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Review

A Systematic Review of Engineering Students in Intercultural Teamwork: Characteristics, Challenges, and Coping Strategies

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Abstract: In response to the challenges posed by globalization and internationalization, engineering education programs are increasingly focused on knowledge, technologies, and competence that meet global needs. Against this backdrop, higher engineering students are often encouraged to collaborate in teams with others from diverse, cultural, and disciplinary backgrounds, for the purpose of preparing them to accommodate change and innovation across international working contexts. Within a growing number of intercultural systematic and meta-analysis reviews in engineering education, little attention has been paid to intercultural team characteristics, and even less has been given to the challenges of intercultural teamwork and the relevant coping strategies. Using a systematic approach, this paper reviewed 77 journal articles to identify the intercultural team characteristics of engineering students based on team formats, level of collaboration, learning goals, evaluation methods, and learning gains. Through the process of intercultural collaboration, several challenges and corresponding coping strategies were reported at the individual, relational, and contextual levels. Recommendations for future practice for engineering educators and programs faculties, and future research directions for engineering educational researchers, are proposed in order to support engineering students' intercultural team learning.

Keywords: challenges of international teamwork; coping strategies for intercultural teamwork; engineering education; intercultural team collaboration; systematic review

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1. Introduction

Teamwork is the predominant mode of professional practice in engineering, and engineering students nowadays are often required to actively participate in team projects or tasks and collectively address disciplinary, process-related, and complex problems [1]. An effective and well-functioning collaborative learning environment supports students' agency, sense-making [2], self-regulated learning [3], persistence, motivation [4], achievement, and skill acquisition [5]. In recent decades, several systematic and meta-analysis reviews have focused on engineering team issues, presenting a summary of evidence on topics such as the main effects of personality traits on team performance, team effectiveness, learning outcomes, and team competence development [1,6,7].

As global challenges become more complex and universities become more international, engineering students must focus on the knowledge, technologies, and competences that not only to define their own field of expertise, but are also essential to meet global needs and work with others from diverse backgrounds [8,9]. To meet these requirements, many institutions now deploy international project teams to prepare their students for accommodating change and innovation in future intercultural and international workplaces [10].

In order to systematically analyze intercultural teamwork, it is necessary to understand the notion of culture first. Handford et al. [11] framed culture as both a given and as a construct. The culture-as-given approach understands culture as predefined groups based on nationality, and emphasizes the differences between other (national) cultures [11,12]. However, this approach has widely received criticism for being overly simplified, due to the limitations of its focus on nationality. The culture-as-construct approach regards culture as something "liquid" in which subjectivity, knowledge, and society are all dynamic and context-bound [13]. They interact with and influence each other and co-construct meanings regardless of national frontiers, and have blurred boundaries [14]. Therefore, an intercultural team describes a group of individuals from different backgrounds interacting in order to complete assigned, interdependent tasks, and to share responsibility for the final results [15]. In addition, it has been recognized as a collective entity, with team members interacting with other small groups or even larger socio-cultural settings [16].

Prior studies indicate that through intercultural team collaboration, students benefit from increased self-awareness and sensitivity [17], reduction of prejudices and stereotypes [18], and the development of new ideas, learning practices, and interaction skills [19]. However, challenges experienced by students in intercultural teamwork might constrain their learning and cause negative outcomes. An increasing number of articles have revealed that engineering students encounter challenges in communication and collaboration such as language barriers [20], a lack of interpersonal relations [21], and different ways of working and thinking [22], indicating that it is therefore necessary to summarize these intercultural team challenges from previous research articles in a more comprehensive manner. Furthermore, the coping strategies used to address these challenges must also be investigated to provide engineering students, engineering educators, and educational institutions with practical implications and recommendations.

Given the increasing focus on internationalization and teamwork in engineering education, it is therefore necessary to establish a broader understanding of the nature of intercultural teams. Despite the fact that a great number of studies have reported student teamwork in an intercultural setting, no comprehensive overview of this topic has been formulated as of yet. This research gap inspired us to generate deeper insights into the current characteristics of intercultural teams, as well as the challenges and coping strategies documented in the empirical engineering education research. In addition, it is hoped that this systematic review will contribute to our knowledge on the definition of culture, the context of intercultural collaboration, ways of preparing engineering students for working in intercultural teams, and their learning gains from intercultural team experiences. Finally, this paper will expand both the educators' and institutions' understanding of how engineering students' teamwork can be evaluated, and which team learning goals should be set. Therefore, this study aims to address the following research questions:

(1) What are the characteristics of intercultural team collaboration that have been reported in engineering educational research in terms of the formats, countries, level of collaboration, learning goals, evaluation methods and learning outcomes?
(2) What challenges have engineering students encountered in intercultural team collaboration, and what are their corresponding coping strategies?

2. Methodology

This study used a systematic review approach, which is defined as "a systematic, transparent means for gathering, synthesizing, and appraising the findings of studies on a particular topic or question. The aim is to minimize the bias associated with single studies and non-systematic reviews." [23] (p. 1).This approach allowed our study to make important contributions not only by presenting a comprehensive and explicit summary of the available evidence on our topic of intercultural team collaboration among engineering students, but also by using a rigorous and scientific approach to analyze the relevant works. To this end, a three-stage process was implemented, which was as follows: (1) planning the review; (2) conducting the review; and (3) reporting and dissemination [24,25]. Each stage will be elaborated in the following sections.

2.1. Stage 1. Planning the Review

2.1.1. Scoping, Search Terms, and Documentation Sources

As suggested by Booth et al. [25], this study began with an informal scoping search and review in September 2022, which served as a "trial run" for the systematic review in the next round. The scoping search and review enabled us to become familiar with the topic of international team effectiveness for engineering students, determine the research questions, refine the search strings, identify the relevant databases, examine the range of the literature, and develop an appropriate search strategy. In October 2022, the initial keywords were reviewed and revised by three librarians who had rich experience on database search and literature reviews. Table 1 shows the refined search strings.

Table 1. Keyword search string.

BLOCK	KEYWORDS
Block 1	Inter- OR cross- OR trans- OR multi-
AND	
Block 2	Cultur * OR nation *
AND	
Block 3	Team OR group OR collaboration OR cooperation
AND	
Block 4	Higher education OR HE OR universit *
AND	
Block 5	Engineering

* Truncation to broaden the search.

To ensure that the relevant literature was retrieved, five online databases, representative of engineering education, were consulted in October 2022: (1) Web of Science; (2) Scopus; (3) EBSCO; (4) ERIC (via ProQuest); and (5) Engineering Village. The key factors for selecting these databases were their extensive resources on journal articles, conference papers, and other documents, and their diverse coverage of engineering practice, research, projects, and concepts [26].

2.1.2. Inclusion and Exclusion Criteria

The search was limited to peer-reviewed journal articles in English to ensure the quality of the sources to be utilized and a manageable number of papers for analysis. A previous systematic review on intercultural learning in engineering education investigated the conceptualization of culture from 2000–2015 [11]. For this study, the timeframe was thus set from 2000 to 2022, which not only provides an updated overview of current intercultural studies, but also lays the groundwork for investigating intercultural team environments since the early 2000s. Furthermore, our informal scoping review found that relevant papers regarding this topic have proliferated since the 2000s. In order to focus on the empirical evidence on the students' intercultural team performance and challenges, conceptual and theoretical studies were excluded. The results of the scoping review indicated that while several prior systematic reviews and meta-analyses provided inspiration and a starting point, they do not directly address the focus of the current study. Therefore, while they were not analyzed, they were utilized for additional snowball searching, as the context for this study must be conducted within higher education in engineering. Full inclusion and exclusion criteria are presented in Table 2.

Table 2. Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Publication year	2000–2022	
Language	English	Not written in English
Type of manuscript	Journal articles	Conference papers, book chapters, dissertations, proposals, and reports
Type of publication	Research papers, project papers, and introduction of practice	Conceptual papers, systematic reviews, etc.
Topic	Intercultural team collaboration of engineering students	Students' international mobility, international co-authorship and research cooperation, international teachers' collaboration, introduction of the study abroad program, etc.
Context	Engineering education	Medicine, nursing, mathematics, and science
	Higher education	K-12 education, vocational education, and continuing education

2.2. Stage 2. Conducting the Review

2.2.1. Selection of Studies

The filtering process adopted the search-screen-appraise method recommended by Borrego et al. [26] in engineering education, in which studies are filtered based on titles and abstracts, and subsequently appraised for inclusion based on full-text analysis. Figure 1 illustrates the filtering process. In order to keep the results manageable, the review was initially limited to title, abstract, and keywords or topics retrieved from the five databases. The initial search yielded 769 articles. After removing 46 duplicates, a total of 723 articles were sorted for the further screening.

