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*CORRESPONDENCE
Rubén Andrés Miranda-Rodríguez
✉ ruben.miranda@zaragoza.unam.mx
José Miguel Sánchez-Nieto
✉ cheverego@hotmail.com
Ana Karen Ruiz-Rodríguez
✉ hikary1990@gmail.com

Effectiveness of intervention programs in reducing plagiarism by university students: a systematic review

Rubén Andrés Miranda-Rodríguez*, José Miguel Sánchez-Nieto*
and Ana Karen Ruiz-Rodríguez*

Facultad de Estudios Superiores Zaragoza, Universidad Nacional Autónoma de México, Mexico City,
Mexico

Introduction: Plagiarism in universities is a problem with potential academic, social, ethical, and legal implications. Systematic review research on academic integrity programs, including plagiarism, has been conducted, but few studies have assessed plagiarism. Therefore, this review synthesizes knowledge on the effect of educational interventions designed to prevent or reduce plagiarism by university students.

Method: A systematic review was performed using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) criteria to analyze experimental or quasi-experimental studies aimed at reducing plagiarism through objective assessments. The search strategy was implemented in Web of Science, PubMed, Scopus, PsycArticles, ProQuest, ERIC, Redalyc, SciELO, and Tesiunam.

Results: Six interventions were evaluated, and 1,631 undergraduate students were included pursuing different majors from different universities. The intervention and assessment strategies varied considerably between studies, 5 of which reported a lower plagiarism frequency in the intervention group than in the control group.

Conclusion: The results suggest that interventions with practical elements, such as plagiarism detection, paraphrasing, citation skills, in addition to using software to identify similarities, may reduce plagiarism. However, few studies include an objective evaluation, so more research is needed.

Systematic review registration: https://inplasy.com/inplasy-2023-7-0104/.

1 Introduction

University education involves multiple challenges related to students' professional development. In addition to providing students with theoretical and practical knowledge on a discipline, universities must promote ethical principles (Mason, 2001; Illingworth, 2004). For this purpose, ethics should be included in professional training to prevent university students from using their skills and knowledge to place their interests above their professional codes of conduct (Moore, 2006; Mion and Bonfanti, 2019). In these contexts, authors such as McCabe and Stephens have highlighted how fundamental it is to preserve academic integrity

through the behavioral exercise of honor codes, accompanied by various commitments and responsibilities of different people who fulfill the role of promoters of quality professional training, so that problems of academic dishonesty are prevented (McCabe and Trevino, 1993; McCabe et al., 2006; Stephens et al., 2021). Unfortunately, issues such as plagiarism is one of the prevalent problems which entails a breach of professional ethics.

Plagiarism is the appropriation of words or ideas of other authors without giving them due credit, which also has academic, social, and legal repercussions (Park, 2003; Awasthi, 2019). Recently, research on university education highlights the risk of plagiarism due to its increasing ease of use to "solve" academic tasks, due to quick access to information that can be copied from one document and pasted into another (Kampa et al., 2024; Zhang, 2024), mainly in stressful school situations (Tindall et al., 2021). In addition to this, the ethical debate around plagiarism has been exacerbated by the arrival of artificial intelligence, so it is a phenomenon that must continue to be studied (Eaton, 2023; King, 2023). Plagiarism is a multifactorial phenomenon comprising cognitive, affective, contextual, sociocultural, and institutional variables (Husain et al., 2017; Moss et al., 2018), also found in professional scientific research (Pupovac and Fanelli, 2015). Systematic review (SR) studies on plagiarism have shown a wide range of computer tools for understanding this issue in depth (Moss et al., 2018; Awasthi, 2019). These SR studies have gathered evidence to describe and explain plagiarism, albeit without investigating educational interventions aimed at preventing or reducing plagiarism.

Interventions aimed at avoiding or reducing the incidence of plagiarism by university students primarily consists of conceptually raising awareness of the phenomenon and developing academic writing skills (Marusic et al., 2016). Some studies measured the effectiveness of their interventions in terms of the increase in students' unfavorable attitudes toward plagiarism, knowledge about plagiarism, and plagiarism detection skills (Curtis et al., 2013; Rathore et al., 2018; Giuliano, 2022). However, these evaluations indirectly measured these variables, which may entail self-report or social desirability biases. Therefore, evidence on plagiarism prevention or reduction must be based on objective measurement criteria (Martin et al., 2009).

Objectively assessing plagiarism should involve detecting coincidences between paragraphs and words in texts prepared by participants and published documents, primarily using software specialized in this task, such as Turnitin (Dahl, 2007; Halgamuge, 2017; Meo and Talha, 2019). Experts should also identify paraphrasing problems in texts, lack of citations or mosaic plagiarism (directly copying and pasting the text and replacing only some words by synonyms to differentiate the text, also known as patchwriting) (Vieyra et al., 2013; Rogerson and McCarthy, 2017; Memon, 2020). These proposals enable us to more easily assess the effectiveness of interventions aimed at reducing plagiarism objectively.

