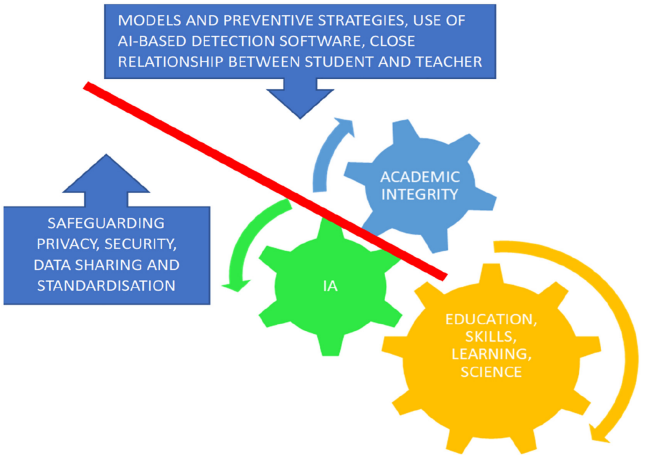


Figure 6.
Balance between AI and academic integrity

Source(s): Author's own work

redrawn to understand the role AI will play in education. Figure 6 mirrors this line, so, fundamentally, academics and students understand that these tools are not substitutes for teachers but rather complementary means, in addition to the need to safeguard the issue of privacy, among other aspects. Although it is argued that it is relevant to include these tools in the classroom and to design new didactic-pedagogical methods for that purpose, their excessive use deprives students of critical skills (e.g. critical reasoning, writing, reading, comprehension). On the other hand, AI raises enormous difficulties in academic integrity among students and their counterparts, with personal and institutional repercussions, so there is an urgent need to review the dissemination of the integrity strategy of universities, the implementation of screening mechanisms for illicit conduct and the introduction of other AI screening tools. Finally, the close links between students and teachers are a way to prevent this conduct, so the overuse of AI limits coexistence between humans and can be a predictor of academic nonintegrity.

5. Conclusions

In response to the defined objective, it was found that academic integrity has aroused the interest of academics in the last five years, the period with the most publications. In addition, AI has been little related to academic integrity in the 163 articles analysed, although indirect reference is made to plagiarism detection software and online teaching platforms. A tendency for students to engage in misconduct practices with awareness has also become clear, the predictors being cultural values, perception and peer pressure, self-efficacy and the achievement and attainment of designed goals. It is important to counteract this tendency so that the quality of teaching and the reputation of higher education institutions are not affected. On the other hand, individuals who opt for these practices can understand, express, perceive and manage their emotions, so working on students' emotional intelligence would be an interesting strategy to apply, associated with using other AI-based detection tools. Nevertheless, AI can be used to: monitor students' behaviour in real time, such as class attendance, time spent on school activities and access to course resources, acting as an aid to identify students who are having difficulties and need additional support, as well as, for the detection of abnormal behaviour, such as plagiarism or academic fraud; analyse large amounts of data related to student's academic performance, including grades, teacher feedback and demographic data, enabling the identification of trends and patterns contributing to inappropriate behaviour; suggest resources, activities and programs to students based on their interests, skills and academic performance, as a way of preventing harmful behaviour. These arguments are the main contributions of this bibliometrics.

AI tools are triggering many doubts in the educational community about good academic integrity practices, as the associated algorithms provide texts on topics without bibliographic citations. On the other hand, this tool is appealing to students as a facilitator for developing academic tasks. Many studies already exist on this topic, in which plagiarism has been a concern present them, but in a dispersed way, so the theoretical implication of bibliometry presented here is represented by the use of the word AI in the database search, which allowed us to conclude the emergence of combating AI tools motivating disruptive behaviour by students and, also the perception that students consider these tools "wonderful" for their success, often without realising that they are committing an ethical fraud, which requires an effort from the academic community in terms of communicating codes of ethics. The implications for practice are that these tools can also detect students who plagiarise, i.e. they can be useful in identifying students with fraudulent behaviour.

6. Contributions and practical implications

As theoretical contributions, this bibliometry has provided the insight that AI tools can be facilitators of plagiarism by students (increased ease of plagiarism), and their detection becomes a

challenge for academics; they can also be used to improve the quality of teaching, as they enable personalised tutoring and automated assessments. In short, from a theoretical perspective, it is argued that AI will transform educational projects in higher education, with benefits associated with personalisation and efficiency but also challenges related to ethics and academic integrity.

