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The role of peer mentoring program elements in promoting academic success and preventing student dropout in higher education: a systematic literature review

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ABSTRACT

Peer mentoring programs have been implemented to address higher education institutions' demands for promoting academic success and preventing student dropout. However, it is still unclear what elements best contribute to their effectiveness. A systematic literature review on the peer mentoring programs' elements focused on promoting academic success and preventing dropout was conducted to understand better how to improve peer mentoring effectiveness in academia. Twenty-three studies were included and evaluated for quality. A thematic analysis was developed to report patterns in the elements of the included peer mentoring programs. Results demonstrate the effectiveness of formal peer mentoring programs where participation is voluntary, no financial incentives are provided, and faculty members are involved. Future research must ensure a more detailed description of the peer mentoring programs' elements and robust methodology quality. It is necessary to evaluate the mentoring program's effectiveness by considering mentor screening based on academic performance, matching characteristics, mentoring models, and program coordination feedback, in addition to analysing mentor training efficacy.

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Academic success; higher education; peer mentoring; student dropout; systematic literature review

1. Introduction

Student dropout prevention and academic success promotion are concerns in higher education institutions (Ma and Pender 2023; Tight 2019), especially regarding first-year and at-risk students (Eather et al. 2022). Currently, these concerns also cover political parameters, considering that one of the European Union's strategic objectives until 2030 concerns ensuring that 45% of adults between 25 and 34 years old have a higher education diploma (Council Resolution 2021/C 66/01).

Academic success is defined as 'academic achievement, satisfaction, acquisition of skills and competencies, persistence, achievement of learning objectives, and career success' (York, Gibson, and Rankin 2015, 5). Despite its multidimensionality, studies usually measure this construct as academic achievement (Eather et al. 2022; York, Gibson, and Rankin 2015). In governments and academic institutions, academic success is still commonly assessed by the number of students who graduate (Eather et al. 2022). Contrarily, *student dropout* or attrition is defined as the number of

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students who leave the higher education system without obtaining their diploma (Realinho et al. 2022).

Tinto's Student Integration Model (Tinto 1975, 2006) is one of the most used models to study student dropout (Schuman et al. 2021; Tight 2019). According to this model, is the student integration into the university's academic and social environment that, through continuous interaction between educational, environmental, psychological, and social factors, determines academic achievement and student dropout. Similarly, the systematic review of Bowles and Brindle (2017) considers that the factors facilitating student retention include situational (e.g. having a scholarship, positive support networks, accommodation and high socioeconomic status), dispositional (e.g. self-motivation, academic success and sense of belonging) and institutional factors (e.g. institutional climate, positive relationships between students and teachers, campus support and peer mentoring). Therefore, higher education institutions are essential in promoting academic success and preventing dropout.

To meet these needs, formal peer mentoring programs have been implemented in academic settings, with positive results in terms of academic success promotion and student dropout prevention (e.g. Alonso-García 2021; Lane 2020; Lim et al. 2022; Lorenzetti et al. 2019; National Academies of Sciences Engineering and Medicine (NASEM (2019). Traditionally, *mentoring* is defined as a one-way, long-term support relationship between a senior (mentor) and a junior (mentee or protégé) colleague, where the former is considerably older and more experienced, providing the latter career (e.g. sponsorship and challenging assignments) and psychosocial (e.g. counselling and role modelling) functions (Kram 1983; Mullen 2017).

Peer mentoring emerged with a focus on psychosocial support and reciprocal learning, being defined as a supportive and developmental relationship between students of similar ages and experiences, where senior students (mentors) provide junior students (mentees) with career-related functions, such as giving feedback on academic work and sharing information, and psychosocial functions, such as emotional support and friendship (Mullen and Klimaitis 2019; Terrion and Leonard 2007). For example, in traditional mentoring, a teacher supports a student, while in peer mentoring, a first-year student receives guidance from an upper-level student. Although less common, peer mentoring is also known as a buddy scheme, in which higher-year students are designated as big buddies and lower-year students as new buddies (Naidoo, Byles, and Kwenaita 2021, Pointon-Haas et al. 2024).

In the academic context, peer mentoring's primary goal is to promote student retention and timely completion of their studies (Collier 2017). However, research has identified positive associations between peer mentoring programs in higher education and various student domains, including academic (e.g. integration and academic completion), social (e.g. social interaction and interpersonal skills development), personal (e.g. self-confidence and well-being), and career-related (e.g. leadership skills and teamwork) (e.g. Alonso-García 2021; Lorenzetti et al. 2019; Naidoo, Byles, and Kwenaita 2021). The age proximity between mentors and mentees contributes to these outcomes by encouraging open discussions about doubts and concerns, allowing mentees to follow their mentors' guidance and example in both personal and academic matters (Abbott-Anderson, Gilmore-Bykovskyi, and Lyles 2016; Collier 2017). In fact, the systematic review by Pointon-Haas et al. (2024) on peer support interventions for student mental health and well-being in higher education stated peer mentoring as one of the most effective interventions for reducing anxiety and stress. Furthermore, peer mentor support can complement faculty supervision by helping students obtain relevant information about the university and their academic program, as well as develop the necessary skills and experiences for degree completion (Lorenzetti et al. 2019).

