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Engineering students' thoughts on teamwork and approaches to solving a problem with an underperforming member

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Abstract: Engineering programs have to develop students' teamwork skills. However, the onus on content specialists to teach teamwork skills may be challenging partly because of students' negative attitudes towards and experiences with teamwork. This study investigated 295 engineering students' thoughts on teamwork and the strategies they used to solve problems with underperforming team members. Data were collected using a survey and a discourse completion task. The results revealed that among the key reasons why the students liked such activities was the exchange of information and experience, increased quantity and quality of work, and interpersonal communication. However, they indicated lack of harmony, social loafing, lack of attention paid to tasks, and individual approaches to learning as reasons for skepticism about teamwork. As to problem-solving strategies, emphatic inquiry and judgmental questioning were most common. Based on these results, we suggest that engineering faculty collaborate with communication instructors in planning and executing soft-skills training for students. Engineering faculty should also be provided with technical support for the incorporation of teamwork activities in virtual environments.

Keywords: engineering education; interactive learning; interpersonal communication; problem solving; soft-skills; teamwork

1. Introduction

Successful engineers require a variety of soft skills, among which are those related to teamwork, which can be defined as “the actions of individuals who have been brought together with their diverse but complementary skills to achieve a common purpose or goal” [1]. Therefore, the Accreditation Board for Engineering and Technology (ABET) [2] mandates that engineering programs demonstrate that their graduates exhibit ability to function on multi-disciplinary teams and communicate effectively. Accordingly, curricula in college degree programs often include a variety of learning outcomes pertaining to teamwork.

Much research has been conducted to identify the elements of successful teamwork in engineering education as well as the barriers to it. Regarding the former, goals and values being shared by all team members is the main determining factor [3]. On the other hand, team members' limited contributions, individual differences between team members (e.g., abilities and expectations), problems with assessment, and teams' process-related issues diminish the success rates and, therefore, reduce students' satisfaction with team experiences [4]. Similarly, female engineering students have reported limited learning because of their limited role on teams [5]. The impact of a negative team experience can be such that students, particularly females, may question their place in their respective engineering disciplines, causing some to

drop out [6].

Communication is “the practice of producing and negotiating meanings [and it] always takes place under specific social, cultural, and political conditions” [7]. Just as there are different countries with distinct cultures, organizations also each have their own sub-cultures within the dominant culture of the country in which they are situated. That is, the reasons why teamwork in a particular engineering education setting is (not) popular may be similar to or different from those in other settings within the same country or culture.

It is also important to note that gender plays a significant role in team interactions. There is evidence that gender diversity in scientific work and successful interaction between genders improve group processes, leading to greater innovation [8]. Such improvement is equally important in engineering education. However, it is also important to note that our communication patterns are influenced by the gender of the interlocutors. For example, Basow and Rubinfeld [9] observe that women are generally more expressive and polite, while men tend to be more assertive and dominant. Also, Amelink and Creamer [10] found that female and male team members have different approaches to interaction and problem solving. To illustrate, a student in their study noted that a female student would tend to wait until the end of a group discussion to contribute a solution to a problem. Additionally, when faced with a challenge involving the opposite sex, female engineering students were found to use more conciliatory language in exchanges with male team members so that they could avoid direct conflict. However, this was frequently perceived by male students as a sign of weakness leading them to exert power over them [6].

Team members’ awareness of individual roles and responsibilities plays a significant role in the success of team activities and the kinds of relationships that form as a result [11]. Each team member must take full responsibility for their own team experience [12]. One way to do this is by recognizing that no member is a passive recipient; each person affects the team at least as much as the team affects him/her. Also, it is important to accept that each member has shared responsibilities, to learn the types of behaviors and processes that lead to a successful team, and to exhibit them. Yet not all students may be willing to act on those principles. A commonly observed problem in teams across different contexts is a lack of responsible behavior in the form of ‘slacking’ [13] and ‘social loafing’ [14].

