# Effective Teaching of Technical Teamwork to Large Cohorts of Engineering Students in China

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# Statement of originality

I, Dan Zhang, confirm that the research included within this thesis is my own work or that where it has been carried out in collaboration with, or supported by others, that this is duly acknowledged below and my contribution indicated. Previously published material is also acknowledged below.

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Date: 27th Nov. 2013

Details of collaboration and publications:

The papers below were published during the course of this research.

Zhang, D., Cuthbert, L., & Ketteridge, S. (2011). *Work in Progress - Effective Teaching of Technical Teamwork to Large Cohorts of Engineering Students in China.*

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To my parents, my husband and my daughter

# Abstract

Teamwork skills have been recognised as one of the key skills required for engineering graduates by industries world-wide, including in China. However, very little work on teamwork teaching has been done in the Chinese context, especially in an academic setting. This context is important as the approach to teamwork is very different in China, but effective teamwork is essential for successful engineering projects.

This work researches effective ways to teach technical teamwork skills to large cohorts of engineering students in China. Research is performed in a joint Sino-British bachelor degree programme in China, and the participants are all Chinese engineering students.

This work researched the applicability of successful cooperative learning practices from the West to China, by implementing them into a Personal Development Plan module that takes team working as one of its key teaching objectives. It employed quantitative statistical methods to compare different group forming methods, analyse the correlation between team performance and academic performance, and test the validity and reliability of peer rating. The effectiveness of the practice was evaluated based on the qualitative open-ended results, and the cultural appropriateness of the practice was discussed. An MBTI test was done to the students, and it was found higher frequencies of Feeling over Thinking, and Judging over Perceiving. This study also investigated the perspectives of the Chinese engineering students on team working and the way they prefer to learn. For the first time it attempted to put some tests in the group project of a technical module.

This work has given a new understanding on how Chinese engineering students react in a cooperative learning practice and their perspectives on teamwork

learning. It was found the inherited practices and cultural norms have a big influence on team behaviour, and there is a gap between the declarative knowledge and the skill-based outcomes. In conclusion the cooperative learning practice is generally effective leading to an improved cultural appropriated approach to teamwork teaching being proposed.

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My sincere appreciation also goes to my husband, Wei Wei and my little daughter, Qingyang Wei. Without them I might have completed the study earlier, but without them the life would become colourless and boring. Thank my husband for sacrificing his personal interests to support my study and undertaking more family responsibilities and work. He always encourages me and supports me in pursuit of a better-self. Thank him for his tolerance, understanding, support, and love. Thank my little daughter for her

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Finally my sincere gratitude goes to my parents, for their selfless and endless love and support. I know whenever, whatever, and where ever, they are always there with me, support me and love me. Their love and support are beyond words. I wish them a good health and happiness.

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# List of Abbreviations

ABET            U.S. Accreditation Board for Engineering and Technology

BUPT            Beijing University of Posts and Telecommunications

CL              Cooperative Learning

CHC             Confucius Heritage Culture

EA              Engineers Australia

ECUK            Engineering Council UK

EUR-ACE         European Accreditation

IET             The Institution of Engineering and Technology

HQP             Highly Qualified Personnel

JP              Joint Programme (Joint Bachelor Degree Programme between Beijing University of Posts and Telecommunications and Queen Mary, University of London)

KSAs            Knowledge, Skills and Attitudes

KSA             Knowledge, Skill, and Ability

MOE             Ministry of Education of the People's Republic of China

PBL             Problem-Based Learning

PDP             Personal Development Plan

QMUL            Queen Mary, University of London

SE              Software Engineering

TKT             Team Knowledge Test

TPC             Team Process Check

UK-SPEC         UK Standard for Professional Engineering Competence

Yr 1            Year 1

Yr 3            Year 3

# Chapter 1 Introduction

## 1.1    Introduction / Motivation

The work was initiated by a complaint in 2007 from a top Year-3 student on the Joint Programme (JP) between Queen Mary (QM) and Beijing University of Posts and Telecommunications (BUPT). She complained about her teammates not pulling their weight in a group coursework. After an interview with her, it was found that she was really upset about having to complete a coursework exercise in a group, although she performed very well in leading a student union department and in relating with her peers. She preferred individual work, or self-selected groups. In her words, "teamwork and communication skills can be practiced in extra class activities or sharing dormitories, but should not be included in the academic arrangement".

This caused a re-consideration of engineering education in China. In such a highly collective society, almost all activities are organized in groups. Has it been a problem for young people to cope with others? Is the cooperative spirit in daily life the same as the technical teamwork in academic or working settings? The answer seems to be "No".

In China, more than 600,000 engineering students graduate in each year (Epstein, 2006). However, many western countries are not producing enough engineers; in America, nearly two-thirds of industries reported that the engineering and science related jobs are the hardest posts to fill ("The Engineer Shortage Debate," 2011); in Australia it is even worse with Engineers Australia estimating a shortage of 20,000 engineers (Silverman, 2010; Walton, 2012). Chinese engineering students should be prepared for the global work force as there will be plenty of opportunities out there for them.

Compared with the quantity (the enormous number of annual graduates), the quality of Chinese engineering education is not rated that highly. One study (Epstein, 2006) showed that "only 10% of Chinese engineers can compete in the global market". Engineers educated from the Western countries have more advantages in interpersonal skills and innovation; they understand better customers and markets, and are productive from the time they graduate ("The Engineer Shortage Debate," 2011). Chinese engineering education needs to be enhanced in the soft skills (professional skills) although they are good at hard skills in mathematics and physics.

Teamwork skills have become one of the key skills engineers are required to have by many employers internationally. Industries keep expressing their desire for engineering graduates with good teamwork skills, and also complain about the low level in team performance of graduates (Dunne & Rawlins, 2001; Rugarcia, Felder, Woods, & Stice, 2000). Because of this demand, accreditation organizations request that higher education institutes incorporate teamwork skills into the design of the curriculum and prepare students with teamwork skills for the workforce. China's engineering education has not formally included professional skills, especially teamwork skills, into its curriculum design or assessment. Such kind of soft skills are mainly fostered in after-class activities and moral education.

How teamwork skills can be effectively taught and learned is another question. "Cooperative Learning" (CL) (Johnson, Johnson, & Smith, 1998b) instructional methods help to train students in teamwork skills, but due to its complexity CL is not widely used in universities. Moreover, although CL has been thoroughly researched in the West, study of it in China is still at an early stage. Most of the studies on CL in China focus on language learning and business management, but little work has been done on engineering education. A few educators (Chen, Qiu, Yuan, Zhang, & Lu, 2011b; Wei, 2006; Yu & Ye, 2006) have suggested

introducing group discussion and group projects to engineering courses, but none explain the explicit practices and strategies, or how to evaluate the effectiveness of team work.

Furthermore, previous research on cultural appropriateness of cooperative learning in Confucius Heritage Culture (CHC) has been done in Vietnam, Hong Kong, and Singapore, but not yet in mainland China.

Therefore, this research on effectively teaching technical teamwork to large cohorts of engineering students in China is a pilot work with great significance. This work might be the first concerned with professional skills training in engineering education in mainland China.

## 1.2   Scope of the research

The objective of this research is to identify the effective strategies to teach teamwork to large cohorts of engineering students in China. The strategy should be practicable in Chinese universities and suitable for Chinese students.

Before working out the effective pedagogy strategies, two aspects must be studied and considered: the *context* and the *object*. In this work, the influence of Chinese culture, society and the Chinese educational system is analysed, and the students' characteristics and perspectives on teamwork learning in engineering education are investigated and examined.

Based on the understanding and consideration of the context and object, a set of teaching mechanisms and strategies is designed, tested and evaluated.

The research is undertaken in a joint Sino-UK engineering programme in China. It investigates in detail a suitable mechanism for designing and administrating group tasks, and what students actually need and lack in knowledge and skills to be an effective team player. This research is carried out in the *Personal*

*Development Plan* (PDP) module but the results from the PDP class can be used in group projects in technical modules. The knowledge and skills gap found in the PDP module can profit from the development of various workshops, where different teaming, communication and interaction skills can be taught, practised and evaluated. The PDP module allows students to get familiar with team process and practices, and it prepares students to have a positive attitude towards teamwork for real engineering group project.

## 1.3    Research contributions

This research is novel in the Chinese context. The main contributions are:

➢    Chinese students and teamwork

The attitude towards teamwork, previous experience with teamwork, current knowledge and skills obtained, capability, cultural thinking and norms of Chinese students are investigated. The context in China for teamwork training is also analysed. This part of the research will help the educators of the world have a better understanding of Chinese students and the context of China.

➢    Team formation

Four team-formation methods are used in creating groups for the PDP task. The four methods are compared in terms of team effectiveness, students' preferences, and teamwork training effect.

➢    Team roles

Students are designated different roles within their teams and their understanding of team roles and their performance in that position are studied.

➢ Group work administration mechanism

How to monitor and administer the group work-process is an important part of improving the teamwork effectiveness. Many strategies suggested by cooperative learning experts are tested and evaluated.

➢ Teamwork assessment

Different assessment methods are compared and studied; whether peer assessment works well for Chinese students is discussed.

## 1.4 Author's publications

Zhang, D., Cuthbert, L., & Ketteridge, S. (2011). *Work in Progress - Effective Teaching of Technical Teamwork to Large Cohorts of Engineering Students in China.* Paper presented at the 41st ASEE/IEEE Frontiers in Education Conference, Rapid City, SD, US.

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## 1.5    Organization of this report

The thesis is organized as follows.

Chapter 2 introduces the relevant background, and it includes four parts:

- ➢ Social emphasis of teamwork: introduces how industry and accreditation organizations value and emphasize teamwork skills.

- ➢ Situation in China: why is it necessary and urgent to do research on teamwork training in China and what is the current situation.

- ➢ Team and teamwork: this includes the definition of team and teamwork, the main dimensions/components of teamwork skills and team development stages.

- ➢ Cooperative learning: Cooperative learning is introduced. The advantages, essential elements, types, and usage are explained.

Chapter 3 introduces the previous research on teamwork teaching, and mainly discusses the mechanism to design and administer group projects. Many aspects are investigated: introduction of teamwork skills, group project design, team formation, team size, team roles, administration mechanism, instructor support, teamwork assessment. The experiment strategies are specified and explained when introducing the previous research mechanism.

Chapter 4 briefly introduces studies on CHC cultural appropriateness of Cooperative Learning and puts forward some questions and barriers that might be met in China.

Chapter 5 analyses the results of the experiment along five lines: MBTI test, comparison of four team formation methods, correlation between teamwork performance and academic performance, teamwork peer rating, and team roles.

Chapter 6 reports feedback from students on teamwork learning: their general perspectives of teamwork and team experience are stated and their preference for grouping methods, assessment and instructor guidance are examined. The survey also investigates the usual practices of students when they complete the task or tackle team problems during the group work.

Chapter 7 evaluates the effectiveness of the Cooperative Learning approach applied in the previous experiment. It focuses on the open-ended and qualitative items in students' expectation agreements, team function evaluation forms, peer ratings, and questionnaires.

Chapter 8 reports the new findings from the supplementary experiments in the PDP module and the technical module. It attempts to propose an improved approach to teamwork teaching at university, based on the experience derived from the previous experiments and a summary of students' feedback.

Chapter 9 considers the results of the experiments and the student survey, and attempts to analyse and answer the questions and hypotheses proposed in Chapter 4 from the cultural point of view.

Chapter 10 presents the conclusions and suggestions for future work.

# Chapter 2 Background

## 2.1 Introduction

This chapter describes the background to this research. It starts with the social emphasis of teamwork: how industry and accreditation organizations value and emphasize teamwork skills. Then it discusses the necessity of the research on technical teamwork learning in the Chinese context and the current situation in China. It introduces the joint programme where this research is carried out as well as Cooperative Learning.

## 2.2 Social emphasis of teamwork

Although there are many examples of single scientists and engineers making significant discoveries, complex large projects being carried out in industry generally require teams of people from different disciplines, even from different countries and cultures, to work together on major projects. It is very likely that many engineering graduates will have to work in a team.

The ability to cooperate with others and work effectively in a team is often more important than technical knowledge according to the comments of big international corporations (T. & Johnson, 1994). Previous study also sets out the employers' perspectives on what forms the important characteristics needed for work, which are personal transferable skills - problem-solving, communication and teamwork - rather than technical skills within narrow disciplines (Slee, 1989). Many surveys of employers give evidence of their desire for graduates with teamwork skills and complain of low level of communication and teamwork skills in engineering graduates (Dunne & Rawlins, 2001; Rugarcia et al., 2000). It is easy to find out that almost all jobs across the world, including

China, identify teamwork as one of the fundamental skills that employers look for (Tagetjobs, 2013).

The U.S. Accreditation Board for Engineering and Technology (ABET) introduces a set of six "professional skills", including *an ability to function on multidisciplinary teams*, as part of the eleven outcomes that all engineering graduates should attain (ABET, 2010). The American Society for Engineering Education (ASEE) also finds that engineers' accomplishments are often more limited by social considerations than by technical capacities, and concludes that engineering education must (i) take into account the social, economic and political contexts of engineering practice, (ii) help students develop teamwork and communication skills, and (iii) motivate students to learn new knowledge and capabilities by themselves. (ASEE, 1994).

In the *Subject Benchmark Statement Engineering 2010* (QAA, 2010), it was stated that engineering graduates need to possess the characteristics of being "capable of team working, effective communicators, and able to exercise responsibility", and specifically it required the curriculum to "include both design and research-led projects, which would be expected to develop in graduates both independence of thought and the ability to work effectively in a team". In the accreditation handbook of higher education programmes published by the Engineering Council UK (ECUK) it is clearly stated that "*working with others*" is one of the general transferable skills and learning outcomes that graduates must obtain irrespective of engineering categories or qualification levels (ECUK, 2010a). The UK Standard for Professional Engineering competence (UK-SPEC) also includes detailed requirements of *competence to work in a team project and manage a team* for professional engineers and technicians (ECUK, 2010b).

In the European EUR-ACE (European Accreditation) Framework Standards for the Accreditation of Engineering Programmes, transferable skills are one of the required six Programme Outcomes of accredited engineering degree

programmes. It requires that graduates should be able to *"function effectively as an individual and a member of a team"*, and to the advanced level graduates should be able to *"function effectively as leader of a team that may be composed of different disciplines and levels"* (EUR-ACE, 2008).

In Australia, Engineers Australia (EA) publishes National Generic Stage 1 Competency Standards (EA, 2011), which includes *"effective team membership and team leadership"* as one element of competency for professional engineers, and in its Accreditation Criteria Guidelines for Education Programmes at the Level of Professional Engineers, it is stated that the *"ability to function as an individual and as a team leader and member in multi-disciplinary and multi-cultural teams"* should be developed and demonstrated in the curriculum design, and a wide range of learning activities should be organized throughout all stages of the programme to map the development of these skills (EA, 2008).

The undergraduate Joint Degree Programme (JP) between Beijing University of Posts and Telecommunications (BUPT) and Queen Mary University of London (QMUL) that started in 2004 is the first programme accredited by the Institution of Engineering and Technology (IET) in mainland China. In order to meet international standards for engineering education, China started the accreditation of engineering programmes in 2005 in a few pilot universities (She, 2013). In the Accreditation Criteria for Engineering Programmes, the generic standards require that graduates must attain organizational and management skills, good communication skills, interpersonal skills, and the *capability to perform well in teams*; must have global view and intercultural communication, competition and cooperation skills (MOE, 2010). This action means the Chinese government has realized the importance of professional skills in engineering education, and has started to incorporate these skills into curriculum reform through professional accreditations.

Responding to this need, many universities set teamwork skills as one of the curriculum objectives of engineering programmes, and cooperative learning is often the main strategy to teach technical teamwork. (Johnson, Johnson, et al., 1998b).

However, there are also disadvantages of teamwork (Jones, 2010; Joseph & Media; Schreiner; "Team Advantages & Disadvantages,"): (i) the incidence of group think; (ii) possible ambiguity in roles and responsibility; (iii) the cost of collaboration may be high; (iv) collaboration often leads to longer decision times; (v) conflict within the group; (vi) limiting creativity; (vii) unequal participation; and (viii) difficult to evaluate individual contribution.

Harris et al (Harris, Harris, & Vaught, 2008) pointed out that the disadvantages of teamwork for students included increased conflict, greater difficulty in coordinating and completing the work, dominance by certain group members, social pressures to go along with the majority, social loafing and free riding. The primary disadvantages for instructors were the difficulty to accurately assess and grade the inputs of individuals working in teams.

## 2.3    Situation in China

In 2013, China joined the "Washington Accord", an international accreditation agreement for professional engineering academic degrees, and become the 21st member country (She, 2013). It was reported that the scale of engineering education in China was the largest in the world: in 2013, there were 4.5million undergraduate engineering students and 600,000 postgraduate students (Wu & Kuang, 2013). Many of these students are preparing to pursue further education abroad or work in international companies. It is important to make sure that these Chinese engineering graduates have been equipped with teamwork skills.

Fortunately society in China emphasises collectivism, mutual help, and cooperation. Students get used to study and live in a collective, like an administrative class, a study group, a student dormitory or a department of the student union. Extracurricular activities are organized within or between these collectives. Chinese students always belong to some communities, and were taught how to relate well to others in a group from very young. Each administrative class has a class committee to manage and serve themselves. In daily study or other entertainment activities, students learn how to cooperate with each other, compromise over differences, help each other and deal with conflicts under the instruction of tutors. In this case, should Chinese students learn teamwork again and on purpose?

In Chinese universities, students practise teamwork skills more in extracurricular activities, like entertainment activities or sports games. Technical courses seldom incorporate teamwork activities into their curricula and although students are often assigned into groups to finish lab exercises the work is normally assessed individually. As individual contributions will not affect each other's marks, there is unlikely to be any real conflict happening in the group.

Furthermore, the emphasis of collectivism is unity, harmony, cohesiveness, and often unanimity among individuals. Is this what teamwork advocates?

The research described in this thesis is based on an undergraduate engineering degree (between a UK university (QMUL) and a Chinese university (BUPT). This joint programme (JP) aims to combine the best of Chinese and British practice to build a new type of engineer who would have the rigour of the traditional Chinese system coupled with the entrepreneurial and creative skills that are engendered in UK education. Students are taught totally in English, and the teaching is provided 50% from each institution. The teaching styles generally follow the UK model, but picking up aspects of the BUPT curriculum where

they are more demanding. The JP has very high standard, higher than a UK or a Chinese degree. Students must pass the top (key) level in the Chinese entrance examination for universities (the *GaoKao*).

Not only do they do well in the entrance examinations they also do well in the JP itself: for instance, in the year 2011, more than 40% students got a 1st class Honours degree (much higher than expected in the UK) and in the programme Telecommunication Engineering with Management, about 80% girls[1] received a 1st class degree. This result is not only unexpected, but amazing. The JP aims to cultivate and is cultivating highly qualified personnel.

Group work was introduced into the curriculum by QM staff. However, it will not necessarily work the same as in the UK with the different group of students in China. This initiative in trying and testing a new pedagogy to the JP students, who have the same background, local environment and resources as other Chinese students in standard BUPT programmes can lead to the concepts being introduced to other Chinese degree programmes, and it might also be beneficial to the development of teaching back in the UK.

Through interview, some students complained that they were working in terrible groups: some group members did not contribute, and some did not put in enough effort to do well. Students even questioned why they were put into group work in class, when they said that teamwork skills could be practised entirely in extracurricular activities and by living in collective dormitories. But apparently the teamwork skills that students acquired out of class fail to transfer fluently into professional teamwork skills in technical situations. Therefore, it is necessary to incorporate teamwork skills into the curriculum in Chinese engineering education.

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[1] In China the normal terms for young people of university age are "girls" and "boys".

## 2.4 Team and teamwork

In order to make students become good team players, it is necessary to understand what is meant by a *team* and *teamwork*.

### 2.4.1 *What is a team?*

The study of the team and team process started in the 1950s and 1960s, and there are several definitions of teams. The predominant definition is: "a distinguishable set of two or more people who interact dynamically, interdependently, and adaptively toward a common goal. Further, each individual in a team has specific roles or functions to perform and has a limited membership in the team" (Salas, Dickinson, Converse, & Tannenbaum, 1992).

Both group and team comprise individuals that collaborate with each other towards a common goal. Teams are different because of the complementary skills of individuals that lead to synergy.

### 2.4.2 *Team development stages*

The literature has stated that students need to understand how a team develops, so that they can successfully manage the process. Tuckman firstly proposed in 1965 that teams proceed through five developmental stages: forming, storming, norming, performing and adjourning (Bacon, Stewart, & Silver, 1999; Tuckman & Jensen, 1977).

1) *Forming*

This part is the foundation for team development. Team members start to know each other and the team's expectations. This stage is optimistic, but cautious and individualistic.

*2)* *Storming*

This stage has characteristics of impatience and discouragement. As the individual personalities emerge, and students get to know each other's ability and level of responsibility, conflict occurs on the team objectives, roles, and tasks.

*3)* *Norming*

At this stage, the conflict is resolved, and team members agree on team leadership, roles, responsibilities, and behaviour norms. The members begin to feel like a team; they work together to accomplish tasks, share responsibilities and synergize individual effort into a whole. Team cohesiveness is established.

*4)* *Performing*

Team members concentrate on the problem solving and production. They feel trust and respect for each other, and work together to complete the task. This stage is the most productive and efficient period for the team.

*5)* *Adjourning*

The team is dissolved when its mission is accomplished.

### *2.4.3    What is teamwork?*

When researchers tried to define teamwork, they met many difficulties. The dynamic and multidimensional nature of teamwork makes it a difficult construct to study. Furthermore, teams are not created the same. They are formed to do a variety of tasks, and are affected by a variety of environmental and situational factors. When it is defined, the components of teamwork within different models are not similar.

Cannon-Bowers and colleagues explained that teamwork competencies consist of relevant Knowledge, Skills and Attitudes (KSAs) (Cannon-Bowers,

Tannenbaum, Salas, & Volpe, 1995). Knowledge competencies are knowledge that team members need in order to execute the team tasks, including an understanding of team roles and responsibilities and shared mental models. Skill competencies are the skills that enable the team members to fulfil their functions and responsibilities (Stout, Salas, & Fowlkes, 1997). Cannon-Bowers et al. proposed eight core skill dimensions of teamwork: (i) adaptability, (ii) shared situational awareness, (iii) performance monitoring and feedback, (iv) leadership / team management, (v) interpersonal relations, (vi) co-ordination, (vii) communication and (viii) decision-making. Table 1 has the detailed definition of each dimension from that work. Cannon-Bowers et al. suggested that the team cohesion, mutual trust and collective efficacy must be shared to optimize team effectiveness; team orientation, teamwork attitudes, collective orientation, beliefs about the importance of teamwork do not have to be similar but must be compatible (Cannon-Bowers et al., 1995).

Table 1 Integrated teamwork skill dimensions[2]

| Skill dimension | Definition | Sub skills /alternate labels |
|---|---|---|
| Adaptability | Process by which a team is able to use information gathered from the task environment to adjust strategies through the use of compensatory behaviour and reallocation of intra-team resources. | Flexibility<br>  Capacity for closure<br>  Development of innovation<br>  Mutual adjustment<br>Compensatory behaviour<br>  Backing-up behaviour<br>  Provide/ask for assistance<br>  Fail stop<br>Dynamic reallocation of functions |
| Shared situational Awareness | Process by which team members develop compatible models of the team's internal and external environment; includes skill in arriving at a common understanding of the situation and applying appropriate task strategies. | Situational awareness<br>  Orientation<br>  Team awareness<br>  Development of integrated model of environment<br>Development of system awareness<br>Shared problem model development |

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[2] This is from Table 1 in reference (Salas, Burke, & Cannon-Bowers, 2000)

| | | |
|---|---|---|
| Performance monitoring and feedback | Ability of team members to give, seek and receive task clarifying feedback; includes the ability to accurately monitor the performance of team-mates, provide constructive feedback regarding errors and offer advice for improving performance | Intra-member feedback<br>  Performance feedback<br>  Planning review<br>  Feedback/reinforcement<br>  Acceptance of/giving suggestions, criticism<br>Mutual performance monitoring<br>  Monitoring and cross checking<br>  Systems monitoring<br>  Performance monitoring<br>  Error identify/correction<br>  Intra-team monitoring<br>  Strategy development<br>Procedure maintenance |
| Leadership/team management | Ability to direct and co-ordinate the activities of other team members, assess team performance, assign tasks, motivate team members, plan and organize and establish a positive atmosphere. | Task structuring<br>  Delegation and assignment<br>  Task assignment<br>  Resource distribution<br>  Resource management<br>  Performance direction<br>  Establishment of priorities<br>Mission analysis<br>Motivation of others<br>  Leadership control<br>  Goal setting<br>  Drive to completion<br>  Goal orientation |
| Co-ordination | Process by which team resources, activities and responses are organized to ensure that tasks are integrated, synchronized and completed within established temporal constraints. | Task organization<br>  Co-ordination of task sequence<br>  Integration<br>Task interaction<br>  Technical co-ordination<br>  Response co-ordination<br>Timing and activity pacing |
| Communication | Process by which information is clearly and accurately exchanged between two or more team members in the prescribed manner and with proper terminology; the ability to clarify or acknowledge the receipt of information. | Information exchange<br>  Closed-loop communication<br>  Information sharing<br>  Procedural talk<br>  Volunteering/requesting info.<br>Consulting with others<br>  Effective influence<br>  Open exchange of relevant info.<br>  Evaluative interchange |
| Decision making | Ability to gather and integrate information, use sound judgement, identify alternatives, select the best solution, and evaluate the consequences (in team context, emphasizes skill in pooling information and resources in support of a response choice). | Problem assessment<br>Problem solving<br>  Emergence of solutions<br>  Probabilistic structure<br>  Hypothesis formulation<br>  Information processing<br>  Information evaluation<br>Planning<br>  Planning development<br>  Use of information<br>Metacognitive behaviour<br>Implementation (jurisdiction) |

Stevens and Campion infer 2 major categories of Knowledge, Skill and Ability (KSA) requirements for teamwork, with 5 subcategories and 14 specific KSAs, which provides explicit guidance on KSAs for teamwork on an individual level rather than on a group/organizational level (Stevens & Campion, 1994). These teamwork KSAs have also been referenced for the modification and development of human resource management system in many companies. The specific KSAs are listed in Table 2.