Marusic et al. (2016) performed an SR assessing the effectiveness of interventions aimed at preventing research misconduct and promoting academic integrity in scientific publishing. Among the misconduct topics that they evaluated, plagiarism was found in university students, especially in undergraduate students. Their results showed that interventions based on information defining plagiarism and its consequences, academic integrity modules, feedback from plagiarism detection software, and practical academic writing exercises to promote citation and paraphrasing skills help to mitigate this problem. However, the authors also noted the low quality of

evidence. This low quality derives from the lack of homogeneity in intervention techniques and from the use of self-report assessments in multiple studies.

In addition to the lack of objective evaluations and the heterogeneity in interventions to prevent or reduce plagiarism, recent technological advances have had a considerable impact on education in general and university education in particular, in terms of both academic integrity and misconduct (Turnbull et al., 2021). The increase in plagiarism has even been associated with the lack of direct supervision given the conditions of distance education in recent years (Eshet, 2023). Nevertheless, currently available computer tools facilitate efforts to objectively assess the effect of interventions. Accordingly, an SR should be conducted to synthesize knowledge on the effect of educational interventions aimed at preventing or reducing plagiarism by university students. In specific terms, it was also proposed to review how the effectiveness of such interventions has been evaluated objectively and which intervention strategies can be considered the most appropriate.

2 Method

This review was organized based on the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (Page et al., 2021), in addition to a protocol registered in International Platform of Registered Systematic Review and Meta-analysis Protocols (Registration number INPLASY202370104).

2.1 Search strategy

The search strategy was based on the research question "What are the effects of interventions to reduce plagiarism in university students?" An interval of years of publication was not specified for the search of the articles. The search was conducted on July 27, 2023. The Web of Science, PubMed, Scopus, PsycArticles, ProQuest, and ERIC databases were searched using the following strategy: *(plagiarism OR misconduct OR cheating OR academic dishonesty) AND (student OR university students) AND (intervention OR training).* On July 28, 2023, the Redalyc, SciELO, and Tesiunam databases were searched using the following strategy: *plagio AND estudiantes universitarios AND (intervención OR entrenamiento) [plagiarism AND university students AND (intervention OR training)]* in Redalyc; *Plagio AND estudiante [Plagiarism AND student]* in SciELO; and *Plagio [Plagiarism]* in Tesiunam. The last search was performed to identify gray literature.

2.2 Eligibility criteria

The studies were selected based on the population, interventions, comparators, outcomes, and study designs (PICOS) framework. *Population:* undergraduate university students pursuing any major or from any university; *intervention:* direct strategies aimed at preventing or reducing plagiarism, encompassing academic integrity modules, training and instructions on plagiarism, Turnitin use, referencing tasks, preventive tutorials, and warnings on plagiarism detection for assignment evaluation, among others; *comparators*: no plagiarism

intervention, normal lessons or any other intervention not directly related to plagiarism; *outcomes:* objectively assessing plagiarism detection in writing assignments using software or expert review; *study designs:* randomized controlled trials or studies with quasi-experimental designs. Articles in English, Spanish, or Portuguese were included in this SR. Studies with graduate students, academics, or professional researchers, with interventions unrelated to plagiarism or without specifying the type of intervention conducted in the study, without a comparison group, with plagiarism indicators based only on self-report tests of attitudes or knowledge, or observational studies were excluded.

2.3 Data collection

The studies were independently reviewed by two researchers (RAMR and JMSN) based on the inclusion and exclusion criteria. Using Microsoft Excel tools, a database was constructed, organizing the articles by title and abstract and identifying duplicates. Once the list of articles was complete, the duplicates and studies that failed to meet the eligibility criteria based on their title and abstract were excluded. After reviewing the full text of the selected articles, the two researchers selected those that met the eligibility criteria for qualitative review. Meta-analysis was not performed given the high variability among plagiarism criteria and strategies used in intervention programs.

2.4 Data analysis and synthesis

The data from the studies selected in this SR, namely authors, year, design, sample size (n), participants' sex, age and major, type of intervention, comparator, plagiarism assessment strategy, and main outcomes were filled into a Microsoft Excel spreadsheet (and subsequently transferred to Microsoft Word).

The quality of the studies was evaluated using the tool for assessing risk of bias in randomized trials (RoB 2; Sterne et al., 2019) and the tool for assessing risk of bias in non-randomized studies of interventions (ROBINS-I; Sterne et al., 2016) criteria. More specifically, we analyzed the studies for selection, performance, detection, attrition, and reporting biases (RoB 2 criteria) and for biases due to confounding, due to selection of participants, in classification of interventions, due to deviations from intended interventions, due to lack of data, in measurement of outcomes and in selection of reported outcomes (ROBINS-I criteria). Risk of bias was illustrated using RevMan software version 5.4.1 for RoB 2 criteria and the robvis digital tool (McGuinness and Higgins, 2021) for ROBINS-I criteria.