2. The significance of the study and research questions

The main significance of the current study stems from its examination of a particular issue surrounding teamwork in engineering education regarding soft skills development and gender dynamics within team interactions. As emphasized by accreditation standards and existing literature, effective teamwork is essential for engineering graduates, necessitating a deeper understanding of its intricacies. As discussed above, previous research has identified shared goals and values as pivotal to successful teamwork while also highlighting various challenges such as limited contributions, individual differences, and gender-related disparities. Notably, negative team experiences, especially for female students, can have profound implications, potentially leading to a loss of confidence and even dropout rates. Moreover, team

interaction can also be negatively impacted by ineffective communication behaviours relating to self-expression and differing problem-solving. Eventually, such behaviours will have negative effects on collaboration and the quality of work produced by the team. The current study's focus on students' perceptions of teamwork, their strategies for addressing underperforming team members, and potential gender variations therein offers valuable insights for educators and communication instructors. Identification of the ways in which students approach such problems and how they communicate their feelings and thoughts to an underperforming team member can help engineering educators and communication instructors design curricular activities that support effective communication among team members and, therefore, increase the effectiveness of their team-based learning experiences. There is indeed evidence that a positive correlation exists between engineering students' responsibility orientations and their aptitude for interpersonal communication [15]. Ultimately, the findings hold promise for fostering a more inclusive and effective learning environment in engineering education, addressing not only technical competencies but also essential soft skills vital for future engineers' success in diverse professional settings.

With these in mind, the current study sought answers to the following research questions:

- 1) How much do the students like or dislike teamwork? Why?
- 2) a) What are their approaches to dealing with an underperforming team member?
b) Does their approach change according to the gender of the underperforming student?

3. Methodology

3.1. Data collection method and participants

Based on convenience sampling, 295 engineering students in a single Turkish university (namely Dicle University) were involved in the study. Of this number, 31 (11%) were freshmen; 129 (44%) were sophomores; 57 (19%) were juniors; and 78 (26%) were seniors. The majority ($n = 225$) were mechanical engineering students, while 37 were civil engineering, 25 were electrical and electronics, and eight were mining engineering students. Also, 216 (73%) were male and 79 (27%) were female. The students' ages ranged from 18 to 47. The mean age was 24.

The choice of the above-mentioned data collection method (i.e., convenience sampling) was influenced by several factors, including the participants' geographical proximity, availability, and willingness to participate in the study [16], which were facilitated by the second author's use of 'captive audiences' [16] in his own institution (Dicle University in Diyarbakir, Türkiye). The choice of this method was also because of our time and budget constraints, as well as our wish to collect data quickly without extensive planning and recruitment efforts [17]. However, it is important to acknowledge the possibility that the participants' responses might have been influenced by other factors, one of which is sampling bias, limiting the accurate representation of the larger population and generalizability of the results.

3.2. Data collection tools and analysis

The data were collected using a survey comprised of several sections. In the first section, the students were asked questions related to demographics. In the second section, the students were first given a working definition of teamwork (i.e., the actions of students brought together with their diverse but complementary skills to complete an assignment given by their course instructor). Then they were asked to indicate the extent to which they liked teamwork. For this, they were given Likert-type scales. They were also asked open-ended questions to explain their responses. In the third section, two different hypothetical situations were described to them, one indicating a male team member (Ali) and another one indicating a female (Fatma) who failed to effectively carry out the responsibilities of a team task. They were given a discourse completion task (DCT) asking them to imagine they see Ali/Fatma alone, and they decide to go and speak to him/her. They were asked to write the exact words they would say to Ali/Fatma. For this, they were given separate spaces in which to write their responses.

The data on demographics were then analyzed using descriptive statistics, including frequencies and percentages. The student responses to the Likert-type questions were analyzed using Microsoft Excel. The students' responses for the male and the female underperforming students were compared using a *t*-test. A *p*-value of less than 0.05 was considered significant.

In analyzing the qualitative data, we adopted the thematic analysis approach, which, according to [18], “Can highlight similarities and differences across the data set, can generate unanticipated insights, and allows for social as well as psychological interpretations of data.” To increase the validity of the analysis, we—as the two researchers—first analyzed the data separately after a brief standardization session. To that end, we followed the following steps [18]: (a) immersing in the data, (b) generating initial codes, (c) searching for themes, (d) reviewing themes, (e) defining and naming themes, and (f) producing the report. In doing this, as recommended by Jamieson et al. [19], both of us aimed for reflexivity by reflecting on our own potential biases, assumptions, and interpretations. After the separate analyses were completed, we held a meeting to compare our analyses. We discussed the results until we reached a consensus.