Table 2 Knowledge, Skill, and Ability (KSA) Requirements for Teamwork[3]

| Interpersonal KSAs | A. Conflict Resolution KSAs | 1. The KSA to recognize and encourage desirable, but discourage undesirable, team conflict. |
| | | 2. The KSA to recognize the type and source of conflict confronting the team and to implement an appropriate conflict resolution strategy. |
| | | 3. The KSA to employ an integrative (win-win) negotiation strategy rather than the traditional distributive (win-lose) strategy. |
| | B. Collaborative Problem Solving KSAs | 4. The KSA to identify situations requiring participative group problem solving and to utilize the proper degree and type of participation. |
| | | 5. The KSA to recognize the obstacles to collaborative group problem solving and implement appropriate corrective actions. |
| | C. Communication KSAs | 6. The KSA to understand communication networks, and to utilize decentralized networks to enhance communication where possible. |
| | | 7. The KSA to communicate openly and supportively, that is, to send messages which are: (1) behaviour- or event-oriented; (2) congruent; (3) validating; (4) conjunctive; and (5) owned. |
| | | 8. The KSA to listen non-evaluatively and to appropriately use active listening techniques. |
| | | 9. The KSA to maximize consonance between nonverbal and verbal messages, and to recognize and interpret the nonverbal messages of others. |
| | | 10. The KSA to engage in ritual greetings and small talk, and recognition of their importance. |
| Self-management KSAs | D. Goal Setting and Performance | 11. The KSA to help establish specific, challenging, and accepted team goals. |

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[3] This is from Table 1 in reference (Stevens & Campion, 1994).

| | Management KSAs | 12. The KSA to monitor, evaluate, and provide feedback on both overall team performance and individual team member performance. |
| | E. Planning and Task Coordination KSAs | 13. The KSA to coordinate and synchronize activities, information, and task interdependencies between team members. |
| | | 14. The KSA to help establish task and role expectations of individual team members, and to ensure proper balancing of workload in the team. |

Salas, Sims and Burke suggest that there are a set of "Big Five" core components in teamwork that promote team effectiveness; these are team leadership, mutual performance monitoring, backup behaviour, adaptability, and team orientation. They proposed three coordinating mechanisms to meld these components together: shared mental model, mutual trust and closed loop communication (Salas, Sims, & Burke, 2005).

According to Hoegl and Gemuenden's research, teamwork quality (TWQ) can be measured by analysing the effectiveness of cooperation in teams from six facets: communication, coordination, balance of member contributions, mutual support, effort and cohesion (Hoegl & Gemuenden, 2001).

Students need to know what teamwork skills are, and what teamwork skills are expected in the work place. The above studies somewhat overlap with each other, but the core components of teamwork are similar.

From the knowledge, skills and ability point of view they are: (i) communication, (ii) coordination, (iii) mutual performance monitoring and back up, (iv) team leadership/management, and (v) conflict resolution.

Ffrom the attitude and personality point of view, they include: (i) mutual trust, (ii) team orientation, (iii) shared mental model, and (iv) cohesion.

Students can be introduced to these declarative knowledge and skills and be tested on how much of this knowledge they have acquired in the training process, and be assessed based on these requirements by the end of group

projects to ascertain whether they acquired the necessary knowledge and converted them into practical skills.

## 2.5    Cooperative Learning

### 2.5.1    *The definition and history of Cooperative Learning*

Cooperative Learning (CL) is defined by Johnson, Johnson, and Holubec as an instructional strategy that draws benefit from the interaction of students working in small teams to maximize their own and each other's learning (Johnson, Johnson, & Holubec, 1990).

Cooperative learning has its theoretical roots in social interdependence, cognitive-developmental, and behavioural learning theories (Johnson, Johnson, et al., 1998b). The social interdependence theory was formulated by Deutsch in the 1940s, indicating that interdependence can be positive (cooperation), negative (competition), or non-existent (individualistic efforts) (Deutsch, 1949b). Cognitive-developmental theory sees cooperation as a vital prerequisite for cognitive growth. The behavioural learning theory presumes that students will work hard on tasks that secure a reward and will not work on tasks that will bring no reward or cause punishment. (Johnson, Johnson, et al., 1998b) The use of cooperative learning in university classes can be traced back to Deutsch's work in the late 1940s demonstrating the power of cooperative learning in a psychology class in MIT (Deutsch, 1949a). The model of cooperative learning has been mainly developed by Johnson and Johnson in the 1960s, and applied to engineering by Smith (K. Smith, Johnson, & Johnson, 1981).

Cooperative learning is related to collaborative learning, which encourages student participation in the learning process and emphasizes the "natural learning" in which students work together in unstructured groups and learn. Collaborative learning is "an umbrella term for a variety of educational

approaches involving joint intellectual effort by students, or students and teachers together" (Goodsell, Maher, Tinto, Smith, & MacGregor, 1992). It encompasses a set of group-based instructional methods, including cooperative learning. Some people use the two terms interchangeably, but they are different. The main difference is that Cooperative Learning is a more structured form of group work, and requires carefully structured individual accountability, whereas Collaborative Learning does not (K. A. Smith, 2011).

The central element of collaborative learning is collaborative *vs* individual work and the emphasis is on student interactions rather on learning as a solitary activity, while the core element of cooperative learning is focused on cooperative incentive rather than competition to promote learning (Prince, 2004).

Active learning is generally any instructional method that encourages student activity and the engagement of students in the learning process. Active learning is different from the traditional lectures where students passively receive information from the lecturers.

Cooperative learning represents a shift in university classes from teacher/lecture-centred learning to student-centred active learning; from knowledge transmission to knowledge construction; from extrinsic motivation to intrinsic motivation; from structured to loose control. The old learning process of lecturing-listening-note-taking is changed. Teachers view their roles less as expert transmitters of knowledge - the sole academic authorities, and more as expert designers of intellectual experiences for students – facilitators or coaches. Students are more actively involved in the learning experience instead of passively receiving information from the instructor, and they learn better when engaged.

Cooperative learning is also the heart of Problem-Based Learning (PBL), which is an instructional method where relevant problems are introduced at the beginning of the instruction cycle and used to provide the context and motivation for the learning that follows (Prince, 2004). The process of subject-based learning is "Start - Told what we need to know - Learn it - Give problem to illustrate how to use it", while the process of PBL is "Start - Problem posed – Identify what we need to know – Learn it – Apply it" (K. A. Smith, 1995). PBL involves much self-directed learning for students.

In cooperative learning, students participate in groups much of the time and solve problems with mutual help and motivation. Cooperative learning inspires more interest and gives greater motivation for learning. The more students are involved in cooperative learning, the better they achieve academically, the more they are attracted by the joy of learning and the intention to improve themselves, the more they understand the knowledge and know how to use it in problem solving, and the more they acquire life-long learning skills (Johnson, Johnson, et al., 1998b).

## 2.5.2    *Cooperative learning effort*

As Johnson, Johnson and Smith summarized (Johnson, Johnson, & Smith, 1985):

- In a cooperative learning situation, students work together to achieve shared goals to maximize their own and each other's learning where cooperation means "we sink or swim together".
- In a competitive learning environment, individuals work against each other to achieve a goal that only one or a few can attain, where competition means "I swim, you sink; I sink, you swim".
- In an individualized learning context, individuals work by themselves to accomplish learning goals unrelated to others, where individualistic means "we are each in this alone".

The benefit and advantages of cooperative learning are well documented, with hundreds of studies (Johnson & Johnson, 1989; Johnson, Johnson, & Smith, 1998a; Johnson, Johnson, et al., 1998b). The results of the research comparing the cooperative, competitive and individualistic efforts are often classified into three broad categories: academic success, quality of relationships, and psychological adjustment to college life (Johnson, Johnson, et al., 1998b). Cooperative learning results in: (i) higher academic achievement (better performance in knowledge acquisition, retention, accuracy, creativity in problem-solving and higher-level reasoning and thinking), (ii) more caring, supportive, and committed relationships and positive race relations, and (iii) greater psychological health, social competence, and self-esteem.

Cooperative learning also has advantages in promoting meta-cognitive thought, intrinsic motivation, willingness to take on difficult tasks, persistence (despite difficulties) in working toward goal accomplishment, more continuing interest and commitment to achievement, the incentive for everyone to succeed together, transfer of learning from one situation to another, and greater time on task. The competitive or individualistic learning environment fosters more extrinsic motivation, less continuing interest in achievement and low persistence on tasks (Goodsell et al., 1992; Johnson, Johnson, et al., 1998b).

Furthermore, studies find that cooperative learning promotes more positive attitudes towards learning, subject matter than competitive or individualistic learning (Johnson, Johnson, et al., 1998b).

Cooperative learning provides a natural environment to foster effective teamwork and interpersonal skills. In cooperative learning, the development of teamwork and interpersonal skills is as important as the learning itself. Many group tasks, unlike traditional classes, have both academic objectives and teamwork skills objectives.

### 2.5.3    *What is and is not a cooperative group*

Actually not all group efforts are cooperative. It is not enough to just assign students into groups and tell them to work together. Many group efforts might go in the wrong direction. In (Johnson, Johnson, & Holubec, 1998) the authors defined different types of group:

1)    *Pseudo-Learning Group*

Though students are assigned into groups, they have no interest in doing tasks together. They think they will be evaluated and ranked by individual performance. Even though they talk to each other face to face, they compete under the surface. They see each other as competitors, who must be defeated. They block or interfere with other's learning, hide information from each other, and try to mislead and confuse others. In this case, students will do better if working individually.

2)    *Traditional Classroom Learning Group*

Students are put into groups, and they accept that they must be. However the assignment is designed so that little joint work is required. Students will be evaluated and rewarded as individuals, but not as members of a team. They meet only to clarify how the task could be finished and what is the work division. They seek information from each other but have no attempt to teach what they know to help others. Some team members might take a free ride and the most hard-working students feel exploited. The sum of the whole is more than the accomplishment of some members, but the more conscientious students would achieve more if working alone.

3)    *Cooperative Learning Groups*

Students work together for the same objective, which will be beneficial to all. They discuss together, help with each other to make sure every member

understands the material, and motivate others to work hard. Individual effort will also be checked regularly to ensure that every one contribute and learn. The result is that the group accomplishment is more than the sum of each member, and all students achieve more academically than they would when working alone.

4) *High-Performance Cooperative Learning Group*

Johnson, Johnson, & Holubec (Johnson, Johnson, & Holubec, 1998) also identified a High-Performance Cooperative Learning group which is the same as a Cooperative Learning group, but outperforms all the expectations. The level of commitment and success is higher than most of the cooperative learning groups. Few groups can come to this level of development.

## 2.5.4    *Essential elements that make cooperative learning work*

Not all group activities are cooperative. Sitting students together and letting them share work together does not actually make them cooperative. How well the small group performs depends on how teachers structure it. Five elements have been shown to be essential for actual cooperation (Johnson & Johnson, 1989; K. A. Smith, 1995). These elements should be carefully structured and included in any cooperative efforts. Project groups, lab groups, and reading groups can become cooperative learning groups only when the basic elements of cooperative learning are implemented, otherwise they are just learning groups. These five elements are as follows.

1) *Positive Interdependence*

Positive interdependence is the core element of cooperative learning. Team members "sink or swim together". They are linked together; if one fails, all will suffer the consequences. Positive interdependence can be structured by goal

interdependence and role interdependence. The normal strategies are joint rewards, shared resources and a division of labour.

*2) Face-to-Face Promotive Interaction*

Team members promote each other's success and learning by supporting, encouraging and praising. Although some of the work might be parcelled out and done individually, most of the work should be finished interactively. Team members provide each other with feedback, challenge each other's conclusions and reasoning, explain concepts and knowledge, discuss strategies, teach and encourage one another. In order to get good face-to-face promotive interaction, the team size cannot be large.

3) *Individual Accountability/Personal Responsibility*

The final goal of cooperative learning is to make everyone a stronger individual. Students learn together in groups, and subsequently they will perform better individually. To make sure that each team member is strengthened, individual accountability is checked to see whether they finish their share of work and understand all the materials and other's contribution. The individual performance will be assessed and the results will be fed back to individuals and the group. Nobody can hitchhike on other's work. Team members have to know who needs additional assistance to complete the task and give help. Common strategies to structure individual accountabilities are: (i) giving an individual test to students; (ii) randomly selecting individual members to represent their group to answer; or (iii) giving an oral exam to individuals when monitoring group work.

4) *Teamwork Skills*

Teamwork skills are necessary for cooperative effort. Many students have never worked cooperatively in a learning situation, and do not have the basic teamwork skills to do so. Therefore, students must be taught leadership skills,

decision-making skills, trust-building skills, communication skills, and conflict resolution skills as purposely and precisely as other academic skills.

*5) Group Processing*

Group members should periodically meet and discuss how well they work together as a team. They need to find out what behaviours are helpful and unhelpful, what the problems are and how to solve them, and what actions need be taken to improve the working relations and efficiency. This processing helps the group members to concentrate on team maintenance and get feedback on their participation, it facilitates the learning of teamwork skills, and reminds them to practice teamwork skills consistently. Some conditions for successful processing are: (i) giving enough time for processing; (ii) making the requirements specific rather than vague; (ii) ensuring student involvement in processing; and (iv) articulating the expectations and purpose of processing.

Johnson, Johnson and Smith (Johnson & Johnson, 2014; Johnson, Johnson, et al., 1998b) say that understanding these five basic elements and knowing how to structure them in their designed group work are the basis for instructors to adapt cooperative learning to their unique circumstances. It prevents and solves problems that students might have in working together. The aim is to make the group learning genuine effective cooperative learning.

## 2.5.5    *Types of cooperative learning*

By the mid-1970s, Johnson, Johnson and Smith started to design practical procedures to incorporate cooperation into learning activities for their teaching at the University of Minnesota and the University of California at Berkeley. They developed three interrelated types of cooperative learning: formal cooperative learning, informal cooperative learning, and cooperative base groups (Johnson, Johnson, et al., 1998b).

1) *Formal cooperative learning*

Students work together for several weeks or a term to achieve a shared goal of jointly completing tasks and assignments.

2) *Informal cooperative learning groups*

Informal cooperative learning groups are used to enhance direct instruction, like presentations, lectures, and demonstrations. Students work together for a few minutes or a class time in temporary ad hoc groups to achieve a joint learning objective. Instructors can use informal cooperative learning groups to (i) focus students' attention on the learning materials, (ii) set a mood beneficial to learning, (iii) help to set expectations on what will be covered in a class session, (iv) ensure the cognitive process of learning for students, and (v) provide closure to an instructional session (Johnson & Johnson, 1999).

3) *Cooperative base groups*

Cooperative base groups are long-term groups that last for at least one semester with stable membership. Their main purpose is to let students provide support and encouragement to each other to accomplish courses successfully and to make academic progresses.

## 2.5.6    *Usage of cooperative learning*

Cooperative learning may induce an inclination that students are intent to learn together with others, discuss things with friends, and work on tasks in a group (Johnson & Johnson, 1999). Working together with people can become a natural habit for students.

Though the effectiveness of cooperative learning in higher education has been proved by numerous studies, its use is not widespread in universities.

The complexity of cooperative learning makes it used less in university than competitive and individualistic learning. Many authors (Cooper, Prescott, Cook, Smith, & Mueck, 1990; Felder & Brent, 2001; Jacobson, Davis, & Licklider, 1998) state that it is difficult to develop good team exercises, and there is a big concern on how to effectively assess teamwork and individual performance. It is also a time and energy consuming task to organize group work, especially with large cohorts of students.

Furthermore, there are often one or more problem members in a team. The most common problems are described in (B. Oakley, Felder, Brent, & Elhajj, 2004):

i) hitchhikers, who refuse to do their share of work, and do not fulfil their responsibilities but want to get the same mark as the other teammates;

ii) dominators, who dominate the whole process, and force others to do everything in their ways;

iii) couch potato, who is nice but does not put much effort into doing the work;

iv) resistant team members, who resent having to work in teams and refuse to participate; and

v) team members who have widely divergent goals.

Sometimes good students just complain that they really tired to motivate others to work hard and contribute, and in some teams they are held back by weaker students. The weaker students also complain that the top ones just dominate the work, their own opinions and suggestions are never considered and adopted, and they lose the opportunity to learn and practice.

In China a course lecturer teaches around 90 to 130 students. The lecturers prefer to use individual/competitive learning to ensure every student learns. They believe that individual work ensures that everybody actually does work

and takes accountability to themselves, though it may not inspire interpersonal interaction, communication, nor peer learning and teaching.

Another reason for cooperative learning being underused is that students do not know how to cooperate with others, as the prevailing culture and reward system in our society is oriented to the competitive and individualistic work. In schools, class rank is stressed and teachers have to evaluate students on norm-referenced basis. The situation in China is even worse because of the large population. If hundreds of people are competing for a single job or a graduate admission position, it will consequentially result in a very high competition in school years.

Whereas in America, since it was firstly introduced to engineering education by Smith in 1981 (K. Smith et al., 1981), Cooperative Learning has become widespread practice now. As indicated by the UCLA Higher Education Research Institute Survey of Faculty, the use of CL is increasing largely in American colleges as shown in Table 3.

Table 3 American College Teacher: Approach for Evaluation and Teaching (from DeAngelo, Hurtado, Pryor, Kelly, & Santos, 2009)

| Methods Used in "All" or "Most" Classes | All Faculty 2005-% | All Faculty 2008-% |
|---|---|---|
| Cooperative Learning | 48 | 59 |
| Group Projects | 33 | 36 |
| Grading on a curve | 19 | 17 |

## 2.6 Geographical variation

Literature search indicated that most of the research and application of cooperative learning has been conducted in North America, Europe and Australia, and little research has been done in Asia, South America, Africa and the Middle East (Costa & Perkusich, 1996; Johnson & Johnson, 2009; Johnson, Johnson, & Stanne, 2000; Van den Bergh & Engelbrecht, 2000). Bulut

(Bulut, 2010) examined graduate students' experiences of cooperative learning in higher education in five ethnically, culturally and geographically different countries (Saudi Arabia, Brazil, Korea, Turkey and United States), and found that culture did not have effect on learning preferences.

## 2.7    Summary

In this chapter, some essential concepts about team and teamwork and the main educational theory on teamwork teaching have been explained. Social emphasis on teamwork skills was illustrated, and the conditions of technical teamwork teaching in China were investigated as China is the main context of this research.

Teamwork competencies were explained in some detail because the declarative knowledge of these competencies is what we want student team members to know and the skills are what students need to gain after team practice in preparation for the work force.

Cooperative Learning theories were examined in depth as this is the dominant pedagogy for cultivation of teamwork skills. It gives the main principles and guidance when designing teaching mechanisms. The detailed implementation mechanisms are introduced in the next chapter.

# Chapter 3 Effective teaching of teamwork skills

## 3.1    Introduction

After discussing the educational theory, the concrete implementation mechanism should be explored. This chapter introduces the normal strategies that educators and researchers have used to teach teamwork skills effectively within their classes and then considers the experiment plan in this study.

## 3.2    Previous research on teamwork teaching

The usual strategy adopted by educators to teach teamwork is the formal cooperative learning pedagogy, where students learn how to work effectively in teams when doing projects in groups. Research has focussed on team dynamics and contextual conditions for effective team work, while incorporating the five essential elements for actual cooperation. The contextual variables comprise such aspects as team formation, team size, longevity, teamwork assessment, instructor guidance.

Educators have been investigating how to help students develop positive team experience and teaming skills and to identify factors that will affect group performance (Lingard & Berry, 2002; Scott-Ladd & Chan, 2008). Bacon et al. (Bacon et al., 1999) conducted empirical research on how teacher-controlled factors affect the student team experience, and found out that by (i) offering written instructions for the teams, (ii) maximizing team longevity, (iii) giving students a say in team assignments, (iv) avoiding the traditional peer evaluation process, (v) matching the team size to the pedagogical objectives, and (vi) finding ways to improve team training, instructors can establish an environment that is most likely to lead to good team experiences. Oakley and colleagues presented a concise but comprehensive instructor's guide to the design and

management of team assignments in a university classroom where little class time is available for explicit instruction on teamwork skills (B. Oakley et al., 2004).

Many computer-based *team forming* and *peer rating* systems have been developed (Brown, 1995; Cavanaugh, Ellis, layton, & Ardis, 2004; Layton & Ohland, 2007). Some systems are designed to offer guidance and suggestions as well. The system provides training and feedback to students for them to perform well in teams, and equips instructors with information and tools to facilitate the management of student teams (Layton & Ohland, 2007; McGourty & Meuse, 2001; M. Ohland, Layton, Loughry, Salas, & Woehr, 2008). Among these systems, WebPA from the University of Loughborough, CATME of Purdue University, and Team Developer from the United States are widely used and researched. Ghanem (Ghanem, 1999) found that group self-assessment aids in improving student team performance; (Duzer & McMartin, 2000; Layton & Ohland, 2001; M. W. Ohland, Layton, Loughry, & Yuhasz, 2005) considered the validity, sensitivity and reliability of peer ratings. Lingard and Barkataki suggested an approach to teach team working skills using free web-based tools (Lingard & Barkataki, 2011). Students communicate, manage the project, and share information online; they are assessed using the message records generated through that process.

Some researchers suggest that students can use Kolb learning style theory to enhance communication strategies, and improve teamwork, and teams can be formed according to students' learning styles (Sharp, 1998, 2001).

However as technical modules often have tight schedules and large amounts of teaching content, it is difficult for the lecturers to really concentrate on the teamwork training. One solution is to implement a team project module with teamwork as its main objective, giving students a hand-on experience with different aspects of working in a team on a large task (Bielikova & Navrat, 2004).

This model of teamwork subject is part of an engineering project with the emphasis being on teamwork rather than technical achievement.

Seat and Lord argue that interpersonal skills are not learned by just being with people, and they must be taught, practised, and evaluated like any other skills (Elaine Seat & Lord, 1999). They developed a programme for teaching interaction skills, including skills in interviewing, questioning, exchanging ideas, giving advice, defending oneself, disagreeing, agreeing and managing conflict. Not long after that, a minor in Engineering Communication and Performance was created at the University of Tennessee, designed to improve the ability of engineering graduates to work on teams, to be effective communicators, to be socially adept, and to be prepared for leadership roles (Eliaine Seat, Parsons, & Poppen, 2001).

The approach taken in this work is to teach, practise and evaluate teamwork in the PDP module, which can be extended to technical modules. In the PDP module, a brief introduction of teamwork skills is given, and a group task carried out. Different methods will be tested in the PDP task, and the most suitable mechanism will be identified. The technical modules will also feed back to the PDP module with requirements. All aspects of the PDP team programme will be examined in this empirical research, and different approaches will be compared.

## 3.3   Introduction to teamwork skills

In the PDP class, a brief introduction of teamwork skills was given. It included team effectiveness, team development stages, assertive communication skills, social skills, interpersonal skills, conflict resolution skills. Skills like interviewing, questioning, exchanging ideas, giving advice, defending oneself, summarizing information were introduced and then carried out in the subsequent PDP tasks throughout the whole undergraduate period.

## 3.4    Group project design

There are two guiding principles for instructors to follow when designing a group project in technical modules: fidelity and complexity (Shuman, Besterfield-Sacre, & McGourty, 2005).

*Fidelity* is the similarity between the educational situation and the real work conditions. Workplace conditions can be simulated by designing the temporal environment and inter-group activities.