Despite advances in mentoring research, Ziegler et al. (2020) conclude the existence of a mentoring paradox since there is evidence that mentoring can be highly effective, but meta-analyses commonly present small to moderate effect sizes and sometimes even negative effects. Mentoring is susceptible to negative experiences, such as mentor-mentee incompatibility, distance,

and lack of mentor skills (NASEM 2019). Furthermore, the heterogeneity of mentoring implementations and models contributes to inconclusive findings on what elements best promote mentoring effectiveness (Lane 2020; Ziegler et al. 2020). For example, unlike the informal mentoring model, where mentoring relationships occur spontaneously, the formal mentoring model ensures the mentoring relationships' planning, structure, and intentionality (Mullen and Klimaitis 2019). Mentoring may also adopt other formats, such as configurations of one mentor for one mentee (dyadic mentoring), formats that correspond to more than one mentor and mentee (e.g. group mentoring, co-mentoring/collaborative mentoring), and formats with remote interaction (electronic mentoring) (Kram 1983; Mullen and Klimaitis 2019; Stoeger, Balestrini, and Ziegler 2021). In line with this, several authors agree that further studies are required to understand the program design impact on the results obtained (Lorenzetti et al. 2019; Mullen and Klimaitis 2019; NASEM 2019) and Lim et al. (2022) highlight this issue on retention.

To increase the mentoring programs' effectiveness, Stoeger, Balestrini, and Ziegler (2021) outline several key elements that cover the programs' operation and evaluation. Starting with programs' operation elements, these authors suggest that the mentoring programs be based on the state-of-the-art without disregarding their specific idiographic characteristics (i.e. target groups, mentors and mentees, and implementation context), their goals and expectations, mentoring phases, and the provision of mentoring resources, such as individual, economic, cultural, social, infrastructural and didactic resources (Ziegler and Baker 2013; Ziegler et al. 2020; see Table 1 for a clear definition and description of these programs' operation elements). Fallatah et al. (2018) consider that gender,

Table 1. Definition of the program operation elements analysed in the included studies.

Element	Definition	Description
Participation	Type of participation in the mentoring program	Voluntary or mandatory
Mentee screening	Selection method of mentees	Based on academic performance or academic needs
Mentor screening	Selection method of mentors	Based on academic performance, extracurricular achievements, soft skills (social and leadership skills, motivation), or availability
Mentor training	Training to prepare mentors for their role	Focused on soft skills training (e.g. social skills, time management) and program functioning (e.g. goals, mentor roles)
Incentives	Benefits offered to participants	Based on academic credits, mentor ceremony, financial support, certificate or small gifts
Matching	Correspondence method between mentors and mentees	Based on major, participants' preferences or sociodemographic characteristics (e.g. gender, age, race/ethnicity) Through an event, mentoring plan, mentoring contract, or contact by e-mail
Support in initiating mentoring	Support provided at the beginning of the mentoring program	
Meetings type	Frequency of mentoring meetings	Frequent meetings (weekly, fortnightly, monthly, bimonthly) or with a meetings minimum limit Individual or group meetings
Meetings format	Format of mentoring meetings	Based on reports or meetings with program coordination
Regular mentors' feedback	Feedback from mentors provided to program coordination	Based on mentoring, soft skills, academic issues, program reminders
Resources	Materials or dynamics (e.g. workshops) to improve participants' educational and learning processes	Given by faculty members, rectory, students' society representatives, or members related to student support advisory
Didactic		
Institutional	Formal support from academy members on mentoring program functioning and organisation	Through social events and contact with professionals or alumni
Social	Informal social support to promote participants' learning and educational processes	

institutional resources, and mentor attributes such as motivation, interest, and experience can influence program effectiveness; however, their group peer mentoring program demonstrated no significant influences between group and individual mentoring support. Terrion and Leonard (2007) also made a relevant contribution regarding mentoring programs' operationalisation by proposing a taxonomy of fundamental characteristics for the mentors' role effectiveness. According to them, these characteristics essentially include correspondence based on gender, race, study program, and personality; soft skills such as motivation for self-improvement, communication skills, reliability, and flexibility; the ability and willingness to dedicate time; university experience and academic performance; and the interdependent attitude between mentor, mentee and program team, where the latter promotes the personal and professional development of mentors, and there is a reciprocal nature of relationships between peers.

In terms of mentoring programs' evaluation, Stoeger, Balestrini, and Ziegler (2021) emphasise the importance of assessing mentoring programs before, during, and after participation, using measures that analyse behaviours as authentically, objectively, and rigorously as possible. The authors also state the need to use control groups so that results are attributed to the development induced by the program and not to external factors. The use of quasi-experimental studies is a constant need reported when studying mentoring programs in higher education (Alonso-García 2021; Lane 2020).

Despite the efforts to improve mentoring programs' effectiveness in higher education, little research systematically reviews this issue focused on student retention and/or success (Eather et al. 2022; Lim et al. 2022). More studies are needed to determine which elements best enhance the validity of peer mentoring programs (M. Graham et al. 2022). By enabling the identification of future research priorities, addressing questions that are not answered by individual studies, and generating or evaluating theories about how or why phenomena occur (Page et al. 2021), implementing a systematic review about peer mentoring programs focused on preventing student dropout and promoting academic success can allow us to gain more certainty on the elements that contribute to their efficacy. Furthermore, using this methodology provides an opportunity to understand the successful programs' elements across diverse populations, and it can assist in implementing policies that promote quality and inclusive education, as mentioned in the United Nations' fourth goal of sustainable development (Silva 2020).

Considering what was mentioned, this systematic review aims to answer the following research questions: (a) What are the most common elements of higher education peer mentoring programs focused on promoting academic success and preventing student dropout? and (b) What elements contribute to promoting academic success and preventing dropout among students who participate in peer mentoring programs in higher education?

2. Methodology

This systematic review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al. 2021). The search strategy was performed for studies published between 2018 and 2023, being updated to identify new studies published in 2024. It used EBSCO, Web of Science, and Scopus databases. Terms from four themes were combined: mentoring (mentor* OR mentee* OR protégé*) AND peer (buddy OR buddies OR peer*) AND higher education (higher education OR college OR university OR post-secondary OR academ*) AND academic success (academic AND success OR achieve* OR perform*) OR dropout (dropout OR attrition OR retention). The terms of the mentoring and peer themes were searched in the title field, and the terms of the remaining themes (i.e. higher education, academic success, and dropout) were searched in the abstract field. Studies were restricted to open access to align with the principle that 'Open access has the potential to improve

scientific research (through improved reproducibility), involve citizens and society as well as accelerate innovation' (European Commission 2016, 2). The complete search strategy is available upon request from the authors.

