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Teamwork Made in China: Soft Skill Development with a Side of Friendship in the STEM Classroom

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Abstract: One demand imposed by the global market is the possession of adequate soft skills, a challenge commonly faced by STEM (science, technology, engineering, and mathematics) graduates. This challenge is particularly prominent in China, which produces millions of STEM graduates annually. Consequently, there is a pressing need to develop and research programs facilitating the acquisition of soft skills, with a specific focus on teamwork, among Chinese engineers. To this end, we created a team-based project as part of a semester-long scientific English communication course at a Sino–foreign STEM university in China. The project aimed at fostering valuable soft skills through active learning, including teamwork, communication, and collaboration. In this report, we examine written reflections by students, aiming to assess their perceptions of soft skill development and overall experience resulting from their participation in the team-based project. Our results show the self-reflected soft skills development was considerable, and, unexpectedly, a noteworthy outcome of the project was the significant development of interpersonal connections, resulting in a positive experience and friendship development. Consequently, the findings of this study shed light on how teamwork can foster soft skills and friendship development, the latter often referred to as relationship development, another soft skill in the 21st century.

Keywords: STEM education; soft skills; teamwork; friendship; Sino–foreign universities; higher education; China; active learning

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1. Introduction

The importance of developing soft skills as part of engineering degree programs has been well established [1,2]. Key soft skills include collaboration, communication, curiosity, creativity, relationship building, and critical thinking [3]. One framework for fostering soft skill training is through active learning and teamwork [4–6]. The importance, benefits, and preference of teamwork and teamwork skills in the workplace has been shown in both research and by demands of employers [7,8]. Implementing teamwork training is especially relevant for STEM fields because of the complexity of projects and problem-solving. While companies can train their employees on the job, this is a costly and time-consuming endeavor; therefore, implementing teamwork training at the university level is one solution as teamwork skills can be incorporated into assessment and pedagogies such as active learning. Despite this awareness, research shows more training at the university level is still needed [9,10]. For example, undergraduate students rate the importance of teamwork higher than they rate their actual ability to work in teams; this is even lower for women than men [2].

A similar situation exists among Chinese students [11]: soft skills have not been a substantial part of Chinese STEM secondary and tertiary education [12] even though China is producing a significant number of engineers [13]. As a result, recent studies have reiterated the need for teamwork in engineering education in China [14]. Despite the

importance of teamwork in STEM fields and the growing number of engineers in China, more research and understanding of teamwork and effective training frameworks such as active learning in STEM education in China are still lacking [14,15].

Therefore, this article presents a teamwork-based project as part of a communication course in a Sino–foreign STEM university in China and investigates students' perspectives and self-assessment of soft skills following the project. As such, the research question that guided this study was "Which soft skills and experiences, from the students' perspective, are fostered by a team-based project in an active learning classroom?" Researching these programs that incorporate active learning, and specifically in the under-researched group of Chinese students, can shed light on the programs for and benefits of fostering teamwork skills in a global world. Our findings show that not only did students self-report improved soft skills, such as communication and collaboration, but students also reported that a key outcome of the project was friendship development. Friendship development is often referred to as relationship development, another key soft skill in the 21st century. This result has potentially positive implications for the success of future teamwork projects for both education and industry.

2. Background and Theory

2.1. The Active Learning Framework

Both higher education and the workplace value skills such as teamwork, communication, and critical thinking. One way this can be accomplished is through collaborative learning and group work, i.e., through active learning styles [4]. Active learning has been shown to be more interesting and effective for many programs and especially STEM programs [16]. It has been shown to improve students' outcomes, understanding, and application of the material [16,17]. Active learning includes activities in which students are "doing", guided by the instructor's design following learning goals with a specific outcome in mind [16,18,19]. In other words, students are engaged in the activity, often feeling a larger workload than just passively listening to a lecture [16].

Active learning is often collaborative and cooperative, focusing on the interaction between the members of small groups [17]. Research on using active learning specifically in the STEM classroom has shown this benefit as well, including the development of soft skills of collaboration and communication, as the use of active learning in STEM places students at the focus of learning according to current engineering education standards [20–22]. Studies have also shown that students have a positive attitude toward active learning, in general, and toward learning outcomes in active learning classrooms, specifically [23–25]. For example, active learning has been shown to have a similar, positive effect on both Western and Chinese cultures though the Chinese education system is based on traditional classroom studies, and Chinese students are often described as reticent (see review by [22]). These studies suggest active learning is a recommended aspect of STEM programs and an effective framework for fostering students' soft skills, and as such, the basis of the team-based project here in our STEM communications course.