*Complexity* is related to the task interdependence and cognitive effort. A complex project should have depth and difficulty so that it cannot be finished by a single person during the time period. The more complex the task is, the more interdependence exists, and the more teamwork skills are required for the team members.

In general, when the fidelity and complexity of the project are high, the teamwork skills can be better transferred to the workplace.

In the PDP module, the task was to produce an advertising video for a Chinese product or culture to be sold in the UK. The aim was to get students to learn how to get a message across in the very short time, an essential skill for engineers. Students worked in groups to complete this task. After producing the video, each group had to play it in front of the other students, and give a short presentation to talk about the advert and the content behind it. Other groups could also comment on their advert. Teams were engaged in the inter-group communication and competition. They were allowed only four weeks to do the work. Within the time period, they had to cooperate with each other to finish the task.

## 3.5　Team formation

There are normally three ways for team formation (Bacon et al., 1999): (i) self-selection, (ii) random assignment and (iii) assignment by the teacher.

*Self-selection* has been recommended by some researchers (Strong & Anderson, 1990) because it can bring initial cohesion. Students often choose to be in a group with people they already know. Bielikova and Navrat (Bielikova & Navrat, 2004) state that acquaintance-based teams can easily overcome or minimize problems. They shorten the time to get started, they have more common time to meet outside class, and they do not want to let friends down. Self-selected groups can jump over the first two stages of team development, forming and storming, and come into the norming or performing stage. This facilitates productivity. Some authors (Mello, 1993) also stated that self-selection may encourage the ownership of team management, and they are more likely to solve inter conflicts by themselves. But there are also shortages for self-selection. There is a tendency for self-selected groups to be overly homogeneous (Jalajas & Sutton, 1984-1985), and to have *groupthink* and thought unanimity (Bacon et al., 1999). This approach reduces the creativity of the group, while diversity and variety can increase synergy. Sometimes when self-selection is allowed, top students often get together to form groups, leaving weak students to fend for themselves; some researchers (Richard M Felder, Donald R Woods, James E Stice, & Armando Rugarcia, 2000) argue that this is unfair. Furthermore, self-selection does not match the real work situation. Oakley and the colleagues (B. Oakley et al., 2004) suggested explaining to students that employees cannot expect that the boss shows them the staff list, and they choose people who they want to work with.

*Random Assignment* may seem to be the fairest method. However, due to the random nature of this method, student groups can be quite unbalanced in terms of skills, capabilities and personalities (Bacon et al., 1999). Some groups might

fortuitously work well together whereas others may be dysfunctional. This is actually unfair for students who should be given the same chance to work with every other student.

The third approach is *Teacher Assignment*. Teachers can assign students into groups by different criteria. They can group students by their academic rank, with each group containing only students of the same ability range. This method is called "academic merit". Teachers can also mix students with good, middle and weak together, according to their academic mark of previous courses - the "fair system". Research shows that teacher-assigned groups on average performed better than self-selected groups (Richard M. Felder, Donald R. Woods, James E. Stice, & Armando Rugarcia, 2000).

Hybrid Assignment approach can also be considered. Based on students' preferences, teachers can mix the abilities, personalities or learning styles.

Studies show that mixed-gender teams often build a good balance, and are more likely to lead to positive team experiences for both genders (Scott-Ladd & Chan, 2008). Researchers also suggest that the minorities should not be out-numbered in a group (Felder & Brent, 1994). In the JP, girls perform much better than boys, (as mentioned in 2.2). This phenomenon should be considered when organizing group work.

In this work, four classes of Year 1 students (134 students) were chosen for the experiment in the PDP module. Students were grouped into 5-6 by four different methods: self-selection, random assignment, fair system and academic merit. Except for the self-selection class, in the other three classes, students were

assigned to groups with at least two females[4] in it. This prevents the isolation of minorities and mixes the groups by gender.

## 3.6 Team size

The frequent suggestion about the size of a team is between 4 and 8, and with 5 or 6 as optimum (Bielikova & Navrat, 2004). If the team size is small, its creativity and flexibility decreases, and someone might dominate the process; if the team size is too big, there might be some people social loafing and hitchhiking on other's work.

In this experiment, the team size was 5-6 students.

## 3.7 Team roles

Though there are many other team role classifications in the workplace, like Belbin team roles (http://www.belbin.com), the team-role divisions suggested by Felder et al are used, as these are more appropriate in the educational situation (Richard M. Felder et al., 2000).

Experiment students were asked to designate a *coordinator*, *recorder* (two for 6-person groups), *checker*, *monitor* and *sceptic* for their groups. The responsibilities of each role are as follows.

*Coordinator* keeps every member on task and involved, divides tasks into subtasks, and allocates responsibilities; *recorder* checks for consensus, makes a record, and prepares the final work to be turned in; *monitor* ensures that every member contributes and their contributions are acknowledged by the

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[4] One feature of the JP is that the proportion of female students is high compared with that in similar engineering courses in the UK – around 40%.

others, and all materials and final work are understood by all team members; *checker* proof reads and corrects the final report before it is submitted, and turns in the coursework; *sceptic* proposes alternative possibilities and suggestions to keep groups from coming to premature conclusions in a haste.

These role responsibilities are conveyed clearly in the *Team Policies* document, which is distributed to students after the team is formed.

## 3.8   Administration mechanism

Many strategies and mechanisms suggested by Oakley et al were explored in this research (B. Oakley et al., 2004). They are listed as below.

➢ After the introduction lecture, students discussed and formulated a list of expectations and rules they agreed to adopt, and all the members signed up to the agreements.

➢ Policies for responsibilities and practices expected were distributed to students, and it was clearly stated that firing and quitting were only allowed following two formal warning memos.

➢ In the middle of the period, every group completed a teamwork performance evaluation form. This gave them a good chance to sit and discuss problems that had occurred so far, reinforcing their understanding of effective team activities and helping them to improve their teamwork.

➢ One member is selected to represent the team to do a test or a presentation, and the mark this individual gets will be given to the whole team, as suggested by (Richard M Felder et al., 2000). This will enhance the individual accountability.

➢ The *mine/ours strategy* suggested by Lingard and Berry (Lingard & Berry, 2002) is used. With the "mine/ours" strategy, each member is asked to be individually well prepared before the group discussion and cooperation, and finally a team consensus is produced. Both the team consensus and the individual contribution will be checked.

## 3.9 Instructor support

Research shows that guidance from the instructor on effective teamwork had a significant effect on promoting student satisfaction with their team experience (B. A. Oakley, Hanna, Kuzmyn, & Felder, 2007). Instructors should explain to students what they are supposed to do and why. They can also run clinics to solve common problems that have occurred in the team process.

Though enough freedom should be given to students to simulate the reality of the workplace, some amount of supervision, monitoring, and guidance from instructors are necessary to promote progress and successful results, as students usually do not have much project experience.

## 3.10 Teamwork assessment

A concern for instructors is how to evaluate team work. Normally students can be assessed in these three ways: (i) all team members get an identical group mark based on the final product; (ii) an individual mark calculated by individual contribution will be given; (iii) an individual mark determined by team citizenship performance will be given.

In a cooperative learning situation, students work together to achieve a common goal where cooperation means "we sink or swim together" (Johnson et al., 1985), so that cooperation might be promoted by giving the same group mark to all the team members. However, Willmot and Crawford (Willmot & Crawford, 2004) questioned the fairness of allocating the equal group marks, and Bielikova and

Navrat (Bielikova & Navrat, 2004) found from their student survey that students did not like to be evaluated equally. If the assessment is based on a product not a process, students may not shed a light on the team performance, but just concentrate on the result - the product design, though good team cooperation will lead to synergy and finally a better product. As teamwork skills are one of the teaching objectives, it needs be emphasized and assessed. This means even though a student is academically strong, if they are not a cooperative team member, they will not be graded highly. This is the same in reality; companies usually do not need individual talents, but talented people who can work well in a team. Giving an identical group mark might also underemphasize the individual effort. No matter how much work is contributed, everyone gets the same grade.

### 3.10.1 Peer assessment

Peer assessment is an effective way to adjust the team mark to allow for individual performance. It has been noted that it is impossible for instructors to judge the individual effort with limited exposure to the group working; the only people who can make the judgements are students themselves (B. Oakley et al., 2004). Students might pretend to the teachers but cannot hide themselves before their team-mates. Involving students in the assessment can help the teacher get an insight into team dynamics and make measurements. Peer assessment can also develop students' skills of reflection and assessment; they can critically assess their own and peers performance, and enhance the final product (Sommervell, 1993).

There are two alternative approaches for peer assessment (B. Oakley et al., 2004). The first one is to assess relative contributions of team members to the final product, and the other one is to assess the "team citizenship" of each member (such as cooperating with others, fulfilling responsibilities, and helping others

when needed) to adjust individual marks. In this work, the second approach (assessing team citizenship) is adopted. The first one (assessing relative contributions) is intrinsically competitive, and the academically-strong students will inevitably make the greatest contribution to the final product (B. Oakley et al., 2004). If the weak students find that no matter how hard they try, their grade will be lowered by the presence of top students, they will feel depressed and discouraged. The second approach emphasizes teamwork performance more than academic ability. If all members cooperate and fulfil their responsibilities, they will get the product grade. Only the "passengers" and other problem members will be penalized.

Some people are not clear whether peer assessment will bring cooperation or more competition inside the group. Some researchers (Bacon et al., 1999) advise caution when using peer assessment. Because they know a penalty will be given in the final peer assessment, some students will not bother painfully correcting another's behaviour or motivating the other members. This is not beneficial to improve team performance. Peer assessment might also bring a negative effect on member relationships within a group.

Peer assessment might be time-consuming for students, and they have to understand how to do assessment according the criteria (Loddington, 2008). The reliability, consistency and validity of peer assessment also need to be investigated (Kaufman, Felder, & Fuller, 2000). Another potential problem of peer assessment is group collusion, and it is suggested letting students justify their marks by adding textual comments to prevent collusion (Pond, Coates, & Palermo, 2007).

When doing the assessment, some students might be over generous in marking, and others are more conservative. This will cause unfairness between students. Students might get a lower grade because of being over generous.

Peer assessment can be "peer and self" assessment or "peer only" assessment. A worry for self-assessment is that students might over-estimate themselves in the assessment. However, it is argued that self-assessment allows students to reflect on their own performance, and it is a very important learning process by self-reflection (Loddington, 2008). Studies also find that students do not over-rate but under-rate themselves (Kaufman et al., 2000). In this work the "peer and self" assessment method is used, where students will rate themselves and their peers on team citizenship.

### 3.10.2   Peer assessment instrument

The peer assessment instrument used in this work was based on the instrument modified by Layton and Ohland (Layton & Ohland, 2001). It included a list of behavioural characteristics of good teamwork, such as attending scheduled meetings, contributing to discussions, attempting to communicate clearly and with civility. This made the instrument more reliable and consistent, and ensure that we measure what we intended to measure. Compared with other assessment criteria, this list was far more concise. Because students are likely to complete a short instrument more consciously and seriously than a long one, it is better to make it simple without sacrificing the reliability.

As for the rating category, nine discrete levels of rating (excellent, very good, satisfactory…no show), as proposed by Brown with behavioural anchor terms (Brown, 1995), were used in this work instead of the Likert Scoring Scales. It has been found that the use of behavioural anchors can significantly improve the reliability of the instrument (M. W. Ohland et al., 2005). Thus, a commentary blank was added at the end, and the students had to write some comments to justify the marking.

The instrument used in this work is included in the Appendix.

### 3.10.3   Algorithm

There are many methods for deriving individual marks from the group mark. The algorithm used in this work was:

*Individual mark = Team mark \* (average individual peer rating mark / average peer rating mark of the team)*

An alternative algorithm is to allocate some percentage of the final individual mark to team citizenship, like 5%.

*Individual mark = team mark \* 95% + average individual peer rating mark \* 5%*

More algorithms are given in Loddington's study on peer assessment of group work (Loddington, 2008).

## 3.11   Summary

The strategies and mechanism of teamwork teaching were introduced in this Chapter together with experiment plan.

Four classes of Year 1 students (134 students) were chosen for the experiment in the Personal Development Programme (PDP) module. Students were grouped into 5-6 by four different methods: (i) self-selection, (ii) random assignment, (iii) fair mix of academic rank and (iv) uniform academic merit.

Each group had to produce an advertising video with the aim being for them to learn how to get a message across in a short time. Instructions on teamwork skills and effective practices were given at the beginning. Students did an ice breaker exercise – sharing commonalities in class. Policies for responsibilities and practices expected were distributed to the students, and firing and quitting were allowed. Students created and signed an agreement of expectation, and

they were notified at the beginning whether a group mark or individual marks calculated by peer rating results will be given.

Two weeks later each group completed a teamwork evaluation form to discover any problems and reinforce their understanding of effective teamwork. Four weeks later, all students filled a peer rating form confidentially. Peer rating marks are seen as indicators of teamwork effectiveness; the team average mark may indicate how the team functions. The individual contribution was also be checked during the presentation.

# Chapter 4 Chinese cultural appropriateness

## 4.1   Introduction

Confucius heritage culture (CHC) countries[5], such as China, Japan, Korea, Vietnam, Singapore, have the same characteristics of a collectivist society, where collectivism emphasizes group characteristics. Phuong-Mai and colleagues analysed the cultural conflicts and educational system conflicts between CHC culture and cooperative learning (Phuong-Mai, Terlouw, & Pilot, 2005). This chapter attempts to analyse the cultural and educational characteristics of China, a typical and important CHC country, to identify the confrontations, barriers and conflicts when applying cooperative learning; this is done using the framework of Phuong-Mai (Phuong-Mai et al., 2005).

## 4.2   Chinese cultural characteristics

The Chinese culture will be analysed along five dimensions according to the research of Hofstede: (i) power distance, (ii) individualism *vs* collectivism, (iii) masculinity *vs* femininity, (iv) uncertainty avoidance, and (v) short term oriented *vs* long term oriented (G. Hofstede, 2003).

### 4.2.1   *Power distance*

*CHC background*:

Power distance is the extent to which the less powerful people accept that the power is distributed unequally (G. Hofstede, 2003). It is noted that CHC

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[5]  CHC country: It refers to the countries that have a Confucius heritage culture. To some extent, it can also be understood as Asian countries in general. These countries may not share the actual CHC background, but all have characteristics of a collectivist society.

countries have a high score in power distance (Phuong-Mai et al., 2005). Confucius taught that the stability of society depends on the unequal relationships between people. Teachers are ranked very highly in CHC countries, and get a lot of respect from people (G. Hofstede, 2003). According to Confucius's thought, the teacher is not only a person who teaches knowledge, but more importantly a model of correct behaviour and virtue. A teachers' position and ability cannot be doubted, challenged or offended. They are the only and ultimate source of knowledge in the classroom besides textbooks (Phuong-Mai et al., 2005). Students defer to the wishes, opinion and decisions of teachers through respect and in recognition of their knowledge and authority. The class is quiet and orderly. Students cannot speak in class before raising a hand and get permission from the teacher. The educational process is teacher-centred (Phuong-Mai et al., 2005). Students follow the path that the teacher outlined for them. It is supposed that the teacher should actively teach and students should passively learn. It is found that CHC students prefer didactic and spoon-fed education, and normally learn better when getting most of the information from teachers rather than discovering for themselves (Kee & Wong, 2004). The knowledge passes along one way, from teacher to students, while in cooperative learning, it may go both ways. As students are the passive recipients of knowledge, it is difficult to implement a constructivist approach, like cooperative learning, in CHC countries.

*Chinese context:*

With the influence of economic globalization and openness, many changes are brought to the values and thinking of Chinese people, especially the young generation. Students learn from the West, and are more likely to express their ideas. They start to doubt the teachers' authority, but sometimes in the wrong way, reducing the respect for teachers. In this way, teachers naturally resist using a cooperative learning method, but stick to the one-way knowledge

passing in order to defend their authority and "face". In the Western cooperative learning approach, the teacher is not expected to be a super master who should know everything, never make mistakes and must outperform the collective endeavour of students. Thus even though they find that the combination of students' knowledge may exceed the knowledge of the teacher, students will not reduce their respect and faith in the teacher, and the teacher will not feel offended.

It is suggested in this work for applying cooperative learning in China: (i) do not set such high expectations for teachers from the society and from the students; (ii) mutual respect between teacher and students and among students is requested and encouraged.

In cooperative learning, students learn cooperatively, and the teacher plays a role as a guide and facilitator to help and motivate students' learning. However, there is much pressure and resistance from society on the university when such pedagogical reform is conducted. The main resistance will come from the parents. People get used to the "teacher teaches, students learn" model. Only through the traditional method of teaching from the teachers can the parents see the school's efforts. If the teacher's role is changed to a silent and patient facilitator with students learning together from each other, the parents will complain that the tuition fee is not worthwhile, and the university does not take its responsibility seriously. Some students and their parents may claim that they pay tuition fees to be taught by instructors and not by classmates or themselves. This leads to two questions:

*Q 1: Will students accept that the teachers are not the only source of knowledge, and they can also learn well through self-learning and cooperative interaction within their groups?*

*Q 2: Will the Chinese parents and students accept the CL pedagogy and see its advantages without censuring the university?*

On one hand, students welcome the change from the teacher-centred style to student-centred style; on the other hand, they still have high dependence on teachers. They expect teachers to tell them where to find the content taught in class from the textbook, to give exercises to practice with detailed solutions, to teach all the knowledge and skills required in the coursework, and to point out the emphasis and the key points for the exam. They want the teachers to tell them what to learn and then they will just learn what have been assigned.

Because Chinese students have the inertia of entrenched dependence on teachers, there is another issue:

*Q 3: Can the Chinese students be equipped with the independence and ability to learn by themselves and from school peers in a cooperative learning environment?*

In cooperative learning, shared leadership is encouraged, which means there is no formal leader and every member takes shared responsibilities, but in CHC countries, people will feel uncomfortable without a leader because of the Confucius emphasis of unequal relationships. In China, when there is a group, there is a leader. In an administration class of 30 students, there is a monitor, and in a dormitory of 4-8 students, there is a head. Without a leader, they cannot get the work started, and the project progresses slowly. Based on this, the following question is proposed:

*Q 4: Will Chinese students adapt to the shared leadership style in CL?*

### 4.2.2 *Individualism – Collectivism*

Collectivism is not the opposite of individualism (Phuong-Mai et al., 2005). Though more emphasis is put on the collective interests, self is also important in

collectivist society. All human relationships are extended from self and centred on self. It is found that the CHC students prefer to work individually as they can have more control of the process and the final product (Kee & Wong, 2004).

In the Chinese education system, more emphasis is placed on competition rather than cooperation. Study is organized individually and competitively, rarely with cooperative goals. Competition is used to stimulate harder work and better performance. The education selection and job assignment are based on academic marks and ranks, which will place students into fierce face-to-face competition. When good students help weaker team members to achieve more academically, they themselves learn more through teaching, but they still think their advantages over the others are reduced and they will not shine. This will put them at a disadvantage in university application and job hunting. From this perspective, the next question is:

*Q 5: Will Chinese students actually cooperate with others to progress together without reservation?*

As mentioned in 4.1.1, a stable society is based on unequal relationships between people, and authority cannot be challenged. The strong hierarchical rules in China cause the obedience of the lower level to the higher level. In a family, children dare not argue with parents; in school, students obey the order of the teacher; in the work place, subordinates will not express ideas before the leaders, and always restrain personal opinions to prevent showing different ideas from their leaders.

*Face* is very important to Chinese people. Saving face for themselves and others is the premise for any actions (Phuong-Mai, Terlouw, & Pilot, 2007). In this case, students dare not express their opinions for fear of being thought silly or for fear of making others feel humiliated.

Chinese people advocate harmony in all communities: family, school class, company, and society (Phuong-Mai et al., 2007). Team members avoid confrontation and conflicts to maintain group harmony.

To get group harmony and consensus, group thinking is often implemented (G. Hofstede, 2003; Phuong-Mai et al., 2005). Team members stifle their opinions for fear of controversy. Contradictory information is prevented from group discussion. There is an invisible pressure for conformity within the group. The superficial unanimous thinking and behaviour gives people an illusion of team cohesiveness and high efficiency. The consensus principle of CL is different from the collective identity (Johnson & Johnson, 1994). Actually group members might have different ideas, but due to the high pressure and a desire to conform, they hide them. Conflicts accumulate underneath. People talk and agree face to face, but resent contributing, or do things reluctantly behind the backs of the others.

There is a Chinese idiom "The bird out of the group will be shot"; the same meaning is also expressed in other sayings: "The nail that sticks up gets hammered down", "The loftiest tree most dreads the thunder". Therefore, Chinese people get used to hide themselves in the collective, and seldom put up different or contradictory ideas to expose themselves.

All of these cultural characteristics of Chinese people make it difficult to apply the Western approach of working in a team and dealing with conflicts in China. Western CL encourages different ideas, and face-to-face interaction. The unanimous thinking will reduce the creativity and synergy of the group, and make the storming stage of the team development process in vain. There is one more question:

*Q 6: Is it possible for Chinese students to discuss and resolve conflicts openly?*

### 4.2.3 Masculinity – Femininity

Masculinity means the gender roles in the society are distinct: men are supposed to be assertive, tough, and focus on material success; women are supposed to be modest, tender and focus on quality of life. Femininity means both men and women are modest, tender and concern about the quality of life (G. Hofstede, 2003).

In traditional China, women have a lower social position, and must comply with the "three follows" (at home she follows her father; when married, she follows her husband; when widowed, she follows her son) and "four virtues" (good worker, good demeanour, good speech and good behaviour) proposed by Confucius. Will the traditional passive status of women lead to the unequal role of women in a mixed group? Will it be the situation that men discredit women, dominate discussion and interrupt women's talk?

After the founding of the People's Republic of China, society advocated that to work was the highest glory and the labourers were the honourable people who performed the lofty duties. Labourers were not differentiated by gender and women were pulled out from the family and took the same responsibilities as men. In modern China, girls in school often outperform boys, and sometimes the girls dominate the school life. One more question is proposed:

*Q 7: Will both genders in China be active participants in the group learning?*

### 4.2.4 Uncertainty avoidance

Uncertainty avoidance is the extent to which people in a culture feel uncomfortable because of uncertainty and unknown situations (G. Hofstede, 2003).

As mentioned in 4.1.1, Chinese students want to be told what need to know and learn, and precisely how to prove what has been learnt. They prefer structured learning with precise objective, detailed assignments, and strict timetable. But cooperative learning does not give detailed instructions and knowledge with well-structured tasks and precise objectives. Another question needs analysis:

*Q 8: Can Chinese students adapt to the uncertainty style of cooperative learning?*

## 4.2.5 *Short term oriented – Long term oriented*

China takes the top position in the long term oriented index (Phuong-Mai et al., 2005). Long term oriented learners often take time to learn, digest, and reconstruct knowledge, while others will get the task done as soon as possible. Fluid time value is one of the characteristics of collectivism (Gudykunst, Ting-Toomey, & Chua, 1988). One more question is added into the list:

*Q 9: Can Chinese people overcome the fluid time habit to deal with the strict time pressure in group learning?*

## 4.3 Educational characteristics in China

There are many constraints in the educational system in China when incorporating cooperative learning pedagogy.

The class size is large in China. The student number in a normal class is 90-130, but in some big lectures, it might be more than 150. It is difficult to manage and organize cooperative activities to a large number of students.

The curriculum is strictly defined and the lecture duration is fixed in China. Teachers have less space to make any change. Furthermore, if students are put at a disadvantage in the final exam because of using cooperative learning, students will resist the change. The only way to solve this problem is to change

the exam model to assess the capabilities to apply knowledge to solving real problems, rather than assessing how much knowledge is memorized and how many exercises have been done. This is exam-oriented adjustment.

University teachers do not get adequate training on the cooperative learning pedagogy. If just putting students into groups to do some work together, pseudo groups are more likely to form, which is less effective than individual work.

In this work, all of the questions raised above will be analysed in the experiment and survey, and a better model of cooperative learning that is cultural appropriate will be designed.

## 4.4 Summary

In this chapter, Chinese culture was analysed along five dimensions. The particular characteristics of the Chinese culture were explained by comparison with the Confucius Heritage Culture. Based on these specific cultural characteristics of the Chinese students, nine questions were proposed as a basis for this study.

# Chapter 5 Result of the experiments

## 5.1    Introduction

The participants of this experiment are all registered students of both BUPT and QM, having been recruited through the national Chinese university entrance examination system achieving a score above the BUPT minimum, which is above the top line[6] in the examinations. They are, therefore, representative of Chinese students in a national key university.

There are about 500 students in each cohort, divided into 16 classes. The four classes that were chosen all contain students studying for the degree of Telecommunication Engineering and Management, where the management is an add-on subject. The particular four classes were chosen for the convenience of timetabling and they do not perform better or worse than the other classes not used for the experiment.