Search results were downloaded into Mendeley Desktop version 1.19.8. After removing duplicates, authors independently screened study titles and abstracts and determined if they fulfilled the inclusion criteria. When decisions were unclear, both authors read the manuscripts' full texts separately to ensure an unbiased selection. Disagreements were resolved through consensus afterwards. Studies were included if they reported on: (a) undergraduate or graduate students who participate or have participated in a peer mentoring intervention in the academic context; (b) academic success and/or student dropout as outcomes of peer mentoring interventions performed with higher education students; and (c) programs where mentor support was not strictly related to instruction. Studies were excluded if they reported on: (a) non-higher education students (e.g. faculty members, students in elementary or secondary education); (b) mentors and mentees in the same academic level or that participate in a specific group where they were actively stimulated in diverse competence development, such as a peer-led team learning, a learning community or a class leader project; (c) mentors or mentees with physical diseases or cognitive deficits; (d) studies in which academic success and/or student dropout was not reported as outcomes of peer mentoring interventions. Scientific research not published yet, bibliometric studies, psychometric studies and grey literature were excluded.

2.1. Data extraction and analysis

The first author performed data extraction, and the other one checked it. Disagreements were resolved through consensus afterwards. From each study, the following data was extracted to an Excel spreadsheet: authors, year and country; participants characteristics (i.e. academic year, sample, percentage of women) and setting; mentoring model (i.e. dyadic, group, or co-mentoring; formal or informal) and program duration; peer mentoring program operation elements; evaluation methods; major outcomes.

Thematic analysis was implemented independently by each author to report patterns of meaning (themes) regarding the peer mentoring program operation elements described in each study. Like Gallagher and Hamed (2022), authors began identifying words or phrases that alluded to peer mentoring program elements (e.g. selection and training). The highlighted text segments were then grouped into common themes of those presented in other studies (e.g. Lorenzetti et al. 2019; Stoeger, Balestrini, and Ziegler 2021) focused on the operation of a mentoring program (e.g. mentees screening and mentors training). Data was reviewed to confirm whether any themes needed to be refined. Cross-checking was done until both authors agreed on the final outcome (Creswell 2009).

2.2. Quality appraisal

Following PRISMA guidelines regarding assessing bias risk in the included systematic review studies (Page et al. 2021), the Mixed Methods Appraisal Tool (MMAT), version 2018, was used to evaluate its quality. MMAT was chosen because of its continuous improvement and specific design to evaluate systematic reviews that include quantitative, qualitative and mixed methods studies (Hong et al. 2018). As recommended by the MMAT guidelines, both authors independently assessed the quality of each included study. Disagreements were resolved through consensus afterwards. Table 1 of Supplemental Materials presents the scores of each criterion, although they were not used to exclude studies.

3. Results

3.1. Study selection

In the first research, 285 studies were identified, resulting in 119 after removing duplicates. The titles and abstracts of the 119 studies were screened, with 60 excluded for not meeting the inclusion criteria. The remaining 59 studies were read for eligibility. The second search identified 46 studies, reduced to 25 after removing duplicates. Of these, 12 studies were read for eligibility, resulting in a total of 71 articles to analyse. Forty-eight of these studies were excluded for one of the following reasons: they did not measure academic success or school dropout; the sample did not correspond to university students or peer mentoring program participants; the mentors were not more experienced students than the mentees; they reported programs related to peer-team learning and/or learning communities; they were not empirical studies. Twenty-three studies were included in this systematic review. Figure 1 illustrates the flowchart of the selection process.