3 Results

3.1 Study selection process

The initial search yielded 3,098 articles. When duplicates were removed, 2,619 remained in the sample of articles. Upon title and abstract review, 2,577 articles were excluded with 97% of agreement (Kappa = 0.579, $p < 0.001$); therefore, a total of 42 articles were selected for a slow review. After discussing disagreements, six articles met the eligibility criteria to carry out a systematic review, but not to carry out

a meta-analysis due to considerable heterogeneity observed between these studies (see Figure 1). There was no need for a third reviewer.

## 3.2 Synthesis of the selected studies

Three of the selected studies had an experimental design, and the other three had a quasi-experimental design (Belter and du Pré, 2009; Dee and Jacob, 2012; Newton et al., 2014; Henslee et al., 2015; Obeid and Hill, 2017; Yang et al., 2019). The six studies included only post-test evaluation. The number of participants of all studies totaled 1,631 undergraduate university students, ranging from 697 in the study with the most participants to 33 in the study with the smallest sample. The majors included Social Sciences, Psychology, Business, and Biology (see Table 1).

All study interventions included a definition of plagiarism (as the appropriation of words or ideas of other authors without giving them due credit) but varied in methodology. The interventions were based on citation tasks and on the review of common writing problems (Yang et al., 2019), plagiarism detection strategies (Obeid and Hill, 2017), examples of plagiarism and specific tips on how to avoid plagiarism (for example, paraphrasing, using quotation marks, recording group members' contributions, and not procrastinating, among other strategies) (Newton et al., 2014; Henslee et al., 2015), tutorials with examples of plagiarism, proper citation, and general strategies (e.g., not procrastinating and careful notetaking); questionnaires with examples (Dee and Jacob, 2012); and general discussions on academic integrity, including strategies to avoid plagiarism, identifying sanctions for misconduct, and evaluating academic integrity (Belter and du Pré, 2009). Most studies failed to specify the length of the intervention. Only Newton et al. (2014) indicated that the intervention lasted 1 h.

As for comparators, no intervention was conducted in three of the studies (Dee and Jacob, 2012; Newton et al., 2014; Yang et al., 2019). In the other three studies, the participants included in the control group attended the usual classes (Obeid and Hill, 2017), watched pre-recorded lectures on academic integrity (Henslee et al., 2015), and either did not complete the intervention or attend the course in the previous academic year (Belter and du Pré, 2009).

3.3 Effectiveness evaluation

To assess plagiarism, five studies used specialized software, particularly Turnitin or SafeAssign. However, the plagiarism assessment tasks and strategies varied among studies. Yang et al. (2019) asked the students to write two research reports from 3 and 6 months after the course and classified the type (copying with and without referencing and patchwriting) and severity of plagiarism and the corresponding section of the document. Belter and du Pré (2009) required each student to discuss a clinical psychology case, referencing sources; they measured the number of times the students committed plagiarism. Dee and Jacob (2012) compared written reports, setting the plagiarism threshold at 11% similarity. In two studies, the documents that were used to analyze plagiarism were not clearly identified, with one study reporting the percentage of plagiarism (Obeid and Hill, 2017) and the other, the number of cases of plagiarism (Henslee et al., 2015). In the only study without a specialized plagiarism detection software, the