The first phase of screening reduced the number to 235 studies. Studies with irrelevant titles and keywords were removed, as were systematic reviews and conceptual papers. Following the process of abstract screening, the sample was further narrowed down to 95 articles. A total of 140 articles were excluded due to their focus on K-12 education, vocational education, continuing education, other higher education stakeholders (e.g., staff, teachers, institutions, or administration), or covering other fields (e.g., medicine, science, or mathematics). The selection process was repeated twice to ensure that any relevant publications had not been mistakenly removed. Through full-text screening, a total of 62 studies were selected for further open-coding analysis. The full-text screening process filtered out 33 studies due to their focus on the following: (1) international co-authorship among researchers; (2) collaboration among different institutions across countries; or (3) students' international mobility without emphasis on their team performance. As electronic searching may miss significant published studies, where the level of indexing is limited due to errors, inaccuracy, or concepts lacking appropriate subject headings [25], we identified further sources by manually examining the reference lists of these 62 studies and relevant systematic reviews. A total of 15 additional relevant non-indexed journal articles, such as Bani-Hani et al.'s [22] study published in the Journal of Problem-Based Learning in Higher Education, were found and subsequently included in this review. As a result, the final number of selected articles for our review was 77.

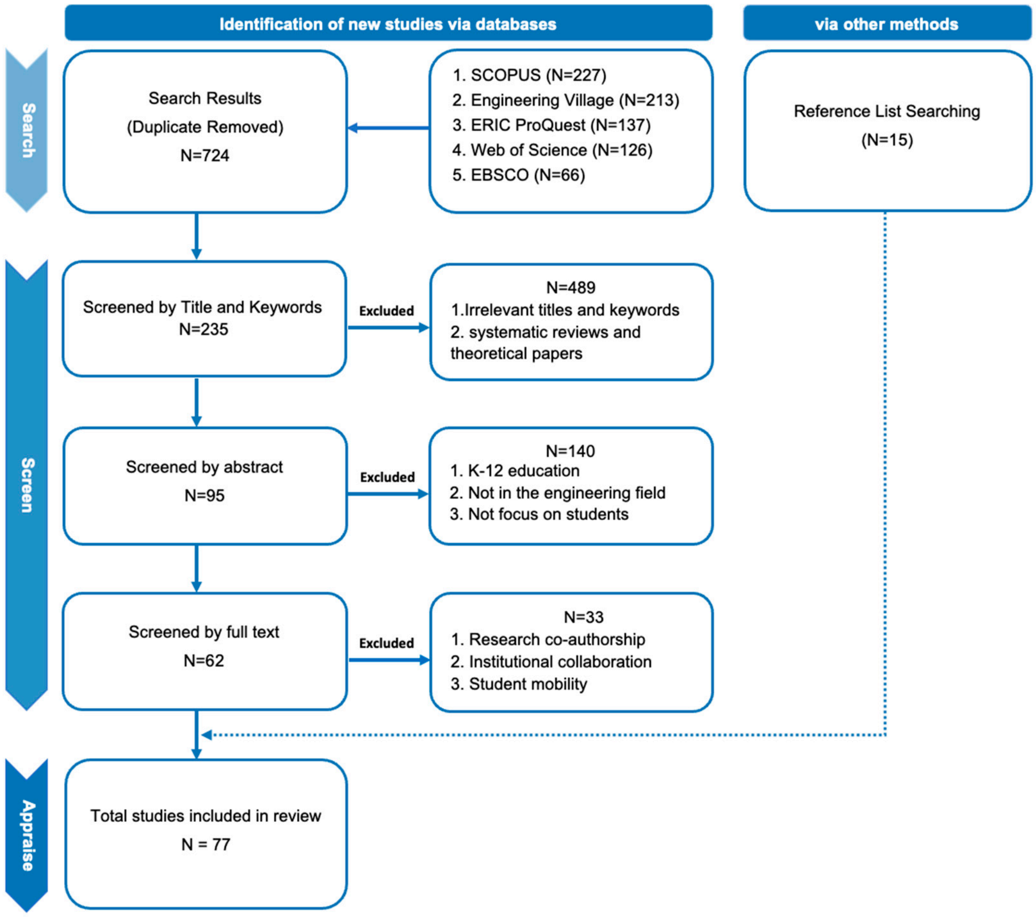

Figure 1. A flowchart of the filtering process.

2.2.2. Tracking and Analysis

In accordance with the content analysis process described by Borrego et al. [26], our analysis was carried out mainly using an integrated approach including both an inductive and a deductive approach. The initial codebook was developed and revised through two rounds of debriefing sessions among the authors; codes included themes such as basic information (journal names, type of collaboration, year, students' disciplines, and countries), research design, group formats, team size, group activities, learning goals, learning outcomes, challenges, and coping strategies. After the codes were decided upon, open coding was subsequently conducted. In order to minimize the researchers' bias and increase the validity of the coding process, all selected papers were read multiple times, and the coding process was led by the first author and triangulated by two experienced educational researchers in the research group. To enhance inter-coder reliability, all open codes from five articles were compiled into an assessment form and reviewed by one graduate student who is experienced in qualitative research but not familiar with this specific project. Consequently, 213 out of 247 codes were agreed upon, resulting in an acceptance rate of over 86%. As the final step in this auditing process, discrepancies between the results were discussed again within the research group, and the codes were revised accordingly.

2.3. Stage 3. Reporting the Metadata Analysis

In order to describe these 77 studies on engineering students' engagement in intercultural teams, the metadata were analyzed and categorized based on: (1) the publication source; (2) researchers' countries; (3) subjects of study participants; (4) research methods and number of participants; (5) analytical theories or framework; and (6) the year of publication.

Sources of publication. Approximately one-quarter of papers (n = 20) were published in the International Journal of Engineering Education, followed by the European Journal of Engineering Education (n = 9); Journal of Professional Issues in Engineering Education and Practice (n = 4); Australasian Journal of Engineering Education (n = 2); IEEE Transactions on Education (n = 2); and IEEE Transactions on Professional Communication (n = 2). Each of the remaining 38 articles was published from a different journal within the fields of engineering (e.g., Journal of Biomechanical Engineering); language and culture (e.g., The Modern Language Journal); technology (e.g., International Journal of Computer Applications in Technology); and education (e.g., Higher Education Studies).

Researchers' countries/territories. Collaboration between researchers spanning different countries was evident in this study. Of the 77 selected publications, 33 involved collaborations by researchers within the same country, while the remaining 44 articles reported inter-country collaborations among two or more nations. Figure 2 shows all the affiliated countries of these researchers and the number of articles that mentioned them. These countries were marked blue, ranging from the darkest to the lightest to symbolize their numerical ranking. The leading country with the most publications was found to be the U.S., which accounted for nearly half of the contributions (n = 30), followed by the United Kingdom (n = 10), Denmark (n = 7), the Netherlands (n = 7), and Spain (n = 6), and so on.