## 5.2    MBTI Test

Before the task, students were asked to do the Myers-Briggs Type Indicator (MBTI) test that indicates personality styles. This appears to be the first MBTI test done to mainland Chinese engineering students, and many interesting results have been found (Shen, Prior, White, & Karamanoglu, 2007).

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[6] The results in the Chinese university entrance examinations are grouped in bands, and to be admitted to a national key university (universities in the 985 or 211 groups) a student must achieve above the top line, This line varies by province and in addition each university may have a requirement (like BUPT does) of scoring at a certain level higher than that line.

The MBTI assessment is "a psychometric questionnaire designed to measure psychological preferences in how people perceive the world and make decisions" (I. B. Myers & Myers, 1995). It indicates personality types but not personality traits; it does not represent ability or aptitudes. All types are equal, and there is no type better or worse than the others.

The MBTI sorts the psychological differences into four opposite pairs based on the following (B. Myers, 2012):

- *Favourite world*: Do you prefer to focus on the outer world or on your own inner world? ***Extraversion (E) or Introversion (I)***.
- *Information*: Do you prefer to focus on the basic information you take in or do you prefer to interpret and add meaning? ***Sensing (S) or Intuition (N)***.
- *Decisions*: When making decisions, do you prefer to first look at logic and consistency or first look at the people and special circumstances? ***Thinking (T) or Feeling (F)***.
- *Structure*: In dealing with the outside world, do you prefer to get things decided or do you prefer to stay open to new information and options? ***Judging (J) or Perceiving (P)***.

The interaction of preferences results in 16 distinctive personality types (Table 4 ) and the description of these types can be found from .

Table 4 MBTI Personality Types

| ISTJ | ISFJ | INFJ | INTJ | ISTP | ISFP | INFP | INTP |
|------|------|------|------|------|------|------|------|
| ESTP | ESFP | ENFP | ENTP | ESTJ | ESFJ | ENFJ | ENTJ |

The MBTI test result of the 134 Chinese students is shown in Figure 1; the type ISFJ forms the largest group (16%).

# MBTI test

ISTJ ISFJ INFJ INTJ ISTP ISFP INFP INTP
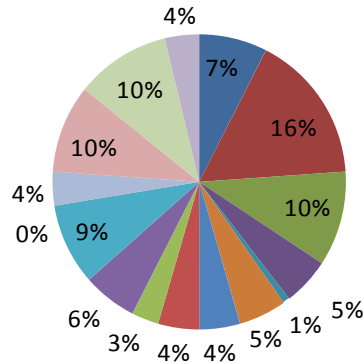ESTP ESFP ENFP ENTP ESTJ ESFJ ENFJ ENTJ



Figure 1 MBTI Test results of 134 Chinese university students

A summary of the results and comparison of the frequencies in each opposite pair of preferences is shown in Table 5. It was found that in the categories of Favourite World and Information, there was not much difference overall in distribution between the two opposite preferences.

Table 5 Summary of students' percentages in each opposite pair of preferences

| Category | Type | Class 7 | Class 8 | Class 9 | Class 10 | Total |
|---|---|---|---|---|---|---|
| Favourite World | Extraversion (E) | 63.6% | 54.3% | 39.4% | 60.6% | 54.5% |
| | Introversion (I) | 36.4% | 45.7% | 60.6% | 39.4% | 45.5% |
| Information | Intuition (N) | 42.4% | 42.9% | 57.6% | 48.5% | 47.7% |
| | Sensing (S) | 57.6% | 57.1% | 42.4% | 51.5% | 52.2% |
| Decisions | Feeling (F) | 72.7% | 60% | 75.8% | 78.8% | 71.6% |
| | Thinking (T) | 27.3% | 40% | 24.2% | 21.2% | 28.4% |
| Structure | Judging (J) | 57.6% | 71.4% | 66.7% | 72.7% | 67.2% |
| | Perceiving (P) | 42.4% | 28.6% | 33.3% | 27.3% | 32.8% |

However in the category of Decisions, 71.6% of the 134 students chose "Feeling" indicating that the majority had the inclination to "instinctively employ personal feelings and impact on people in decision situations, naturally sensitive to people needs and reactions, naturally seek consensus and popular opinions,

unsettled by conflict; have almost a toxic reaction to disharmony" ("Myers Briggs Test * What is your Myers-Briggs Personality Type?,").

This finding is consistent with the characteristics of people in CHC cultures: (i) they prefer to react to their feeling about people, rather than logic and consistency when making decisions; (ii) they are easily influenced by others; (iii) they are more likely to have group thinking; and (iv) they try their best to avoid confrontation and feel upset and helpless in a conflict.

However, team working requires objective judgments, critical analysis, and the capability to solve conflicts. It is necessary to explain this clearly to these students, and to teach them conflict resolution skills.

In the category of Structure, 67.2% chose "Judging". This means that two-thirds of the students prefer (i) planning in detail in advance before moving to actions, not planning on-the-go; (ii) focussing on task-related actions (but they do not like multiple tasks); (iii) working best without stress when working ahead of deadlines but cannot tolerate time pressure; and (iv) using targets, dates and standard routines to manage life (but they do not like flexibility, freedom or variety) . This may relate to the characteristics of people in CHC countries - high uncertainty avoidance; they feel threatened by uncertainty and unknown situations (Phuong-Mai et al., 2005). The lack of people preferring "Perceiving" hinders the performance of groups in staying open to new information and options.

Though the majority instinctively prefers working with plans and ahead of deadlines, it does not mean they will definitely be able to achieve this, because that requires more self-discipline and time management skills. There are quite a few students on the JP who only start to work hard on an assignment just before the deadline. Phuong-Mai, Terlouw and Pilot also found out in their study that

Hong Kong students started to work just before the deadline (Phuong-Mai et al., 2007).

People in CHC countries value a time rhythm in which they might often change plans and deadlines (Phuong-Mai et al., 2007) and it is difficult to manage and cope with time pressure with this fluid time habit. The MBTI result also found that two thirds of students did not tolerate time pressure. However, coping with time pressure is required in cooperative learning in the Western model.

Students on the JP often complain when several pieces of coursework from different modules are due in the same period of time. The MBTI result also reflects this in that many students do not like to multitask, even though around 30% are female and women (in the West) are generally thought to be better at multi-tasking than men. Though the deadlines were near to each other, each coursework was assigned at a different time and all had sufficient time before the submission date. Students need to learn to get used to this kind of multitasking model as this is the situation in the work place.

However, the MBTI type distribution is different in the USA (CAPT, 2010) as shown in Table 6. The case that shows a significant difference is that of S-N, where it was found 66-74% of the US population prefer Sensing (S) over Intuition (N), whereas almost half of the experiment group in China prefers Intuition. This indicates that more American people live for now and attend to present opportunities, use common sense to create practical solutions, recall memories of facts and past events and like clear and concrete information ("Myers Briggs Test * What is your Myers-Briggs Personality Type?,").

Table 6 Estimated Frequencies of the Types in the United States Population form

| E | I | ISTJ | ISFJ | INFJ | INTJ |
|---|---|------|------|------|------|
| 45-53% | 47-55% | 11-14% | 9-14% | 1-3% | 2-4% |
| **S** | **N** | **ISTP** | **ISFP** | **INFP** | **INTP** |
| 66-74% | 26-34% | 4-6% | 5-9% | 4-5% | 3-5% |
| **T** | **F** | **ESTP** | **ESFP** | **ENFP** | **ENTP** |
| 40-50% | 50-60% | 4-5% | 4-9% | 6-8% | 2-5% |
| **J** | **P** | **ESTJ** | **ESFJ** | **ENFJ** | **ENTJ** |
| 54-60% | 40-46% | 8-12% | 9-13% | 2-5% | 2-5% |

Between different classes, the MBTI type distribution is different. Class 9 had more introversion type (60.6%) than extraversion, while the other classes had more extraversion over introversion. In the category of information, Class 9 had more intuition than sensing, while the other classes had more sensing than intuition. For the other two categories of decisions and structure, the tendency was similar between classes. The MBTI type distribution for each class can be found in Figure 2.

Students' percentages in each opposite pair of preferences were also compared between genders (Table 7). It was found male students had more Feeling over Thinking than the female students. For the other pair of preferences, the distribution was similar between male and female students.

This study also checked the MBTI types of the coordinators (Table 8), who were elected by the group members. Among the coordinators, they had more Sensing characteristics (62.5%) than Intuition, more Feeling characteristics than Thinking (70.8%), and more Judging than Perceiving (70.8%). It was interesting that half of them had extraverted characteristics and the other half had introverted characteristics. It was not that extraverted people tended to be the coordinator.
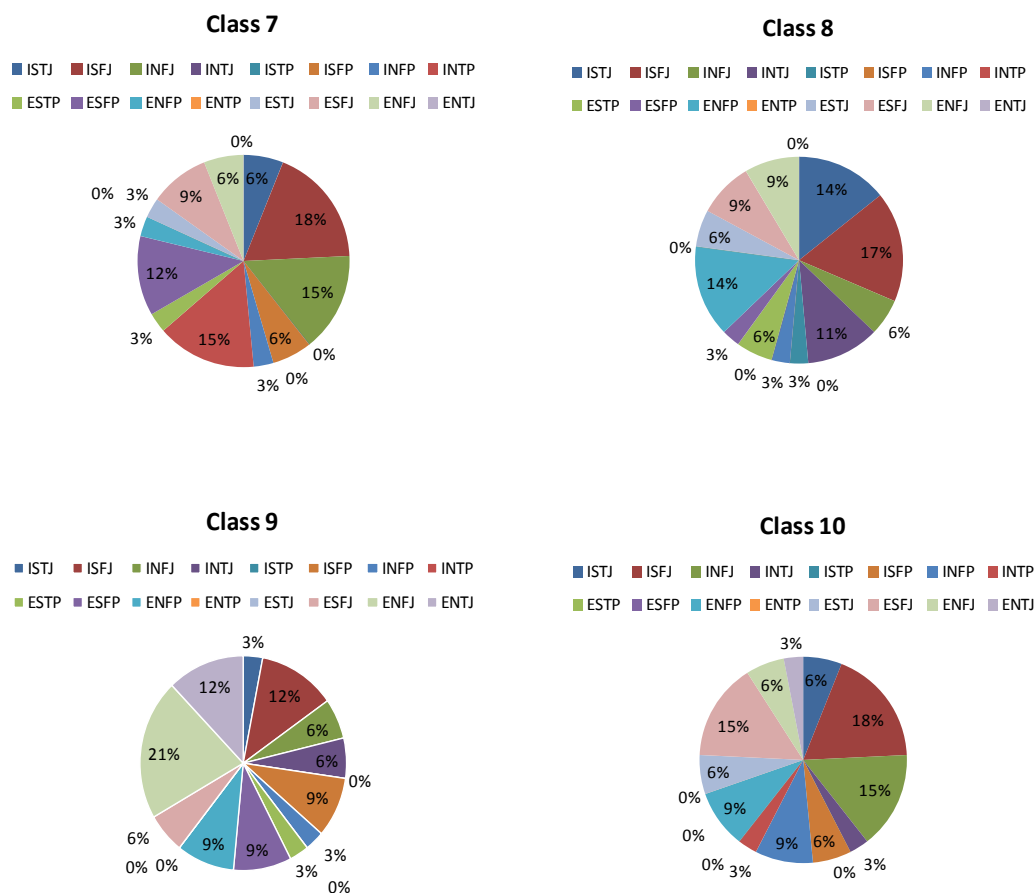
Figure 2 MBTI type distribution for each class

Table 7 Students' percentages in each opposite pair of preferences between genders

|  | **E** | **I** | **N** | **S** | **F** | **T** | **J** | **P** |
|---|---|---|---|---|---|---|---|---|
| **Female** | 24 | 25 | 27 | 21 | 27 | 21 | 30 | 18 |
|  | 50.0% | 52.1% | 56.3% | 43.8% | 56.3% | 43.8% | 62.5% | 37.5% |
| **Male** | 39 | 47 | 46 | 40 | 56 | 30 | 59 | 27 |
|  | 45.3% | 54.7% | 53.5% | 46.5% | 65.1% | 34.9% | 68.6% | 31.4% |

Table 8 Frequencies of the MBTI types for the coordinators

|  | E | I | N | S | F | T | J | P |
|---|---|---|---|---|---|---|---|---|
| **Coordinator** | 12 | 12 | 9 | 15 | 17 | 7 | 17 | 7 |
|  | 50.0% | 50.0% | 37.5% | 62.5% | 70.8% | 29.2% | 70.8% | 29.2% |
| ENFJ | ENFP | ESTJ | ESTP | INFJ | INFP | ISFJ | ISFP | ISTJ |
| 5 | 3 | 3 | 1 | 2 | 1 | 4 | 2 | 3 |
| 20.8% | 12.5% | 12.5% | 4.2% | 8.3% | 4.2% | 16.7% | 8.3% | 12.5% |

## 5.3 Comparison of team formation methods

There were 32-35 students in each class, divided into 6 groups with 5-6 members in each group, so it is statistically a small sample. The same group mark of the PDP task was given to all members of a group. Given the very small proportion of marks that the PDP contributes to the overall degree (each mark on PDP task contributes 0.002% towards the degree result) any variation in approach between groups or classes will not affect their final degree result.

Analysis of variance (ANOVA)[7] was used to evaluate whether the PDP result and the average group peer rating result were significantly different between groups that were formed by the 4 different methods. ANOVA showed that there was no statistically significant difference between team formation methods on PDP result and peer rating result (p: probability of obtaining the data assuming the null hypothesis; F: variation; df: degrees of freedom):

- PDP result: $p=0.09>0.05$, $F=2.484$, $df=3$;
- Peer rating result: $p=0.281>0.05$, $F=1.369$, $df=3$.

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[7] Analysis of variance (ANOVA) is a collection of statistical models used to analyze the differences between group means and their associated procedures (such as "variation" among and between groups). The reason for doing an ANOVA is to see if there is any difference between groups on some variable.

The means of PDP result and average group peer rating result are provided in Table 9. Groups formed by the "fair system" got the highest score for PDP task of 82.5, "by random" 78.3, "academic merit" 77.5, and "self-selection" the lowest of 70. For the average group peer rating results for teamwork, groups formed by "academic merit" got the highest mark of 94.4, and "self-selection" the lowest mark of 90.1. The interesting point is that the self-selection groups performed worse in both the PDP task mark and the average group peer rating.

Table 9 PDP result and average group peer rating result by different group forming methods

|  |  | N | Mean |
|---|---|---|---|
| PDP Result | self-selection | 6 | 70 |
|  | by random | 6 | 78.3 |
|  | academic merit | 6 | 77.5 |
|  | fair system | 6 | 82.5 |
|  | Total | 24 | 77.1 |
| Average Group Peer Rating Result | self-selection | 6 | 90.1 |
|  | by random | 6 | 93 |
|  | academic merit | 6 | 94.4 |
|  | fair system | 6 | 92.3 |
|  | Total | 24 | 92.5 |

Students prefer to choose their own groups by themselves. However interestingly in the class where self-selection was allowed, groups are either all male or all female. During the lecture, a male student tried to persuade a female group to mix with their group, but was refused. Self-selection may shorten the time of getting the team acquainted with each other, but it is also likely to stop the possibility of being grouped with new people, as people generally choose to join the same group with friends, roommates or acquaintance. This situation is very typical in China: people avoid losing face for both themselves and others. They would not like to upset friends by choosing others as group mates instead

of the friends; neither would they leave their friends to join a new group as that would seem like a betrayal. In China, self-selection groups may not be selected as students really wish for doing the work, but are influenced by "face" and "*guanxi*" (relations). The results indicate that self-selected groups can neither cooperate better nor perform better academically compared with other formation methods, indeed they are worse.

Phuong-Mai, Terlouw and Pilot suggested affinity-based grouping (based on existing friendship, geographical origin, and family connections) for Asian students in the CL process (Phuong-Mai et al., 2007). However, universities in China always deliberately break the original affinity relations (such as geographical origin, middle school attended) at the beginning of enrolment, mixing students up in different dormitory rooms and class units. In this way students should make new friends and learn more from different people.

## 5.4    Teamwork performance and academic performance

Running a Pearson (Wikipedia, 2014) product-moment correlation coefficient test[8] showed that there was no correlation between group average peer rating result of teamwork and academic PDP result for the group (r=0.15, Sig.=p=0.485>0.05, N=24). This means groups with good team performance do not necessarily get a higher or lower mark for the PDP task.

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[8]    The Pearson    product-moment    correlation    coefficient    is    a    measure    of    the linear correlation (dependence) between two variables X and Y, giving a value between +1 and−1 inclusive, where 1 is total positive correlation, 0 is no correlation, and−1 is negative correlation.    The letter r refers to the sample Pearson correlation coefficient, p refers to the significance level, and N refers to the number of the sample.

## 5.5    Teamwork peer rating

The students in the experiment were in Semester 2 of Year1. The academic result of the previous Semester 1[9] is regarded as their previous academic performance. A Pearson product-moment correlation coefficient test was conducted to find out the correlation between previous academic performance and individual teamwork peer-rating result. It showed that there was a weak positive correlation between previous academic performance and teamwork peer rating result (r=0.2, Sig.=p=0.021<0.05, N=133). This indicates that if a student performs better academically he/she is more likely to cooperate well as a team member.

It also tested the gender differences on teamwork performance (individual peer rating mark). The means of individual peer rating marks for male and female are listed in Table 10. Individual peer rating marks for male and female do not follow a normal distribution, the box plot indicating that the data has a skewed distribution. The independent samples T-test [10] showed that there was no significant difference between genders on the teamwork performance (t=-0.442, df=131, Sig.=p=0.659>0.05).

Table 10 Means of individual peer rating marks for male and female

|  | gender | N | Mean | Std. Deviation |
|---|---|---|---|---|
| peer_rating_indv | Male | 85 | 92.3 | 4.5 |
|  | female | 48 | 92.8 | 8 |

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[9]  On the JP there are examinations every semester.

[10]  An independent samples t-test helps you compare whether two groups have different average values.

The means of self-peer rating for both genders are provided in Table 11. As the self-peer rating data for both genders are non-normal, a non-parameter test (Mann-Whitney U Test[11]) was used to test the difference. The test result in Table12 showed that there is no significant difference between genders on self-peer rating (Z=-0.807, Sig.=p=0.42>0.05). This indicated that neither male nor female would rate themselves lower or higher than the other gender.

Table 11 Means of self peer rating for both genders[12]

peer_rating_self

| gender | Mean | N | Std. Deviation |
|--------|------|-----|----------------|
| male | 92 | 83 | 8.4 |
| female | 90.6 | 48 | 9.1 |
| Total | 91.5 | 131 | 8.7 |

It has often been doubted whether self-rating is objective: people may over-rate or under-rate themselves. Wilcoxon Signed Ranks Test[13] ref (Table 13) showed that there was no significant difference between self-rating and average peer rating for individuals (Z=-1.509, Sig.=p=0.131>0.05). This indicated that the Chinese students in the experiment did not over-rate or under-rate themselves when evaluating their team working.

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[11] The Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed.

[12] Noted: in self-rating data, N=131, 2 missed. Two students did not submit the peer rating table.

[13] The Wilcoxon signed-rank test is the nonparametric test equivalent to the dependent t-test. As the Wilcoxon signed-ranks test does not assume normality in the data, it can be used when this assumption has been violated and the use of the dependent t-test is inappropriate.

Table 12 Gender difference test on self-peer rating

Test Statistics[a]

|  | peer_rating_self |
|---|---|
| Mann-Whitney U | 1838.50 |
| Wilcoxon W | 3014.50 |
| Z | -.81 |
| Asymp. Sig. (2-tailed) | .42 |

a. Grouping Variable: gender

Table 13 Wilcoxon Signed Ranks Test on the difference between self-rating and

average peer rating

**Test Statistics[b]**

|  | peer_rating_self peer_rating_indv |
|---|---|
| Z | -1.509[a] |
| Asymp. Sig. (2-tailed) | .131 |

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

At the beginning of the experiment, two classes were told that an individual mark based on peer rating would be given at the end of the task; the other two classes were told that peer rating would not be used for differentiating individual marks but only for research purpose, and no individual mark would be given. This difference aims to test whether peer rating bring more competition within groups or coherence, and whether the marking scheme will influence the objectivity of peer rating. The Independent Samples test showed that students did not rate individual task mark differently when they know the peer rating will change their individual task mark (t=-1.633, df=131, Sig.=p=0.105>0.05). For the students who were told individual mark would be given, they did not compete to give lower rating to others or to raise themselves, neither did they collude together to give higher rating to all.

## 5.6 Team roles

Through class observation and final presentation questions, it was found that students got used to single leader groups even though they were assigned different roles immediately after the groups were formed: the coordinator or the monitor were often considered as the sole leader. The task was often parcelled out into parts and each member did one part. Students got used to do and be responsible for their part of the academic task that they were assigned to do, but did not know how to undertake other responsibilities to the team. Therefore, getting them to perform the other roles (such as checker, sceptic) seems like a vain hope.

During the final presentation, one group made several typographical mistakes (for example Beijing Duke instead of Beijing Duck) in their slides. When the Checker and Sceptic were asked whether they checked the slides, they shook their heads and looked at a third person who made the slides. This implied that they thought this was the responsibility of the one who made the slides, but not theirs. In another group, when they were asked about the meaning of a sentence in the slides ("Wish you a fair wind" in a kite advert), nobody in the group could answer and all explained that the one who made the slides was ill and did not show up.

In groups, members did not normally understand other's contributions. For example, students did not know what software was used to edit the video and how it worked except for the one who made the video. This is not the essence of teamwork suggested in the Western Cooperative Learning model.

## 5.7 Summary

This might be the first study of this kind conducted in China. The main objective of the experiment is to reveal the real situation when an attempt to use the

Western Cooperative Learning strategy is made in a Chinese engineering programme, albeit a joint programme with an English university.

From the preliminary results, it is fairly obvious what Chinese engineering students tend to do and what they lack. There are no statistically significant differences (i) between genders on team performance and self-rating, (ii) between self-rating and peer rating, nor (iii) between grouping methods on peer rating and PDP task result. However it was found that self-selected groups achieved the lowest results academically and on teamwork performance.

There are no significant correlations between peer rating and PDP task result. It was also found that some students gave ratings of 100% in self and peer rating; however, they justified the mark using literal commentary. This issue will be looked at in detail later to decide whether the peer rating is reliable.

# Chapter 6 Students' perspectives

## 6.1    Introduction

A teaching strategy can only succeed when it facilitate students' learning. Many educators shed light on students' response to the cooperative learning arrangement and their perspectives on how teamwork can best be learned. Oakley, Hanna, Kuzmyn and Felder conducted a survey with 6,435 engineering students to identify the important conditions for teamwork in an academic setting (B. A. Oakley et al., 2007). Aman et al collected data from surveys, class observation and teacher commentary to get a deeper understanding of group functioning, the role of the course structure and the value students put on the CL experience (Aman et al., 2007).

This Chapter will investigate the perspectives of Chinese engineering students on team working and the way in which prefer to learn. This appears to be the first study with respect to the viewpoints of students on technical teamwork learning in engineering education in the Chinese context.

A survey on teamwork study was designed and conducted among the Year 1 (Yr1)14 and Year 3 (Yr3) students at the end of the second semester of the academic year 2010-2011. Yr1 students took a Personal Development Plan (PDP) module that takes team working as one of its key teaching objectives; Yr3 students had participated a lot in group projects in technical module coursework as well as PDP. An educational experiment was also carried out on 134 of the 500 Yr1 students in a PDP course: they were given more introductions

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[14]  The JP is a 4-year degree programme like all Chinese BS degrees – so that Yr 1 is effectively a foundation year in English terms.

about teamwork skills and guidance from instructors, and were administrated by a CL mechanism.

About 100 questionnaires were distributed[15], and 93 copies returned: 40 from students in the Yr1 experiment group, 24 from other Yr1 students, and 29 from Yr3 students.

Frequency distributions were calculated and analysed by survey items with comparisons between students from different years, and between the experiment and non-experiment groups, being conducted. Students' commentary to the open-ended questions was examined.

## 6.2 General perspectives of teamwork and team experience

Regarding the question investigating the students' satisfaction with team experience, a Likert five-point scale was used to calculate the satisfaction mark for each response, from "very satisfied" (4) to "very dissatisfied" (0). Survey results demonstrated that:

    (i)       94% of the whole group were satisfied or neutral about their experience of working in a team, with nearly 40% being very satisfied (Table 14);

    (ii)     the average satisfaction of Yr1 students (3.3) is higher than the satisfaction mean of Yr3 (2.8);

    (iii)    students in the experiment group of Yr1 reported the highest satisfaction of 3.4, non-experiment Yr1 3.2, and Yr3 2.8; and

    (iv)    among the Yr3 students, fewer chose "very satisfied" compared to Yr 1 students, but more chose "somewhat satisfied" and "neutral".