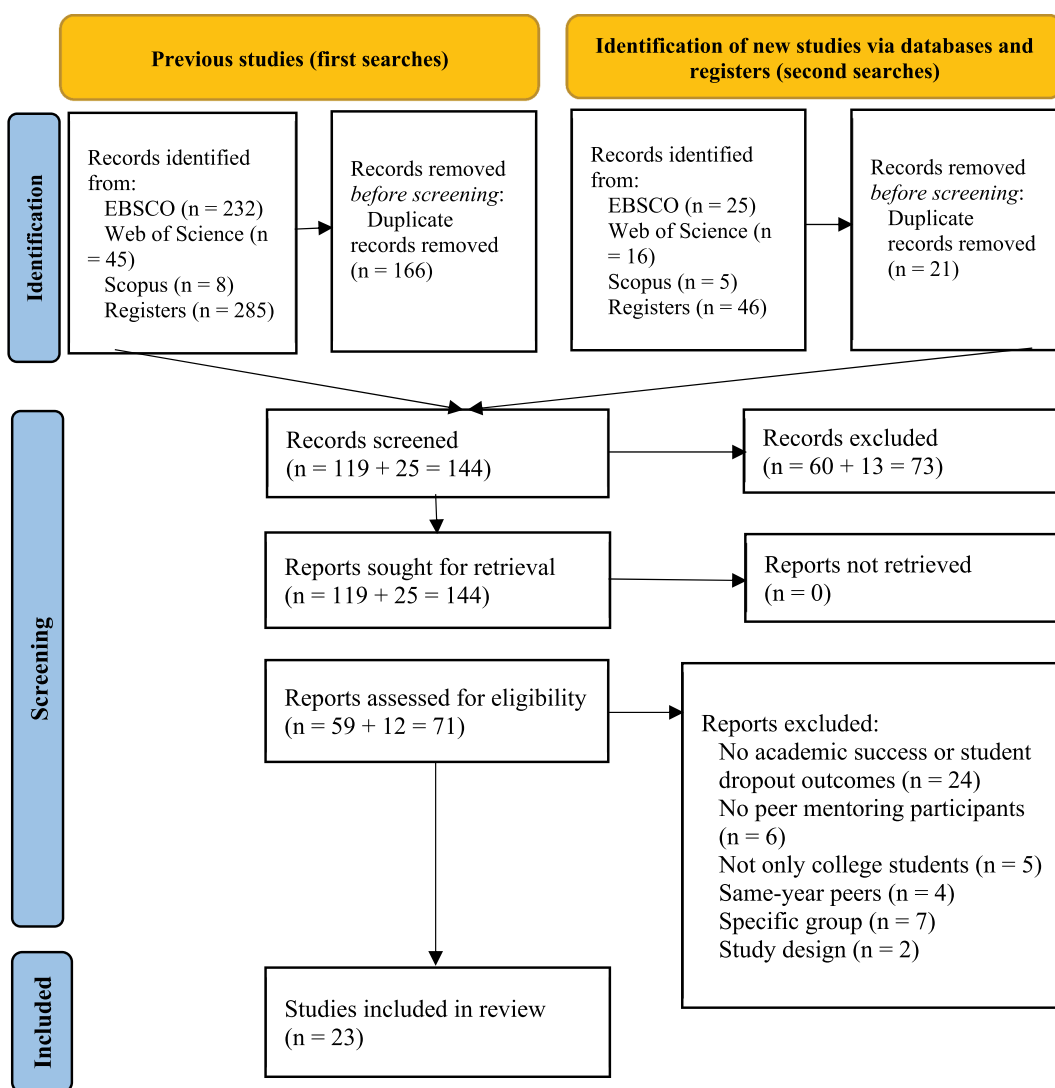


Figure 1. PRISMA flowchart of the study selection process.

Table 2. Simplified overview of the mentoring model, program operation elements and results' significance of the included studies.

Study	1	2	3	4	5	6	7	8	9	10	11	12	13
Alobaid et al. (2024)	F	V	No	Ac	No	Yes	M	Yes	NR	I, G	No	D	Ac*
Ayoobzadeh (2023)	F	V	No	No	No	No	M, P	Yes	F	I	No	No	D*
Boutakidis et al. (2024)	F	V	No	Ac, S	No	Yes	M, P	No	F	G	No	I	Ac*
Etzel et al. (2018)	F	V	No	Ac	R	No	M, P	Yes	F	G	Yes	D, I, S	D
García et al. (2024)	F	V	No	No	No	Yes	M	No	L	G	No	I	Ac*, D*
Fard et al. (2020)	F	V	No	Ac	No	Yes	M	No	L	G	No	I, S	Ac
J. Graham and McClain (2019)	F, I	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Ac
Policha et al. (2022)	F	V	No	No	No	No	M, S	No	NR	I	No	I	No
Rockinson-Szapkiw, Wendt, and Stephen (2021)	F	V	Ac	Ac	No	Yes	M, S	Yes	F	I, G	Yes	D, I	Ac*, D*
Schuman et al. (2021)	F	V	No	No	No	No	M	Yes	F	I	Yes	D, I	Ac*, D*
Venegas-Muggli et al. (2021)	F	V	Ne	Ac, S	R	Yes	M	No	L	G	Yes	I	Ac*, D*
Wu, Thiem, and Dasgupta (2022)	F	V	No	Ac, S	F	Yes	M	No	F	I	Yes	D	Ac
Heim and Holt (2022)	F	V	No	S	No	No	M, S	No	F	I	No	S	No
Lorenzetti et al. (2020)	F, I	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	No
Reister (2023)	F	V	No	Ac, S, Av	No	Yes	M	Yes	F	I, G	Yes	D, I, S	No
Dekhane et al. (2024)	F	V	No	S, Av	F	Yes	M, P	No	F	I, G	Yes	I, S	No
Deshler, Fuller, and Darrah (2019)	F	M	No	Ac, S	F	Yes	M	No	F	G	Yes	D, I	Ac, D
Dos Reis and Yu (2018)	F	V	No	No	R	Yes	M	Yes	F	I, G	Yes	I	Ac*, D*
Foy and Keane (2018)	F	V	No	Ac, S	No	Yes	S	Yes	L	I, G	Yes	I	No
Gallagher and Hamed (2022)	F	V	No	Ac, S, Av	No	Yes	M	Yes	L	I	Yes	I	No
Hall, Serafin, and Lundgren (2020)	F	V	Ne	Ac, S	F	Yes	M	Yes	F	I, G	Yes	I, S	Ac, D*
Liu et al. (2022)	F	V	No	No	R	Yes	M, P	Yes	F	I	No	D, S	No
Thompson-Tinsley and Li (2022)	F	V	No	Ac	R	No	M	Yes	F	I	No	D, S	No

NR = Not reported. **1. Mentoring Model** [Formal (F), Informal (I)]. **2. Participation** [Voluntary inscription (V), Mandatory (M)]. **3. Mentee screening** [Academic standing (Ac), Academic needs (Ne), None (No)]. **4. Mentor screening** [Academic performance (Ac), Soft skills (S), Availability (Av), None (No)]. **5. Incentives** [Financial (F), Recognition (R)]. **6. Mentor training** (Yes, No). **7. Matching** [By major (M), Preferences (P), Sociodemographic characteristics (S)]. **8. Support in initiating mentoring** (Yes, No). **9. Meetings type** [Frequent (F), Limited (L)]. **10. Meetings format** [Individual (I), Group (G)]. **11. Mentor's regular feedback** (Yes, No). **12. Resources** [Didactic (D), Institutional, Social (S)]. **13. Results' significance** [Academic success (Ac), Student Dropout (D), Significant result (*), Significance not measured (No)].