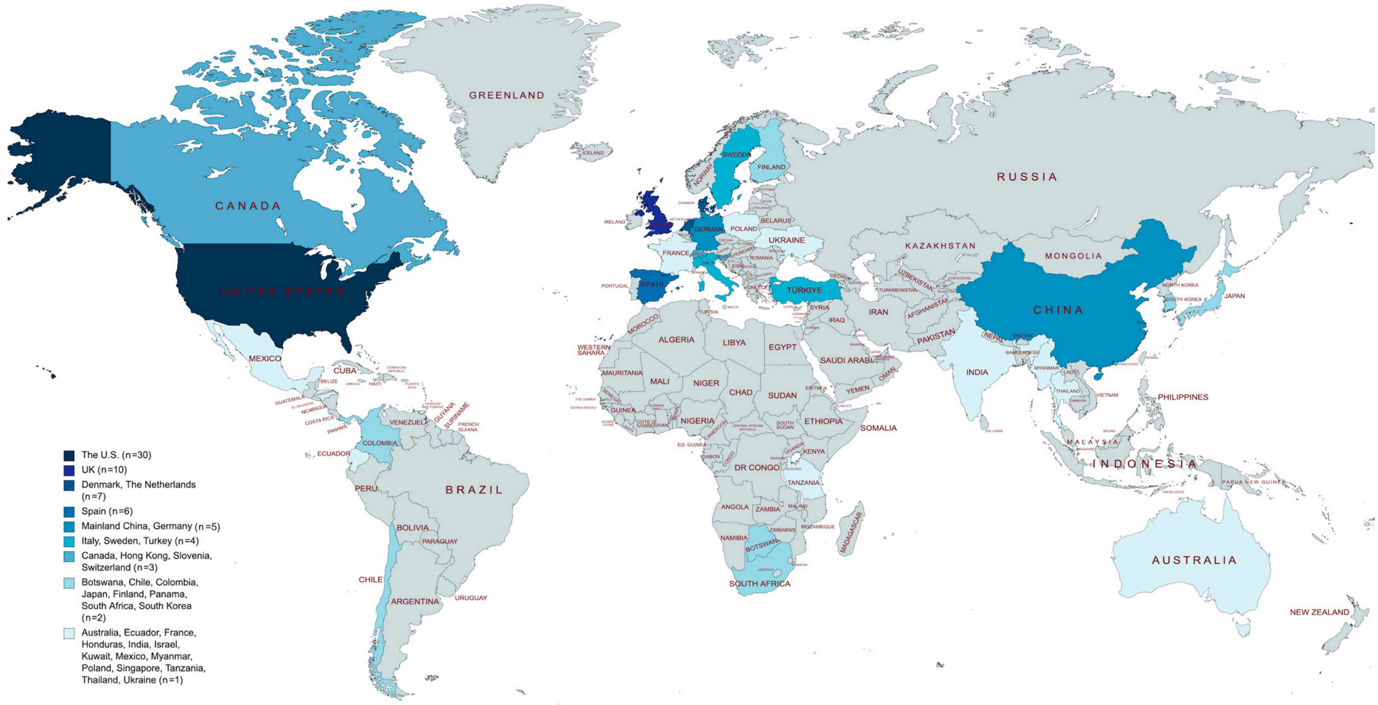

Figure 2. Affiliation countries reported in all included publications.

Study participants. A total of 53 out of 77 studies specified the students' disciplines. Among them, participants from 18 studies collaborated within one single engineering discipline. Twenty-one studies were conducted across multiple engineering disciplines, while fourteen articles reported multidisciplinary team collaboration or data collected from different disciplines, which not only included members from the engineering fields, but also from other STEM disciplines (e.g., chemistry, biology, physics, etc.), as well as social science, business, and management. Within the engineering fields, the reported studies mainly focused on mechanical engineering (n = 15), computer and software engineering (n = 15), electronic and electrical (n = 13), civil engineering (n = 9), and design engineering (n = 7). Other research was conducted in the areas such as architectural engineering, bioengineering, chemical engineering, environmental engineering, mechatronic engineering, industrial engineering, and so on.

While several studies mentioned student teamwork in the context of multi- or interdisciplinary approaches, only 16 articles linked cultural or intercultural issues to the students' academic disciplines. While all sixteen of these studies considered interdisciplinarity as a cultural variable, only two of these articles found that the differences between the disciplines were more prominent than the differences between the nationalities in their studies [27,28].

Research Methods and number of participants. Most of the studies (*n* = 30) employed mixed methods, combining qualitative approaches (e.g., observations, interviews, focus groups, reflective journals, etc.) with quantitative approaches (e.g., surveys, pre- and post-tests, etc.). There were 19 qualitative studies, the majority of which used interviews, observations, and document analysis. Fifteen studies used quantitative data collection and analysis, mainly in the form of surveys or questionnaires. These 64 research papers gathered data from various numbers of participants: fewer than 20 (*n* = 16), 20–50 (*n* = 21), 51–100 (*n* = 15), or more than 100 participants (*n* = 10), respectively. Two studies did not provide an exact number of participants. The research methods were not specified in the remaining 13 papers regarding project design or introduction of practice.

Analytical theories or framework. This was specified in 32 out of 77 articles. Several studies employed more than one theory or model to perform their analysis. The analytical theories or frameworks used in these articles can be categorized as follows: (1) active learning theories (e.g., problem- and project-based learning (PBL), experiential learning, service learning, and collaborative learning, etc.) (*n* = 18); (2) theories related to culture (e.g., Hofstede's cultural theory, socio-cultural theory, etc.) (*n* = 6); (3) theoretical models (e.g., the BIM model, the Revit model, the iceberg model, the dual-team model, etc.) (*n* = 13); and (4) other theories (such as the rhetorical theory and socio-constructivism) (*n* = 2). PBL (problem- and project-based learning) was found to be the most frequently employed analytical theory (*n* = 11), followed by Hofstede's cultural theory (*n* = 4).

Year of Publication. Figure 3 illustrates the number of papers in the sample published in each year from 2000 to 2022.

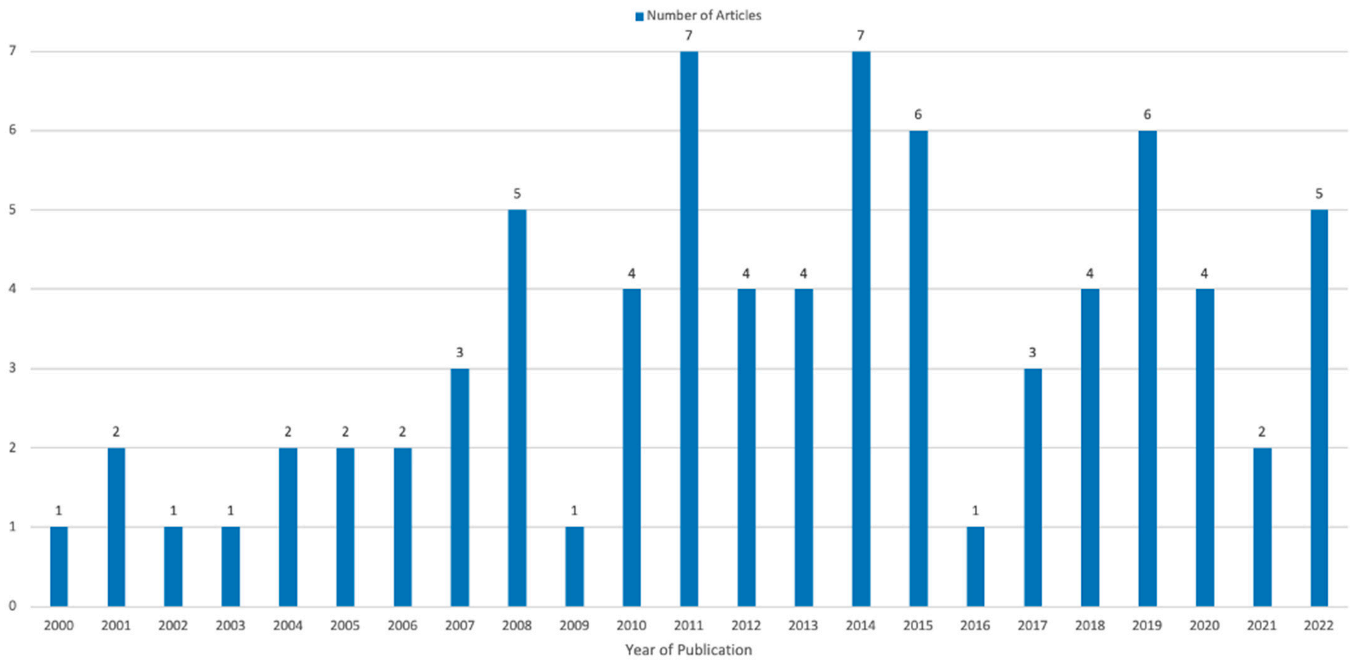

Figure 3. Year of publication and corresponding number of articles.

3. Findings

Consistent with our process of analysis, and for the purpose of answering our research questions, these findings offered details regarding intercultural team characteristics based on team formats, collaborative countries, level of collaboration, learning goals and preparation for intercultural teamwork, evaluation methods, and learning gains. The intercultural team challenges identified in the sample studies and the relevant coping strategies adopted by students were also explored in this section.