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[15] A limited number of questionnaires was distributed to ensure the reliability of response. Only those who would like to participate and give real perspectives completed the questionnaire. Looking into the distribution of the participants, it covered well all levels of students in academic performance and follows a normal distribution.

Table 14 Frequency distribution of students' response on satisfaction with team experience

| % within Grade | Year 1 | Year 3 | Total |
|---|---|---|---|
| very satisfied | 48.4% | 17.2% | 38.7% |
| somewhat satisfied | 37.5% | 55.2% | 43.0% |
| Neutral | 9.4% | 20.7% | 12.9% |
| somewhat dissatisfied | 3.1% | 6.9% | 4.3% |
| very dissatisfied | 1.6% | | 1.1% |
| Total | 100.0% | 100.0% | 100.0% |

Yr3 students showed more reservations in grading the degree of satisfaction on the team experience. One consideration is that Yr3 students experience more team working as they go through the programme and with the increase of importance and difficulty of technical modules, students care more about marks and more team conflicts occurred.

Regarding the question "do you think it is important to have teamwork skills for the work force", 98% of the students chose "Yes". 86% of the students reported that they benefit from the group coursework and academically achieve more. In the question "do you feel the group coursework help you learn teamwork skills", 97% of the experiment-group Yr1 students reported "Yes", other Yr1 students 88%, and Yr3 students 93%.

When they were asked whether they prefer to work individually or in groups in future coursework projects, 81% of Yr1 students and 90% of the Yr3 students preferred group projects.

## 6.3   Team function conditions

### *6.3.1  Grouping methods*

It was suggested in (Phuong-Mai et al., 2007) that affinity-based grouping was more appropriate for Asian students. This allows self-selection as students will choose their groups according to the existing social identity. In the survey, the students also presented their big preference on "self-selection" (55%) as shown in Table 15.

Table 15 Students' preferred method to choose their group

| % within Grade | Year 1 | Year 3 | Total |
|---|---|---|---|
| by random | 22.6% | 13.8% | 19.8% |
| self-selection | 61.3% | 41.4% | 54.9% |
| assigned by teacher | 9.7% | 10.3% | 9.9% |
| group by academic rank | 3.2% | 34.5% | 13.2% |
| other | 3.2% | | 2.2% |
| Total | 100.0% | 100.0% | 100.0% |

Yr1 students firstly chose "self-selection" (61%) and then "by random" (22%); Yr3 students also firstly chose "self-selection" (41%) but secondly chose "by academic rank" (35%). One of the design courses in Year 3 grouped students by their academic ranks; the instructor explained that this grouping method allowed good students to work together to design really good products and prevented there being a "passenger" in the group. Students in the later years of the programme might find it easier to cooperate and communicate with those of the same academic rank, and they would emphasize more on the other skills like design skills than teamwork skills.

Students of each academic rank showed the same preference order as "self-selection" first and "by random" second. Male and female students

reported just the same percentages in each choice, and followed the same order of choice.

## 6.3.2  Assessment

Regarding the assessment of the team project, Yr1 and Yr3 students showed consistent responses as shown in Table 16: 38% would like to get the same group mark, or an individual mark according to peer evaluation of contribution and teamwork performance, and 25% would like to be given an individual mark according to their academic performance in the project.

Table 16 Which way do you think is better for the assessment of group work? Comparison between Yr1 and Yr3

|  | Year 1 | Year 3 | Total |
|---|---|---|---|
| Get same group mark | 37.5% | 37.9% | 37.6% |
| Give individual mark according to their academic performance in the project | 25.0% | 24.1% | 24.7% |
| Give individual mark according to peer evaluation of contribution and teamwork skills | 37.5% | 37.9% | 37.6% |
| Total | 100.0% | 100.0% | 100.0% |

As illustrated in Table 17, students of different academic ranks have slightly different preferences of assessment methods: "top" students thought "get the same group mark" is best, while the other students (from good to weak) preferred individual mark calculated by peer rating on contribution and teamwork performance. Between genders, male students rated "give individual mark by peer rating on contribution and teamwork performance" more highly whereas female students preferred "get the same group mark"[16].

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[16] The top students participated in this survey are not all female, which only takes 41.7%.

Table 17 Which way do you think is better for the assessment of group work?

Comparison between genders and different academic ranks

| % within previous academic rank / gender | previous academic rank | | | | gender | | Total |
|---|---|---|---|---|---|---|---|
| | top | good | middle | other | male | female | |
| Get a same group mark | 58.3% | 31.7% | 25.0% | 50.0% | 32.1% | 45.0% | 37.6% |
| Give individual mark according to their academic performance in the project | 25.0% | 22.0% | 33.3% | | 26.4% | 22.5% | 24.7% |
| Give individual mark according to peer evaluation of contribution and teamwork performance | 16.7% | 46.3% | 41.7% | 50.0% | 41.5% | 32.5% | 37.6% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

The validity and reliability of peer rating have always been a problem. According to students' self-judgement, more than half of the students stated that they would evaluate group members' work objectively, but there were still 40% of the students indicating that they would avoid embarrassing others when rating peers (Table 18).

Table 18 Will you evaluate your group members' work including yourself objectively?

| % within Grade | Year 1 | Year 3 | Total |
|---|---|---|---|
| Yes | 54.7% | 48.3% | 52.7% |
| No, avoid to make some group members too embarrassed | 35.9% | 48.3% | 39.8% |
| No, evaluate highly on myself | 6.2% | 3.4% | 5.4% |
| No, evaluate lowly on myself | 3.1% | | 2.2% |
| Total | 100.0% | 100.0% | 100.0% |

People from Confucius Heritage Culture countries often avoid "face-losing" for both themselves and others. If they rate another team member lowly, it will make that person lose face, and they will also find it uncomfortable when relating with that person in daily study and life, especially as they all live on campus in shared rooms (of 4). Yr3 students showed more reservation when rating others, perhaps because they are more mature or because they have closer bonds with other students having known them longer.

### 6.3.3 Instructor guidance

Among Yr1 students, the experiment-group students were given guidance and instruction, whereas other Yr1 students were let loose after setting up the task without extra guidance or checking. Therefore only the effect of the instructor guidance for experiment-group Yr1 students is examined. The result showed that

(i)     60% students found "*little help*" in having instructor guidance for improving team effectiveness - "*Students feel that the skills and guidance is very useful, but often forget to use, or do not know how to use, the skills in practice*";

(ii)     30% found it "*much help; the guidance is helpful, and students tried to solve problems and improve team performance using the skills introduced*"; and

(iii)     10% found it had "*no effect; nobody really takes the guidance seriously or use the teamwork skills actually during the team work*".

It may be here that the type of instruction given needs to be reviewed for its effectiveness in the light of these comments.

It is noted that 76% students wanted the instructor to check work and progress at least once a week, and Yr1 students expressed more demands for instructor to check (81%). It may be because Yr1 students have more enthusiasm in improving skills and desire more interaction with instructors to practice skills

and resolve problems that occurred, and Yr3 students showed more independence and problem solving capability.

## 6.4    Teamwork practices

The survey result showed that more groups divided their work into parts (65%) than working together as a whole, with Yr3 students having a bigger percentage in this respect (76%). Though CL does not encourage parcelling, students may find it easier, more convenient and efficient. Yr3 students may be more inclined to get the work done quickly and save time for other commitments.

This survey also collected students' response to the usual team problems. Most students showed a positive attitude and took constructive measures towards team problems. To those members who did not contribute, 74% would persuade and help them to do their work (Yr3 students with less patience), which is a very encouraging finding (Table 19). Only a small amount would do nothing or attempt to "carry" them by doing the work for them.

Table 19 What will you do if some members do not contribute?

| % within Grade | Year 1 | Year 3 | Total |
|---|---|---|---|
| Do their work for them | 7.8% | 24.1% | 12.9% |
| Ask for mediation, counsel, support from instructors | 12.5% | 6.9% | 10.8% |
| Persuade and help them to do their work | 78.1% | 65.5% | 74.2% |
| Switch groups | | | |
| Do nothing | 1.6% | 3.4% | 2.2% |
| Total | 100.0% | 100.0% | 100.0% |

For those members who are academically weak, 57% of students would let them do what they are good at and 31% would help them, with Yr1 students showing more enthusiasm to help (Table 20).

Table 20 If your partner is academically weak, what will you do?

| % within Grade | Year 1 | Year 3 | Total |
|---|---|---|---|
| Do his/her work for him/her | 10.9% | 10.3% | 10.8% |
| Help him/her | 34.4% | 24.1% | 31.2% |
| Let him/her do what he/she is good at | 54.7% | 62.1% | 57.0% |
| Other | | 3.4% | 1.1% |
| Total | 100.0% | 100.0% | 100.0% |

## 6.5    Summary

There are compelling reasons for assigning university students into cooperative groups for coursework projects to learn and practice teamwork skills. However, Chinese students have got used to individualistic and competitive learning, and they care more about the diploma and transcript score. With cooperative learning, students have less control on their work and score, but depend more on team cooperation. When team working was introduced in the JP many students complained about working in teams. But over the last 9 years, with JP staff and students working together, it is found that the situation has changed. This survey showed very inspiring results: the majority of students were satisfied with their team experiences; most of them found team projects helped them learn teamwork skills and achieve more academically; almost all students thought teamwork skills were important for work; and the majority of students welcome group projects in future learning.

The results also demonstrated a higher rating of satisfaction for the students in the experiment-group, and nearly all that group of students felt that the group coursework had helped them learn teamwork skills. This means the instruction and mechanism used for the groups were effective and helpful. However, students also reported that although they found the skills given by instructors were very useful, they often forget to use them or did not know how to use them in practice. Indeed most of instructors only gave initial guidance and

turned groups loose. Among students' suggestions for future teamwork teaching, one said "if time permits, I hope the instructor can talk with each group and each person more"; the other suggested that instructors should make examples for them and help with the team function during the process. Students would like more advice from instructors.

In summary, the students welcome new challenges and showed positive and constructive attitude in relating with others in groups, although some of their inherent cultural values may influence their judgement and preferences. This survey revealed well the students' perspectives on teamwork skills and how they would like to learn. Educators and instructors can use these results for the design and implementation of cooperative learning for Chinese engineering students.

# Chapter 7 Evaluation of the effectiveness of the Cooperative Learning approach of the experiment

## 7.1 Introduction

An important aspect needed to be studied is how effective is the teaching of the teamwork skills, evaluated by how well the students learn the skills. This chapter attempts to evaluate the effectiveness of the cooperative learning practice tested to Chinese engineering students and to identify the gap between the declarative knowledge and the skill-based outcomes.

Data for evaluation focuses on the open-ended and qualitative items and was collected from four main sources: (i) students' expectation agreements, (ii) team function evaluation forms, (iii) peer ratings, and (iv) questionnaires. Class observation and informal interview responses were also considered.

The data was analysed using inductive text analysis and descriptive statistics. The responses were coded using open coding (Corbin & Strauss, 2008) to label each response with simple words and phrases. Common key words and phrases were identified and organised into clusters.

This qualitative study provides a good supplement to the previous quantitative findings in Chapter 5 and contributes to understanding by displaying how students perceived a Cooperative Learning practice in a mainland Chinese context, and how they reacted to the experience. It also provides an insight into the underlying cultural considerations behind the team behaviour. It was noted that students' skills that inform their team behaviour are influenced more by their inherited practices and cultural norms than the declarative knowledge

learned at the beginning. Instructors can design and improve team tasks for Chinese students based on these findings.

The validity, reliability, effectiveness and objectiveness of peer rating are analysed and a few questions are considered: (i) whether the students understand the rating criteria well and rate what they are supposed to rate (the team performance but not the academic contribution); (ii) how is the consistency of the marking; will they rate themselves and others objectively; (iii) whether they give marks using the same grading levels; (iv) can their commentaries justify their marking, and (v) the 100 mark phenomenon.

The effectiveness of the practice is also discussed according to students' feedback: (i) their satisfaction, (ii) their attitude toward group work, (iii) the biggest problem in the teamwork process identified by themselves, and (iv) their suggestions to future teamwork training.

## 7.2    Evaluation results

This section will mainly evaluate how the experiment strategies and mechanisms achieved their teaching objectives and learning outcomes; and whether students understood and performed what was expected of them.

### 7.2.1  Instruction of teamwork skills

It is agreed that students cannot gain team skills by just working in groups (Siciliano, 2001). They are not born to know teamwork skills, and these skills must be taught deliberately, as with other academic skills. However, technical modules often have tight schedules plus a large amount of teaching content and the instructors do not have enough training on teamwork teaching, so the most common situation is that students are allocated into groups to complete an assignment but are not given any instruction on how to work in groups.

In the experimental PDP class that takes teamwork skills as one of its main objectives, a brief introduction to these skills was given at the beginning. This included team effectiveness, team development stages, assertive communication skills, social skills, interpersonal skills, and conflict resolution skills. Other skills, like interviewing, questioning, exchanging ideas, giving advice, defending oneself, and summarizing information, are introduced and practised in later PDP tasks throughout the whole undergraduate period.

However, because of the time limitation, it is only possible to schedule a two-hour lecture to set up the PDP task and give basic knowledge of teamwork skills. According to the questionnaire results, students found that the instruction is not enough: 90% of the students in the experiment wanted the instructor to check work and progress at least once a week. It is also noted that there is a gap between declarative knowledge and skill-based outcomes: 60% students found "*little help*" in having instructor guidance for improving team effectiveness - "*students feel that the skills and guidance is very useful, but often forget to use, or do not know how to use, the skills in practice*".

Declarative knowledge is easy to learn, but skills are difficult to acquire. Students found the knowledge and skills were very useful, but often forgot or did not know how to use them in practice. They also expressed the desire for more specific practice and instruction during the process.

Because of time constraints, the skills had only been introduced but not been practised to any extent within the class. It is suggested that more time be allocated so students can do more exercises to practice skills within class, such as brainstorming skills, decision-making skills, group-meeting skills, conflict-resolution skills, listening skills, clear-expression skills, summarizing skills, and assertive communication skills. Different forms can be used for this practice - including lectures, tutorials, workshops, and clinic sessions.

### 7.2.2 Team Expectations Agreement

After the introduction of team skills, students were asked to work out an expectation agreement for their teams. They were expected to list the rules and expectations they agreed as a team to adopt. Everyone signed the sheet to indicate their agreement and intention to fulfil them. They were told that the expectations were for their use and benefit; if they made the list thorough without being unrealistic, they would give themselves the best chance.

Western cultures place emphasis upon rules, laws, equity and contracts that should be applied in all situations, irrespective of personal relationships. However it is very different in the Chinese culture, which puts more emphasis on relationships instead of rules: people have obligations to those they know personally, and each situation is treated differently (Nguyen, Elliott, Terlouw, & Pilot, 2009). Chinese people are usually motivated to complete tasks because of a sense of personal loyalty and attachment to others in the group, but are not compelled by rules (Nguyen et al., 2009). Therefore the following questions were addressed: (i) is there any resistance from students in making and following rules and expectations; (ii) do they know how to make rules; and (iii) what kind of rules will they make.

The result was very inspiring: all the 24 groups took it seriously and worked out a detailed expectation agreement. This indicated that students were concerned to improve team effectiveness using rules and intended to use the skills and knowledge they learned to drive their behaviour.

The expectations they listed can be grouped into six categories: (i) meetings, (ii) decision making, (iii) leadership, (iv) discussion, (v) interpersonal and conflict resolution, and (vi) project management.

### 7.2.2.1 Meetings

Most of the groups expected all members to attend meetings on time, ask for leave if they could not attend, concentrate on tasks, and maintain focus during the meeting (Table 21). One group had even more concrete meeting rules: they decided the frequency and duration of meetings, and stated that there was zero tolerance for lateness of 10 minutes and above: "*Have a meeting twice a week; no one can be 10 minutes late; meeting time should be limited to 30 minutes*".

Table 21 Expectations in the category of meeting

| |
|---|
| 1. Have a meeting twice a week; no one can be 10 minutes late; meeting time should be limited within 30 minutes. |
| 2. Attend meetings and group activities on time. |
| 3. Ask for leave to the monitor if you cannot attend the meeting. |
| 4. Accomplish your tasks allocated by the last meeting (if you have any trouble, inform the coordinator or monitor in advance) / everyone should finish his / her tasks on time |
| 5. Everyone should talk about what relates to the topic in the meeting. |
| 6. Be conscientious when working; never have entertainment during working time. |

The expectations were more about discipline, but no group mentioned having an agenda and capturing action items. Students were not used to making meeting agendas and minutes so this meeting skill should be taught and practised more.

This could be explained by the *polychromic time rhythm* valued by Asian people, who change plans and deadlines frequently and consider schedules as goals rather than as imperatives (Wessel, 2003). However this fluidity does not help coping with time pressure and raising work efficiency in groups so that there is a need for Chinese students to learn how to make and follow meeting agendas and project plans.

## 7.2.2.2    Decision making

Eleven of the 24 groups agreed on the decision making method (Table 22): eight groups chose majority rule voting for the best, and three groups decided on consensus instead of majority rule. Chinese people normally vote for majority to show democracy when making decisions as it is an easy way to reach a final decision but not the best way. People in collectivist cultures are disposed to subordinate their personal interests to collective goals (Earley, 1989): the majority's interests and choice are often perceived as the collective interest. However the majority decision may not be the best solution as it stops alternative discussion and hinders group synergy. Sometimes the real situation with majority voting is that with majority voting the minority may in fact impose a decision on the majority. They tend to ask "*we are all agreed on this, right?*" to suppress dissension. Only brave members will speak out against that, but normally in order to save face to both themselves and others, Chinese people will keep silent to avoid confrontation to maintain the group harmony. However, CL encourages different ideas, constructive conflicts and discussions to reach a consensus that surpasses the sum of individuals'. Students should be aware of the benefit of the consensus approach, and practise how to make a consensus within a group.

Table 22 Expectations in the Category of Decision Making

| |
|---|
| 1. Final decision should be based on the number of support. Minority should obey the majority. |
| 2. If we have different opinions toward a question, we should listen to each other's' ideas and vote for the best one. |
| 3. Different ideas are encouraged. What we want is not the majority's idea but the best one. |
| 4. When there is a disagreement, we would try to form a consensus via communication and compromising instead of quarrelling. |
| 5. Manipulate each step after discussion with agreement of everybody. |

### 7.2.2.3 Leadership

From students' statements, it was clear that they preferred sole leadership, and interestingly they liked to use the word "*obey*" to describe the action they took in response to the leader's orders and arrangements. People depended on a good leader to lead them to success. It was believed that obeying the leader's order was the most efficient route to success with no doubts or different ideas being encouraged. Only one group expected shared leadership and confirmed the accountability of each member.

In many Asian cultures, leadership is more about management of people than management of work (Hui & Lin, 1996). A good leader acts as a moral example who receives high-level loyalty and devotion from team members. Personalities rather than work-related competence are more likely to be the criteria for leadership (Nguyen et al., 2009). Team members need to follow the leader's order and arrangement. In addition, influenced by Confucius' value of unequal relationships, people need a leader to maintain group harmony and stability. Without a leader, the group does not know how to work. This is quite different from the shared leadership advocated by CL (Johnson & Johnson, 1994): each member has a job to do and the team does not have a formal leader.

### 7.2.2.4 Discussion

In the discussion category, students encouraged different opinions, creative ideas, active participation, good listening skills, and critical remarks in a constructive, respectful, and polite way (Table 23). This indicated that students became aware of professional communication skills and welcomed open and fruitful discussion by giving constructive feedback.

Table 23 Expectations in the Category of Discussion

1. Express your opinions and show your abilities actively and bravely; never keep silent all the time.
2. We should respect everyone's idea.
3. Try to develop others' ideas. When difference arises, every member please tolerates and resolves them.
4. Listen to others carefully, no interruption, and suspect their ideas in a polite way.
5. Get as much creative ideas as we can.
6. Everyone should try his/her best to make the idea more creative, and make details perfect. Then others should not complain on his/her work, but give suggestions and ask questions. No question, no progress.

### 7.2.2.5 Interpersonal and conflict resolution

Students agreed on the following aspects in interpersonal relations and conflict resolution (Table 24): willingness to know each other; showing respect and care to each other; trusting others; being open-hearted, honest, considerate, tolerant, modest, and helpful; avoiding blaming others or attacking them; dealing with anger, insults and disagreements peacefully; and correcting mistakes immediately. A few groups expected no arguments and avoided conflicts.

CL emphasises "*face-to-face promotive interaction*" to challenge each other's conclusions and reasoning (Johnson & Johnson, 1994) and encourages constructive conflicts, which involve disagreements over thoughts and different views on how to work further (Garvin & Roberto, 2001). Chinese students in a collectivist culture are traditionally perceived to value the harmonious relationship within the group (G. H. Hofstede & Hofstede, 2005). They are more emotionally controlled, and prefer indirect communication (Nguyen et al., 2009). Because of the strong emphasis on harmony and face in the collectivist culture, Chinese people are not encouraged to speak out, to question or to criticise. In order to save face, speakers often become very defensive after expressing their opinions. If other people put up different views or disagreements, they feel humiliated so that constructive conflicts turn into affective conflicts, involving personal friction, rivalries, and clashing personalities (Zou & Ko, 2012).

Affective conflicts are destructive to productivity and also a threat to group harmony. Therefore, when the problem is approached in different ways, people often choose to avoid it, bypassing the topic of conflict, or being "*obliging*", or asking for mediation from a high-status individual (Zou & Ko, 2012).

Though the Chinese students in this experiment showed desire for open discussion and different ideas, they were very careful in coping with differences by controlling emotions and using majority voting to solve conflicts. However the awareness of the concept to relate professionally and maturely to different ideas and feedbacks was something they had learnt.

Table 24 Expectations in the Category of Interpersonal and conflict resolution

1. Each member should try to know each other in order to cooperate well.
2. Team members should respect each other instead of blaming and attacking others.
3. We should have confidence, trust our partners, and believe that they can do their best to complete their own work.
4. We should be openhearted and honest to others.
5. We encourage open-ended discussion and active problem solving meetings.
6. Everyone should not only do their own things well but also help each other.
7. We should express concern and understanding for others.
8. We should deal peacefully with anger, insults and disagreements.
9. Correct the mistake immediately.
10. We should be on friendly terms in each meeting.
11. Being tolerant. We should spare no efforts to avoid conflicts.
12. No argument.
13. Be respectful, considerate and modest.

### 7.2.2.6 Project management

Some groups also listed expectations on project management: they expected members to follow the project schedule, take care of equipment, reduce expense, and divide work fairly.

Some of the expectations were not concrete. Some listed the general objectives of team work: cooperate with others, work efficiently, build an effective

communication mechanism, have a good leader; and be creative. Some propagandised team spirit: be united, confident, full of passion, and optimistic, never be selfish, put the team's interests first and create a harmonious atmosphere. These slogan expectations were not realistic: they do not actually tell team members how to achieve goals and what to do. But this reflected that traditional Chinese teamwork training is focused on the cultivation of a collective spirit instead of skill-based practice. Collective teamwork advocates maintaining collective interests by sacrificing personal interests.

### 7.2.3 *Evaluation of progress toward effective team functioning*

Students were asked to evaluate, against the intended learning outcomes, how well their team functioned in the middle of the task and to list changes they all agreed to make. This step reinforced students' team knowledge, and initiated voluntary improvement through evaluation.

The most common problem reported by nine groups is that members were not well-prepared for meetings. The second biggest problem (eight groups) is the lack of good listening skills: students constantly interrupting each other or talking in pairs without listening.

Chinese people are not encouraged to speak out or to question, so do they know how to evaluate? This mid-term evaluation was intended to teach evaluation skills and problem-solving skills. Students need to learn how to evaluate based on behaviour instead of attitude, and be able to make concrete and specific work plans to solve problems. In general, students' evaluation was effective, and their problem-solving plans were specific and practical (Table 25).

## Table 25 Changes agreed in the evaluation process

Make a detailed schedule and plan before action and follow it strictly;

Set up a certain goal for each meeting;

Everyone should finish their part of work on time;

The division of work between members should be clear and specific;

Have more meetings, contacts and discussions to share ideas and let the others know what you are doing and thinking;

Everyone should be brave to speak out their own opinions in discussion, even though it might be an opposite view or crazy thinking, because the team encourages different ideas and the crazy idea might be a really good idea;

Listen to others carefully, with patience, attention and respect;

Attend meetings on time;

Be prepared for meetings;

Make conclusion and follow-up actions after meetings;

Concentrate on work, reduce useless work, talk less and do more during meetings and activities;

Clarify the team role responsibilities;

Use more online tools to discuss to make better use of time;

Encourage, help and trust each other;

Be positive, optimistic, and creative;

If some members break the rules, he/she should be punished;

Team is the topmost, everyone should serve the team but the team serve individuals;

Consider more about other's feelings than yourself during the cooperation period.