In practical terms, the use of AI-based plagiarism detectors can aid in detecting plagiarism, reducing subjectivity in assessments, for example, but this requires these tools to be used ethically and responsibly. In addition, academic curricula should include a section that educates students about academic integrity, highlighting the negative implications of academic misconduct, such as plagiarism and cheating. To sum up, the heads of higher education institutions should implement a holistic approach in their curricula by combining education, awareness-raising, task design and monitoring actions to promote academic integrity in the face of its weakening by AI tools. At the same time, lecturers should promote a culture of academic integrity in their teaching and emphasise communication with students about ethical issues in the field.

In short, AI presents challenges and implications for the academic community. This means that it can be used to develop advanced plagiarism detection systems, capable of identifying copied content in academic documents with high accuracy, facilitating the maintenance of the integrity and originality of academic work; monitoring and detecting suspicious activity during online exams; to helping identify academic fraud. In addition, it can help researchers collect, analyse and organise large volumes of data. However, AI tools can be used negatively, as they can create more sophisticated plagiarised content and raise ethical challenges about student privacy.

Academic integrity is a fundamental cornerstone of education, representing the values of honesty, trustworthiness and ethical conduct within the academic community. However, in today's rapidly evolving technological landscape, technology and the Internet present threats and assets to academic integrity. So, the threat to Academic Integrity is Plagiarism—the Internet provides easy access to a vast amount of information and content, making it tempting for students to plagiarise. Copying and pasting information from online sources without proper attribution remains a significant threat to academic integrity; Essay Mills—The proliferation of online essay mills, where students can purchase prewritten essays or hire others to write their assignments, poses a severe threat to academic integrity. It encourages dishonesty and undermines the educational process; Cheating in Online Exams—With the rise of online education and remote exams, students are more likely to cheat during assessments. Technology allows easy access to unauthorised resources or collaboration with peers during exams.; Fake Credentials—the Internet has made it easier for individuals to create fake academic credentials or diplomas. This undermines the credibility of educational institutions and can lead to a lack of trust in academic qualifications. Unverified Information—The ease of access to information on the Internet also means that students may rely on unverified or unreliable sources in their research, which can lead to inaccurate or misleading academic work. As for assets, we have plagiarism detection tools. Technological advancements have developed sophisticated plagiarism detection tools that can identify copied or unoriginal content in academic papers. These tools serve as a valuable asset in maintaining academic integrity; Online Learning Platforms—Many educational institutions now use Learning Management Systems (LMS) that include features for secure online assessments and anti-cheating measures, which can help maintain the integrity of online exams; Open Access to Research—The Internet has facilitated open access to a wealth of academic research, enabling students to access a broader range of scholarly materials. This can enhance the quality and originality of their work; Online Collaboration Tools—Technology allows for collaborative learning and group projects, fostering a sense of academic community and shared knowledge while adhering to ethical guidelines; Digital Record Keeping—Academic institutions can use technology to maintain digital records of academic achievements and credentials, making it more challenging for individuals to falsify their qualifications.

In conclusion, technology and the Internet are a double-edged sword regarding academic integrity. While they can provide tools to maintain and uphold academic honesty, they also present numerous challenges and temptations that can erode it. To preserve academic integrity in the digital age, educational institutions must invest in preventive and detective measures, educate students on ethical conduct and continually adapt to the evolving technological landscape. Balancing the potential threats and assets of technology is crucial in safeguarding the integrity of academic pursuits.

As with any study, this one is not without limitations. One limitation refers to the research string, using only the WoS database and the selected knowledge areas. Another limitation relates to the software used, as many others could have been used. Apart from bridging these gaps in the future, this is a fertile topic for future research agendas. Thus, a qualitative empirical study on the influence of the pandemic on misconduct practices by higher education students is suggested, as well as another study on the importance of AI-based detection software. These studies will allow the use of AI to preserve academic integrity. For example, universities can use plagiarism detection algorithms to identify possible cases of plagiarism in academic papers. These algorithms can compare the text of a paper with other text sources to identify whether the text is original or copied from another source. However, human judgement should not be excluded when determining whether or not a breach of academic integrity has occurred. Teachers still need to review and evaluate the evidence collected by AI to determine whether a breach has occurred and take appropriate action. Also, these arguments suggest future avenues of investigation. Other future clues include using qualitative methodology to study this social phenomenon, specifically by using face-to-face focus groups to understand what leads students to adopt AI tools to develop their tasks, from undergraduate to doctoral level; another quantitative study (questionnaire) is also needed to conclude on the frequency of use of these tools by students; research on teachers' strategies to detect situations of student misconduct would also be interesting.

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