3.1. Intercultural Team Formats

Our review found that students collaborated in different structures and formats, as shown in Figure 4. Around one-third of papers (*n* = 26) reported that students worked together in culturally-mixed groups for projects or courses organized by their own or other institutions. Teams may be composed of both home and international students with diverse backgrounds from different engineering faculties within one university, or students from several institutions within the same country. The latter was only shown in a single study by Downey et al. [10]. Another one-third of papers (*n* = 25) indicated that student groups located in different parts of the world worked on projects or common tasks online, mainly communicating through various virtual tools such as emails, video- or tele- conferencing, and other synchronous or asynchronous collaborative software such as Skype, Facebook, Google Hangouts, Trello, etc. [29–31]. This type of team structure is becoming more common due to technological advancements, and the increasing demand for remote work arrangements [32,33]. Fifteen articles revealed that engineering students from different universities across various countries collaborated on global joint projects on-site. These projects were each primarily hosted by one university, which invited students at other universities from various countries to participate.

Six studies reported that teams were formed within an institution and students collaborated with international communities, mentors, or companies for project work or course work. For instance, in Borg and Zitomer's [34] research, students from an American university joined an international engineering service-learning project to improve the solar-powered water pumping system used by an orphanage in Guatemala. In another study conducted by Fox et al. [35], a partnership on a course was described by students from a U.S. institution, students from a German institution, as well as German industries. This course emphasized the concepts of sustainability and globalization to engineering students, as well as providing practical industrial experience in the global context.

Three studies described engineering students who worked in teams for short-term international field trips in 2–6 weeks to learn more about different cultures and gain practical engineering experience [36–38]. Students also developed their teams in international competitions, which challenged them with more complex engineering problems (e.g., [39,40]).

Figure 4 shows a breakdown of the structure, size, level of collaboration, learning goals of student teams and evaluation methods. The latter three will be explained in Sections 3.3 and 3.4. In most cases, students formed small groups with one to four members, followed by medium-sized groups of approximately five to eight members. Only six studies demonstrated student collaboration in large groups of more than eight members. To improve team building and foster intercultural communication and collaboration, engineering students were reported to attend various formal and informal team activities such as joint symposia [31], lab work [41], group projects, role-playing simulations [42], outings, and social activities.

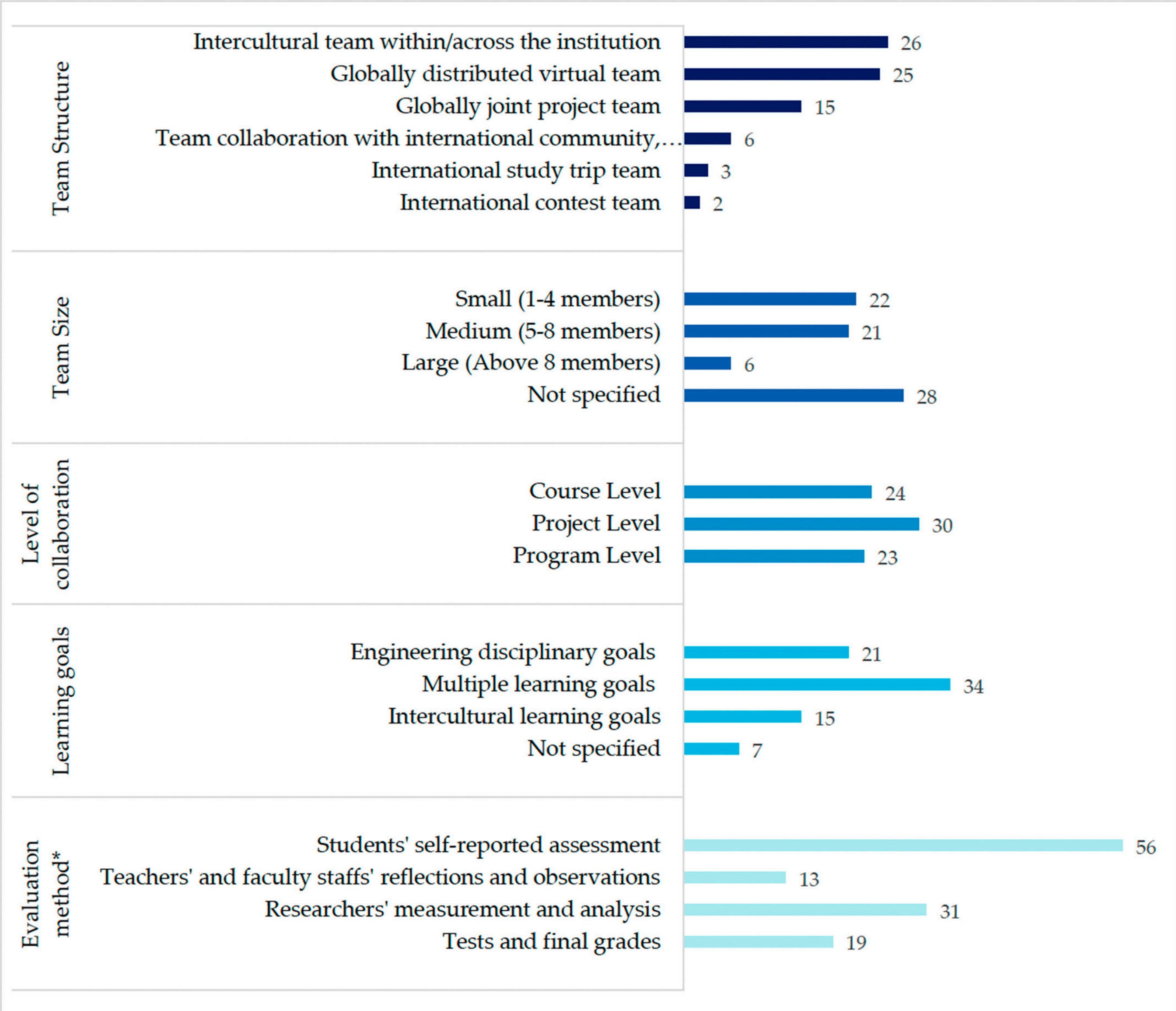

Figure 4. Number of articles in each subcategory of team structure, size, the collaboration level, learning goals, and evaluation method categories (N = 77). * Some articles reported two or more evaluation methods.

3.2. Collaborating Countries

This section highlights the specific countries in which the student teams were collaborating. Two articles did not specify the name of any country within the study, and the collaborations were discussed in terms of general intercultural contexts [40,43]. Student teams in 26 studies collaborated within the same country, including Denmark (n = 6), the United Kingdom (n = 5), the U.S. (n = 5), Canada (n = 2), and Spain (n = 2), respectively. The remaining six articles were each the sole study representing their country of origin; these countries included Italy, Japan, Kuwait, Singapore, Sweden, and the Netherlands.

Fifty-nine studies illustrated students' team collaboration across two or more countries. The collaborating countries from these 59 studies are shown in Figure 5. The lines in Figure 5 indicate the collaborative relationships that existed among the countries, while the line thickness represents the link strength or frequency of collaboration. To make the map clearer, countries in Europe were abbreviated as two-letter country codes, representing Finland (FI), France (FR), Germany (DE), Hungary (HU), Italy (IT), Lithuania (LT), Norway (NO), Poland (PL), Slovenia (SI), Spain (ES), Sweden (SE), Switzerland (CH), the Netherlands (NL), the United Kingdom (UK), and Ukraine (UA), respectively. In the case where there were multiple countries collaborating in one single study, each country in the pair was counted in the frequency. For instance, in the study of Bufardi et al. [44], students from three countries—Switzerland, the Netherlands, and Slovenia—collaborated, and thus, the collaboration was counted three times; first between Switzerland and the Netherlands, second between Switzerland and Slovenia, and third between the Netherlands and Slovenia, respectively.