2.2. An Overview of Teamwork in STEM and Its Connection to Soft Skills and Relationships

While hard skills are a prerequisite for science, engineering, and math professions, there is evidence to suggest that it is the acquisition and use of soft skills that predict success in career and life [26]. The concept of hard versus soft skills is often equated to the difference between explicit and tacit knowledge. Hard skills are acquired through more formal learning processes, and soft skills through experience [27].

According to research, several soft skills are key in STEM fields; for example, Refs. [28,29] present similar lists including teamwork, collaboration, leadership, problem-solving, critical thinking, work ethic, persistence, emotional intelligence, organizational skills, creativity, interpersonal communication, and conflict resolution. Focus has also been given specifically to the 4Cs—collaboration, communication, curiosity, and creativity and their development in the STEM undergraduate classroom through group projects. Indeed, collaboration is

developed through teamwork, which requires both listening and negotiation skills [30]. Moreover, both communication and creativity have been a focus of research at all levels of STEM education and can even be regarded as a primary goal [31]. These skills are not only important for employers but also benefit employees: researchers have found a correlation between soft skills competency and higher pay, and, when combined with technical competencies, higher job promotion potential [32,33].

More specifically, teamwork is one of several 21st-century skills that STEM education should foster. The importance of teamwork in the workplace, and specifically for engineers, has been firmly established [11,34,35]. Studies have shown that teamwork positively affects work effectiveness, learning benefits, and soft skills [5,6]. It also benefits skill development through "increased creativity", "increased motivation", and "ability to make new connections" [12] (p. 11). Moreover, researchers have found that active group- and teamwork can improve, for example, communication and interpersonal skills [6] and foster better work outcomes [36].

Researchers have suggested that the university is an appropriate place to further such skills and have indeed found that they have been incorporated into engineering degree requirements [11,37,38]. Teamwork has been shown to benefit active student engagement, social and interpersonal skills, cooperation, and collaboration [39–41]. One study on teamwork among undergraduate students shows that they expressed improved collaboration and communication and had a positive experience following teamwork; in another study, they even preferred collaboration and cooperation, but in other cases claimed it may waste time [40–42].

Good relationships in teams have also been shown to produce better work outputs [43]. While relationships and friendship are not on the list of the top soft skills for STEM, research has shown many benefits of workplace relationships and friendships. For example, coworkers who are friends tend to communicate more intimately and about more topics and share more information than those who are not [44,45]. Moreover, certain peer relationships (coined "special peer relationships") in the workplace provide emotional support, personal and professional feedback, and friendship [46]. Workplace friends also provide support when dealing with colleagues or with stress [47]. Such friendships also facilitate and benefit decision-making and creativity [48,49]. Other studies have shown friendship can support academic achievement, including increasing academic self-confidence among minorities [50]. Moreover, a study has shown that active learning activities may facilitate friendships among students [51]. Therefore, the facilitation of workplace relationships and friendships has many advantages, and may be encouraged through soft skills development, especially teamwork, in higher education programs.

2.3. Chinese STEM Students and Soft Skills

Despite their significant number, estimated at over 8 million a year, Chinese STEM students graduate with a lack of professional skills that can be fostered from experience and experiential learning [34]. The prevailing foreign perspective on Chinese STEM students describes them as "passive obedient learners" who are seldom active learners in the classroom [52] (p. 20) [53]. However, this popular stereotype may be due to Chinese students' overall learning environment, the classroom educators' teaching approach, and the goals of the Chinese education system [24,54,55].

The most important goal for most Chinese high school students is to achieve high grades in the GaoKao, a standardized achievement test used to rank students to enter universities from high school [56,57]. This exam and the resulting university education are considered to be the determining factors in Chinese students' future careers and even roles in society [58]. This possibly life-altering exam explains why Chinese pedagogy focuses on the ability to solve standard predetermined problems instead of a dynamic classroom environment as it will cost too much time away from the prescribed material. Classroom educators are also evaluated based on their students' GaoKao performance, perhaps encouraging the use of knowledge-based teaching methods and the idea that

teaching is one-way knowledge transmission. This process does not involve student participation. Consequently, less attention is paid to soft skills such as collaboration, creative expression, and critical thinking during the formative high school years [56,59,60].