The themes identified were further validated through peer debriefing [20], where we discussed our interpretations with two other colleagues with experience in education research to gain alternative perspectives and ensure credibility.

Among examples of themes related to the students' reasons for positive attitude towards teamwork are efficiency in learning, quantity and quality of work produced, and interpersonal relationships. On the other hand, example themes regarding their skepticism about teamwork include lack of harmony, differing approaches to learning, and lack of responsibility. The analysis of the qualitative data collected through the DCT revealed themes like sympathetic inquiry vs. judgmental inquiry, offer of help, complaint, demand, and request.

4. Results

The first research question asked why the students liked or disliked teamwork. It

also aimed to compare the female and the male students' responses. The themes that emerged out of their responses are given in **Tables 1** and **2**.

Table 1. Reasons for liking teamwork*.

Reasons	<i>f</i>	%
Exchange of ideas, knowledge, and experience	77	37
Efficiency in learning	35	17
Quantity and quality of work produced	33	16
Interpersonal relationship	27	13
Speed of problem solution	13	6
Personal development	11	5
Motivation	7	3
Personality traits	4	2
Reduced work-load	2	1
Total	209	100

*Frequencies and percentages were calculated from the total number of responses as some students did not answer this question. Some students indicated more than one theme.

Table 2. Reasons for disliking teamwork*.

Reasons	<i>f</i>	%
Lack of harmony	36	33
Individual learning approach	20	18
Students' lack of responsibility	15	14
Lack of interpersonal communication skills	11	10
Unwillingness to share	7	6
Time consuming	7	6
Lack of care	4	3
Lack of previous experience	3	3
Unfair distribution of work	3	3
Other (health, divergent needs, self-centeredness)	3	3
Total	109	100

*Frequencies and percentages were calculated from the total number of responses as some students did not answer this question. Some students indicated more than one theme.

Table 1 shows that the most frequently occurring reason was the opportunity to exchange ideas, knowledge, and experiences ($f = 77, 37\%$). In general, the students stated that through teamwork they acquire new knowledge and information and learn to look at issues from different perspectives. Others' prior experiences were also cited as a contributing factor. One student noted, "Knowledge multiplies and becomes more useful as it is shared." Similarly, a male student said, "Where there are many people, there is much knowledge."

The second most frequent reason was efficiency in learning ($f = 35, 17\%$). The students often stated that teamwork allows them to reinforce learning, unlearn false information, and notice their mistakes. One student noted that teamwork encourages him to engage in more research, while another said it makes her a more active learner

during and outside of classes. In the words of one female student, “Team work teaches me to be self-disciplined, which is an important skill in the workplace, too.”

The third most frequently occurring reason was the increased quantity and quality of the work produced by the team ($f = 33$, 16%). Sample student responses include, “When the number of hands increases, the quality of the work increases,” “Strengths come from unity, which increases success,” and “Strength in numbers.”

Interpersonal relationships were the fourth most frequently occurring reason ($f = 27$, 13%). The students often pointed to the chance to socialize with others. They noted that this enables them to catch up with friends, make new friends, and tighten bonds with classmates. One student also indicated that teamwork allows her to meet people from other cultures. Collectively, these consequences appeared to make learning activities more engaging. Another student stated, “I like increasing my social circle.” Another one said, “The more time I spend with my friends, the stronger our ties become.”

The speed at which problems are resolved was in the fifth place, and personal development was in the sixth place ($f = 13$, 6%, and $f = 11$, 5%, respectively). Pertaining to the former, the students said teamwork reduces the likelihood of mistakes while also decreasing the time spent on tasks. Teamwork was also noted to enable them to reach quicker solutions to problems. Those who referred to personal development indicated teamwork increases their self-esteem and teaches them communication and planning skills.

Infrequent though they were, increased motivation and personality traits were also detected in the data set as reasons for appreciating teamwork ($f = 7$, 3%, and $f = 4$, 2%, respectively). The students said teamwork makes the learning experience more fun, which increases their motivation for learning. One of the students said, “I have the qualities of a leader; I can manage teams well and persuade team members easily.” Another one noted, “I like teaching to others.”