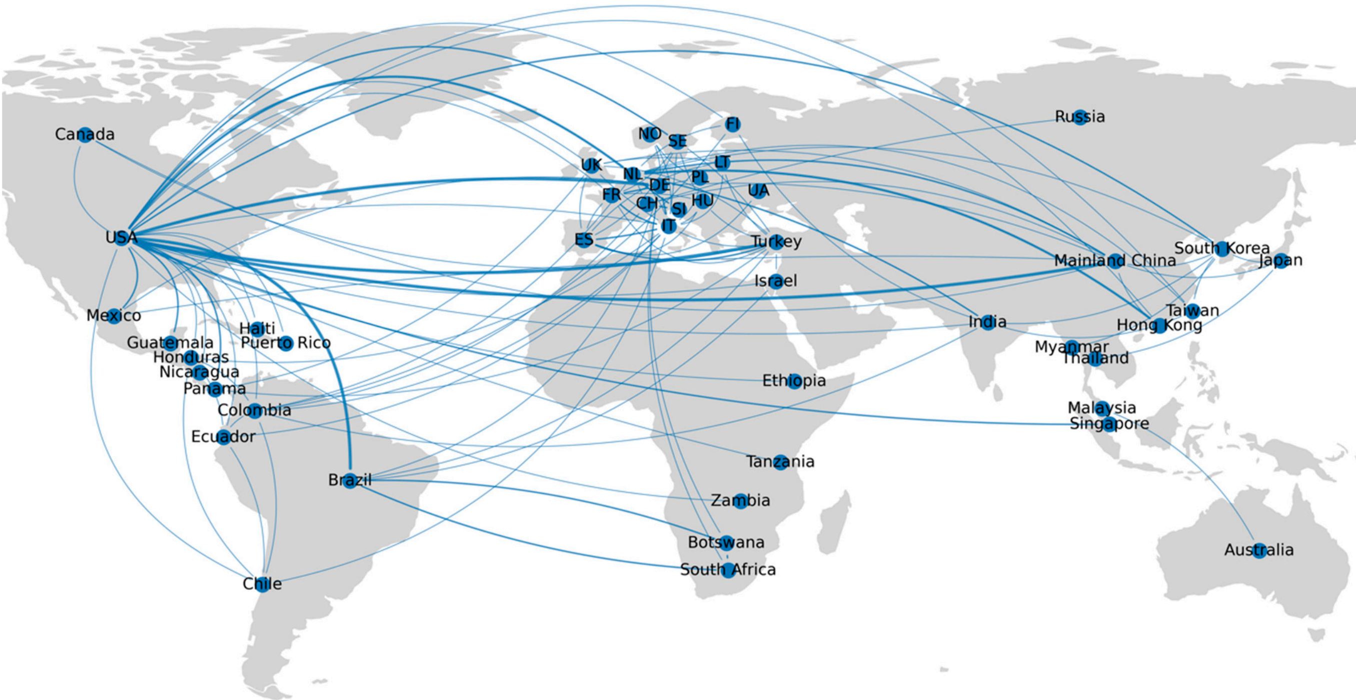

Figure 5. A map for country–collaboration networks.

In total, 165 collaborations among various countries were detailed within the sample of articles. The U.S. stood out as the top collaborating country with 63 international collaborations, the highest number. The next highest quantities of collaborations were observed in Italy (*n* = 20), Turkey (*n* = 19), the Netherlands (*n* = 19), Germany (*n* = 17), Mainland China (*n* = 15), Brazil (*n* = 11), Colombia (*n* = 11), France (*n* = 10), India (*n* = 10), Spain (*n* = 10), and the UK (*n* = 10), respectively. The remaining countries not mentioned above had less than 10 collaborations. The thickest lines between countries were between the USA and Brazil, the USA and Germany, the USA and Turkey, and the USA and Mainland China, respectively, which all represent the most intensive collaborations, shown in four studies each.

3.3. Level of Collaboration and Learning Goals

3.3.1. Level of Collaboration and Teamwork Preparation

Analysis of these 77 selected articles indicated that engineering students collaborated in intercultural teams at the course level, project level, and program levels (see Figure 4). At the course level, engineering students participated in their universities' international courses (e.g., [39,45]), cross-institutional collaborative courses (e.g., [10,46]), joint transnational online courses (e.g., [47]), or collaborative courses with industries (e.g., [35]). These courses were mostly short-term, ranging in duration from one week to one semester, and generally require students to work together to complete multiple tasks including group discussions, group presentations, group exercises, and/or course-related projects.

At the project level, engineering student groups joined a variety of projects which may have been organized by a single university (as was the case with the Innovative Design, Education, and Teamwork project [48,49]), or may have been conducted jointly with higher education institutions (e.g., the Hong Kong-Netherlands project) [33,50,51], or with companies and communities (e.g., the International Capstone project [52]). In most project-level collaborations, students work full-time to complete their projects for approximately four to twelve weeks, in which they apply theories and techniques to solve problems, develop software, or design products.

At the program level, students participated in intercultural collaborations that were more systematic and repeated over the years. Teams are formed for a particular program which includes a structured set of lectures, trainings, workshops, group projects, laboratory experiments, and other activities that support students' professional learning and competence development [53–55]. Examples of such programs that were reported in these 23 studies include an articulation program [56,57], Global Engineering Teams [58], Innovation Research and Education of Asia [59], and European Project Semester [53,54,60]. These programs took place over a longer duration of time, ranging from one semester to five years or more.

Fourteen papers also demonstrated how students prepared for intercultural teamwork to ensure that every team member could work together effectively and break down barriers. Most of them (n = 11) reported that students attended cultural orientation courses such as courses on cross-cultural behaviors or teambuilding, technical courses for virtual teams, and language training courses held by the relevant institutions or programs [41,54,61]. In addition, a few of these 14 articles (n = 5) mentioned predeparture meetings before short-term study abroad, and informal social activities intended to develop a sense of group identity [38,48,62].

3.3.2. Learning Goals

Engineering students attempt to achieve a variety of learning goals through the above-mentioned courses, projects, and programs. The emphasis of each program's learning goals can be categorized into one of three types, which are as follows: (1) focusing on intercultural studies such as language and culture; (2) multiple goals including both engineering disciplinary studies and learning about culture/languages; and (3) focusing solely on engineering disciplinary studies. The number of articles in each category and corresponding papers are shown in Figure 4. However, learning goals were not specified in seven articles due to their primary research focusing on students' opinions about intercultural teamwork without further details of the courses, projects, or programs.

The courses, projects, or programs focusing on intercultural studies prioritized learning objectives that were intended to broaden the students' cultural and social experiences [34,63], build their appreciations for cultural diversity [10], develop their intercultural competence and linguistic skills [64,65], and help them behave appropriately in international teams [47].

Courses, projects, or programs with multiple goals combined cultural studies and engineering professional studies. From the analysis of the 34 selected articles in this category, these goals included dealing with ill-structured problems within global contexts [9,53]; developing software and increasing technical innovation for other countries [66,67]; acquiring knowledge about cross-cultural product design [20,44]; and developing professional communication and competence for the international workplace [33,68].

Goals that focused primarily on engineering disciplinary studies were described in the 21 studies. In these courses, projects, or programs, cultural learning was not prioritized. The engineering students' goals were to acquire the skills and knowledge necessary for becoming a professional engineer or a product designer. More specifically, these goals may include generating a model in specific software [32]; developing digital resources [48]; tackling engineering challenges [69]; and gaining project experience [62], among others.

3.4. Evaluation Methods and Learning Gains of Intercultural Team Collaboration

3.4.1. Evaluation Methods

Within the included 77 articles, several methods of evaluating engineering students' learning outcomes for intercultural teamwork were reported. These can be summarized into four main categories which are as follows: (1) students' self-reported assessments; (2) the reflections or observations of the teachers or faculty staff; (3) researchers' measurements or discussions; and (4) language tests and grading of team contribution. Several articles reported two or more evaluation methods. The number of articles using each category of method is shown in Figure 4.

Students' self-reported qualitative or quantitative assessments were reported with the highest frequency (n = 56). We did not count the frequency of each assessment method reported by students as they were combined in several articles, but examples are given below. Quantitative pre- and post-surveys are gathered to measure the changes in respondents' skills, interest, attitudes, and knowledge following their participation in courses, projects, or programs [9,50]. Furthermore, survey-based questionnaires with relatively large numbers of respondents are conducted to assess students' opinions and level of satisfaction with their intercultural teams [39,70]. Several surveys also posed open-ended questions which allowed the respondents to provide more detailed and personal reflections [34]. Students' intercultural learning is qualitatively evaluated by means of individual interviews with students, focus groups, reflective journals, and blog posts [16,68,71], etc. Students' self- and peer assessments are also evaluated; these primarily include periodic self-reflection reports and peer-written feedback on their own and other members' contributions [8,60]. Both of these forms of assessment enabled students to reflect on their own or their team's progress with intercultural working, identify areas for improvement [16], increase group efficacy, think critically about the competences that intercultural collaboration requires, and find solutions to tackle their challenges.

Teachers' or faculty staff members' reflections and observations were reported in 13 articles. For instance, Bani-Hani et al. [22] designed a survey to investigate university staff's opinions about challenges in students' intercultural team building, the suitable number of members for a team, and team performance. Grimheden and Hanson [72] conducted in-depth interviews with course teachers to gather information on students' learning gains in virtual team collaborations between the Royal Institute of Technology in Sweden and Stanford University in the U.S. Through observing videotaped students' meetings and having conversations with them, university staff in the study conducted by Grimheden and Strömdahl [73] were able to identify the difficulties that students encountered in online intercultural team interactions.