FIGURE 1
PRISMA flow diagram of the process of the systematic review on plagiarism.
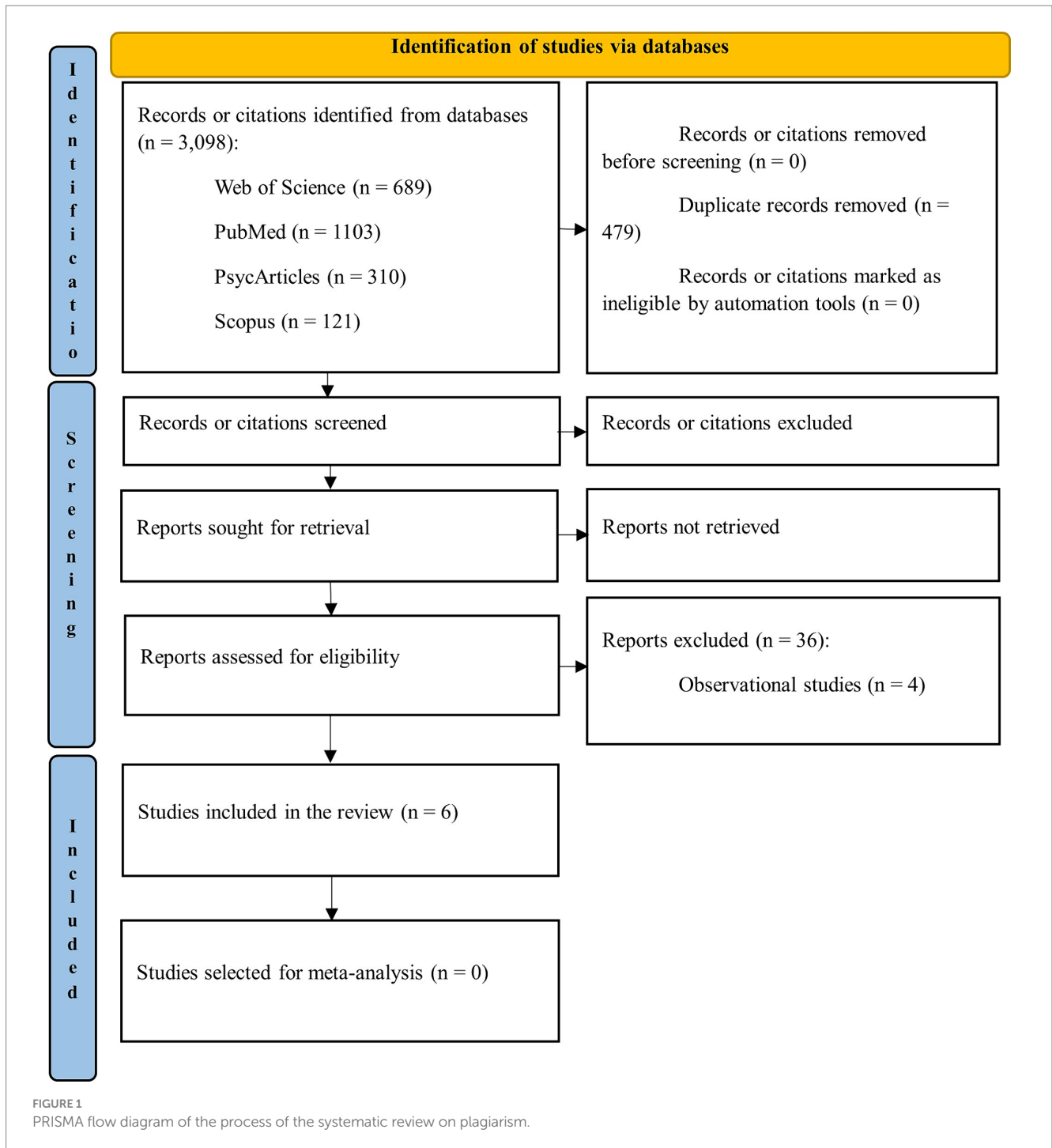
authors relied on a pen-and-paper survey, including a paraphrasing task with a 174-word text (Newton et al., 2014). Five studies reported a lower percentage or number of cases of plagiarism in the experimental group than in the control group; only one study failed to find significant differences between the groups (Henslee et al., 2015).

3.4 The most appropriate strategies

As three studies randomly selected the participants (Dee and Jacob, 2012; Newton et al., 2014; Henslee et al., 2015) and the other three were quasi-experimental studies (Belter and du Pré, 2009; Obeid and Hill, 2017; Yang et al., 2019), their risks of bias were assessed based on the RoB 2 and ROBINS-I criteria, respectively. Broadly speaking, the risk of bias was moderated because the studies not only used appropriate methodological strategies to avoid biases in their data collection and interpretation but also identified difficulties in assigning the participants to the control and experimental groups and limitations in intervention procedures. Table 2 shows the risks of bias of each study and their explanations, and Figures 2, 3 show the corresponding risk of bias graphs. Based on the analysis of these six studies, there is a considerable effectiveness in reducing and

TABLE 1 Synthesis of selected studies.