3.2. Study characteristics

The twenty-three included studies reported peer mentoring experiences of university students from various countries and years. Most investigations ($n = 15$) were conducted in the United States, with the remainder in Australia, Canada, Chile, Iran, Saudi Arabia, South Africa, Spain and the United Kingdom. Regarding the year of publication, six studies were published in 2022, four in 2024, three in 2020 and 2021, and two in each of the remaining years.

The methodological procedures comprised cross-sectional, quasi-experimental, comparative, and longitudinal designs, comprising twelve quantitative studies, three qualitative, and eight mixed methods studies. The majority ($n = 10$, 53%) of the investigations only assessed mentees, with one only focusing on mentors and eight on both mentoring roles. In fourteen studies, most participants were female, and eight studies measured participants from two or more cohorts. Table 2 of Supplemental Materials describes the results.

3.2.1. Peer mentoring program elements

The peer mentoring programs reported were analysed regarding the number of participants and the academic context to which they belong, the mentoring model used, the duration, and the program operation elements. The latter were defined based on scientific evidence (Lorenzetti et al. 2019, Stoeger et al. 2021; Ziegler and Baker 2013; Ziegler et al. 2020) in Table 1.

Participants ranged from 5 to 1887, being in undergraduate courses ($n = 16$), master's or doctoral courses ($n = 6$) or both ($n = 1$). Most ($n = 14$, 60.9%) of the peer mentoring programs were

implemented in a single major, and only five favoured multidisciplinary approaches. However, courses in STEM areas (Science, Technology, Engineering and Mathematics) were the main targets investigated, contrary to those in human and social sciences, with 14 studies and two studies, respectively. Seven programs addressed specific characteristics, namely under-represented populations, women, and transfer students or those at risk of failing.

Considering the mentoring model, all studies used formal models, with five (Ayoobzadeh 2023; Liu et al. 2022, Policha et al. 2022; Schuman et al. 2021; Thompson-Tinsley and Li 2022) centred on dyadic mentoring, one (Foy and Keane 2018) in co-mentoring and the remaining 17 in group mentoring relationships. Two studies (J. Graham and McClain 2019; Lorenzetti et al. 2020) reported informal mentoring models, which referred to group mentoring relationships.

The duration and programs' operation elements mentioned in this systematic review were differentiated but not clarified in two studies (J. Graham and McClain 2019; Lorenzetti et al. 2020). As for the duration, the mentoring programs lasted for 1 academic year ($n = 10$), 1 semester ($n = 9$), 8 months ($n = 1$) and 4 weeks ($n = 1$).

Regarding programs' operation elements, Table 2 presents a simplified overview, detailing their association with the mentoring model and the significance of the included studies' results. Participating in the peer mentoring program was mandatory in one study, whereas the remaining 20 programs were based on voluntary inscription. Selection criteria for mentees were considered in three studies, and fifteen included criteria for mentor screening, which were essentially based on academic needs and academic performance, respectively. Most programs also required mentors to participate in mentoring training ($n = 16$), implemented with diverse durations.

During the mentoring relationship, nine studies attributed incentives to the participants – essentially to the mentors –, namely financial incentives or certificates. Similarly, 12 studies adopted strategies to support the mentoring relationship beginning, such as promoting a welcome meeting, developing an action plan, or signing a mentoring contract. Each mentor accompanied between one and ten mentees, with a preference for correspondence based on major similarity ($n = 20$). In nine studies, other factors were considered in the correspondence, such as the mentee's preferences and the life context, sex, age, race, and ethnicity of the participants. There was a propensity to encourage participants to meet frequently ($n = 14$) and facilitate both group and individual meetings when the mentor supported more than one mentee ($n = 7$), with mentors providing to mentoring team regular feedback about these meetings ($n = 12$). Regarding programs' resources, institutional resources were notable ($n = 18$), followed by didactic ($n = 10$) and social resources ($n = 9$).

3.2.2. *Peer mentoring evaluation on academic success and student dropout*

The included studies used various instruments and variables to examine academic success and student dropout. Nineteen studies assessed academic success using informant-report checklists, mentor reports, self-report questionnaires, university records, and interviews. The variables evaluated were the Grade Point Average (GPA) reported by the participant or the university, academic grades in a curricular module, graduation rate, academic performance, and perceived academic achievement.

Both qualitative and quantitative studies showed that peer mentoring benefits participants' academic success. On a qualitative level, the assessed students perceived themselves as more academically successful (Lorenzetti et al. 2019; Reister 2023). Mentors also recognised this, observing a greater impact of their support on mentees' academic development than on mentees' social development (Heim and Holt 2022).

In quantitative terms, although five studies (Dekhane et al. 2024; Gallagher and Hamed 2022; Liu et al. 2022, Policha et al. 2022; Thompson-Tinsley and Li 2022) did not test significance, eight investigations observed significant results, either by comparison with different groups (e.g. no

mentor condition and faculty condition) or different evaluation moments. However, when using GPA, results were not always evident. Three of the five studies that used this measure reported no significant differences. Although the findings of two studies (J. Graham and McClain 2019; Hall, Serafin, and Lundgren 2020) may be unreliable due to the small sample size, the remaining investigation (Wu, Thiem, and Dasgupta 2022) that also evaluated academic success with the STEM graduation rate observed that participants accompanied by female mentors had significantly higher graduation rates than those supported by male mentors, contrary to GPA.

Concerning student dropout, this construct was evaluated in 11 studies using university records and self-report questionnaires. Dropping out of college was measured using retention and dropout rates, attendance, intention to leave major, and perceived persistence in the major choice. The results demonstrated significantly positive effects, except for two studies (Deshler, Fuller, and Darrah 2019; Etzel et al. 2018). Two studies (Dekhane et al. 2024; Foy and Keane 2018) did not test the significance of differences.