Researchers performed measurements and analyses in a total of 31 articles. In these research papers, researchers measured student learning through quantitative and qualitative analysis of students' team interactions [74,75], and participant or classroom observations of changes in team behavior [69,76,77]. For project design and the introduction of practice papers, researchers mainly discussed about intercultural learning outcomes.

With regard to tests and final grades (n = 19), students' team performances and contributions were evaluated through the assessment of group assignments or the grading of group final reports and presentations [78,79]. Language tests were also used in some studies to measure the students' language proficiency after working in an intercultural team [61].

3.4.2. Learning Gains

From the evaluations mentioned above, 65 of 77 articles discussed the students' learning gains from their international team experiences. Using both inductive and thematic analysis, five aspects of learning gains emerged as follows: (1) cognitive development; (2) affective development; (3) competence improvement; (4) behavioral adjustment; and (5) relations with larger contexts. These are listed in Table 3 and will be further explained below.

The first theme is students' cognitive development. This refers to students' acquisition, and the improvement of their understanding, awareness, and knowledge of basic intercultural values and traits [80–82], and of the engineering profession. First, working on an intercultural team cultivated the engineering students' confidence in their understanding of a wide range of views and cultures [16], and of the complexity of ongoing engineering problems in both global and societal contexts [34,42]. The integration of others' cultural and disciplinary views and practices encouraged the generation of new ideas and alternative solutions when exploring complicated engineering challenges [40,47]. Second, students also became more aware of the finer details of the similarities and differences between their own culture and other cultures [55], of how to interact with people from different countries in a respectful and meaningful way [38], and of the social and environmental realities [16]. A greater intercultural awareness can facilitate students' effective communication across the boundaries of nationality, promote diversity in teams, and help individuals to interact with others in various settings. Finally, students gained more comprehensive information and knowledge regarding social and cultural issues [37], co-created meaningful professional knowledge such as sustainable development or mechatronic practices [42,72], and learned to implement technologies in different situations [9]. Brennan et al. [83] revealed that, based on their improved understanding and increased knowledge, student levels of self-efficacy in cultural adaptation and problem analysis were also improved.

The second theme that emerged was the students' affective development. This includes emotions, empathy, open-mindedness, tolerance of uncertainty, curiosity, and attitudes toward different cultures and cross-cultural environments [81,82]. The selected papers indicated that students overcame their shyness and reluctance towards collaboration [84]; respected other members' contributions and cultures more [47,68]; increased their openness to different views [85]; and gained sensitivity to differences among cultures and local policies [38,47]. Through the process of collaboration, students became more curious about different engineering practices in other countries [47], more confident in communicating on intercultural teams and dealing with complex and real-world engineering problems [16,50], and more intrinsically motivated to explore intercultural learning for engineering [86]. As their mutual help and support increased, students felt more accepted by their teams and developed a sense of connection and belonging [51,71].

The third theme is related to students' competence development, i.e., the process through which students develop their skills and abilities to be more effective and successful in the intercultural environment [87], as well as in the engineering profession. Professionally, students were observed to become more competent in identifying, formulating, and solving engineering and social problems [34]; designing real-life products [88]; taking professional and ethical responsibility [37]; applying their knowledge of mathematics, science, and engineering in practice [83]; thinking in a critical and contextual manner [47,55]; effectively presenting their work and writing reports [64]; managing cross-cultural and cross-disciplinary research [62]; and being innovative and creative in their projects [59,88].

In addition, they learned how to manage their time and make plans regarding budgets, schedules, or construction [16,55]. Students were also reported be more capable of working collaboratively and communicating effectively with other team members [66]; functioning in multidisciplinary teams [37]; making decisions together [45]; taking team responsibilities and contributions [85]; taking leadership in terms of the project work [30]; resolving intercultural conflicts [40]; helping and trusting each other [89]; sharing knowledge and co-creating meanings [77]; keeping the team at the same pace [32]; developing team interactions and discussions [69,90]; and communicating proficiently in other languages [61,86]. Students also improved their capacity to effectively use a range of tools and technologies [33]; understand the relationship between technological innovation and social innovation [67]; and develop models using global software [91]. In the future, these skills will be beneficial when working and interacting with people from diverse cultures in the global workplace [28,68].

The fourth theme is connected to students' behavioral adjustment, or their ability to adapt their behaviors to the cultural and social norms of a new environment [81,82]. Students changed from initially observing others to ultimately becoming active participants in intercultural teamwork and discussions [66,92], accomplishing collective learning and problem-solving goals [58], and providing others prompt feedback and peer assessment [16]. In order to perform more effectively in international teams, engineering students adapted their communication and working styles based on the cultures of other students [93], and provided flexible environments for every team member to work on projects more freely [73].

The last theme focuses on the student teams' increased interactions with other stakeholders, such as communities, industries, and their international mentors. With more collaboration through projects, they not only gained experience with a variety of interactional norms [71], but also understood the relationship between technical systems and social innovation [67].

Table 3. Learning Gains of Intercultural Team Experience (* Duplicates Removed).

Themes and Number of Articles *	Content and Paper
Not specified (n = 12)	[27,35,36,43,44,48,49,57,65,78,94,95]
Cognitive development (n = 38)	• Increased understanding of engineering problems in global contexts [10,16,34,42,45,67,70,75,79] • Increased awareness on cultural differences [9,15,16,21,28,33,38,41,46,50,54,55,68,71,72,79,96] • Increased cross-cultural, technical, and professional knowledge [9,10,21,33,34,38,41,42,45,51,66,71,72,79,85,86,90,97] • Creation of new ideas from different views [16,28,31,40–42,47,53,64,66,70,85] • Increased level of self-efficacy [83]
Affective development (n = 27)	• Increased openness, respect, and sensitivity to other cultures [8,9,16,28,38,41,45,47,55,58,64,68,84,85] • Increased confidence in project work and intercultural interactions [9,16,30,40,50,51,55,61,71,90,92] • Increased curiosity to learn engineering practices from different countries [47,68] • Increased motivation and interest in intercultural and engineering learning [9,16,60,72,86] • Increased feelings of belonging and acceptance [51,62,71,90,97]
Competence improvement (n = 52)	• Improved professional skills • [9,16,29,30,34,37,42,47,55,58,59,62,70–72,79,83,88,90] • Improved collaborative and teamwork skills [8–10,15,16,21,22,29,30,32,37,38,40,42,45,51,52,55,56,58,66,68–70,73,76,77,85,88–90,92,94,96,98,99] • Improved communication skills [9,15,16,30,38,42,45,58,60–63,71–73,78,79,86,88,90,93,96,99] • Improved project management skills [16,22,32,33,40,55,62,66,70] • Improved technical skills [9,50,55,61,67,71,74,86,89,91,99]
Behavioral adjustment (n = 16)	• Increased active engagement in team meetings [16,47,62,66,92] • Improved appropriate actions in intercultural collaborations [20,33,47,71,91–93] • Improved flexibility in completing tasks [8,73] • Increased intercultural team feedback and assessments [16] • Managing more to achieve shared learning goals [8,39,40,58,62,91,97]
Interactions with larger contexts (n = 6)	• Increased experience and interactions with communities, industries, and mentors [52,55,62,67,71,92] • Increased social Innovation [67]

3.5. Intercultural Team Challenges and Coping Strategies

The papers included in this review reported a range of challenges faced by engineering students when working in intercultural teams. These challenges can be categorized into three levels, as shown in Appendix A: the individual, the relational, and the contextual levels. Challenges at the individual level are difficulties faced by the individuals, including those relating to language barriers, mental health, and prior background and experience. The relational level refers to the issues encountered when relating with others in teamwork contexts, including challenges in time management and planning, interaction and communication, technology, and team building. The contextual level involves the challenges that are derived from larger socio-cultural contexts, including the lack of support from the faculty, staff, departments, and universities, or the lack of interaction with communities, companies, etc. The challenges described in the reviewed studies, along with the coping strategies students used to deal with these challenges, are elaborated below.

3.5.1. Individual Level

Linguistic challenges. The language barrier was the main individual-level challenge faced by students collaborating in international teams. As reported in the reviewed papers, linguistic challenges can include difficulty understanding specific accents and different languages [98], struggles in expressing opinions using a foreign language [9], and unfamiliarity with certain terminologies or jargon in other languages [16]. For better linguistic comprehension, native and advanced language speakers have tried to replace slang or jargon with simpler and more precise words, while non-native speakers utilized translation applications such as Google Translate or resources including translation booklets to communicate [62,66].