Finally, two students mentioned a reduced workload. They explained that sharing the tasks among team members reduces the amount of work each person has to produce, which in turn decreases the tension they feel.

Table 2 shows that the most frequent reason why the students were skeptical about teamwork was the lack of harmony in teams ($f = 36$, 33%). Clashing personality traits caused a lack of harmony. One male student, for example, stated that pessimistic types often cause problems. Another one mentioned people with strong personalities but inadequate knowledge. Five of the students attributed the problem to the age gap between team members. One student said, “Because of my age, I have difficulty adapting to the younger generation.” A similar sentiment was expressed by another student: “Since I am older than the others, I face communication problems.”

The second most frequent reason for skepticism was individual learning approaches ($f = 20$, 18%). These students indicated that they like to study alone. One of the students said, “In this way, I have the ultimate control over things. So, I am more confident in the quality of the work.” Another student noted, “When I work alone, I am not distracted by others.”

Other students’ lack of responsibility came in third (14%). The students complained that there are often students who do not carry out their responsibilities. One student lamented, “In a group last year, I had to take all the responsibility for the

project since no one was willing to work.” Another student said, “Some in the team might not be fully aware of what it takes to be a team.” There were also comments on some students’ tendency not to participate in the task actively. One student pointed out that there are always students who depend on more able students on the team.

Linked to the lack of harmony above, the lack of interpersonal communication skills was another reason (11%). These students explained that they either did not know the other students or had difficulty meeting new people. One of the students said, “I cannot show myself in team activities.”

Some of the students also had concerns about how much time the completion of team tasks likely takes (6%). One student remarked that team members often resorted to activities or discussions unrelated to team tasks, because of which assignments required more time.

Unfair distribution of work was another critique of teamwork (3%). The students noted that some teammates take a smaller portion of the work or the easier tasks. Consequently, this increases the workload on others. Among additional reasons were students’ unwillingness to share with others (6%), the lack of care given to the tasks (3%), inadequate prior experience (3%), and others (3%) including health, divergent needs, and self-centeredness.

The second research question was related to the approaches the students would adopt to tackle problems with an underperforming team member. Toward this end, they were first asked questions to identify their general attitude. Statistical analyses were conducted to see whether the students’ responses would differ for the male and the female underperforming student. The results are given in **Table 3**.

Table 3. Comparison in regard to student gender.

	Ali (male)	Fatma (female)	<i>t</i>	<i>p</i> *
1) No matter how concerned I might be, I would not speak to Ali/Fatma about the situation.	1.6	1.7	-2.3041	0.0219
2) I would speak to the course instructor about the issue.	2.6	2.7	4.084	0.0000
3) I would speak to the other team members about the issue.	4.1	4.1	0.0742	0.9409
4) I expect Ali/Fatma would have a valid reason(s) for the issue.	2.9	3.4	10.3477	0.0000
5) The team should help Ali/Fatma to carry out his/her tasks.	3.8	3.9	3.3371	0.0009

**p* < 0.05.

There were often statistical differences between the approaches the students thought they would adopt towards the male student and the female student. First, the students indicated disagreement with the statement that they would not speak to the underperforming student regardless of his/her gender. However, their disagreement was slightly stronger concerning Ali’s performance, a result at a statistically significant level ($t = -2.3041, p = 0.0219 < 0.05$).

Pertaining to the second statement, the students tended to refrain from complaining to the course instructor about their team members’ poor performances. However, they were slightly less willing to discuss the male student’s performance

with the instructor than they were to discuss the female student’s performance ($\bar{x} = 2.6$ vs. 2.7). The difference between the averages was statistically significant ($t = 4.084, p = 0.0000 < 0.05$).

The students’ overall average scores for the third statement for both Ali and Fatma were 4.1. The comparison of the data sets revealed no difference at a statistically significant level ($t = 0.0742, p = 0.9409 > 0.05$).