Traditionally, the environment in the Chinese STEM undergraduate classroom is often similar to high school, and soft skills development has not been a substantial part of Chinese STEM education. This has been substantiated by recent findings that Chinese undergraduate students do not acquire critical thinking or teamwork skills compared to their American counterparts during their undergraduate education [13,14]. Consequently, engineering education, including the lack of such soft skills, is believed to put Chinese engineers at a disadvantage in the worldwide industry and China [61,62]. To remedy this, several engineering education initiatives in China have over the past decade brought about the recognition for improving soft skills [14].

However, in China, there is still a lack of research on the impact on soft skills from teamwork in the Chinese STEM classroom as much of the research has concentrated on the overall preference and team member makeup: for example, Ghannam and Ahmad [34] surveyed Chinese students engaged in a team-based project. The students reported finding the experience beneficial and expressed a preference for teamwork. However, another study suggested that the preference for group work versus individual work is approximately equal [39]. Zhang et al. [63] found that when researching self-chosen and assigned groups, self-chosen groups performed less academically among Chinese engineering students. Zhang et al. [63] also observed that Chinese engineering students preferred to choose one member to be in a leadership role rather than sharing responsibilities; they also found that they preferred to choose their own group, which ended up in groups divided by gender.

While several studies have demonstrated that students react positively to teamwork [34,42,64,65], there is less evidence from China, and especially among Chinese STEM students [66]. Moreover, few studies have examined friendship among Chinese students and teamwork. In one study on workplace friendships and teamwork in China, results showed that subordinates are less interested in workplace friendships than supervisors; the researcher claims this may be because "The main concern for the subordinate is to complete his or her job on time" [67] (p. 64). Another study looked at a module for teaching undergraduate engineers in China and suggested an improved version based on student feedback; though not the focus of the project, they found that students enjoyed the group project and became friends as a result of working together as a team [68]. More work, however, has been achieved on active learning and Asian countries. A meta-analysis of studies on active learning in Asian countries shows its effectiveness [24], and recent work on active learning has shown that student–student relationships—among both the Chinese and US students analyzed—are stronger in active learning classrooms than in traditional classroom learning [15,69].

Beyond these studies, because of the global world and the millions of STEM graduates coming out of China, there remains much to contribute to soft skills training and research on teamwork in China, and especially among STEM students. Specifically, here we aim to present and analyze a team-based project in a communication course and students' self-assessment of teamwork, communication, and collaboration skills following the project. This analysis aims to shed light on which soft skills are fostered by a team-based project in an active learning classroom.

3. Methods

3.1. Setting, Participants, and Intervention

To describe the protocol of the team-based project, we use the guidelines of the TIDIER protocol [70], which offers a series of questions to describe a research intervention. The protocol includes, for example, the procedures, activities, mode, location, number of sessions, delivery, and modifications of the intervention.

The setting of the research is a semester-long undergraduate "Science and Professional Communications" course for undergraduate second-year STEM students at a Sino–foreign

research university. The participants are undergraduate Chinese students in all the engineering programs offered at the university: chemical engineering, food and biotechnology engineering, and materials engineering.

The required course meets twice a week for two-hour classes for thirteen weeks. The course takes place on campus in classroom meetings, which include lectures, pair work and teamwork. The course was developed at the home university and has been given for 20 years. On the Chinese campus, it had been delivered previously over three years. The instructors, trained by the original developers of the course, have PhDs and over a decade of experience teaching academic writing and communication courses. On both campuses, the course is held in English, as English is the language of all programs at the university and the lingua franca of engineering and global communication [71].

Following two years of experience at this Sino–foreign university, lecturers from the home university found that Chinese students did not participate actively in class discussions or ask questions as they were used to. This reticence was of concern since the university's goals are to train engineers who can develop future research and hi-tech initiatives. These goals require active discussions and question-asking, central to such research inquiry. Therefore, the communications lecturers, i.e., the authors of this article, developed a unit as part of the communications course to encourage this. The course, and specifically the unit, is based on active learning, including pair work, teamwork, and presentations. Active learning was chosen since research has shown its effectiveness in the development of soft skills [20–22]. Moreover, studies have also shown that students have a positive attitude toward active learning in general [23–25].