Psychological challenges. In the process of intercultural collaboration, students often struggled with psychological issues. For instance, in culturally-mixed teams within a single institution, several international students felt excluded from taking part in the project, and had little opportunity to participate in discussions and negotiations [90]. This challenge further decreased their confidence in voicing their opinions [30] and their enthusiasm to engage in team activities [45]. Some international students stated how they spent a considerable amount of time to adapt to the new international team contexts [78,90]. In addition, acclimating to other cultures can make them feel lost or struggle to identify their own identity and culture [21]. In addition, several local students held negative attitudes regarding intercultural collaboration, as shown by their prejudice and stereotypes about international students having different orientations to work and different levels of extroversion, and therefore being even harder to collaborate with than local students [28]. These stereotypes and prejudices can be harmful, and can lead to the marginalization and exclusion of members of other nationalities; they can also be disrespectful to groupmates [46]. Specific coping strategies for addressing these issues were not documented in the reviewed studies, but it was observed that students attempted to create a positive and inclusive team atmosphere as a means of addressing these problems [16].

Prior background and experience challenges. Engineering students were reported to have very limited experiences of working in intercultural teams [67]. Furthermore, it was also shown that students find compromising and negotiating within the group to be challenging when members possess differing backgrounds in professions, disciplines, and cultures [75], different levels of knowledge and competence [16], or insufficient professional and technical knowledge [45]. Again, specific strategies for addressing these issues were not clearly described in the literature, but several articles emphasized that students' learning on professions, technologies, and cultures improved over time [15,51].

3.5.2. Relational Level

Challenges for time management and planning. When working in a globally distributed team, time zone differences, including summer and winter time changes, present a challenge for students [73]. These differences make it harder for them to schedule a meeting on short notice for urgent matters [77]. When lacking explicit plans or an agenda for team meetings, students struggled with time pressure to finish their assignments on time [94]; displayed inconsistent project performance [91]; demonstrated inefficient working progress [99]; had arguments over daily tasks completion [16]; experienced task overlap [73]; and had work overload due to some less competent team members [45]. To manage stressful situations regarding time management and planning, especially in virtual teams, students held frequent meetings to learn about each other's progress [32]; made preparations for meetings, wrote agendas and minutes [60]; defined work processes with deadlines for each task [20,51]; visualized working progress using tools such as Gantt charts [16]; and applied a "sandwich structure" alternating between synchronous meetings and asynchronous tasks [50].

Interactional and communicative challenges. Intercultural interaction or communication is one of the main obstacles engineering students face when working together in intercultural teams. Due to limitations of language, team cohesion, time, and space, students are hesitant to take part in team discussions, put forward their ideas, and give feedback [73,90]. Furthermore, the diversity of their cultural backgrounds, along with personal bias stemming from disciplinary differences, can lead to their communication with their teammates being unclear, confusing, or not well-received [51]. For instance, in Vogel's [51] study, Hong Kong accounting students perceived their Dutch technology management teammates as being too technical. In contrast, the Dutch students felt that the contributions of their Hong Kong counterparts were superficial, and that they lacked knowledge in some areas of the topic. These issues can therefore result in poor interactions and confusion during the progression of the project.

These limitations also lead to difficulties in managing different communication styles (e.g., expressive and straightforward communication vs. reserved and indirect communication) [15]; negotiations with different ideas and understandings [8]; and reluctance to build interpersonal relationships with each other outside of academic activities [57]. In some cases, the high costs of international study trips hindered students' face-to-face interactions [97]. To keep the team on the same level of understanding, students asked questions and explained the more challenging aspects of their work through written texts [66], visual help (e.g., drawings, sketches, tables, etc.) [20], and social media [32]. In order to build interpersonal relationships, several teams met before the start of the project to get to know each other [90], held social gathering events [71], and discussed their cultural differences [8].

Technological challenges. This type of challenge arose when using technology in a virtual team setting. Delayed team discussions and slow response times from some team members resulted from slow or unreliable internet connections [67], as well as outdated hardware and software [74]. In addition, students' unfamiliarity with some software and their difficulties in using the new technology led to data misinterpretations and ambiguity [32].

Without having proper communication and guidance, team members could end up using different versions of certain software or tools on project work, which can therefore prevent file sharing and information transfer [66]. In some international service-learning projects, the lack of equipment and software availability in local communities also caused difficulties for project completion and collaboration [52]. To minimize the technological problems, several universities have introduced new collaborative platforms for students [69], upgraded their facilities and tools [58], and provided students with extra trainings on how to use the relevant tools [50]. Student teams not only selected the most useful tools for collaboration, but also employed multiple technologies to foster stronger communication and understanding [33,93].

Challenges for teamwork and team building. Several challenges were demonstrated in students' intercultural teamwork. First, students felt ambiguous regarding their team roles and responsibilities as a result of their different perceptions of work procedures, lack of familiarity with their teammates, and inefficient communication. It was also a challenge that new members were added to teams after the projects had already begun [15,16]. In response to these difficulties, students took team role or personality tests such as the Belbin self-perception inventory test to clarify their roles and responsibilities that they could take on to help complete their team projects [33,54]. They also designed team contracts which outlined the organizational structure of their groups, the role of each group member, and the responsibilities and work process of each role [45].

Another teamwork challenge laid in the fact that some passive learners can be reluctant to contribute to ideas [58], accept challenging tasks [30], or participate in discussions and project work [92]. To motivate every member, teams assigned tasks based on their strengths and areas of needed improvement [16,22]. Furthermore, members of several teams also took turns as the team leaders or coordinators [74].

A final challenge in this area stems from group formation across disciplines and cultures [27], and a lack of team trust [89]. This can make it even more difficult for group members to compromise between different working and learning habits [78], set common learning goals [16], and make decisions [91]. To build a more inclusive atmosphere, students tried to understand members' cultural and disciplinary differences [64], actively participated in the ice-breaking activities [49], and took initiative in discussing what learning goals they intended to achieve together [16].

3.5.3. Contextual Level

Challenges in team relationships with other stakeholders. Alongside the challenges within their group work, students also confronted relational issues with their project supervisors, industrial mentors, consumers, companies, or local communities. To be more specific, faculty and supervisors often gave little guidance of how to work effectively in an international team, and provided little support as the projects progressed [56,73]. When designing products for companies, student teams struggled to accommodate the needs of their different international clients [98]. In joint projects with local communities in another country, students were obliged to abide by local regulations and understand the local conditions [52,66]. However, strategies were more focused on addressing the relationships between students and stakeholders within the university such as faculty staff and institutions. For instance, students took the initiative in communicating with their supervisors to ask for better suggestions [16], and participated in cultural orientation courses or activities organized by their institutions [63,76]. To coordinate the intercultural teams, the faculty aimed to provide their students with more useful tools in team organization and decision-making [55], and give prompt feedback on their project progression, technology use, and team collaboration [33].

4. Discussion and Conclusions

This study set out to provide a comprehensive overview of peer-reviewed journal articles on the current characteristics of intercultural teamwork among engineering students, the challenges students face in intercultural teams, and the coping strategies they employ in response. By consulting five databases (SCOPUS, Engineering Village, ERIC via ProQuest, Web of Science, and EBSCO) and using a systematic filtering process, 77 articles were included in this study, and a wide range of intercultural team characteristics were identified based on the collaborating countries, team formats, levels of collaboration, learning goals, evaluation methods, and learning gains. Additionally, intercultural team challenges at the individual, relational, and contextual levels were described, along with the relevant coping strategies students adopted in response to these challenges. These findings have the following practical implications and future research directions.

First, in this systematic review we followed the culture-as-construct approach proposed by Handford et al. [11] to conceptualize culture. This approach means that individuals co-construct their meanings and interact dynamically with others regardless of national boundaries. In this sense, national culture is one of the variables in the construction of one's identity. Other variables may include one's academic background, discipline, ethnicity, institutions, or lived learning and international experiences [21]. In our analysis, however, most included studies were found to limit their understanding of culture to one's nationality, geographic region, or institutions. Only a few studies conceptualized culture at the multidisciplinary or inter-disciplinary levels, and there was a general lack of recognition and discussion of ethnic cultures. Therefore, when organizing and coordinating intercultural team activities, teachers and academic staff should consider the inclusion of students with diverse backgrounds not only in terms of different nationalities, but also in terms of the various ethnic groups and disciplines within engineering and beyond. This finding echoes previous studies which called for researchers to examine the societal and intercultural dimensions of broad interdisciplinary issues [100]. It has also been suggested that future works should elaborate further on aspects such as ethnicity, and comprehensively enhance intercultural diversity.