The fourth statement was about the excuses Ali and Fatma might have. There was a stark difference between the students responses for Ali and Fatma to the benefit of the latter ($\bar{x} = 2.9$ vs. $\bar{x} = 3.4$). Also, the paired *t*-test showed that the difference was statistically significant ($t = 10.4377, p = 0.000 < 0.05$).

The students leaned towards agreement for the fifth statement. However, their approach appeared to be slightly different for Ali than for Fatma. For the former, the average was 3.8 while it was 3.9 for the latter. The difference was at a statistically significant level, too ($t = 3.3371, p = 0.0009 < 0.05$).

In order to understand how students would behave pragmatically, two hypothetical situations were described to them (one with Ali and another with Fatma), and they were asked to indicate the exact words they would say. The results are summarized in **Table 4**.

Table 4. Strategy use*.

	With Ali (male)		With Fatma (female)	
	<i>f</i>	%	<i>f</i>	%
Sympathetic inquiry	111	28	107	29
Judgmental inquiry	89	23	91	24
Offer of help	67	17	65	17
Complaint	63	16	54	14
Demand	28	7	24	6
Request	11	3	14	4
Recommendation	11	3	5	1
Warning	13	3	12	3
Total	393	100	373	100

*Some students didn’t complete the task. Frequencies and percentages were calculated from the total number of strategies used as the students normally used more than one strategy.

Taken as a whole, the students leaned towards sympathetic inquiry about the reasons why their team member’s performance was inadequate. Sympathetic inquiry accounted for 28% of the strategies used with Ali and 29% of those with Fatma. Sample responses are given below.

If you don’t take it wrong, I’d like to speak with you. Is there something bothering you? It appears you haven’t done your tasks for the team project. I will be more than happy to help if there is anything I can do. Would you like to tell me about it? (To Ali).

We were going to a collaborative project. You are not participating much. I thought there might be an important reason. (To Ali).

How are you? There were things you were expected to do for the project. Have you been able to finish it? (To Fatma).

You know, all our friends have finished their tasks. Yours is the only one left. I wonder if you have a problem. I hope there isn't something serious. (To Fatma).

The percentages of judgmental inquiry in exchanges with Ali and Fatma were similar (23% and 24%). See below for sample statements.

I want to speak to you about the project. Unfortunately, I see you have not paid the necessary attention to it. Can I learn the reason for that? (To Ali).

How are you? Do you have a problem? If so, I can do my best. If not, why did you leave us half way through? Can you explain? (To Fatma).

Complaint was employed by the students speaking to Ali slightly more than those speaking to Fatma (16% vs. 14%). Offers of help were employed with a similar percentage with the male and female students (17%). Sample responses are given below.

We together are in a project, and everyone has a responsibility. But I think you are not carrying out your responsibilities, unlike the others. (To Ali).

You did not do what you were supposed to do. If you want, we should find a solution. (To Fatma).

A solution was sought using a demand or a request. The former was used slightly more in responses to Ali than in those to Fatma (7% vs. 6%), whereas the latter was used slightly more often in responses to Fatma than in those to Ali (4% vs. 3%). Request, on the other hand, was used more often with the female student. Sample responses include:

Submit your portion of the assignment on time. (To Fatma).

I request you give importance to the project. (To Ali).

Can you do your task for the group on time? (To Fatma).

The students also made recommendations, which occurred more often in exchanges with Ali than those in Fatma (3% vs. 1%). On the other hand, warnings, albeit infrequent, were issued with the same frequency for Ali and Fatma (3%). See the sample responses below.

If you have a specific reason, you should speak to the instructor, who always gives a second chance. (To Fatma).

If you do not pull yourself together, we will inform the instructor. (To Ali).

5. Discussion

The results pointed to the students' above-average rating for how much they liked teamwork activities. When asked for the reasons, they often referred to the opportunity to exchange ideas, knowledge, and experience—a result commonly reported in previous research, too [21,22]. Although mentioned less often, the increased quantity and quality of work was another important reason. Taken together, these data may suggest the students tended to pay more attention to group processes than products—a result lending credence to earlier observations [23].