This unit centered around a team-based project to facilitate communication, curiosity, and question-asking. Throughout the project, students work in teams and communicate in English while learning about the value of question-asking and curiosity in successful Nobel Prize-winning research.

The research on the project was conducted in two phases. First, a pilot project was conducted with 40 students in the winter semester of 2020–2021 via Zoom. The results of this pilot study have been presented in. Finally, a revised version of the project was given and researched in the following semester (see below).

In both the pilot and final phases, the project was divided into four stages during the 13-week semester-long project. This allowed students and teams to work iteratively based on feedback from the instructor and group discussion. The initial stage involved team formation of 3–5 students, completion of a pre-project online questionnaire, and selection of Nobel Prize-winning research from the hard sciences. This was followed by an exploration of winning researchers' biographies and an initial investigation into the scientific curiosity triggering the research. Students had the flexibility to focus on one or all the researchers from the prize and the aspects that intrigued them the most. The instructor gave feedback at each stage on the content and progress of the project.

In the second stage, students incorporated feedback from the first stage, continuing their research into the evolution of questions guiding the Nobel Prize-winning research. They also delved into potential industrial applications and subsequent research spawned by the answers uncovered by the winning researchers. Stage three again involved feedback from the instructor. Students then incorporated this feedback, outlining the presentation and resources for the final presentation. The culmination in the fourth stage comprised a formal group presentation and submission of the slides. All stages were completed by the end of the semester.

Several adjustments were made from the pilot to final version, including the change from a Zoom course, due to COVID restrictions, to a face-to-face course on campus in the spring semester of 2021. Other changes were made based on the instructor's experience and student feedback. For example, one major change was the additional time allotted to work in teams in class, and not only outside of class time. The students' preference for face-to-face can be found even in student reflections, for example:

"I also found that, when we need to discuss something and make decisions, the best way is to talk face to face but not on line, only in this way can we finish the project with high efficiency."

Another change as a result of the face-to-face option was to lessen the number of digital platforms used: we used Moodle for sharing the course content, Zoom for lectures, and Microsoft TEAMS for team collaboration and meetings. Students found TEAMS cumbersome, and since all team meetings were now face-to-face, this platform was not needed. A final change was in the feedback given by the lecturers to students: this was expanded to include not only written feedback but also face-to-face conversations.

3.2. Data Collection and Analysis

The data collection and analysis were based on student reflections following the project. Students were required to fill out a personal reflection as part of their individual participation grade; however, the content of the reflection was left undefined so as not to bias any results. Student reflections can be a valuable source of qualitative data, especially for education research [72,73]. Indeed, previous research has shown the value of qualitative research on undergraduates' perceptions [74,75]. Analyzing students' open reflections, without questions to direct them, allowed us to collect data without bias and find what students had experienced most saliently. Data collected from students were anonymized before analysis.

To analyze students' reflections, we chose the Thematic Analysis method [75]. The data were analyzed thematically according to Braun and Clarke's six steps in qualitative data analysis: familiarizing (yourself) with data, generating initial codes, searching for themes, reviewing themes, defining themes, and writing the results [76]. After the first stage, the two authors, both researchers and lecturers of communication with over a decade of experience (lecturers with PhDs and over a decade of experience teaching academic writing and communication courses), independently coded the data from 146 reflections. The qualitative analysis was conducted by both authors independently in 4 rounds. In round 1, the reflections were coded by identifying topics that arose from the students' reflections. In round 2, the data were put into tables according to all the nine generated topics: important abilities; friends; enjoying/enjoying learning; helping each other/cooperation; problem solving/inspiration; communication; collision of ideas (building on ideas; working through ideas); gaining confidence; and consensus/agreement. After further investigation by the two authors, topics were made more explicit and descriptive—and some topics became redundant. This led to round three, in which the most salient topics were refined to 5 specific topics, and round four, creating 4 accurate well-supported final topics.

The main limitation of this methodology is that our project followed students across one semester. Both the course and team-based project were designed for one semester, and so our findings reflect this. We do not follow students in subsequent stages of their studies, or in other content courses. Moreover, we only chose to use anonymous reflections for this project, as face-to-face interviews with students on the China campus may have caused undue stress both because of the pressure to succeed and the pressure to interview in English [77].