In one group they agreed: "*Student A (a student's name) should speak out his own opinions more frequently*". This indicated that they had found that student A did not contribute his/her ideas during the discussion, and they wanted to encourage him/her to speak out more often. In another group's agreement, they stated: "*If there are some creative ideas, they would better be put forward in time*". This commented on the belated advice and action, and requested that ideas should be put forward in time.

Regarding the problem of late attendance for meetings, some groups worked out very specific rules: (i) everyone attend the meeting five minutes early; (ii) circulate the meeting time three days beforehand; iii) get everyone to confirm they can make it and can come on time.

Regarding the problem of no preparation for meetings, some of the rules were also concrete: (i) before the meeting, the monitor will tell everyone the topic of the meeting, so members could think about it and work out their own thoughts and constructive solutions; (ii) each member should summarise their own opinions[17] in general before group discussion; (iii) prepare fully individually before the meeting to make brainstorming effective.

Regarding the team role problem, some groups requested that: (i) the coordinator takes more responsibility in the detailed task; (ii) to combine the roles of monitor, sceptic and checker to one role because they found there was not an absolute boundary between the three roles; (iii) to divide the work into roles as well as specific tasks; (iv) to elect a person to be responsible for the whole work; and (v) to establish a supervisory mechanism.

### 7.2.4  Peer rating

How to assess teamwork and individual contributions has always been an issue for instructors when marking group work. Among various evaluation mechanisms, peer rating has been found the most effective one to get insight into individual contribution and performance. Many peer rating systems and schemes have been developed (Loddington, 2008). The evaluation schemes can be grouped into two approaches: one is a qualitative approach to assess "*team citizenship*"; and the other assesses the contribution and effort invested by each team member to the final product (J.K.L. Poon, 2011) (Doerry & Palmer, 2011).

The peer rating system used by Oakley and colleagues (B. Oakley et al., 2004) was adopted, which emphasises how people contribute cooperatively to team goals, but not on their academic ability for their own individual work. Working

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[17] Some people might not have conveyed their ideas clearly and systematically before.

together with others to develop synergy is very important. This reinforces the training of teamwork skills to meet the learning outcomes.

This system sets up a behaviour-anchored criteria (the behavioural characteristics of good teamwork), and explains the meanings of the rating list ranging from "*excellent*" to "*no show*" in terms of individual team performance. However the peer rating was still based on a subjective judgement of observable performance and effort. The validity, reliability and objectiveness of the rating are areas that need to be considered.

### 7.2.4.1    Do they understand the rating criteria?

Students were asked to rate team members including themselves using the rating words (excellent, very good…no show), and were also asked to give justifying commentary. These commentaries were investigated to see how they understood the rating criteria and how they made the judgement. Students' commentary included the following topics:

- Listed what each member did in the task, for example: shoot the video; direct the show; act in the play; make PowerPoint slides; edit the video; organise meetings; put forward a proposal and revise our plan; look after for the equipment; search information.

- How each member fulfilled their work: are they a good director/editor/actor/leader/checker; can they shoot video in high quality; can they make good presentation slides or write a good script.

- Their team performance: did they attend all meetings, but did not contribute much; did they finish their own work and help others; did they have lots of good/creative/amazing ideas and advice; were they a good listener; did they share ideas with us; were they absent for some meetings/activities; did they point out problems and help to solve them;

did they need more courage to intervene; were they punctual and well-prepared; were they sometimes late and contributed very little.

- General appraisal: were they active, creative, full of passion, careful, easy-going, enthusiastic, generous, hard-working, or talented; did they have an open mind; were they technically good, diligent, earnest, selfless, efficient, or humorous; did they devote a lot to the work.

This study demonstrated that students understood the rating criteria, and they inclined to rate each other based on their general judgement of a person, which also includes their contribution and ability. However, some commentary did not justify the ratings. One example is shown in Table 26: all the commentaries were good, but the ratings were different.

Table 26 Commentaries do not justify ratings - example

| A | Very good | Helped the team work effectively and made the ppt |
| B | Very good | Came up with good ideas about the ad |
| C | Satisfactory | Made the video well |
| D | Satisfactory | Came up with ideas and acted well |
| E | Satisfactory | Acted as the main character in the video perfectly |

It was also noted that students were very generous in giving good ratings ("*excellent*" and "*very good*"). Within the 134 sample students there were 44 students who gave all the team members "*excellent*" ratings, and 15 students who gave all the team members "*very good*" ratings.

Some people might argue that this does not reflect reality, giving everyone the same mark or the full mark. The reason for this phenomenon might be that people do not want to offend others even though the marking is anonymous. Though the generous rating does not promote objective evaluation, it at least indicated that students had learned to respect and acknowledge others' work and contributions instead of being rigorous and picky to their faults, which is also a good thing in team building.

### 7.2.4.2 Consistency of the marking

The overall rating is generally consistent. However differences were also found in rating a particular team member: some members found her work was fine and satisfactory, while others felt she did little (Table 27).

Table 27 Different rating for the same person

| A | Ordinary | a little careless (*This is self rating.*) |
|---|---|---|
| B | Deficient | She had done nearly nothing |
| C | satisfactory | Compliant |
| D | satisfactory | She could finish her job. |
| E | satisfactory | Can complete the task in time, and have her own opinions. |
| F | superficial | I don't know what she has really done |

There is another example: one student rated a team member "satisfactory" with commentary "*He played a role in the advertisement, but he did not make many suggestions for the advertisement.*", while the others rated him "excellent" or "very good" with comments "*good actor, share ideas, good skills in video editing*".

### 7.2.4.3 Can students rate themselves and others objectively?

It has often been doubted whether self-rating is objective: people may over-rate or under-rate themselves. A previous statistical test showed that there was no significant difference between self-rating and average peer rating for individuals (Z=-1.509, Sig.=p=0.131>0.05). This indicated that the Chinese students in the experiment did not over-rate or under-rate themselves when evaluating their team working.

In a previous survey, when students were asked whether they would evaluate members' work including themselves objectively, (i) 60% reported "*Yes*"; (ii) 27.5% of them chose "*No, avoid to make some group members too embarrassed*"; (iii) 7.5% said they would evaluate themselves highly; and (iv) 5% said they would evaluate themselves harshly.

Interestingly any inconsistent rating (normally a lower rating) often came from the students themselves, which means students often underrate themselves. For example, one student rated himself "satisfactory" with comments "*As the coordinator, I should carry more load and take more responsibilities*", while others rated him "excellent" and "very good". It was found that students were often modest in self commentary: "*I should pay more attention to the task*"; "*Just perform ordinary, have potential to improve*". This is in keeping with the modest characteristics of Chinese people. Confucius told people to do self-questioning and self-examination before a conflict or problem, instead of blaming others. Therefore if the team does not perform well, they often blame themselves.

### 7.2.4.4    Did they give marks using same grading scales?

It is true that students often have different understanding of the grading scales. Some people are generous in giving high marks while some are very mean and strict in rating. It was found that in one group, all the others rated group members with "*excellent*" or "*very good*", but one member rated others all with "*satisfactory*". Making the rating criteria more particular might help reduce the marking difference.

## 7.2.5  Team Roles and Individual Contribution

Through class observation and final presentation questions, it was found that students got used to single-leader groups even though they were assigned different roles immediately after the groups were formed: the coordinator or the monitor was often considered as the sole leader. The task was often parcelled out into parts and each member did one part. Students only completed and took responsibility for their part of the academic task, but did not care about others' work or undertake other responsibilities for the team. Therefore, getting them to perform the other roles (such as Checker, Sceptic) seems like a vain hope.

Members did not normally understand each other's contributions. For example, students did not know what software was used to edit the video and how it worked except for the one who made the video. Others cannot present the work if they were not assigned to make the presentation slides.

## 7.3 Students' Feedback

Students are the best judge as to whether a teaching approach is effective or not. This section mainly examines the perspectives of students towards this team training practice and their suggestions. A survey was conducted after the experiment and the results had been analysed in Chapter 6 where it was clear that team training practice was acknowledged and welcomed by the students overall.

### 7.3.1 Attitude toward future group work

The reasons students preferred group work are summarised in Table 28.

Table 28 Reasons why to choose group works in the future

| |
| --- |
| Group work can help to develop teamwork skills, and interpersonal skills. |
| Teamwork is important and interesting. |
| It is a pleasure to work together with others, and they can learn a lot from each other. |
| Group members share ideas and help with each other to improve together. |
| Group work is more efficient and time-saving; it makes the hard technical tasks easier to accomplish. |
| Nobody is good at everything, and teamwork gathers all the powers together. |

### 7.3.2 What they learnt from the project?

Students learned a lot from the project: it brought challenges to their inherited and cultural views. Details are shown in Table 29.

Table 29 What the students learned from the project, preparing them for real life

Teamwork makes life more efficient and interesting, and we can make more friends.

It helps me to have team spirit, and be more responsible.

Respect other's opinion in a team.

Cooperation helps us do work more easily and make the result better.

Learning to get along with others is important.

Everyone has their advantages; we should believe others and let them do what they are good at.

Communicate with other team members;

Listen to others' advices;

Control our temper when we have different opinions;

Give other people opportunity to express their opinions;

The proper way to express our ideas and give feedbacks to others' ideas;

Be considerate of feelings of others; never be authoritarian and rigor to others;

Compromising with others;

Make agenda before meetings;

Make plan before work;

How to lead a group;

Actually learn more academically.

One student explained their new understanding about values and leadership: *"I learn that each member's value is equal. We should respect each other, even though there is a relationship between a leader and team members."* This contradicts the traditional monopolistic leadership in China and respects equal opportunity of expression.

### 7.3.3  Problems Students Found in the Process of Group Work

Students also listed the biggest problems they found in the process of the group work (Table 30). These problems need be studied and illustrated when delivering team skills training in the future.

Table 30 The team problems students found

Time management problems;

Lack of inspiration and creative ideas;

Lack of work enthusiasm;

Uneven distribution of work;

Group parceled the work into parts, and members only did their part of work individually;

Some people did less and took advantage of others when they found the others can do more;

Some people did not fullfill their responsibilities in team because they were too lazy, or only concentrated on their own studies, or were busy with other things;

Some members finished their work late;

Difficulty to find a common meeting time because everyone had their own arrangement;

Do not have enough time to communicate with each other;

Group leader did not show the leadership at some key point;

Different people have different ideas, and it is difficult to reach an agreement or consensus;

Some people did not listen to other's opinion carefully or seriously during discussion;

Some people did not express their own opinions but just agree with others' opinions;

Some people attended meetings late;

How to relate with strange members at the first meeting;

How to break the ice when all members keep silent in the meeting.

Some members were monopolistic and bossy;

Some members were academically weak and did not want to try their best to contribute;

## 7.3.4 Suggestions to Teamwork Training

Some students thought this PDP task (advertisement video making) is very good and recommend more group coursework like this. They wanted more opportunities to practise team working. One student even suggested reducing or stopping traditional individual assignments and having more group coursework.

Some students recommended designing more group coursework with a lot of originality. Some suggested training team skills in playing interesting games,

which will make the communication and cooperation more natural and effective. Some students asked for more time and space for the team project. When talking about the method of forming, they gave some suggestions: (i) allocate students from different classes into a group; (ii) let students choose their own groups; (iii) let different students form a group every time.

Many students wanted more training on team skills: (i) set up a course to train team skills; (ii) teach more useful team knowledge and skills; (iii) give more specific advice and examples; (iv) have more interaction between students and instructor. One student stated: "*If time permitted, I hope the teacher or instructor can talk with each group individually, or the person individually, which is better, but I think they might not have that much time.*"

## 7.4    Summary

This CL practice is a pilot attempt for Chinese engineering students. It brought a positive attitude to team work to the students and most students were satisfied with the team experience, and wanted more training and practice on team skills.

It was found that most of the experiment strategies and mechanisms achieved their teaching objectives and learning outcomes. Students generally understood and performed what was wanted of them. However a gap was also identified between the declarative knowledge and the skill-based outcomes. The transfer from knowledge to skills needs more practice. Furthermore, the inherited practices and cultural norms also have a big influence on team behaviour.

This CL practice is generally effective in team work training, though some mechanisms were not suitable to Chinese students and appropriate changes and modifications are required. Students also gave many useful suggestions for future work. This qualitative study has supplemented the previous quantitative

findings, and gives a good understanding on how Chinese engineering students react in a CL practice.

# Chapter 8 Supplementary experiments

## 8.1   Introduction

The work reported in earlier chapters was conducted in the Personal Development Plan (PDP) module that takes professional skills as its main objectives in 2011. This chapter describes a supplementary experiment in the PDP module (using a big sample to compare the different group forming methods in both team and academic performance) and a new experiment to put some tests and checks in the group project of a technical module: Software Engineering (SE).

## 8.2   Supplementary experiment in PDP module

### 8.2.1  Introduction

The experiment was conducted in the Year 1 PDP module. Students were asked to produce and deliver a presentation in English for a foreign audience in groups. The topic could have been a famous Chinese engineer or scientist, introduction to the JP for a visiting student, 'Inside Beijing' - tips for travellers, 'Hidden China', or a day in the life of a JP student.

### 8.2.2  Four group formation methods:

It was found in the previous experiment that self-selected groups did not perform better than groups formed by other methods; in fact they were worse (Zhang, Yao, Pritchard, Cuthbert, & Ketteridge, 2012). This was contrary to the finding of Phuong-Mai and colleagues: it was better for Asian students to form groups based on existing friendship to enhance cooperation (Phuong-Mai et al., 2007). However due to the small sample it did not show any statistically

significant difference between the four team forming methods in academic results and team performance in the previous experiment.

This work selected a bigger sample to find the statistical difference of the four different team-forming methods. The Year 1 JP students (20 classes) were grouped by four different methods, with each method grouping 5 classes (25 groups): i) self-selection; ii) random assignment; iii) academic merit (grouping students with the same ability range); iv) fair system (mixing the academic rank with good, middle and bad together). The hypothesis to be tested was: *self-selected groups do not perform better than groups formed by other methods for Chinese students; they are even worse*.

### 8.2.3 Peer rating

Many educators continually invent and improve peer evaluation approaches (Doerry & Palmer, 2011; J. K. L. Poon, 2011). In this experiment, students will still be asked to rate team members including themselves upon team citizenship instead of academic contribution. Because the peer rating system suggested by Barbara and Richard (B. Oakley et al., 2004) did not have detailed grading criteria and the grading consistency is a concern in the previous experiment, in this experiment the Comprehensive Assessment of Team Member Effectiveness (CATME) (Matthew W. Ohland et al., 2012) was used. At the end of the task, each student completes the CATME peer rating form online. Students will rate each team member including themselves along five different behavioural dimensions: (i) contributing to the team's work, (ii) interacting with teammates, (iii) keeping the team on track, (iv) expecting quality, and (v) having related knowledge, skills, and abilities. The full mark for each dimension is 5. An individual mark will be calculated by the weighting factor of the peer rating results (Individual Mark = team mark * (individual peer rating mark / average group peer rating mark)).

### 8.2.4 Result analysis

#### 8.2.4.1 Comparison of team formation methods

Analysis of variance (ANOVA) was used to evaluate the difference of the PDP results and the average group peer rating results between groups that were formed by the four different methods. ANOVA showed that there was no statistically significant difference between team formation methods on the PDP results: $p=0.439>0.05$, $F=0.911$, $df=3$. It was found that there was statistically significant difference between team formation methods on the peer rating results: $p=0.003<0.05$, $F=4.859$, $df=3$.

The multiple comparisons (Table 31) showed that the differences among "self-selection", "by random" and "fair system" were not significant, but the differences between "academic merit" and the other methods were significant (with "self-selection": $p=0.000<0.05$; with "by random": $p=0.008<0.05$; with "fair system": $p=0.020<0.05$).

Table 31 Supplementary Experiment - Multiple comparisons between four group forming methods on peer rating results

| Dependent Variable | (I) Group Forming Method | (J) Group Forming Method | Mean Difference (I-J) | Sig. |
|---|---|---|---|---|
| Group Average Peer Rating Result | self-selection | by random | -.33440 | .350 |
| | | academic merit | -1.30440* | .000 |
| | | fair system | -.46360 | .196 |
| | by random | self-selection | .33440 | .350 |
| | | academic merit | -.97000* | .008 |
| | | fair system | -.12920 | .717 |
| | academic merit | self-selection | 1.30440* | .000 |
| | | by random | .97000* | .008 |
| | | fair system | .84080* | .020 |
| | fair system | self-selection | .46360 | .196 |
| | | by random | .12920 | .717 |
| | | academic merit | -.84080* | .020 |
| *. The mean difference is significant at the 0.05 level. | | | | |

The means of the PDP results and peer rating results are summarized in Table 32. Groups formed by "self-selection" and "fair system" methods got higher PDP scores of 71, and "by random" and "academic merit" had lower scores of 69. However the difference of the PDP results between different group forming methods was not statistically significant. As for the peer rating results, the groups formed by "academic merit" got the highest score of 23.

Table 32 Means of the PDP results and peer rating results by different team forming methods

|  |  | N | Mean | Minimum | Maximum |
|---|---|---|---|---|---|
| PDP Result | self-selection | 25 | 71.4 | 55 | 90 |
|  | by random | 25 | 69.3 | 58 | 80 |
|  | academic merit | 25 | 69.1 | 60 | 80 |
|  | fair system | 25 | 71.2 | 65 | 84 |
|  | Total | 100 | 70.2 | 55 | 90 |
| Peer Rating Result | self-selection | 25 | 21.8 | 19.6 | 25 |
|  | by random | 25 | 22.1 | 20.1 | 24.3 |
|  | academic merit | 25 | 23.1 | 20.6 | 24.8 |
|  | fair system | 25 | 22.2 | 19.8 | 25 |
|  | Total | 100 | 22.3 | 19.6 | 25 |

There were 25 groups formed by each method, and this was a reasonably large sample statistically. In the previous experiment, it was found the self-selected groups perform worse in both peer rating and academic performance. In this supplementary experiment, the self-selected groups performed the best in the academic performance but scored the lowest in the peer rating. Though it did not prove the self-selection method damaged team collaboration, it did not help with the group cohesion and team cooperation. In one of the five classes allowing self-selection, the groups were homogeneous, all male members or all female members.

The peer rating results showed that the groups formed by the "academic merit" method had better team performance and higher team effectiveness compared with the groups formed by the other three methods. This might indicate that students with the same academic rank could communication and cooperate better within their groups. However their average PDP result was not the best. The correlation between team performance (peer rating) and academic

performance (PDP result) were tested. Another consideration is the average previous academic performance of the groups formed by different team forming methods: the groups formed by the "academic merit" method got the lowest score of 53 in the previous academic test, "fair system" got 56, and both "self-selection" and "random assignment" got 58. This might partly explain why the "academic merit" groups cooperated better but did not get a higher PDP mark.

### 8.2.4.2        Peer rating and academic performance

The Pearson product-moment correlation coefficient test showed that there was no correlation between group average peer rating result of teamwork and academic PDP result (r=0.019, Sig.=p=0.855>0.05, N=100). This means groups with good team performance do not necessarily get a higher or lower mark for the PDP task. This is consistent with the previous experiment result.

### 8.2.4.3        Peer rating

Students had taken an English test at the beginning of the semester, and the result was regarded as their previous academic performance; this is reasonable given the nature of the PDP task. A Pearson product-moment correlation coefficient test was conducted and it was found that there was a very weak positive correlation between the previous academic performance and the teamwork peer rating result (r=0.156, Sig.=p=0.000<0.01, N =619). This might indicate that the academically strong students are slightly more likely to cooperate better as a team member. There was not much difference in the teamwork performance between male and female students (Table 33). This means neither male students or female students are better team players than the other gender.

Table 33 Means of the peer rating results between genders

|  | gender | N | Mean |
|---|---|---|---|
| peer_rating_indv | male | 365 | 22.2 |
|  | female | 259 | 22.4 |

### 8.2.4.4 Students' comments

In the final commentary feedback, students showed their satisfaction with this PDP task. They found the teamwork skills to be important and looked forward to more team tasks in the future. They enjoyed the group working process, knew each other better and became good friends after the task. They stated that they learnt a lot that could not be learnt from the books, recognized their weaknesses and learnt from others. They could work through disagreements and difficulties to achieve the goal, expect better results and tried their best.

Students also expressed their fondness for group work rather than the individual work: "*I think the PDP work is such a great chance for our guys to learn how to cooperate with each other. At first, I felt it is a quite difficult thing for our Chinese students to do an assignment together due to our traditional teaching method. It is well known that the way that students in China finish their assignment is to do it individually, so I think it could be strange and fresh to us to do such an important assignment with our classmates. But the things went well because of our classmates' enthusiasm to this PDP work. Every team member is willing to dedicate their efforts to make things better. From this chance, I not only experienced the enjoyment cooperating with our team members but also gained the ability to finish the work well. I hope there are more chances just like this in the future.*"

"*I think that PDP provide us with a good opportunity to improve our ability of presentation and cooperation. We can not only obtain more knowledge through this activity, but also command the skill to communicate with others. In addition, it makes me more confident. It is an opportunity to display myself. Compared with the traditional courses, this kind of activity can give us more experience.*"

Some students commented on the peer rating system, and they found the CATME system very useful: *"I'm grateful to you for providing the nice system called CATME for us. I think it was truly useful. And with its help, I'm sure we will do better next time." "CATME is an excellent system. We can evaluate each other equitably." "I think this survey is good for our exchanges and cooperation."*

### 8.2.4.5 Summary

In this PDP task, students were required to complete the task together, and each team member had to speak during the final presentation, preventing free-riders, and motivating the team to work together, helping each other to get a higher mark.

The peer rating system is very effective. Students can do a simulated exercise to familiarize them with the CATME Peer Evaluation instrument and help them calibrate their ratings of their peers with other users. At the end of the exercise, students were shown how their ratings compared to the expected ratings, based on the original descriptions allowing students to have a better understanding of how to rate different team performance and behaviour properly.

Out of the 100 groups only three were found to have had considerable disagreement among the teammates as to which team members were most effective during team assignments, and four groups were found to have one rating that was not consistent with the assessment of the rest of the team. It was found that there were 19 students who underrated themselves and no students overrated themselves. This might indicate that these 19 students were "under confident" or too critical of their own contributions.

After the peer evaluation, the system released feedback to each student, illustrating which aspects they need to improve in the future. Students learnt the team knowledge and also found the short coming in their team performance during the peer-rating process.

The difference of the PDP results between different group-forming methods was not statistically significant. As for the teamwork peer-rating results, the groups formed by "academic merit" got the highest score and had significant difference with the other methods. There was not much difference between the other three team forming methods.

There was no correlation between group average peer rating result of teamwork and academic PDP result. Groups with good team performance do not necessarily get a higher or lower mark for the PDP task. There was a very weak positive correlation between the previous academic performance and the teamwork peer rating result. There was not much difference of the teamwork performance between male and female students.

In this supplementary experiment, the self-selected groups performed the best in the academic performance but scored the lowest in the teamwork peer rating. This would indicate that self-selected groups do not promote better team cooperation and performance.

## 8.3 Teamwork training in a technical module

### 8.3.1 Introduction

This section describes a pilot study on the supplementary strategies on teamwork teaching in the group project in a Year 3 (Yr3) technical module – Software Engineering (SE), in which teamwork skills are also one of the course objectives. Many educators have done a lot of research on teamwork teaching in SE (Chen, Qiu, Yuan, Zhang, & Lu, 2011a; Clark, Davies, & Skees, 2005).

In this Software Engineering module, students were grouped into 9-10 to do a group project – developing a Technical Conference Management System. The groups were divided into 2 sub-groups each with 4 or 5 students. Each

sub-group was responsible for either paper review management or paper voting management. Although they were divided into two sub-groups, they were still *one* group, and they should work together to complete this system. As a learning process, they should not parcel the responsibilities such that (for example) one student writes all the code and the others do the software engineering. All students in a group had to work on all aspects of the projects.

The weekly reports (1 group leader summary and 9 individual ones) had to be appended to the final project report. This aimed to track the work completed by each member of the group. The coursework mark is marked out of 100 with 90% being the group mark and 10% was given for individual participation and achievement, as presented by weekly reports.

In the middle of the project, students were asked to do two tests: Team Knowledge Test (TKT) (Sims-Knight, Upchurch, Powers, Haden, & Topciu, 2002) and Self Assessment of Communication Skills (Ruff & Carter, 2009). These tests helped students to enhance their awareness, knowledge, understanding and self-reflection of teamwork and communications skills. In the TKT test, students were asked to mark what they thought was correct and what they chose to do. The difference between knowledge and behaviour was examined.

These students are the same cohort of students as in the previous experiment two years beforehand. A similar TKT test was conducted with the current Year 1 (Yr1) students. This allows a comparison of the team knowledge level between Yr1 and Yr3 students to investigate any progress in the process of group work practice.

After the project, students were asked to complete the Team Process Check (TPC) (Sims-Knight et al., 2002) online to evaluate their team performance.

Since the peer rating mechanism had not been shown to be effective, valid, reliable or culturally appropriate in the PDP module, it was not introduced in SE.