Study	Design	Sample	Intervention	Comparator	Assessment	Results
Belter and du Pré (2009)	QE/Post	M: Psychology EG = 200 CG = 66 W = (75%) Age = −	Academic integrity module with 4 sections; plagiarism defined and strategies to avoid it; cheating defined and strategies to avoid it; penalties for academic misconduct; and academic integrity evaluation	Undergraduate students of abnormal psychology in the Spring 2004 who did not complete the academic integrity module (vs. students from the 2005 and 2006 classes who completed the module)	1. Material: Each abnormal psychology student was required to discuss a clinical case vignette approximately 3 paragraphs long from a theoretical perspective, referencing at least 4 research studies. 2. Software: Turnitin and Google search. 3. Measure: Content of plagiarized articles.	Cases of plagiarism: EG = 13 (6.5%) vs. CG = 17 (25.8%) $p < 0.05$
Dee and Jacob (2012)	E/ Post	M: Social Sciences and Humanities classes N = 697 distributed into 28 courses; EG courses = 14 CG courses = 14 W = (56%) Age = −	Blackboard-based Tutorial; examples of plagiarism and citations; general strategies (for example, not procrastinating and careful notetaking); questionnaire with examples	No intervention	1. Material: writing assignments. 2. Software: Turnitin. 3. Measure: 11% or higher similarity = Plagiarism.	11 of 14 comparison indicated higher percentages of plagiarism in CG than in EG, $p = 0.027$
Henslee et al. (2015)	E/ Post	M: Psychology EG = 17 CG = 16 W = (52%) Age = 21.25 ± 5.22	Online academic integrity tutorial defining plagiarism, comparing written examples of original and plagiarized work, including specific tips on how to avoid plagiarism, and addressing academic misconduct and institutional policies and procedures	Pre-recorded, online academic integrity lecture without specific written examples	1. Material: −. 2. Software: SafeAssign. 3. Measure: An instructor indicates whether a student plagiarized or not.	Cases of plagiarism EG = 5 vs. CG = 4 ns
Newton et al. (2014)	E/ Post	M: Business and Economy n = 137 EG = − CG = − W = 59(43.1%) Age = 19.06 ± 2.12	Scalable, short training session on paraphrasing, patchwriting and plagiarism	No intervention	1. Material: Pen-and-paper survey assessing knowledge about in–text referencing, paraphrasing (174–word text), preventing patchwriting and avoiding plagiarism.	Citing: EG = 3.66 ± 0.13 vs. CG = 3.22 ± 0.13 $p < 0.05$ Paraphrasing: EG = 3.49 ± 0.19 vs. CG = 2.54 ± 0.20 $p < 0.01$ Avoiding patchwriting: EG = 4.30 ± 0.16 vs. CG = 3.77 ± 0.17 $p < 0.01$ Avoiding plagiarism: EG = 4.93 ± 0.10 vs. CG = 4.55 ± 0.11 $p < 0.01$
Obeid and Hill (2017)	QE/Post	M: Psychology EG = 174 CG = 139 W = (67%) Age = 17–25	Information on plagiarism and paraphrasing; plagiarism contract; handout defining plagiarism; and exercise on recognizing plagiarism	Usual classes, including the university's academic dishonesty policy	1. Material: −. 2. Software: SafeAssign. 3. Measure: Percentage of plagiarism.	Mean percentage of plagiarism: EG = 14.32 ± 17.12 vs. CG = 20.75 ± 26.81 $p < 0.05$ Percentage of students with less than 10% plagiarism: EG = 61.5% vs. CG = 54.7% ns

(Continued)

TABLE 1 (Continued)

Study	Design	Sample	Intervention	Comparator	Assessment	Results
Yang et al. (2019)	QE/ Post	M: Biology EG = 94 CG = 91 W = − E = −	Three-part plagiarism awareness writing assignment: I- primary literature; II- reviewing common writing and plagiarism problems by providing examples; III- summarizing information from a primary literature source	No intervention	1. Material: 2 scientific reports with introduction, methods, results and discussion. 2. Software: Turnitin. 3. Measure: Plagiarism classified as: 3.1. copying with and without referencing, patchwriting and technical parroting; 3.2. no, low, or high severity; and 3.3. section(s) of the document.	Percentage of assignments with plagiarism: EG = 48% vs. CG = 79% $p < 0.05$ Mean number of cases of plagiarism: GE = 0.67 vs. CG = 1.31 $p < 0.05$ Sentences copied with or without references: 68% vs. 75% ns Percentage of instances of severe plagiarism: 34 vs. 32 ns

QE = Quasi-experimental; E = Experimental; Post = With post-intervention assessment; M = major; EG = Experimental group; CG = Control group; W = Women; " − " = Without data; vs. = Versus or comparison; ns = Nonsignificant.

preventing plagiarism in university students, where the intervention strategies that can be considered most appropriate are those that include the definition of plagiarism, practical strategies, such as citation training, plagiarism and paraphrasing exercises, and similarity detection tools. However, it is recommended that greater homogeneity be sought both in the ways in which interventions are implemented and in evaluating the incidence of plagiarism in students.

4 Discussion

We performed an SR to synthesize knowledge on the effectiveness of intervention programs aimed at reducing plagiarism by university students. In most studies, the intervention programs decreased the frequency of plagiarism, as shown by objective evaluation. However, the assessment and intervention procedures considerably varied across studies. Thus far, no SR on the effect of programs intended for reducing plagiarism by university students had been conducted specifically using objective evaluation. The closest topics on which similar reviews had been performed were related to academic dishonesty and included behaviors, such as cheating, data fabrication, and facilitation, in addition to plagiarism (Marusic et al., 2016; Chiang et al., 2022). Furthermore, prior studies have also differed in their design and evaluation procedures. In fact, our results corroborate the findings of two reviews showing that interventions can reduce plagiarism, albeit flagging considerable heterogeneity.