4. Results

The primary goal of this research is to shed light on a team-based project in a scientific and professional communications course aimed at fostering valuable soft and research skills, including teamwork, communication, and collaboration among Chinese STEM students in a Sino–foreign university. Specifically, here we analyze written reflections in which students assess their perception of their skill development and experience following the team-based project.

According to the Thematic Analysis conducted here [75] on 146 students, four main categories, three corresponding to soft skills and one corresponding with project chal-

lenges, emerged from the students' self-assessed development and experiences during their teamwork project:

- Improved communication;
- Communication fostering collaboration/cooperation;
- Friendship development and enjoyment;
- Frustration and disagreement in teamwork.

Each of the first three themes was considered as developed skills or positive experiences by students. While many of these skills and experiences can be found in the literature, the most frequently mentioned skill/experience in this project was friendship and relationship development. To the authors, both Western educators, this was unexpected. Even more, a search of the literature did not elicit any research on this as a major factor in teamwork in STEM education. The following data provide the student reflections on each of the categories of soft skills/experiences. Following these positive experiences, we note a theme from the analysis that reflects the more difficult side of teamwork.

4.1. Improved Communication and Collaboration/Cooperation

One of the overall aims of the Scientific and Professional Communication course was, indeed, communication and related soft skills. While we expected this to be a primary outcome of the course, this was not guaranteed: according to the course survey, 50% of our second-year students had only been introduced to teamwork in their undergraduate experience, which started only a year earlier, and so the outcomes could have been much less encouraging. Despite this, student reflections show insight into their challenges and breakthroughs in communicating with team members. One comment by a student reflects this overall positive experience of teamwork that includes sharing:

> *"Our teammates also did an excellent job in this presentation. We would share our question and idea every meeting. We would give our opinions of the part to each other. All of them were very positive and enthusiastic about the work and all shared their valuable opinions. Our division of the project was properly arranged and discussed. In this presentation, I learned a lot about the story behind the Nobel prize and its scientific background. The most important thing I learned is how to work in a team and benefit from a team!"*

Many students spoke of how the project positively affected their communication skills overall, and already the theme of a positive experience of working with others can be seen in these general statements:

> *"I learned division of work and cooperation, strengthening communication with classmates."*

> *"Through teamwork with different people, I improved the ability to communicate and deal with different problems."*

Sometimes learning to communicate was unexpected, as with a male student not used to working with females. Indeed, in previous semesters the instructors noticed that students, when given a choice, often did not choose a mix of genders in group work; in this case, they were instructed to include a mix of genders in their teams:

> *"I learned the skill to communicate with my teammates, even though they were all girls."*

Several mentioned the challenges of communication and working with their teammates and the opportunity to overcome this challenge.

> *"What's more, according to the team working with different people, I improved the ability of communication and dealing with different problems."*

4.2. Communication Fostering Collaboration/Cooperation

Many students expressed a direct connection between communication and collaboration. In the below quote, we can see the student closely connects collaboration and

communication, and though the student was "forced" to communicate, the student stated that the cooperation was "nice", framing the experience in a positive light:

> *"Cooperation is also a nice part of this project. Since I tend to just work but not communicate, it is hard for me to cooperate with other people. But this project forced me to communicate with teammates."*

Several students also reflected on their experiences practicing and learning from the cooperation and collaboration activities inherent in teamwork. They present a general, positive attitude toward communication and collaboration:

> *"I also learned a lot during our group's exploration of this Nobel Prize. Because in the process of research, group cooperation is very important."*

> *"We often have to cooperate in groups. This has greatly exercised my interpersonal skills, organization and coordination skills and communication skills."*

Another student emphasized the connection between cooperation and communication, and how the former helped refine the latter:

> *"Through the cooperation with teammates, I also got to know the importance of expressing myself clearly."*

Other students commented on how communication and cooperation made them think more and expand their ideas:

> *"I learnt how to cooperate with teammates. My partners' attitudes and their ways of thinking made me think more during the whole project."*

> *"I tried to communicate with each of them about the thought of the Nobel Prize, I then began to enjoy teamwork, because I think that I gained more ideas and wider thoughts."*

Two students wrote that the experience of working "together" (in a team) showed how one can become aware of one's weaknesses, and how this leads to a benefit from collaboration with others with different strengths:

> *"I used to be a person who did not like working with people together and always thought I was able to do almost everything by myself. However, I realized during this project that I got a lot of help from my teammates when they found my mistakes and cooperation did make my life much easier."*