Because this is a senior core course that takes a reasonably high percentage in the degree Honours calculation, more caution had to be given in changing the evaluation criteria. In senior years, the course content becomes more difficult and students are all busy preparing postgraduate applications and job hunting. If the overhead for students in teamwork learning is too high, the efficacy of the study suffers as student responses become hurried and superficial. A questionnaire was circulated to students to complete, and a semi-structured interview was conducted after the group coursework.

## 8.3.2 Team Knowledge Test

The questions in the Team Knowledge Test were grouped into six categories, and the results will be analysed along these six categories. The detailed results of the TKT were included in the Appendix.

### 8.3.2.1 Listening skills

To the question "when you are listening to other people offering their ideas, what is useful to do", 46% of the Yr3 students thought to maintain eye contact with the person was useful.

When receiving feedback from other team members, 74% of the Yr3 students acknowledged that they should perceive the feedback as information that they can use instead of evaluation of them as a person, but only 56% of them reported that they would do this. 23% of them would anticipate what the others would say and waited to hear that, and 14% of them would anticipate that people would not really understand where they were coming from and be ready to explain.

When a team member was expressing a different opinion, 77% of Yr3 students knew they should listen carefully to what was being offered, even though they had an alternative way of looking at the issue, and 72% of them would do this.

Nobody chose to look away from the team member to register their disapproval discretely. Only 19% of them thought they should politely provide a counterargument to each of his/her points.

These results show that most of the Yr3 students were aware of the importance of listening to others' opinions especially different ideas and feedback, but in their knowledge and practice they would often compare the feedback and opinions with theirs, be defensive, try to explain their own idea, and look for others' weak points. This means they would like to listen carefully but sometimes lacked the skills to do so.

The Yr3 students had more listening skill knowledge than the Yr1 students, but the practice was almost the same.

### 8.3.2.2 Meeting skills

When the students were asked what they should do if the team leader came to a scheduled meeting without an agenda:

- 10.5% of Yr3 students thought they could let the meeting proceed without an agenda;
- 47.4% thought they should make their first agenda item developing an agenda as a team;
- 19.3% chose to tell the team leader to write out an agenda and the others could take a coffee to wait;
- 22.8% chose to postpone the meeting until the leader got their act together.

However, in practice a much higher proportion of students let a meeting take place without an agenda.

On the question of the brainstorming technique to generate ideas for a project:

- 38.6% of the Yr3 students thought the process of generating ideas should be separated from the process of evaluating ideas;

- 24.6% chose "as each idea is generated, one team member should take it as his role to develop and defend it, so that 'ownership' results";

- 31.2% thought "the team should rate the goodness of each idea as it is generated by going through the team members in a round-robin fashion".

It was noticed interestingly in practice there were more students (from 38.6% to 45.6%) who would separate the process of generating ideas from the process of evaluating ideas, which is the proper technique for brainstorming, though not all of these students were conscious of this; fewer students would emphasize "ownership" or evaluate each idea.

An interesting issue is the possible presence of quiet members whose opinions are often not heard.

- 47.4% of Yr3 students thought if they were team leaders, they should set up a specific order for everyone to speak and then follow it;

- 26.3% thought they should ask them to write down their positions and give it to the team leader anonymously after the meeting;

- 24.6% would ask them to adopt roles in the meetings, such as time-keeper and facilitator.

This means most of the students thought everyone's idea should be heard. However, in practice more people (from 1.8% to 10.5%) would leave it be: if they do not want to talk, they should not have to.

When the team meeting time was wasted because of unrelated conversations most students (64.9%) thought it could be fixed by having a meeting agenda and sticking to it, but in practice more students (45.6%) would have the team leader determine what is relevant and prohibit the irrelevant discussions. This

indicated that though students knew they should use an agenda to restrict the conversation topics, they would more likely depend on the team leader to keep the discussion on track.

It was noted from the test results that the students were aware of the importance of making and following the meeting agenda, but sometimes might disregard it, and depend on the team leader to control the discussion; they got used to set an order of speaking to ensure that every member's opinion could be heard; they tended to mark each idea with ownership or rate the goodness of each idea.

### 8.3.2.3 Decision making skills

In a situation where your teammates all agree on a way to solve a problem, but you feel quite sure that your different approach is better, most of the Yr3 students (70.2%) thought they should suggest that they try to find a middle ground by taking the best from each approach; 19.3% suggested a team building exercise; and only 5.3% thought they should be quiet and follow the majority rules. But in practice, more students (21%) would choose to be quiet and follow the majority rules.

75.4% of the Yr3 students thought that consensus has been reached when every team member feels that the decision is workable and defensible, even if it was not what they would have chosen on their own. However in practice, some of them changed to use voting (majority rules) to get consensus: the rate rose from 8.8% to 22.8%.

### 8.3.2.4 Evaluating skills

When they were asked to review another team's process check, more than half of the students (64.9%) thought they should give a variety of responses, some high and some low, because that would give pointers for improvement; and 19.3% thought they should give excellent ratings on the difficult questions, because if

they got their processes correct, task excellence is sure to follow. The practice preference was similar to this thinking.

When giving feedback to someone on the team, most of the students (82.5%) thought it was helpful to offer some positive supportive comments and then propose specific, constructive suggestions for change, but the rate dropped down to 70.2% in practice. Some of them would choose to only discuss the positive aspects of what they were doing, or be general or get directly to what they needed to change in order to get the bad news over with.

This indicated that most of the students knew how to give feedback and how to evaluate other's work; they knew they should give both positive and negative responses, and offer specific, constructive suggestions for change. However in practice, some of them would give only excellent ratings or be general to avoid the negative responses. One consideration is Chinese people often try to save the face of others.

### 8.3.2.5    Expression skills

When expressing an idea or presenting some information, 91.2% of the students thought they should try to understand the listener's point of view, and tailor their presentation to what may be of use to the listener, but the percentage fell down to 68.4% in practice. More students would just let it flow naturally without preparation, or expect other people to see things the way they did, or focus on what was important to them.

### 8.3.2.6    Conflict resolution skills

When there was a disagreement or difference of opinion in the team, 57.9% of the Yr3 students thought it was best to address the disagreement directly and supportively, even if there is a risk of conflict, but in practice the percentage dropped to 38.6%. In practice, 49.1% would find some way to minimize the significance of it so as not to draw attention to it, 7% would point out that

disagreement is harmful to a team, and 5.3% would ignore it altogether. This means more than half of the students knew they should address the disagreement directly and supportively, but in practice most of them would ignore the disagreement. This is consistent with the characteristics of the Chinese people, who often avoid conflict to save face and keep harmony.

When dealing with a team member who did not finish their fair share of the work, 87.7% students thought it was best to have a team meeting at which the norms of the team were discussed in a frank and open manner, and nobody thought it was good to ignore it because these things usually work out in the end. However in practice, the percentage fell down to 42.1%: 35.1% chose to ignore it, 12.3% would have the team query the member at the next meeting, and 10.5% would go straight to the instructor and have them handle it.

To the question "when you and another team member are having trouble communicating, which is the worst thing for you to do", only 35.1% of the Yr3 students thought it was bad to plan the response while the other member was speaking, and 28.1% thought it was not proper to repeat what they thought they said or meant to say. The practice choices had similar ratings. This indicated that students need more communication skills.

When they were asked which was the least productive thing they could do when they had become quite angry in a team meeting, only 19.3% thought it was the least productive thing to get it off their chest, and everyone would feel better if they get it all out. 42.1% thought it best to figure out how you could alter the situation to reduce the anger-producing stimulus; 26.3% excuse yourself to go to the bathroom; and 12.3% explain that you are upset by using "I" statements. This means most of the students thought it was better to restrain their own feeling to make everybody happy. Chinese people often sacrifice their individual interests and restrain their personal feeling to contribute to the collective interests and harmony.

In order to increase the chances of everyone doing their fair share of work, 75.4% of the Yr 3 students thought the team should assign specific tasks and monitor progress, 12.3% thought they should remove members who were not working, 10.5% thought they should have the productive members slow down to allow the others to catch up, and only 1.7% chose to be not too concerned as long as the work was getting done. However in practice, more students (22.8%) would not be concerned about this matter as long as the work was getting done. Though most of the students knew they should try to get everyone do their fair share of work, they often chose to ignore this as long as the work was done.

Effective discussions of team business are often made difficult by people who are argumentative or dominating or disorganized. To get the meeting moving forward (i) 64.9% of the students thought you should let them know that you have understood and appreciated their point; (ii) 21.1% thought the team leader should be assertive enough to insist that such members be quiet; (iii) 10.5% thought you could let them talk, and eventually they will run out of steam and they would still be on good terms; and (iv) 3.5% thought you should argue back until they realized that they were wrong.

In practice, fewer students (50.9%) chose to let them know that you have understood and appreciated their point, and many students would choose to argue back (8.8%) or let the team leader make them be quiet (19.8%). To those argumentative and dominating members, students showed less patience in practice than in thinking.

If a team member is hostile or critical, 73.7% students thought it was generally useful to find some area of agreement or acknowledge some truth in what they were saying to diffuse the attack, but in practice, the percentage fell to 52.6%. The percentage rose in the options to criticize them to let that person know how it felt (from 12.3% to 21.1%), and to try to ignore the behaviour and push on (from 5.3% to 24.6%).

When two members of the team have a genuine disagreement (not just miscommunication or personality conflict), 82.5% thought the most likely approach to lead to a resolution was to ask questions to try to understand each person's position and look for solutions that both might like, but only 63.2% would do like this. Some students would have the other team members come up with a third position they can agree on (12.3%), ask each person to give up something (10.5%), or take a vote among all the team members, and the winner takes all (14%). Half the students would solve the disagreement by letting each side compromise or follow the majority rules.

In summary, (i) though more than half the students knew it was best to address the disagreement directly and supportively, in practice most of them would minimize the significance or ignore the disagreement; (ii) though most of the students thought it was best to have a team meeting at which the norms of the team were discussed in a frank and open manner to deal with the hitchhikers, in reality they would prefer to ignore this behaviour or depend on the instructor to handle it; (iii) though most of the students knew they should try to get everyone do their fair share of work, they often chose to ignore this as long as the work was done; (iv) many students did not acquire the proper communication skills; (v) when angry most students thought it was better to get it off your chest; (vi) half the students showed less patience in dealing with the dominant, argumentative and hostile members in practice: they either argue back or ignore it at all; (vii) half the students would solve the disagreement by letting each side compromise or following the majority rules.

This shows that there are still many students who lack the proper skills and techniques to deal with team problems and conflicts. They do not know how to solve the problem, but choose to ignore it or fight back to keep superficial unanimity and harmony.

### 8.3.2.7    Summary

It was found that the Year 3 students had better knowledge of teamwork than the Year 1 students, according to the answers they selected on what they thought was correct. These Yr3 students are the same students in the previous experiment in 2011, who were given some teamwork training in the PDP 1 course. This indicates the previous training and more group work practice in the first three years for the Yr3 students enhanced their team knowledge, though they still had space to improve.

It was also noticed that there was a big difference between what they thought was correct and what they normally choose to do for the Yr3 students, as shown in Table 34: they knew better than they did. There was not much difference between Thought and Do for the Yr1 students. It was also found there was little difference in what they chose to do between the Yr3 and Yr1 students. This means that although the awareness of team knowledge was developed, the practice was not much improved.

However there only 10% of the Yr 3 students (57 students) submitted answers to this TKT test. The reason for the low participation rate might because the Yr3 students were very busy with the technical modules and various proficiency tests, such as GRE, TOEFL and IELT, and this teamwork study tests did not contribute to the final marks.

Table 34 Team Knowledge Test results

| Question | What you THINK is correct | | What you would choose to DO | |
|----------|------|------|------|------|
| | Yr3 | Yr1 | Yr3 | Yr1 |
| Overall | 62.7% | 54.5% | 49.8% | 48.4% |
| 1 | 57.9% | 32.1% | 38.6% | 30.7% |
| 2 | 45.6% | 42.1% | 38.6% | 30.7% |
| 3 | 47.4% | 38.6% | 38.6% | 35.0% |
| 4 | 87.7% | 80.7% | 42.1% | 55.7% |
| 5 | 38.6% | 20.0% | 45.6% | 20.0% |
| 6 | 73.7% | 61.4% | 56.1% | 55.7% |
| 7 | 91.2% | 80.0% | 68.4% | 70.0% |
| 8 | 64.9% | 52.9% | 59.6% | 46.4% |
| 9 | 70.2% | 71.4% | 61.4% | 62.9% |
| 10 | 35.1% | 22.9% | 31.6% | 25.7% |
| 11 | 19.3% | 20.0% | 24.6% | 21.4% |
| 12 | 75.4% | 63.6% | 59.6% | 54.3% |
| 13 | 26.3% | 31.4% | 17.5% | 38.6% |
| 14 | 77.2% | 77.1% | 71.9% | 72.1% |
| 15 | 64.9% | 42.1% | 42.1% | 37.1% |
| 16 | 82.5% | 80.0% | 70.2% | 76.4% |
| 17 | 75.4% | 65.0% | 63.2% | 56.4% |
| 18 | 64.9% | 53.6% | 50.9% | 49.3% |
| 19 | 73.7% | 76.4% | 52.6% | 66.4% |
| 20 | 82.5% | 79.3% | 63.2% | 62.9% |

## 8.3.3 Communication Skills Test

Students were asked to complete a self-assessment of the communication learning outcomes in the middle of the project. The communication learning outcomes were suggested by Software Engineering professionals (Ruff & Carter, 2009). These 31 communication skills comprise communication in a software engineering workplace; however, most of the outcomes are also applicable to other engineering programmes. They were grouped into six categories: (i) design communication, (ii) explain clearly, (iii) discuss productively, (iv) receive communication, (v) communicate professionally, and (vi) use common forms and tools.

Students were asked to select the option that best reflects whether they have achieved each of those communication skills: strongly disagree, disagree, neutral, agree and strongly agree. The mark will be given accordingly from 0 to 4. This is a formative test, which does not take percentage of the final course grade. Students were encouraged to answer the questions seriously and honestly.

There were 45 of the Yr3 students who completed this test. The average score is 3, and the average marks for each question are all above 2. This means students generally have achieved all the communication skills, but the degree varies from low to high. The average marks for each category are sorted in the order from high to low, as shown in Table 35. The detailed results can be found in the Appendix.

It was found that the Yr3 students had much confidence in their ability to use common forms and tools to communicate agreeing that they could use email appropriately, understand what information should be included and what should not, when to use "reply all", and the necessity to read carefully before sending. However when they were in the first year of university, many of them did not show these abilities: using private email address instead of the university address to write emails to the instructors; did not open and close emails properly (proper address of the receiver and sender were neglected); using abbreviation and slang instead of full sentences; and being unreasonable in expectation of reply times.

Table 35 Average marks for each category of the Self-Assessment of the

Communication Skills

| Category | Average mark | Question | Mark |
|---|---|---|---|
| **use common forms and tools** | 3.16 | 31. Use email appropriately, demonstrating an understanding of what information should be included and what should not, of when to use "reply all," and of the necessity to read carefully before sending. | 3.27 |
| | | 30. Give effective and engaging presentations. | 3.18 |
| | | 28. Demonstrate a mastery of the kinds of formal and informal communication most often used in the industry (email, bug reports, meetings, presentations to groups, one-on-one, teleconferences, code comments, documentation, requirements, and status reports | 3.09 |
| | | 29. Use digital tools that are beneficial for communication and teamwork (tools for document control, bitmap and vector illustrations, documentation, web pages, basic video/audio for presentations, intuitive GUI design, and project planning). | 3.09 |
| **communicate professionally** | 3.08 | 27. Participate in meetings. | 3.69 |
| | | 21. Be nice to others, through words and tone. | 3.42 |
| | | 26. Inform managers and team members of potential problems before the problems become serious. | 3.38 |
| | | 25. Communicate through transparency (make information openly available). | 3.29 |
| | | 19. Give opinions with a balance of confidence & humility. | 3.11 |
| | | 23. Make own accomplishments known without arrogance. Communicate charismatically; be passionate / animated in order to influence people. | 2.96 |
| | | 24. Mentor others and help them grow. | 2.82 |
| | | 20. Avoid complaining, by proposing a solution, fixing the problem, or remaining silent. | 2.53 |
| | | 22. Manage non-verbal communication to avoid sending inappropriate messages. | 2.53 |

| | | | |
|---|---|---|---|
| **receive communication** | 3.07 | 16. Listen actively; ask clarifying questions. | 3.38 |
| | | 17. Read with comprehension and evaluate information to determine what is credible and relevant. | 3.16 |
| | | 15. Solicit help, advice, or information. | 2.98 |
| | | 18. Adjust communication based on non-verbal reactions of the audience; solicit feedback about the effectiveness of the communication. | 2.76 |
| **design communication** | 2.93 | 1. Prioritize communication tasks to use time wisely. | 3.24 |
| | | 2. Distinguish when it is more appropriate / effective to keep silent rather than to speak and to ask questions rather than to assert an opinion. | 2.62 |
| **discuss productively** | 2.91 | 10. Lead a productive group discussion. | 3.22 |
| | | 14. Give criticism constructively and respectfully. | 3.13 |
| | | 11. Deal constructively with conflict: debate/discuss/negotiate/collaborate productively and respectfully. | 3 |
| | | 12. Support the transition from debate to the formation of a decision; | 2.78 |
| | | 13. Hear criticism as a constructive contribution to the outcome of a project without getting defensive. | 2.42 |
| **explain clearly** | 2.86 | 5. Achieve an appropriate balance between conciseness and explanation; go directly to the point. | 3.09 |
| | | 9. Use consistent and appropriate terminology. | 2.98 |
| | | 4. Explain code, methods, and design decisions by communicating the intent—what was meant to be achieved—and reasons—why key choices were made. | 2.96 |
| | | 8. Communicate convincingly. | 2.96 |
| | | 6. Answer questions clearly by going beyond what the questioner has explicitly asked; anticipate what else the questioner might need to know. | 2.8 |
| | | 3. Present information in a way that goes beyond the specific details of a project to provide the big picture, a higher level of summary. | 2.71 |

| | | 7. Communicate effectively under stress. | 2.51 |
|---|---|---|---|

This confidence extended to all forms of communications (details in the Appendix) so that in conclusion:

i) Students had been enabled to use various communication forms and digital tools, and to give effective presentations after three years' learning and practice in the joint programme;

ii) They showed professionalism in communication: participate in meetings, communicate through transparency, be nice to others, help each other, be passionate, give opinions with a balance of confidence and humility, and prevent potential team problems. But they also showed their weakness in avoiding complaining and managing non-verbal communication.

iii) Most of them could listen actively and read with comprehension and evaluation, but they showed less confidence in adjusting communication based on non-verbal reaction and soliciting feedback and help.

iv) Many of them could prioritize communication tasks to use time wisely, but less of them were skilful in using silence and asking questions instead of asserting an opinion.

v) Most of them could discuss productively, deal constructively with conflicts, and give criticism constructively. However, many of them easily got defensive to criticism, and not many people were very confident in supporting the transition from debate to a decision.

vi) Most of the students were competent in explaining clearly with conciseness, using consistent and appropriate terminology, getting to the point directly, explaining by telling the intent, and communicating convincingly. They still need more practice in presenting information by providing the big picture and a high level of summary and answering

questions clearly beyond the question itself. Many students reported less confidence in communicating effectively under stress.

To these experiment students, it was found that many of them were easy to assert their opinion, be defensive to criticism, and complain. This might also indicated the face-saving character of the Chinese people. When their opinion is challenged by others, they instinctively defend their opinion to save face. When a team problem or fault was found, many of them might choose to complain and blame others to wipe off their responsibilities to save face.

However, students showed a lot competence in most aspects of the communication skills, and through this self-assessment they should have been aware of the effective skills for communication and their weaknesses.

### 8.3.4 Team Process Checks

Students were asked to complete the Team Process Checks (TPC) as suggested by Sims-Knight and colleagues (Sims-Knight et al., 2002) individually, as a web-enabled survey, in the middle of the project. The measure consisted of items of two broad dimensions of team functioning, team agency and affiliation. The team agency dimension intended to assess areas such as team process and team decision making, and the affiliation dimension attempted to assess interpersonal functioning, particularly communication and conflict resolution. Participants rated how true on a 1-5 scale (never, rarely, sometimes, frequently, always) each item was of their team.

There were only 15 Yr 3 students who completed this test. Though the response rate is low, it still reflects some common problems and weakness of these students. The detailed results can be found in the Appendix. Points raised were:

i)  Sometimes the team might agree on a solution but not every member accepted or believed that solution wholeheartedly.

ii)   When arguments break out, generally team members were able to step back, calm down, and work out the differences.

iii)  Generally students thought their team members never or rarely had difficulty listening to one another's ideas.

iv)   Students felt that they criticised ideas, not each other always or frequently.

v)    About half of the students found their team members had trouble expressing their ideas clearly.

vi)   Most students stated that their team rarely or never ignored conflicts among team members.

vii)  All students said their team members made helpful and constructive comments on others' ideas.

viii) All students reported that their team encouraged differing opinions to be expressed, although a significant proportion found that when conflict arose, it was "sometimes" likely to be a battle or, at best, a waste of time.

ix)   A minority of students found it difficult to accept criticism openly and non-defensively.

x)    All students reported that their teams tried to get everyone's ideas before making a decision.

xi)   Some pointed out that they had difficulty staying focused and on track.

xii)  All students stated that their team members were clear about what was expected of them.

xiii) All students reported that they were carefully to assign tasks to each of the team member when appropriate.

xiv)  All students had confidence in their team to generate potential solutions and evaluate them in an effective and systematic way.

xv)   All students reported their team could operate according to clear rules.

xvi)  All students stated that their team helped to get the ideas out when someone is struggling to express his or her ideas.

xvii)   Some students found their team tended to start working without an explicit plan.

xviii)  About a third of the students found that some people seemed to do most of the team's work while about the same proportion reported that they had difficulty completing their work efficiently.

These results showed that most of the student teams could get everyone' ideas before making a decision, help individuals to get their ideas out, assign tasks to each members carefully with each member clear about their tasks, operate according to clear rules, generate best solutions through evaluation, and improve work by self-assessment; but some students also reported team problems, such as having difficulty staying focused and on track, working without an explicit plan, some people doing most of the work, and having difficulty completing the work effectively.

## *8.3.5 Questionnaire*

At the end of the group project, students were asked to complete a questionnaire online. There were 24 Yr 3 students who answered the questions, with 14 male students and 10 female students. The academic distribution was reasonable: 50% were good students, 37.5% were ranked in the middle, and 12.5% were top students. There were no weak students who completed this questionnaire.

Among these students, 33% felt very satisfied with the team experience in this group coursework in the SE module, 50% were somewhat satisfied, 17% were neutral, and nobody was dissatisfied.

The preference of how to form groups was different from the previous surveys as shown in Table 36. This result will be discussed in the next section on interviews.

Table 36 Comparison of the results between the previous survey and the present survey: students' preferred method to choose their group

| % within Grade | previous | Present |
|---|---|---|
| by random | 22.6% | 37.5% |
| self-selection | 61.3% | 20.8% |
| assigned by teacher | 9.7% | 25% (mixing) |
| group by academic rank | 3.2% | 12.5% |
| other | 3.2% | 4.2% |
| Total | 100.0% | 100.0% |

71% of students thought the teamwork skills would be very important for the work place, which was an encouraging outcome.

Half of the students reported there were one or more of the students in their team who did not pull their weight. When this happened, 63% would persuade and help them to do their work, 21% would ask for mediation, counsel, support from instructors, and 17% would do their work for them; nobody would choose to do nothing or switch groups. It was noticed that the percentage in the choice of "persuade and help them to do their work" dropped from 78% to 63% when the same cohort of students moved from Yr 1 to Yr 3 (Table 37).

Table 37 Comparison of the results between the previous survey and the present survey: What will you do if some members do not contribute?

| % within Grade | previous | present |
|---|---|---|
| Do their work for them | 7.8% | 16.7% |
| Ask for mediation, counsel, support from instructors | 12.5% | 20.8% |
| Persuade and help them to do their work | 78.1% | 62.5% |
| Switch groups | 0 | 0 |
| Do nothing | 1.6% | 0 |
| Total | 100.0% | 100.0% |

If their partner was academically weak, half of them would let them do what they were good at, 33% would help them, and 13% would do their work for

them. The choices were similar to their previous selection when they were in Year 1 as shown in Table 38.

Table 38 Comparison of the results between the previous survey and the present survey: If your partner is academically weak, what will you do?

| % within Grade | previous | present |
|---|---|---|
| Do his/her work for him/her | 10.9% | 12.5% |
| Help him/her | 34.4% | 33.3% |
| Let him/her do what he/she is good at | 54.7% | 50% |
| Other | 0 | 4.2% |
| Total | 100.0% | 100.0% |

When the students were asked where and how they would like to gain teamwork skills, the selection spread mainly among three choices (Table 39): 29% would like to learn teamwork in group projects of technical modules, 25% chose extra class activities, and 21% chose special academic modules with teamwork skills as its learning objective.