3.3.3. Elements of the peer mentoring programs that contribute to academic success promotion and student dropout prevention

The elements of peer mentoring programs that may contribute to promoting academic success and preventing student dropout were described through the included studies that tested significance. Eight studies showed significant positive results in academic success, whereas seven studies observed significant benefits regarding student dropout prevention. On the contrary, four studies and two studies, respectively, found non-significant results.

Regarding academic success, all eight studies with significant positive results on this variable operated through voluntary participation, used a formal mentoring model where mentors and mentees were matched based on their major, had no financial incentives, and were institutionally supported. Most studies, except one, promoted mentor training and organised mentoring groups instead of dyads. Of the four studies presenting non-significant results, one did not report program elements. In the remaining three studies, all evaluated mostly female mentees, mentors were selected based on their academic performance and were trained. Furthermore, major-based correspondence was used, participants received financial incentives, and frequent mentoring meetings were required, with mentors giving regular feedback to the program organisation.

Concerning student dropout, all seven studies that found significant results implemented a formal mentoring model with voluntary participation where mentors and mentees were matched based on their major. Most studies, except one, did not provide financial incentives but gave institutional resources to participants and required mentors to provide regular feedback to the program's organisation. The two studies (Deshler, Fuller, and Darrah 2019; Etzel et al. 2018) that presented non-significant results screened mentors by their academic performance, matched participants by major, only encouraged group mentoring meetings and required mentors' regular feedback to the program organisation. Additionally, institutional and didactic resources were provided. Note, however, that these two studies had the lowest retention rates regarding participant responses. Table 3 systemises the results obtained in this context.

3.3. Quality appraisal

The MMAT evaluated three qualitative studies, seven non-randomised quantitative studies, two quantitative randomised controlled trials, three quantitative descriptive studies, and eight mixed methods studies (Table S1 of Supplemental Materials). In these last manuscripts, beyond the qualitative appraisal, two studies were quantitative non-randomised, and six were quantitative descriptive.

Three qualitative studies (Heim and Holt 2022; Lorenzetti et al. 2020; Reister 2023), three quantitative non-randomised studies (Boutakidis et al. 2024; García et al. 2024; Venegas-Muggli, Barrientos, and Álvarez 2021), and one quantitative randomised clinical trial (Wu, Thiem, and

Table 3. Common program elements of peer mentoring programs that contribute to academic success promotion and student dropout prevention.

	Academic Success	Student Dropout
Studies with significant results	Program Organization: – Voluntary participation* – Formal mentoring model* – Matching by major* Mentoring Interaction: – Group meetings (except one) Mentoring Support: – Mentor training* (except one) – No financial incentives* – Institutional resources*	Program Organization: – Voluntary participation* – Formal mentoring model* – Matching by major* Mentoring Support: – No financial incentives* (except one) – Mentor’s regular feedback* (except one) – Institutional resources* (except one)
Studies with unsignificant results	Program Organization: – Mentor screening by academic performance* – Matching by major* Mentoring Interaction: – Frequent meetings* Mentoring Support: – Mentor training* – Financial incentives – Mentor’s regular feedback*	Program Organization: – Mentor screening by academic performance* – No mentee screening* – Matching by major* Mentoring Interaction: – Group meetings Mentoring Support: – Mentor’s regular feedback* – Didactic resources – Institutional resources*

In studies regarding academic success, eight studies with significant results and three non-significant are presented. On student dropout studies, seven studies with significant results and two non-significant studies are presented. The characteristics with an asterisk (*) were the most used in all studies in this systematic review.

Dasgupta 2022) presented high methodological quality, representing 30% of the studies. However, the remaining research presented significant methodological limitations. In quantitative studies, common issues included unrepresentative samples – evidenced by low retention rates, ranging from 18% to 47%, and small sample sizes, ranging from 6 to 27 participants – as well as measures without proper validation regarding fidelity and validity. In the qualitative studies of mixed methods approaches, we observed no clear links between data sources, collection, analysis, and interpretation. These central issues affected the overall quality of mixed methods manuscripts, whose evaluation depended on the individual assessment of their qualitative and quantitative components to minimise potential threats to trustworthiness, as outlined in the MMAT (Hong et al. 2018).

4. Discussion

The present study reviewed 23 studies focused on implementing peer mentoring programs in higher education to promote academic success and prevent student dropout. We aimed to understand the current and most used peer mentoring programs elements implemented in higher education to promote academic success and prevent student dropout, as concerns in academic institutions and political goals (Council Resolution 2021/C 66/01; Ma and Pender 2023; Tight 2019). However, to determine which specific elements may be contributing to the effectiveness of these programs, we compared the mentoring programs’ elements between the included studies that tested significance. Eight studies on academic success and seven on student dropout demonstrated significant results. On the contrary, four studies and two studies, respectively, concluded non-significant findings.

The manuscripts identified in this systematic review support the mentoring operation proposed by Stoeger, Balestrini, and Ziegler (2021), as they consider mentors and mentees screening, mentor training, mentor-mentee matching, and monitoring and support of mentoring relationships through institutional, didactic, and social resources. However, when comparing the peer

mentoring programs' elements in terms of the significance of the results, only two elements stand out in all studies that reported academic success promotion and student dropout prevention as outcomes. According to our findings, all these studies implemented formal peer mentoring programs with voluntary student enrolment, highlighting the importance of mentoring relationships' structuring, planning, and intentionality (Mullen and Klimaitis 2019). Abdolalizadeh et al. (2017) found that participants preferred formal mentoring programs due to the reciprocal commitment and reliable, precise, and specific guidance from mentors. Likewise, Lim et al. (2022) point out that the organisation of the mentoring program is fundamental to the mentors' effectiveness in the mentee's learning experience, emphasising the relevance of formal programs for academic success. Voluntary participation is also considered necessary for mentoring success since it contributes to participants' motivation to benefit from their mentor's support, thus increasing the likelihood of academic achievement (Cho and Lee 2021). Hall, Serafin, and Lundgren (2020) even reported that when they required mandatory participation in their pilot study, participating students' retention rate and average grades were lower than nonparticipants with a similar academic profile.