In addition to the aforementioned lack of harmony, some other reasons were also cited by the students as factors with negative impacts on their satisfaction with teamwork. One of these was the students' preference for individual study. They noted

that this enables them to go at their own pace and ensure control over processes and the ultimate product. Those who mentioned this also pointed to team assignments taking longer than individual ones. Infrequent though they were, factors like a lack of interpersonal communication skills and a lack of care taken towards tasks were also mentioned by some students. Consistent with these findings, [4] also found that differences in team members' abilities and some members' limited contribution and motivation were among the reasons students' were worried about teamwork. Pfaff and Huddleston [24] also observed that a variety of similar student-caused problems (e.g., not contributing one's full potential, disruptive behaviors, a leader that was too dominant) and instructor-caused ones (e.g., grading approach) can prevent students from benefiting from teamwork fully.

The results also showed that the students were concerned about not only the effects of an underperforming student on the team as a whole but also the well-being of the student himself/herself. They generally felt the student likely had an acceptable excuse and the team should help each other carry out their tasks. Considering the collectivist nature of the culture in which the study was undertaken, this is an expected result. Individuals in collectivist cultures work to support the needs of the team and emphasize relationship building and collaboration so that the team's outcomes are ensured [25]. The sympathetic inquiries produced by the students often showed that they were willing to listen and help. They also thought the team should meet up and discuss how to tackle the issue and assist the underperforming student. Such social skills create compatibility among team members and reduce tension. However, it is also important to note the results of earlier research indicating that in some collectivist cultures (e.g., the Emirati), team members may choose not to express their disappointment with an underperforming student, at least not verbally or directly to the student himself/herself [26]. This is because complaints are face-threatening acts [27], and members of collectivist cultures may refrain from complaining and expressing dissatisfaction explicitly with the belief that such confrontations prevent harmonious relationships [28]. Such teammates may desist even if it means overriding the task assigned [29]. In the current study, too, there were quite a few students who said they would not speak to the underperforming member.

The analysis of the students' strategy use showed that they were often sympathetic with both Ali and Fatma. However, judgmental inquiry was utilized with Fatma, the female underperformer, slightly more frequently than it was used with Ali, the male underperformer. A closer look at the data set revealed that this occurred more often in the female data set, which also included more frequent use of demand. Together, these data may point to the female students' tougher approach towards a student of the same sex. We wonder if this may be related to 'the Queen Bee Syndrome', according to which women that have been successful in male-dominated environments likely cause problems to other women in the same environment, preventing them from advancing [30]. Or is it because they find it easier to express emotions and thoughts to females than to males, or because they feel more responsible for their female counterparts and feel the need to urge them to work harder? The latter may be explained by social identity theory, according to which individuals tend to favor members of their own group (ingroup) over members of other groups (outgroups), a phenomenon known as ingroup bias [31]. This theory suggests that

individuals tend to favor members of their own group (ingroup) over members of other groups (outgroups). In mixed-gender teams, women may identify more strongly with other women as ingroup members, leading to higher expectations and demands compared to male team members perceived as outgroup members. This ingroup bias can contribute to more demanding behavior towards other women in the team.

The female students' tendency to be more judgmental towards the other female students in the team setting may have been caused by various factors, including socialization, competition, and internalized gender stereotypes [32]. These dynamics can stem from societal expectations about women's behavior, competence, and leadership abilities, which are often internalized by individuals [33]. As a result, female students may unconsciously hold biased beliefs about what it means to be a successful woman, leading to judgmental attitudes towards peers who do not conform to these stereotypes [32]. Additionally, competition for limited opportunities (as in the case of the Queen Bee Syndrome), social comparison processes, and perceived threats to group cohesion can contribute to such judgmental behaviors [33].

Overall, the findings of the research shed light on several significant aspects of students' attitudes towards teamwork, their perceptions of underperforming team members, and the strategies they employ to address these issues. Firstly, the above-average rating for liking teamwork activities, primarily attributed to the opportunity for knowledge exchange and increased productivity, underscores the importance students place on collaborative processes. This emphasis on group dynamics over outcomes aligns with previous observations and highlights a nuanced understanding of teamwork among students. Additionally, the identification of factors negatively impacting satisfaction, such as individual study preferences and communication deficiencies, underscores the complexity of effective collaboration in educational settings. Moreover, the students' concern for both the team's well-being and the underperforming student's individual welfare reflects a collectivist mindset, emphasizing support and collaboration within the team. This cultural context not only influences students' attitudes towards teamwork but also shapes their approach to addressing performance issues. The observation of differing responses towards underperforming students based on gender prompts intriguing questions regarding gender dynamics within teams, including the potential influence of the Queen Bee Syndrome or gender-specific communication patterns. Taken together, these findings offer valuable insights into the multifaceted nature of teamwork in engineering education, highlighting the importance of considering both individual preferences and cultural influences in fostering effective collaboration among students. Such insights can help develop effective strategies to enhance teamwork experiences and mitigate challenges, ultimately contributing to the cultivation of well-rounded engineering professionals equipped with essential soft skills for success in diverse professional environments.