> *"And speaking with a group of people makes me understand teamwork, and makes me know how to communicate with others to make our work more perfect, and each of us has our own advantages and disadvantages. This course also taught me communication skills, brought me a taste of the Nobel field, and made me better understand this prize and the people who have won the Nobel Prize in the past generations."*

Students also spoke of increasing skills of cooperation, using the challenges of teamwork to go through a deliberate process of problem-solving and even developing leadership skills in the process:

> *"This project needed cooperation. The cooperation helped me work with other people better and I practiced my leadership ability."*

4.3. Friendship Development and Enjoyment

From the above student perspectives, we can see students expressed much insight derived from their teamwork experience. However, a substantial unexpected insight into the value placed on the friendship aspect of the assignment. It also suggests that this was also unexpected on the part of the students. We can see the extensive thoughts and focus on the importance of teamwork, while at the same time, the students' meaningful experience of fun and friendship from teamwork. This is seen clearly in many students' reflections, simply addressing the opportunity that the teamwork project provided to make friends. For example:

"Also, during teamwork I got to know new friends and cooperate well."

"I also made more friends that I would never meet outside this class."

"This cooperation experience made us good friends."

"The experience of working together built a better relationship between us."

Some even stressed that it helped create not only friends but "good" friends, indicating that this is more than just classroom relationships:

"By completing the project together my group members and I have become good friends."

Another student commented on how the challenges of teamwork led not only to the project goal but also to friendship:

"My team members are very active to complete each task, we overcame difficulties together, together to fight for the same goal, which also let me gain a very precious friendship."

"I made some new friends by this project and I really enjoyed the process when we worked together."

Some even stressed the number of friends, meaning more than one friend flourished from the experience:

"I got friendship with the other five members during this presentation as we have the same interest in our topic, everyone tried his best and we got together several times to edit the content several times. It is really a joyful moment."

The sheer number of positive insights about the teamwork experience and how it affected friendship was much more than we expected, and the students' enthusiasm can be summed up by these comments:

"We also developed friendships between the collaboration, which must have been my greatest reward."

"Finally, working in a team is a way to establish friendship."

Students' enthusiasm continued and included not only friendship but enjoyment, expressed by words like "fun", "laughing", and "happiness". This may reflect the atmosphere of working in a classroom in teams, allowing for continual communication and interaction, much less typical of the traditional lecture so familiar to the Chinese students from their schooling:

"Nobel project is fun. During the process of gathering material and working together, it gave an opportunity to see how talented my teammates were. Everyone has sparks inside them."

"We were always laughing when we had meetings."

"If asked why I liked it, the experience of overcoming challenges and having fun during group work, that's my answer."

"The teamwork ended in laughter, letting me know the happiness of teamwork, let me know my own shortcomings, but also found the shining point in others, let me not help but yearn for the future of teamwork!"

To sum up the category, lastly we present a student's quote that making friends is "the first":

"The things you experience become the foundation of your life, both for success and for failure. Now I will share with you what I have gained from this activity. The first is to make more friends."

Students' responses reflect the active learning aspects of teamwork—the "doing" and communication it allowed for and the added benefits beyond a successful project.

4.4. Frustration and Disagreement in Teamwork

Despite these overwhelmingly positive experiences and improvements, teamwork is not without its drawbacks, and we can see the students' frustration at some early stages. The frustration and disagreement in teamwork can be seen in this student's comment, one filled with "no one's. . .":

> *"Although the final effect is good, I still summed up the biggest problem exposed in this NQ Projects—no leadership. In a group of six people, everyone spoke freely. The management was very chaotic. No one came forward to play a decisive role, and no one could make a decision at the critical moment. As a result, our project process was very slow and internal friction was serious."*

> *"During the final project, we met plenty of troubles, at first, we couldn't decide who and which of the Nobel Prize's to choose."*

Sometimes, disagreement was quickly dissipated:

> *"During our learning, we sometimes arrived with disagreement with teammates, but I think this is a good thing because we can know different thinking from many angles, and learn more, and through our discussions, we can also learn something we have not been familiar with before. And this is also the reason I like teamwork."*

This student's style sums up the beneficial experiences, challenges immediately compensated for by a positive experience. Below, a student finds that difficulty leads to one's challenge to rise to the occasion, and then another level of frustration, to be completed satisfactorily:

> *"Although sometimes group tasks have to be completed by myself due to improper allocation or special circumstances, this is also a test of my ability. . . As a result, the entire project was actually just completed by a small group of people. Although the whole project ended in a more satisfactory form in the end, I will seriously sum up my experience, by reflecting on the shortcomings in the process."*

5. Discussion

Research has repeatedly supported the need for soft skills, both professionally and socially, in today's competitive global market [62]. Several soft skills are especially important in engineering education, as engineering work is increasingly complex, requiring both communication and teamwork skills [78]. This is especially relevant for China, a country that produces millions of engineering graduates yearly [11].