Second, adequate preparation for intercultural teamwork is necessary to reduce confusion and increase group effectiveness [62]. However, only a small number of studies discussed engineering students' preparation for intercultural teamwork. The majority of these students reported that they attended language, cultural orientation, or technology courses before the team was established. Therefore, it has been recommended that engineering educators and instructors should design more formal and informal preparation activities to help students adapt to working in an intercultural team. Additionally, very few studies mentioned theories related to culture. At the preparation stage, more theories that highlight the interactive and dynamic characteristics of culture could be introduced by teachers to help students understand intercultural teamwork from a theoretical perspective.

Third, although this review has reported the use of four different categories of evaluation methods in the reviewed articles, evaluation by teachers or faculty staff members is the least frequently reported method. This finding suggests that researchers should collect more data from teachers or faculty staff in future work, so as to investigate their perceptions with regard to facilitating intercultural student teams and their opinions of intercultural team challenges.

Fourth, students' learning gains were classed into five key categories, and most studies indicated that learning gains included improved competence when working on intercultural teams, increased knowledge and awareness of both professional and intercultural learning, and affective development [47,61,68,90]. However, only a few articles revealed actual behavioral changes, and even fewer discussed effective interactions with external settings and other stakeholders [62,71,92]. A gap in understanding thus exists between the cognitive and affective developments of students and their actual process of intercultural practices, as well as passivity in their interactions with the wider settings [8]. This echoes the findings of earlier studies in that improved intercultural awareness and knowledge does not necessarily lead to better external interactions and behavioral changes in interculturality [101,102]. This underlines the need to encourage engineering students to be more proactive when participating in intercultural teamwork by making independent choices, taking ownership of authentic tasks and collaborative practices, and developing their collective agency [2,16,103]. Although the included articles have focused on the phenomena of behavioral changes such as behavioral flexibility (e.g., [8,73]) or behavioral adaptation to intercultural teams (e.g., [47,91]), future studies could further explore what elements cause engineering students' behavioral changes and external interactions in intercultural environments.

Fifth, several coping mechanisms for addressing these challenges have been identified, but how engineering students overcame their individual psychological issues in intercultural team environments were not specified. For culturally-mixed teams within institutions, although some international students were able to manage their isolation and anxiety through engaging with cultural orientation events or by building interpersonal relations with others, it has also been suggested that universities and engineering educators should develop on-campus counselling centers, offer structured and relevant lectures, and give advice for local students to help them understand the specific cultures of their international teammates.

For global virtual teams, previous studies have indicated that students' online intercultural communication seldom develops to a higher level [104], pointing to the need for enhanced facilitation and guidance from instructors. Inspired by the work of Artino and Stephens [105] and Baek et al. [67], it was therefore suggested that lecturers should facilitate effective online discussions among different cultural groups, reinforcing students' contributions, requesting explanations when necessary, and assessing student misunderstandings. Furthermore, program managers and collaborating institutions should be more mindful about differences among the collaborating countries when providing access to resources and training, and should create a safe, open, supportive, flexible, and adaptable environment for all students. This would support engineering students to develop their efficacy, motivation, intercultural awareness, self-regulation skills, and cross-cultural interactions in the intercultural online environment.

The reviewed articles' discussions of coping strategies at the contextual level focused primarily on addressing student–instructor or student–institution relationships, without paying sufficient attention on how to build relations with other stakeholders, such as international clients, international companies, and local communities. In light of this, it was therefore advised that universities should introduce students to basic information about the companies they will be working with before the project commences. Universities could also hold more frequent meetings and invite companies and engineering students to discuss their expectations from both sides. In order to work more effectively in local communities, site visits are crucial, and students should be introduced to the local rules and local environments by project managers when designing their projects [52].

Despite generating these useful recommendations, this study is also subject to several limitations. First, the scope was limited to five databases, peer-reviewed journal articles written in English, and materials published in the past two decades. Therefore, there was a lack of further information about intercultural teamwork reported in conference papers, non-English journals, non-academic reports and articles, contributive theses and dissertations, grey literature, and other databases, which could have led to bias in our findings. However, the auditing process mentioned in Section 2.2.2 could have minimized the risk of bias from researchers, and therefore presented our results more objectively [106]. Second, the title screening approach was adopted at the first stage, and thereby 489 papers were removed. Through this process, several important journal papers may have been left out in the case where they were relevant to the characteristics of intercultural teamwork and team challenges but did not clearly state this in their titles and abstracts. This limitation has been reduced through our reference list checking of the selected papers after the database search. More alternative methods, such as key journal searching and key author searching, could also be used in the future. Third, neither the theoretical framework to support students' intercultural team learning, nor the factors impacting their learning effectiveness in team contexts, were investigated in depth. Future review work should analyze and report how cultural theories guide student behaviors when working in a team and make comparisons between the different cultural groups.

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Appendix A Challenges and Coping Strategies Reported under Three Levels

Table A1. Challenges and coping strategies reported at three levels with article numbers.

Individual level	
Challenges	Coping strategies
Linguistic challenges (*n* = 24) • Difficulty in understanding specific accents and languages • Difficulty in speaking other languages • Unfamiliarity of technical words or jargon	Coping strategies for linguistic problems (*n* = 6) • Avoidance of slang/colloquialism/jargon • Using simpler and more precise language • Using translation apps
Psychological challenges (*n* = 25) • Feelings of loneliness and exclusion • Loss of confidence and motivation • Confusion about cultural and professional identity • Adaptation to new cultural environment • Negative attitudes toward intercultural team collaboration • Reluctance to ask for help	Not specified
Challenges for prior background and experience (*n* = 30) • Lack of knowledge about intercultural team collaboration • Weak professional and technical backgrounds • Discrepancies between academic and cultural backgrounds	Not specified
Relational level	
Challenges	Coping strategies
Challenges of time management and planning (*n* = 31) • Time zone coordination • Time crunch for team tasks and meetings • Lack of explicit team plans • Inconsistency of working progress • Heavy team workload • Conflicts and disagreement about task progression	Coping strategies for time-related and planning issues (*n* = 11) • Frequent meetings to keep up-to-date with each other's progress • Written agendas and timing for meetings • Planning in advance • Clearly specifying deadlines for team tasks • Visualizing working progress through project management tools • Using the "sandwich structure"
Interactional challenges (*n* = 38) • Limited team discussion • Ineffective communication • Differences in communication styles • Negotiation with different opinions and understandings • High cost of international field trips and on-site collaboration • Lack of peer feedback • Lack of interpersonal relationships/interactions	Strategies for ensuring effective communication and interaction (*n* = 24) • Explanations of misunderstood aspects of projects • Asking for clarification • Using a variety of tools and ways to communicate • Early meetings to get to know each other • Developing shared theories and knowledge • Social gatherings outside of academic activities • Informal conversations about cultures
Technological challenges (*n* = 21) • Unstable internet connections • Unfamiliarity with software • Not maintaining the same pattern of tool use • Poor technical quality • Lack of equipment or software	Strategies for dealing with technological problems (*n* = 11) • Introducing new platforms • Tool and facilities improvement • Choosing multiple effective technologies • Training for students about tool usage

Table A1. *Cont.*

Challenges for teamwork and team building (n = 33) • Team role confusion and uncertainty • Avoidance of team responsibility • Passive engagement in team tasks • Lack of trust between team members • Inappropriate team rules • Different working and learning habits • Unsuitable group composition • Lack of team goals • Difficulties in decision-making	Strategies for team building and improving team dynamics (n = 24) • Task distribution based on members' strengths and areas for improvement • Assigning coordinators or taking turns as team leaders • Clearly defining different team roles • Engagement in ice breaking exercises and sessions • Taking role tests to form groups • Designing team contracts • Balancing students' cultural backgrounds and disciplines • Discussing common learning goals
Contextual level	
Challenges	Coping strategies
Challenges for team relationship with other stakeholders (n = 8) • Lack of support from supervisors and institutions • Struggling to meet international clients' needs [52,67,98] • How to abide by rules of local communities and understand local conditions	Ways of addressing relationships between students and others (n = 14) • Asking for suggestions/help from supervisors • Participation in cultural orientation courses or activities organized by the institution • Support from faculty members to coordinate teams

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