We identified Turnitin and SafeAssign as the most commonly used software programs in the studies reviewed. Other software programs are available to detect plagiarism, such as Viper, Grammarly, Plagiarisma, and Copygator, several of which recommend a percentage lower than 15 or 20% as the plagiarism threshold. However, finding similarity between texts does not necessarily equate plagiarism. Several classifications and types of plagiarism have been proposed, including copying and pasting, patchwriting, failing to add references, or misattribution, among others (Meo and Talha, 2019; Vrbanec and Meštrović, 2021). Additionally, the frequency of similarity may vary in different sections of a document. For example, a higher number of similarities to other documents are expected in the Introduction and Methods than in the Results and Discussion. While no consensus on the elements of plagiarism has been reached yet, researchers should use objective measures to avoid self-report bias, thereby improving the quality of research (Martin et al., 2009), and describe in detail the type and severity of plagiarism, in addition to identifying the section of the document under analysis (Belyy et al., 2018).

The intervention programs reviewed here similarly specified the definition of plagiarism and used specific and practical plagiarism prevention strategies, such as training in paraphrasing and referencing, providing examples, as reported in previous reviews. Those reviews have indicated that the most effective strategies are based on practical (Marusic et al., 2016), motivational, and environmental (Chiang et al., 2022) elements.

In contrast, intervention programs based on the theory of reasoned action advocate that fostering attitudes and subjective norms associating plagiarism with negative behavior and decreasing self-perceived control over the ease of plagiarism can reduce the intention to plagiarize and plagiarism. Nevertheless, these strategies may be inefficient given the complexity of the phenomenon. Students may

TABLE 2 Description of risks of bias.

RoB 2 studies	1. Random sequence generation (selection bias)	2. Allocation concealment (selection bias)	3. Blinding of participants and personnel (performance bias)	4. Blinding of outcome assessment (detection bias)	5. Incomplete outcome data (attrition bias)	6. Selective reporting (reporting bias)	7. Other biases
Dee and Jacob (2012)	Low: The participants were randomly assigned to EG and CG by an online platform	Low: The courses were randomly assigned to EG and CG, without identifying the participants	Low: The intervention consisted of a web tutorial, without direct interaction with the participants	Probable: No information on this procedure was provided in the article	Low: All participants' writing assignments were submitted and analyzed	Low: All data analyzed in this study were reported, both significant and nonsignificant data	
Henslee et al. (2015)	Probable: No information on the randomization of the participants was provided in the article	Probable: No information on this procedure was provided in the article	High: The same instructor was assigned to both groups	Probable: No information on this procedure was provided in the article	Low: All instances of plagiarism and non-plagiarism were reported for all participants	High: Significant differences in sociodemographic variables were reported according to Student's t-test, but neither means nor effect sizes were mentioned	Statistical power (Probable): The number of participants might have affected the significance of the results
Newton et al. (2014)	Low: The participants were randomly allocated to the EG and CG, ensuring that the two groups were equivalent	Low: The authors controlled who was evaluated before (CG) and after (EG) the intervention	Probable: No information on this procedure was provided in the article	Probable: No information on this procedure was provided in the article	High: Initially, 260 participants were included in the study, but only 137 completed the evaluation and intervention process	Low: All data analyzed in this study were reported, both significant and nonsignificant data	
ROBINS-I studies	D1. Bias due to confounding	D2. Bias due to selection of participants	D3. Bias in classification of interventions	D4. Bias due to deviations from intended interventions	D5. Bias due to lack of data	D6. Bias in measurement of outcomes	D7. Bias in selection of the reported results
Belter and du Pré (2009)	Low: The participants were assigned to the groups based only on completing the module or not	High: The participants who did not complete the module were included in the CG, which might have influenced the plagiarism results	Low: The groups were defined with clear criteria at different times	High: The participants in the CG did not complete the module, but were aware of it	Low: No cases of incomplete data were reported	Low: Software was used to detect similarities	Low: The results reflect the analysis of all measurements
Obeid and Hill (2017)	High: Selection bias might have affected the learning process because one group took the course in one semester and the other in the next	Low: The participants were distributed into EG and CG only by chronological order of the semesters, so the CG was not able to know about the intervention	Low: The groups were defined with clear criteria at different times	Low: The groups participated with the intention of attending the same course	Probable: Citations and references were removed to avoid exacerbating the plagiarism results.	Low: Software was used to detect similarities	Probable: An intervention simultaneously conducted the following year in both groups was mentioned in this article.
Yang et al. (2019)	Low: The lab reports were selected from four consecutive quarters; two lab reports from each group were alternately selected for analysis	Low: The participants were distributed into EG and CG only by chronological order of the semesters, so the CG was not able to know about the intervention	Low: The groups were defined with clear criteria at different times	High: In one of the EG courses, students were allowed to select the topic of interest for their report, but not in the others.	Probable: Two reports were excluded because they contained a high number of copied sentences and were deemed atypical cases.	Low: Software was used to detect similarities	Low: The results reflect the analysis of all measurements