Here we present a team-based project in the framework of a semester-long course on scientific and professional communication at a Sino–foreign STEM university. The primary goal of the project was to cultivate essential soft skills, such as teamwork, communication, and collaboration through active learning. We analyzed students' written reflections, seeking to evaluate their perspectives on how the project advanced their soft skills and affected the experience of teamwork.

Analysis of students' reflections indicates that several skills were learned through their semester-long teamwork project, including key skills such as communication, collaboration, and cooperation. Many attributes of teamwork are also reflected in the literature, including attributes such as interpersonal communication (defined as respect and support for each other) and open/effective communication [5], and much has been accomplished on the research and development of these as skills. In our findings as well, we found the expected skills development in the areas of interpersonal communication, cooperation/collaboration, and teamwork itself.

Specifically, our results show that Chinese students found the teamwork project to be a positive and beneficial experience, a finding supported by previous studies on Western students as well [12]. Moreover, our students self-reported improved communication and interpersonal skills following a team-based project in an active learning classroom, and expressed the value of teamwork as supported by previous work [79].

While these skills are important, our work shows that perhaps other attributes are also part of and developed as a result of teamwork. Therefore, given the volume of comments and the care given on the part of students to express their experiences of friendship and relationship development, this could be considered a key finding of the research. Therefore, we propose another attribute of personal development to facilitate better teamwork while benefiting the individual as well—friendship. This is supported by studies on virtual teams, in which research has shown that relationship-building is key to effective teamwork, as well as work showing the benefits of friendship and teamwork on academic performance and work outcomes [36,46–48]. Friendship development resulting from teamwork was also found in computer science students' feedback in a project-based learning project encouraging teamwork [51].

The self-reflected skills development was considerable and supported by self-reflection. This is supported by the literature on the value of teamwork in undergraduate education. However, given the newness of teamwork for our Chinese STEM students, it is not unreasonable to suggest that the skills development was facilitated by the development of new relationships and even friendships. Having fun through learning or learning through having fun would appear to be a key takeaway from the results.

Moreover, while teamwork does foster relationships, we have not found in the literature that it was a significant finding, i.e., the dominant theme, along with the enjoyment of teamwork and learning, among teamwork studies in general, and in China, specifically. In today's world, in which soft skills such as communication and teamwork are valuable, one motivation might be this potential of friendship and enjoying learning. This might place additional benefits and reasons for adding teamwork to the soft skill toolbox in STEM education in and outside of China.

Despite the positive results, some students found teamwork to have a frustrating aspect as well. While this is not surprising, it is outweighed by the benefits. Other studies have also found these advantages and drawbacks in teamwork [80–82].

Overall, the results of our work support the suggestion that active learning classrooms are imperative and effective in higher education. These results are supported by previous work that showed a positive effect of active learning on Chinese students, as well as in other cultures [15].

There are several limitations to our project. Firstly, we test a specific group of participants, Chinese undergraduate engineering students, in a Sino–foreign university. Future research may examine friendship development in an active learning classroom with a team-based project. Moreover, our research was based on findings in a semester-long course; while the course was an intensive semester course, the facilitation of such skills can be investigated among the students long-term in later semesters or following their implementation of such skills in the workplace. In addition, our work is based on student self-assessment; future research could incorporate the teachers' perspective and compare the outcome of the teamwork projects.

Overall, our results demonstrated that a team-based project in a communications course fosters key soft skills such as teamwork, communication, and collaboration. Moreover, the substantial and unexpected result of friendship development was seen as a very positive outcome of the project and has potential positive implications for students' success in future teamwork projects in STEM education and as they enter the workforce.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study for their anonymized data to be analyzed and reported in this way. Students were asked to sign a written consent form, noting that their participation was voluntary and would not affect their grade in the course. The data were collected anonymously.

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