6. Recommendations and conclusion

In this paper, we discussed the importance of teamwork skills for engineering students. We noted that effective teamwork allows students to draw on each other's knowledge, skills, and experience. Not only does this enhance the quality and quantity

of the work produced, but it also reinforces interpersonal communication among students and contributes to their holistic development and overall well-being. Accordingly, we suggested ways in which teamwork skills could be incorporated in engineering curricula. We also provided data on 295 engineering undergraduate students' general feelings about teamwork and described their approaches to solving a perceived problem caused by an underperforming student on their team.

Both faculty and students may be wary of teamwork activities due to potential problems, many of which were mentioned by the students in the current study too. Based on the results of the study and discussion above, however, several recommendations can be made. One of these is related to team-building activities. At the beginning of projects, faculty can employ team-building exercises to develop stronger relationships and understanding among team members. Among such activities are icebreakers, collaborative problem-solving tasks, or team bonding events that will foster cohesion and trust within the group. There could also be communication training for students. These could emphasize active listening, constructive feedback, and conflict resolution skills. Ultimately, these will enhance team dynamics. Additionally, to circumvent the problem of a student not contributing his/her full potential, team membership can be changed periodically or individual accountability can be increased [24]. In case of behaviors disrupting team dynamics and causing diversion from the task at hand, either team members or faculty can talk to the student directly, requesting attitude change. Instructors could emphasize the significance of individual accountability within teams by clearly defining roles, responsibilities, and expectations for each team member. In addition, students can be assigned specific roles to play in their teams. Furthermore, there could be some sort of mechanism for underperforming students. These could be in the form of peer tutoring and mentorship programs.

It is equally important to address gender dynamics. To this end, instructors can help raise students' awareness of gender dynamics within teams, providing training on gender sensitivity and inclusivity. Mutual respect and understanding among team members can be promoted through an open dialogue about biases, stereotypes, and effective communication patterns. Moreover, there should be regular check-ins and feedback. Toward this, there needs to be regular progress reviews to assess team dynamics, identify challenges, and provide feedback on individual and team performance. Our own anecdotal evidence also points to the benefit of incorporating peer evaluation as part of assessment to mitigate such problems. Oakley et al. [34] suggest peer evaluation can be in the form of students assessing the relative contributions of the team members to the final product or in the form of assessing the team citizenship of each member, which includes cooperation with the team and fulfillment of responsibilities.

In the context of the current study itself, a number of caveats need to be made. First, this study investigated students' anticipated behaviors in the face of a problem. That is, the data on their interaction with an underperforming student were collected using a DCT. Researchers need to be cautioned that DCTs do not collect naturally occurring data. However, they do collect data that might be difficult to negotiate in real-life situations [35]. Future studies could consider supplementing data from a DCT with at least some naturally occurring ones. Also, we were able to include a relatively

small number of students from one particular university setting. Therefore, the conclusions we drew from the data obtained should be approached with caution. Another area of research may be investigating the conflict-resolution behaviors of engineers on teams in the field. This would allow engineering departments to devise curricular activities more akin to real-life situations. As well, a comparison can be made between students' attitudes towards and experiences of teamwork at different levels, which can help understand their development of team skills as they progress. We also suggest that soft-skills training for engineering students be planned and executed in collaboration with communication instructors. This would be compatible with the nature of the engineering discipline, requiring constant contact with a variety of stakeholders in the community. Finally, and no less importantly, teamwork and conflict-resolution behaviors of professionals who are in different disciplines but working together could be compared.

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