When examining the mentoring programs' elements that were only present in one of the investigated variables (i.e. academic success and student dropout), relevant information was also found. Regarding academic success, all mentoring programs that demonstrated significant positive results of this variable included institutional resources and no financial incentives, emphasising the importance of academy members' support rather than monetary incentives. The significant increases in academic success reported in all programs with financial incentives' absence reinforce that peer mentoring programs are cost-efficient (Eather et al. 2022). Results also align with Lim et al. (2022), who stated the importance of academic institutions' involvement in peer mentoring programs. Similarly, Heath and Dagri (2022) found increased peer mentoring program completion rates when professors were included directly in first-year seminar courses. The authors concluded that, although peer mentoring allows sharing common ground and encourages trusting relationships, the teacher's presence demonstrates to mentees that mentoring relationships imply responsibility. However, McConney and Fourie-Malherbe (2022) point out the need to keep mentor and mentee administration simple and minimal. This finding leads us to consider that academy members' support may have positive influence on mentoring program results, but it should not limit participants' autonomy in developing their mentoring relationships.

In case of student dropout, it is likely that institutional resources and no financial incentives also contribute to student dropout prevention, as they were present in most programs showing benefits in this area, except Ayoobzadeh (2023), who did not report using institutional resources but presented significant decreases in dropout intention, and the study by for Hall, Serafin, and Lundgren (2020), who found significant increases in retention rates in a program in which mentors were paid

It is also critical to consider the mentoring programs elements that were present in all studies reporting non-significant results. This occurred in respect to mentors screening based on academic standing, despite being one of the most used elements in the peer mentoring programs. The presence of mentors screening based on academic standing in all mentoring programs with non-significant results denotes that this characteristic can be hindering the peer mentoring programs effectiveness on academic success promotion and student dropout prevention. Terrior and Leonard (2007), despite stating that mentors with good academic performance are effective, suggested further research to evaluate mentors who failed or struggled at the academy beginning, but learnt to be successful, despite having a grade point average below the student model. Rockinson-Szapkiw, Wendt, and Stephen (2021) also provided valuable insights on this topic as they were the unique reviewed study to select mentors with low academic performance, in contrast to the remaining studies, that screened only mentors with high academic performance. Considering that these

authors demonstrated that both mentors and mentees improved STEM achievement when compared to the control group, we hypothesise that mentors' selection based on their high performance is an element affecting peer mentoring programs effectiveness. For a more precise understanding of this issue, we suggest additional studies that compare the effectiveness of mentors with high academic performance to mentors with low academic performance in the context of peer mentoring programs.

Finally, this systematic review identified specific elements used in most mentoring programs studied but that were present in both studies with significant results and studies with non-significant outcomes, making it inconclusive to determine their contribution to mentoring programs' effectiveness. These elements included mentor training, major-specific matching, peer mentoring groups, and mentor's regular feedback. Mentor training is fundamental to improving mentors' skills (Stoeger, Balestrini, and Ziegler 2021), which McConney and Fourie-Malherbe (2022) argue should be considered when screening mentors, namely their attentive, open, and empathetic attitude towards mentees and their genuine interest in helping them. To better understand the mentor training impact, and given that structured training is more efficient than when it is not formally implemented (Lim et al. 2022), it is necessary to invest in studies that individually evaluate mentor training effects instead of focusing on evaluating the effectiveness of mentoring programs that include mentor training (e.g. Hall, Serafin, and Lundgren 2020; Reister 2023; Rockinson-Szapkiw, Wendt, and Stephen 2021).

Concerning matching based on major, we consider that the inconclusive results may be caused by the fact that most included studies only implemented their mentoring programs in one major. Expanding the initiative to all the institution's student body can mitigate data bias. However, given that all studies (Ayoobzadeh 2023; Boutakidis et al. 2024; Rockinson-Szapkiw, Wendt, and Stephen 2021) who complemented the mentor-mentee correspondence by major with the mentees' preferences or participants' sociodemographic characteristics obtained significant results in at least one of the variables of this study (i.e. academic success and student dropout), it seems to us that course-based matching alone may not be sufficient to guarantee programs' effectiveness. This hypothesis is partially supported by Wu, Thiem, and Dasgupta (2022), who identified that female engineering mentees partnered with female mentors had significantly higher STEM graduation rates than female mentees in the male mentor condition. However, there were no significant differences in terms of GPA. Terrion and Leonard (2007) also found conflicting results regarding matching based on gender and race. Further research is thus required to determine the most appropriate characteristics for mentor-mentee matching.

Regarding group peer mentoring programs unclearness in contributing to mentoring programs' effectiveness, McConney and Fourie-Malherbe (2022) meet this incongruity by noting that group contacts (when applicable) should not replace individual contacts. However, Lorenzetti et al. (2019) conducted a systematic review of graduate students' mentoring experiences, which confirmed its prominence as the most prevalent mentoring format in peer mentoring programs. To clarify these results, it is essential to develop comparative studies between different mentoring formats, as Stoeger, Balestrini, and Ziegler (2021) suggested as a strategy for improving mentoring programs.

The request for the mentor's regular feedback was another inconsistent element. However, note that although the mentioned characteristic was present in two studies with non-significant results regarding student dropout (Deshler et al. 2019; Etzel et al. 2018), they had the lowest response rate, making data less reliable. Spaulding et al. (2020) clearly demonstrated the importance of mentor feedback in minimising student dropout, when stating that it enabled staff to follow up with targeted students to get them back on track. Foy and Keane (2018) proceed similarly, requesting that mentors provide a regular report to ensure the mentees' needs are addressed with academic staff. On the other hand,

the non-significant academic success results in studies that requested mentors' regular feedback can be explained by the fact that, by increasing mentors' workload, this request may be decreasing their motivation and time to support mentees, problems that were already identified in mentoring relationships (NASEM 2019, Reister 2023). Comparative studies between different forms (e.g. meeting vs. reports) and frequencies (e.g. monthly, weekly and only at the end of the program) may help to understand the adequacy of regular feedback from mentors.