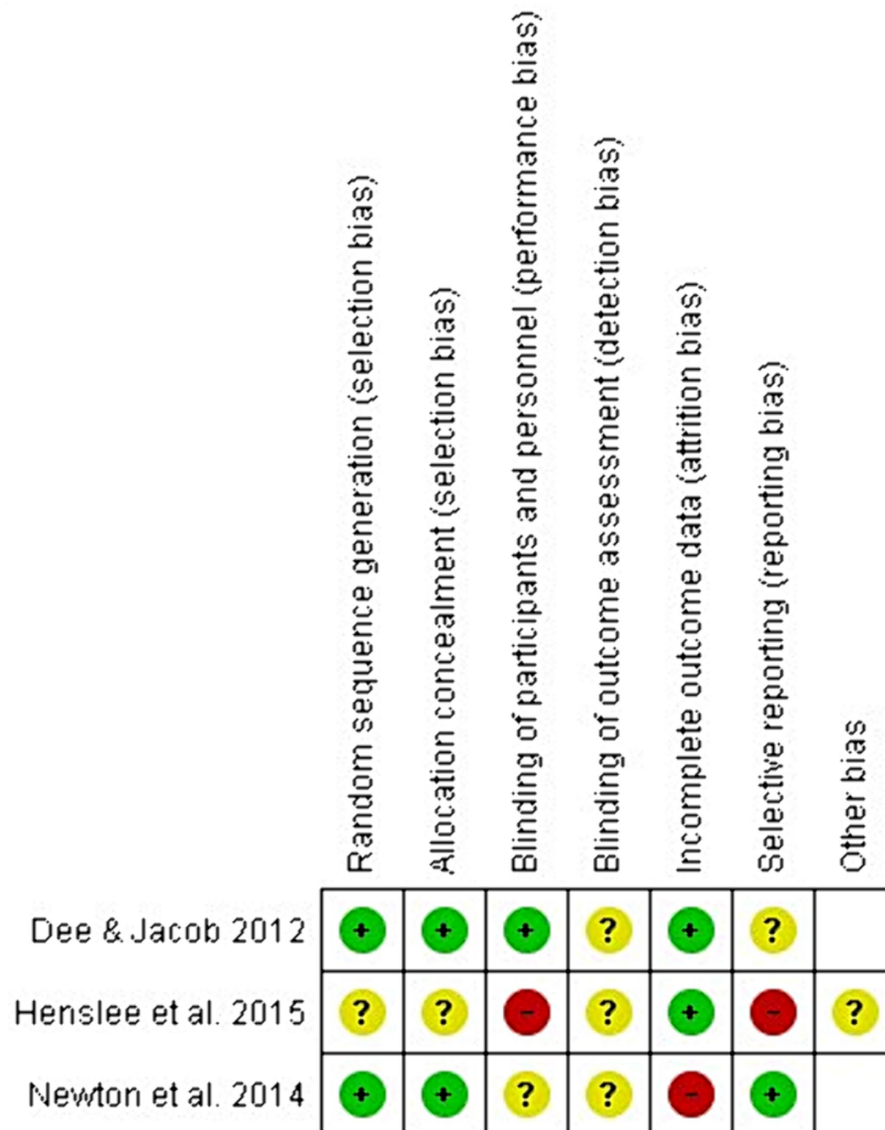D = Domain; EG = Experimental group; CG = Control group.

FIGURE 2
Risk of bias graph (RoB 2).

plagiarize because they feel anxious, consider other values (for example, time) more relevant than plagiarism, overestimate their plagiarizing abilities, perform activities with tight deadlines, or disregard the usefulness of the academic activity, among other reasons. Moreover, environmental conditions may promote plagiarism, such as extenuating circumstances (for example, a sick family member), cultural factors (for example, deeming paraphrasing the author's words disrespectful), implied consent, particularly if the conduct is prohibited, and arguing that others plagiarize as well. Plagiarism may even occur unconsciously, for instance, when reading a document and later thinking that your ideas are your own (Moss et al., 2018).