Despite the potential of this study, it is important to acknowledge its limitations, which allow future research to be considered. First, restricting studies by year of publication, open access, and study type may have excluded valuable studies on the theme. Contemporary studies aligned with the European Commission principle (2016) were reviewed, however the choice of open access articles does not exclude the possibility that important findings may exist in studies behind paywalls. Future research may broaden the scope of published studies by extending the publication year, including non-open access studies, unpublished research, bibliometric studies, and grey literature, and consulting the reference lists of the included studies. Still regarding research strategy, the second limitation is that research on academic success was only associated with academic performance, which is just one aspect of this multidisciplinary variable (York, Gibson, and Rankin 2015). Future studies might assess the remaining dimensions, such as career success and satisfaction (York, Gibson, and Rankin 2015). Third, most reviewed studies had methodological limitations, mainly caused by the small sample size and the use of instruments not effectively tested. Although peer mentoring is likely to have a greater impact on subjective variables, such as satisfaction, than objective variables, such as GPA and rates (Alonso-García 2021), we consider that conducting studies with multiple cohorts (e.g. Gallagher and Hamed 2022; Wu, Thiem, and Dasgupta 2022) and using objective measures (Schuman et al. 2021; Stoeger, Balestrini, and Ziegler 2021; Venegas-Muggli et al. 2021) can address these limitations. It should be noted, however, that, despite being a widely used objective measure, GPA may have limitations in terms of assessing academic success, as Wu, Thiem, and Dasgupta (2022) found that graduation rates increased significantly across mentor gender, contrary to GPA. In this sense, using different measures to assess academic success may be appropriate. Reduced methodological quality may have contributed to the fourth constraint, which is that most studies were from the United States and implemented formal mentoring programs with undergraduate students from a specific STEM major, using primarily female samples. Given that these characteristics may bias the results, it is vital to increase research in European and Eastern countries, implementing programs that cover several cycles of study and majors (including those from human and social sciences) within the same institution or, as suggested by Eather et al. (2022), across multiple universities. It may also be relevant to conduct comparative studies of formal and informal programs to determine the most appropriate format (Stoeger, Balestrini, and Ziegler 2021). Finally, some studies are being published without describing their peer mentoring program (e.g. J. Graham and McClain 2019; Lorenzetti et al. 2020) or presenting it with details on their elements (Ayoobzadeh 2023; Policha et al. 2022). We urge researchers to carefully describe mentoring programs' elements in their studies and reviewers to consider how they are being concretely described so that they may be studied in comparative studies and replicated in other contexts when successful.

5. Conclusion

The present study contributed to practical and theoretical insights to enhance the mentoring programs' efficacy and sustainability, as well as contemporary practices discussion. Based on this systematic review's findings, we propose a framework in Figure 2 with actionable recommendations organised by priority to guide implementers, researchers, and reviewers of peer mentoring programs implemented in higher education to promote academic success and to prevent student dropout.

Priority	Program Implementers	Researchers
High	Implement formal mentoring programs with voluntary participation of mentors and mentees, ensuring structured, planned, and intentional mentoring relationships. Rationale: all included studies with these elements presented significant results on academic success and student dropout.	- Provide detailed and transparent reports of program elements (i.e., voluntary or mandatory participation, mentor and mentee screening, mentor training, incentives, matching criteria, support in initiating mentoring, meetings type and format, mentor feedback, available resources)*. - Use representative samples, incorporating multiple cohorts if necessary, and apply objective or validated measures to assess academic success and student dropout. - Increase research in European and Eastern countries and replicate programs in multiple universities. Rationale: increases the possibility of reliable results by reducing methodological problems.
Medium	Avoid monetary incentives for participants and encourage the academic members (i.e., faculty and student representatives) to support program planning and operation. Rationale: all included studies with these elements presented significant results on academic success, with most also reporting these results in preventing school dropout.	Conduct studies comparing the effectiveness of mentors with high versus low academic performance. Rationale: although most of the included studies presented mentor screening based on academic standing as an element, they all presented non-significant results in academic success and student dropout.
Low	Expand the mentoring program to the entire university student body, covering all academic courses and cycles. Rationale: although the included studies on mentor-mentee matching based on academic major showed both significant and non-significant results regarding academic success and student dropout, most of their programs were implemented in a single major, increasing the likelihood of biased results.	- Conduct studies that assess the effects of mentor training separately from the overall effectiveness of the mentoring program. - Investigate how different mentor-mentee matching characteristics (e.g., course, mentee preferences, participants' sociodemographic characteristics) affect academic success and student dropout. - Conduct comparative studies on different mentoring models (e.g., dyadic, group, informal, formal). - Design comparative studies between different forms (e.g., meetings vs reports) and frequencies (e.g., monthly, weekly, only at the end of the program) of mentor's feedback to program coordinators. Rationale: the included studies with these elements presented both significant and non-significant results on academic success and student dropout.

Figure 2. Framework for promoting academic success and preventing student dropout through peer mentoring programs. *This is also a crucial recommendation for reviewers to consider.

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Mariana Guerreiro: Conceptualisation, Methodology, Formal analysis, Investigation, Resources, Writing – Original draft, Project administration, Funding acquisition, Writing – Review & Editing. **Saúl Neves de Jesus:** Conceptualisation, Formal analysis, Resources, Supervision, Writing – Review & Editing.

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