Sorea et al. (2021) summarized five categories of solutions to the problem of plagiarism, namely improving student training, empowering more engaged teachers, using anti-plagiarism software, enforcing clear anti-plagiarism policies, and educating young people on ethics. These solutions may be translated into general elements of the academic field, such as improving learning and teaching strategies, valuing activities promoting personal and professional development, encouraging collaboration and reducing competition, in addition to including specific elements to reduce plagiarism, such as conceptually defining plagiarism, teaching students appropriate referencing and paraphrasing strategies, highlighting the study reviewed to avoid plagiarism and using similarity detection software. Establishing the minimum number of elements that an intervention should include to reduce plagiarism requires conducting further research detailing its procedures and intervention length as well as using objective evaluation measures (Lendrum and Humphrey, 2012; Schultes, 2023).

In terms of limitations, although the six studies were carefully selected, the evidence derived from this SR may need to

FIGURE 3
Risk of bias graph (ROBINS-I).
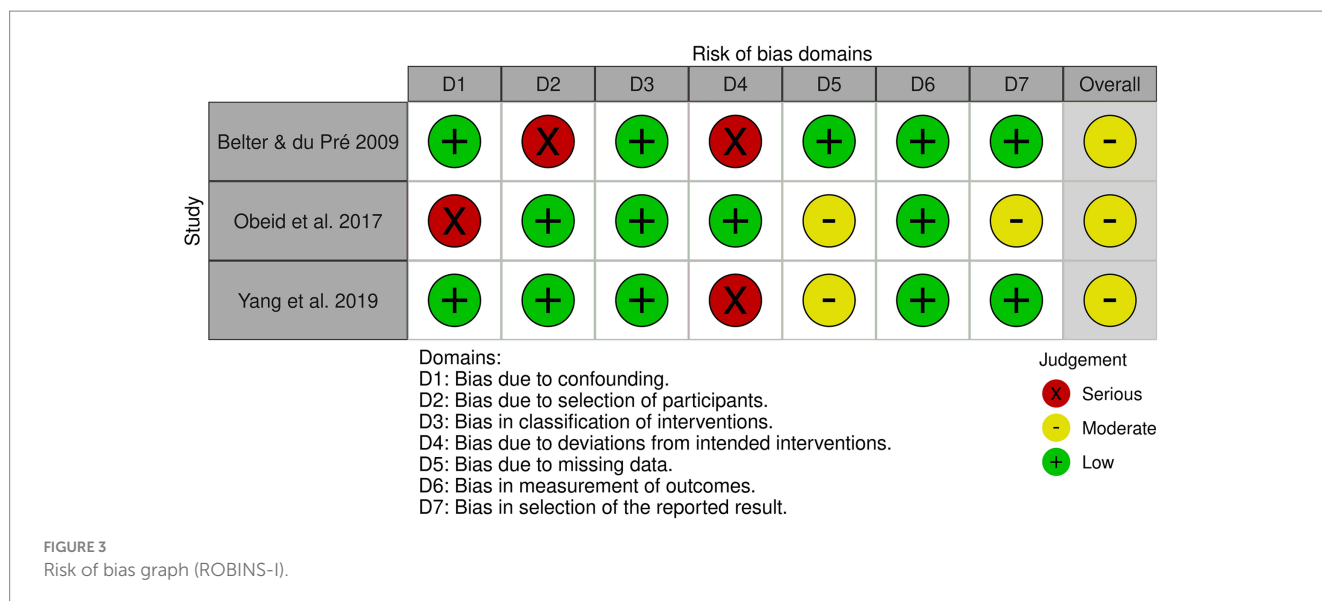
be complemented with other studies that expand the number of empirical foundations. In this sense, we recommend considering the results of this study and contrasting them with those that arise in future research, so that this knowledge can be strengthened or expanded. Other limitation of the present study lies in including only undergraduate students. We included only this population of students with the intention of providing the most precise evidence possible in terms of a target, but the effects of these interventions on graduate students and professional researchers should be assessed because plagiarism has also been reported in these populations (Pupovac and Fanelli, 2015). We also recommend assessing the effect of universities' educational policies and sanctions and differentiating between voluntary and involuntary plagiarism (Bruton and Childers, 2016). Additionally, a key factor is the increasing incursion of artificial intelligence (AI) in education in recent years (Mijwil et al., 2023). Using AI, anyone can produce an apparently genuine document, which has not been previously published, albeit with a striking overlap with similar documents also produced using the same AI and for the same purpose (Misra and Chandwar, 2023). Therefore, future studies should also assess the impact of AI on plagiarism.

5 Conclusion

The results of the present review suggest that university education programs that share information about the characteristics and consequences of plagiarism; include academic integrity modules; promote plagiarism detection, citation, paraphrasing skills; and use similarity detection tools can reduce the frequency of plagiarism from literary sources by undergraduate university students. However, there is little research that evaluates plagiarism objectively and the interventions present a lot of heterogeneity, so it is necessary to carry out more research to reach a conclusion on the effectiveness of interventions to prevent or reduce plagiarism.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

RM-R: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. JS-N: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. AR-R: Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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