Table 39 Where and how would you like to gain teamwork skills?

| | |
|---|---|
| - A. In extra class activities – like entertainment, sports, student union or study activities: | 6 (25.00 %) |
| - B. It should be specially learned and practiced in an academic module with teamwork skills and other professional skills as its main learning objectives, like the PDP module: | 5 (20.83 %) |
| - C. In group projects and coursework of technical modules: | 7 (29.17 %) |
| - D. It can be gained naturally when you are more mature, and do not need to learn: | 3 (12.50 %) |
| - E. Other: | 3 (12.50 %) |

The reasons for how much effort and time students put into team cooperation and team performance improvement are summarised in Table 40. Some students put a great deal of effort and time because they wanted to do the

coursework well, get a high mark and expected high quality products; some explained that it was because they were the team leader; some would like to cooperate with others and learn more; and some complained about some members not doing their work. Many students found that team work was very important, a team could do more than one person, and cooperation could enhance group performance, so they put much effort on team performance improvement. For those who put less effort and time on cooperation and team performance improvement, they often divided the work and finished their task individually.

Table 40 Reasons for why they put that much of effort and time on team

cooperation and team performance improvement

| Amount of effort and time | Reason |
| --- | --- |
| A Great Deal | I really want to do this coursework well.<br>I cooperated with other group members and learned many things.<br>I am the team leader.<br>Because I expected a high quality product in the coursework.<br>Some people didn't do their work, and another subgroup didn't help. |
| Much | This work is important.<br>For a good mark, beside, if I don't put time and effort, I'll be left out.<br>I want to learn it<br>It was a team work. We must do our best.<br>We do not have much homework and have more free time, so it is easy to get together.<br>A team can do more than a person; maximum the team effort is essential.<br>I want our project have a good result (mark).<br>Cooperation is very important to enhance the group performance.<br>Because the time is not enough. |
| Somewhat | We discussed, and finished our work respectively.<br>Other communication was through the Internet.<br>I finished my own duty on time.<br>Many people do not contribute to this work. |

When students were asked which parts of the coursework requirements they thought promoted team cooperation and good team performance, or prevented team problems, they responded that when: (i) the coursework task was big enough to require every member to participate to get the job done; (ii) the target was clear; (iii) the requirements were spelt out in detail; (iv) the coursework time schedule was precise and strict to promote team cooperation; (v) individual marks are used to motivate people to contribute; and (vi) a requirement analysis was included to get everybody to participate and promote team cooperation. However, some students also found that dividing into subgroups did not help

with the communication. Students' responses to this question are summarized in Table 41.

Table 41 Which parts of the coursework requirements or arrangements do you think promoted team cooperation and good team performance, and by some means prevent or decrease team problems?

| |
|---|
| Each team member to have individual score, which can motivate everybody to contribute to coursework. |
| Requirement analysis gets every member to participate and promote team cooperation. |
| Coursework schedule promoted team cooperation and good team performance. Frequent meetings prevent team problems. |
| There is much work to be done in this coursework, which cannot be completed by a few people or individually. It requires discussion, confirmation and correction during each step of the development of the system. It forces us to cooperate and communicate with others. |
| The whole coursework target was clear. When we had disagreement, most of the time the minority compromised. |
| Some coursework requirements are divided into detailed procedures so that it is easier to divide work for team members, and it is helpful for good team performance. |
| I think it is a bad idea to divide the group into two subgroups. |
| Separate into small groups could let everyone do different jobs at the same time. But this reduces the communication between members. The communication is very important to team performance. |

The biggest problems students reported are summarized in Table 42. Students found that they had difficulty in dealing with disagreements and reaching a consensus. The other two big problems are unequal contribution between members and communication between members, especially between unfamiliar members. One student complained about the cooperation between subgroups, in their words it was: *"People cooperate badly. I think it is a bad idea to divide the group into two subgroups. The other subgroup thought it was not necessary to discuss with and help me because I was not in their subgroup. But in my subgroup, there are some people who were really weak in this course and do not want to learn, so they ask me to do a lot. I can only talk with a few people when meeting problems, and if the work*

*was completed late, the other subgroup will blame me though I was not the team leader. At the end, in the description of work distribution, the team leader did not fully describe the large amount of work I did because the leader is in the other subgroup. I also try my best to do a lot of communication work between the two subgroups which should be done by the leader. I got an individual mark that I think is lower than I deserve. I think as one group, each one should help others no matter which subgroup he/she is in. But in this coursework, I feel terrible about this, and our group mark is also lower than we expected."*

The two subgroups, were still in the same group, and should communicate, cooperate and help each other. However, the real situation might be that students concentrated more on their sub-task instead of having an overall view of the whole system. This is also a very important skill to cooperate between groups, which students have to learn and practice more.

Table 42 What problem do you think is the biggest problem you met in this process of group work?

| |
|---|
| Some members lack individual skills and ability to complete the work. The capable one normally does much and feels tired. |
| Some members did not complete the work well, which slowed down the working pace of the whole team. |
| Many people do not contribute to the coursework, and we have to do their work for them. |
| To help the academically weak partners. |
| Task allocation and management. |
| Putting the right person on the right place. |
| Testing is really a laborious work. |
| Group members are not familiar with the standardized design flow. |
| Lack of professional skills. |
| Change in plan. |
| The project is difficult to complete, heavy task |
| Reach an agreement. |
| Disagreement happened when discussing about the next step. Nobody knows the answer. It is hard to persuade others, so I have to insist my ideas. |
| The biggest problem I think is the coordination in our team. Everyone has different views, and it is hard to deal with. |
| Lack of communication |
| The problem is the communication between members. We came from different classes. We have less time to do the project together. We spent a lot of time to negotiate time and place to meet. |
| Most of the group members were not familiar with each other before this coursework. |

When they were asked how much they felt this group coursework helped them learn teamwork skills, 16% chose "a great deal", 58% chose "much", 13% chose "somewhat", and the remainder felt it helped a little. Those who felt the group coursework helped "somewhat" or "a little" included top, good and middle students, and they reported the team problems of communication, with some members not contributing or being too weak to do well, or other people not cooperating or helping.

Even where students had found problems, it did not really detract from their preference for group working. There were 75% of students who preferred to

work in groups in future coursework projects because they found teamwork was very important, because they could help each other to learn more, and because group work is more efficient and productive. Those who preferred to do the coursework individually, did so as they thought they could learn more, and have more control and freedom, their individual ability could be assessed and recognised, and they would not be taken advantage of others. The detailed reasons are listed in Table 43.

Table 43 Reasons for why they preferred individual work or group work in the future coursework projects

| Individual /group | Reason |
|---|---|
| Individually | Team ability and individual ability should be assessed separately. |
| | The truth is it is really hard to avoid social loafing. |
| | I can do entire work and gain more knowledge. |
| | I can control everything by myself. |
| | Free. |
| | Only two or three people work together to complete this coursework, and I have to do other's work. |
| Group project | Can help each other. |
| | Everyone can contribute to the project. It can be completed very quickly. |
| | Although it is difficult, it is valuable. |
| | If people can cooperate together, group work is good because we can discuss. |
| | More people mean more ideas. |
| | Group work brings chances to communicate and learn others' methods to resolve a problem. |
| | It is efficient. |
| | Much happier. |
| | When encountering problems, solve it as soon as possible. Brain storming. |
| | It is good for us, because the world is a cooperation world. |
| | In the practice there is more teamwork. |
| | We can do things better working in groups. Every people could do what he/she is good at. |
| | I can learn more knowledge that I have not learnt before and improve my ability of study. |
| | One's ability is limited and we should learn in practice how to work with others. |
| | A group is much more powerful than individuals. |
| | It is wonderful to work with others. |
| | Group work helps me to prevent faults. |

There were three top students who completed this questionnaire. Interestingly it was found that none of them were very satisfied with the team experience: two of them felt "somewhat" satisfied, and one felt "neutral" about the satisfaction. Two of them found this group work helped "a little" in teamwork learning, and one found it helped "much". None of them wanted to gain teamwork skills in

the technical group coursework or specific module: two of them wanted to learn it in extra class activities and one wanted to do it in other ways. One of them would like to do future coursework individually and two preferred group work. This might indicate that top students were not very happy to work in groups to complete the coursework. They might be academically strong enough to complete the task by themselves. They expected a product of higher quality and higher mark than the other students. They found they did not learn anything or benefit from other group member, but were slowed down by others. Sometimes they did most of the work for the team, and the other weak students got the same mark as theirs. The group work minimized their advantage over the other students. This explained that the top students would rather practise their teamwork skills in extra class activities than in academic settings.

Students also gave many suggestions to the arrangement of teamwork training in university (Table 44). They suggested setting a specific flexible way for teamwork training, focusing more on teamwork itself, more practical opportunities and interesting activities. A series of practical workshops on teamwork training might satisfy students' requirements.

Table 44 What would you suggest for the arrangement of teamwork skills training for the university?

| |
|---|
| The marking criteria should focus on the teamwork skill itself instead of the result of the product. |
| More teamwork practice makes us more familiar with the society. |
| Group activities and group project is good to enhance teamwork skills. |
| Some specific curriculum on teamwork training may work but not in a compulsory way |
| Some courses, such as communication skills, don't have its actual impact on students. Teachers should give more practical chances to students. |
| More group project and more practices. |
| A better rule. |
| Give us more chance and freedom. |
| Maybe another academic course should be set up. |
| More time allocated for teamwork training. |
| Add more interesting activities that need team work and it may be helpful. |
| Some classes about the team communication skills. |
| More activities should be organized, not only in academic setting. |
| Choose group by ourselves. |
| More flexible, free, fair training. Don't combine other difficult knowledge or skills together when training one. |
| Randomly choose team members, and force team members to choose their own team leader. Let the team members communicate and work together before the coursework if possible. |

## *8.3.6 Interview*

A semi-structured interview was conducted after the group project coursework of the Software Engineering module. Ten students (six females and four males) attended the interview. They were randomly selected by the tutors, regardless of their gender, academic rank and class. The interview was a one and half hours semi-structured discussion, based on a questionnaire. Students were encouraged to speak freely and were assured anonymity.

### 8.3.6.1 The effect of the group coursework of SE in learning and improving teamwork skills

One student commented that she found many unexpected problems in this team project and it was not easy to work together with others, but after this practice

she thought she would be able to prevent the same problems in future group work. Some students said that the best thing was they met different people and became friends after this group work. In general, the students presented in the interview thought the group coursework helped practising teamwork skills to some extent but not much in terms of teaching or improving their skills.

### 8.3.6.2 Problems and suggestion

The common problem the students met was that when different opinions were proposed, the consensus was difficult to achieve. Sometimes they found that both the proposals were right, one might be best from the technical view, and the other might b from the time management view. However neither side could persuade the others, so they often put the difference aside and continued with the work to find out the better solution later.

One student said their group normally followed the majority rule to make the decision when different ideas were put forward. When she was asked whether she thought the majority rule was good or not, she explained that she thought it might be the fairest way, as everyone expressed their opinions, and the decision was made on the basis of the common interests of everyone and nobody objected.

Some students reported that their meeting was inefficient, as after a long meeting they could not work out an agreed solution. When they were asked whether they made an agenda before the meetings, most of them admitted that they normally did not prepare formal meeting agendas, but a general plan of what would be discussed during the meeting. Therefore although they wrote meeting minutes afterwards, they did not have the resolution and action points.

One student remarked that the role of team leader was very important. If the leader could not distribute the tasks reasonably, the team members would shift the responsibilities to others, not wanting to complete their work with various

excuses, or show little interests in doing the work. They knew that even if they did not do the work well there would be somebody help to check and improve, and they claimed that they already tried their best.

One student commented that it was very difficult to evaluate each member's contribution objectively. For example, there was a student who was sick for most of the time for the project, but at last they also gave him an equal distribution of the marks, as they thought sickness and absence out of his control.

A male student said in their group they parcelled the task into several parts, and each member took one part as their work. They had no idea about what the others did and their knowledge was isolated and incomplete. They did not do the work together, but changed the group work into individual works. He thought the desire was good to set up a group coursework to practise team working, but because the assessment mechanism was based on groups instead of individuals, it resulted in social loafing and unequal contributions, some members working really hard and some not caring about the work and cooperation. He said if only assessing the reports, these problems would often happen. He suggested that the instructor checked the work by asking questions during the product demonstration. If the students did not participate in the work, they would not be able to understand the process and could not explain clearly. It was important to make a connection between the individual contribution and their final mark, and to find out an effective method to examine what each member had done.

One student commented the task was not very big and difficult, and it did not need so many people (9-10 students) to complete. He remarked that team cooperation and cohesion could only be motivated and enhanced when there were a few people that should complete a big project. If the task was easy, the students did not need to cooperate, and they could complete it easily by

themselves. He suggested letting 2-3 people do the work 5-6 people supposed to do, and setting a basic mark of 60 for the fundamental functions. Students could exert the strength of a team to complete more functions in the limited time to get more marks. This will raise the efficiency and make the cooperation more joyful. The other students did not agree with him. They said if making the task difficult and the group smaller, students would complain and several groups would work together to finish the task. If the weak students found it too hard to do, the work would fall on the shoulders of a few students.

### 8.3.6.3    Reason for the low response rate to the tests

The response rates for the tests were low, with about 10% students completing the tests. Students were asked to comment on the low response rate.

One student said when she informed the other students of these tests, the other students asked whether these tests were compulsory or marked; if they were not compulsory or marked, they would not bother to do that.

When they were asked whether the response rate would rise if the tests were marked, they said it might not help much with the response rate. If it was made compulsory, it might raise the response rate, but the completion quality might not be guaranteed.

Some students thought these skills should be gained by practising in real group work instead of doing several tests, and these tests were no use.

One student commented that she found the tests were very useful: "*There were many problems that I only realised after I did the tests. I would reflect on how I would think about the problem, whether there were other solutions, and what the difference between my thought and the implementation was. If to make all the students complete the tests, it would be good.*"

Though the importance and objective of the tests were explained in the informing emails, students were not aware of this. The tests employed the learning method of self-evaluation and self-improvement. The importance and objective of the training ways should be explained clearly next time, and face to face introduction would be better.

When students were asked how much effort they would spend on teamwork improvement, one student said group members cared more about how to write the final report well and get a high mark, but not how to cooperate well as a good team. It did not matter whether the team cooperated, as long as the report was written well and got a high mark, every member was happy.

One student suggested that the coursework should not be product oriented. One good student in a team might be able to complete the whole task and produce a very good product, but there was no team work and cooperation. If the emphasis was to let the team combine together and get every member to contribute their best the actual result might not be as good, so leading to a lower mark. Therefore, if the coursework was product-oriented (result-oriented), students would concentrate more on the result instead of team working.

### 8.3.6.4    Gap between knowledge and practice

It was found that there was a gap between their knowledge and practice (62.7%-49.8%) of team working. The reason, students explained, was that they knew the better solution, but when they found it was hard and troublesome to implement, they would choose the easy way instead of the better one. Sometimes they knew what should be done, but they had difficulty to put it into practice. This indicated that the declarative knowledge was not well transferred into action.

### 8.3.6.5 Team performance assessment

When they were asked whether we should assess the teamwork performance as well, or just assess individual members upon their contribution and the percentage of their share of work, most of them expressed worries about the objectiveness and fairness of the peer rating of team performance or contribution. They said it depended on how to assess and who should assess it. Even the anonymous rating could not guarantee the fairness. It was difficult to rate oneself and others objectively. Students stressed that Chinese people admired moderation and harmony, and they often rate everyone the same or similar to keep the harmony.

### 8.3.6.6 Group forming methods

Most of the students preferred random selection of group members. They said self-selection would keep the same people in the same group for different coursework, therefore they could not communicate with others; and the resource they could share was limited because they knew each other very well. They thought random selection was better and good for group productivity. It was notable that students remarked that it was more efficient when working with strangers. This was inconsistent with the questionnaire result, where self-selection was the preference and random selection was the second choice.

One student commented that if the aim was to learn more technical knowledge, it was better to do the work individually, but he did not support self-selection, because that would make the good ones better and the weak ones worse.

When they were asked whether they could be in a group with the people they really wanted to work together if self-selection was allowed, the answer was NO. They explained this was for fear of hurting other's feeling and face, which is why they normally chose to group with their friends or those who appealed to join their group. The weak students would distribute themselves into good

student groups, and ask the good students to help, and the good students found it hard to refuse and they were grouped by others, actually.

One student mentioned that some good students expected more for the mark and product, and some students only aimed to complete the assignment and showed less interest in doing the work. He suggested letting the students with the same interest and goal join together to form a group.

### 8.3.6.7    Skills need to improve

Students were asked to comment on which aspect they thought they needed to improve to be a good team player. They did not have a clear idea about this. They said different people had different personalities and characteristics, so they did not need to learn the same teaming skills but did what they were good at. For example, the silent students did not have to learn brainstorming skills, and they might be more suitable to do some implementation work.

As for conflict resolution skills, they stated the characteristics of Chinese students: they were not so aggressive, and were always nice with others; to those problem team members, they might complain behind their backs, and depend on the team leader to take any action and if there was no action taken, they would just let them go. They said the role of the team leader was very important, and should be taken by an authorised person, and most of the students in the team were accommodating and easy-going.

Most of the students did not want to work with the dominant students. However one student said it was not proper to judge whether the dominant students were good team players or not, because this related to their personality. Sometimes a team needed a person, who was decisive and resolute, otherwise the decision process was long, and the discussion was not efficient. Some students did not have their own ideas, and would like the others to make decision for them.

The responses suggested that these students did not find the significance of the teamwork skills; to their understanding, team working is being nice with others, avoiding a quarrel or fighting, not being assertive or aggressive, and doing what they were good at. They also emphasized the importance of the role of a team leader, and they depended on the team leader to make decisions, solve team problems, and manage the members of the team.

### 8.3.6.8    The best way to learn teamwork skills

Talking about the best way to learn teamwork skills, one student suggested setting up a module of career development. She said teamwork learning should not be mixed with technical learning. To those who care about their career development, they could learn teamwork from this module, and they should also be able to consult with the instructors. She suggested that the teamwork learning should not be made compulsory.

Though they admitted the PDP module gave them the opportunity to put into practice many important professional skills, they found the PDP module was more like a big coursework, with setting up and checking, but did not have much knowledge or skill teaching.

For the Communication Skills module, they benefitted more from the material on written communication, like how to writing reports, but not much on teamwork communication.

There are three major ways to influence others to get them to do what you want: one is to threaten them with sticks (coercion); the second is to pay them with carrots (inducement); the third is to attract them or co-opt them, so that they want what you want (Nye, 2002). In teaching and learning relations, it is predicted that these methods also apply. Compared to coercion and inducement, attraction and co-operation are better. Team knowledge learning can be made compulsory in a technical module: students cannot pass the module without

completing the learning arrangements, which is coercion. Extra marks can be added if they complete the teamwork learning very well, which is inducement. It would be ideal if students themselves want to improve the skills and the instructors help and coach in the process. In order to achieve this, the training should be attractive, practical, and efficient, instead of only focusing on declarative knowledge. Selective workshops on different aspects of team working might satisfy the requirements. However, the lazy students might not be attracted, and the mark-oriented characteristics of the Chinese students will bring a barrier to this practice. Students only do work that is marked. To be practical, different methods should be used together to enhance the learning of team working: coercion, inducement and attraction.

### 8.3.7 Summary

The study in the technical module demonstrated that the declarative knowledge of the Yr 3 students on team working increased through the years of learning but it was not successfully transferred into action, the skill based outcome. It might reflect that more experience of group work without instruction does not necessarily teach or improve team skills; on the contrary it might reinforce the wrong understanding and practice, and the frustrated experience might bring negative attitude of team work to students. This finding is consistent with others (Upchurch & Sims-Knight, 2004): it is not sufficient to organize students into group projects and then assume that they will gain the team skills merely by team participation.

Without knowledge teaching, students will not be aware of the many potential problems and the alternative useful practices; and without practical instruction, they will not know how to put the skills learned into practice. However, it was found that the participation rate for teamwork training was low in the technical module, and students focused more on the technical production. A good way to

do this may be that students learn teamwork skills in the PDP module, and attend workshops for the practical instruction to transfer knowledge into action in the first year. After they are well prepared with both knowledge and practice, students can complete some technical coursework in groups. The hard skills are essential and critical in a technical module, although the soft skills are also important. But this does not mean the technical group work does not need any teamwork emphasis. It is suggested to include the peer rating of team citizenship with a certain percentage (5-10%) in the final coursework mark, and also a certain percentage for individual contribution (5-10%). This will switch the product oriented to both teamwork and product oriented, and the individual contribution assessment will prevent social loafing and hitchhiking. The teaching objectives will be well illustrated by these assessment methods: a technically strong person who cannot cooperate with other in a group is not what the university wants to cultivate. The emphasis on technical learning is also reflected by the big percentage of distribution in the final mark.

## 8.4    An improved approach to teamwork teaching

### 8.4.1  Introduction

An improved approach to teamwork teaching is suggested according to the previous study (Figure 3): students would

1)    learn teamwork skills in the PDP module in Year 1;
2)    attend workshops for the practical instruction to transfer knowledge into action; and
3)    complete some technical coursework in groups.
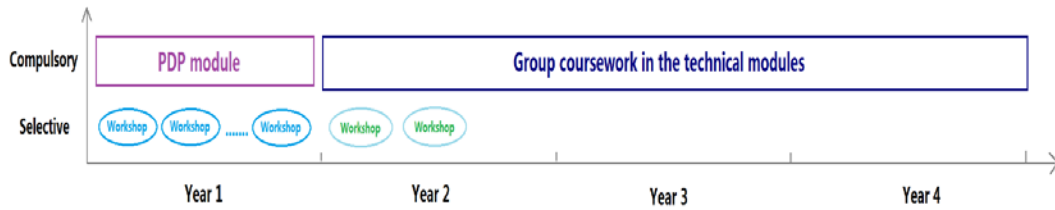
Figure 3 An improved approach to teamwork teaching

## 8.4.2 The PDP module

### 8.4.2.1 Introduction of teamwork skills

In the previous experiment, it was found that the introduction of teamwork skills was helpful and welcomed by students. But the students also expressed demands for more skill training and instructor interaction. It was suggested a brief introduction of teamwork skills being given at the beginning of the task, and then organizing several workshops to discuss and practise specific team skills. The instructor attends some group meetings to give advice and guidance.

### 8.4.2.2 Team policies

In the PDP interview (Pritchard, 2011), students reported that already-confident students were more likely to take the role of leader and presenter to further develop their confidence, while the shy students had no opportunity or space to come forward. The definition of confidence varies: it can be the confidence to speak in public, it can also be the confidence to assert one's right (say NO to others politely), to deal with unexpected problems, difficulties and conflicts in relating with others, and to search for and learn new knowledge and skills to solve a problem. These attributes are required in team work, but are often lacking in Chinese people.

In order to overcome this weakness, an explicit policy should be made. Firing members of the team after two formal warning letters beforehand is allowed.

The sacked members are allowed to form their own groups or join other groups if accepted, otherwise they will work on their own to finish the work. Students are, therefore, encouraged to deal with problem members instead of tolerating their misconduct.

Random checks and mine/ours strategies will be used: the instructor nominates one or two students to represent the group to present their work, and asks questions about the work strategy, individual contribution, and individual suggestions on choosing topics. In this way, the dominant students will share work and knowledge with others to reach the team goals.

It was found that the Chinese students preferred single leadership, and did not know how to set up or accept shared leadership in the previous experiment. In this improved approach, students are asked to select one leader who coordinates the whole group's work and keeps team work on track. Other members take separate shared responsibilities in specific tasks.

### 8.4.2.3 Agreement of expectations & Teamwork evaluation

Students are asked to work out an agreement of expectations for their group at the beginning, and evaluate their team performance in the middle.

### 8.4.2.4 Peer rating

Many educators continually invent and improve peer evaluation approaches (Doerry & Palmer, 2011; J. K. L. Poon, 2011). Students are asked to rate team members including themselves upon team citizenship instead of academic contribution at the end of the task using the online system of the Comprehensive Assessment of Team Member Effectiveness (CATME) (Matthew W. Ohland et al., 2012). An individual mark will be calculated by the weighting factor of the peer rating results (Individual Mark = team mark * (individual peer rating mark / average group peer rating mark)). The weighting factor will be capped at 1.05.

### 8.4.2.5    Give sufficient detailed feedback quickly

Immediate feedback will be given in class to comment on the overall work of all groups: good examples and common problems. The anonymous peer rating results and a short comment on each group's final work will be given together with the mark later.

## 8.4.3  Group coursework in the technical modules

It is suggested to include the peer rating of team citizenship with certain percentage (5-10%), and also a certain percentage for individual contribution (5-10%) in the final coursework mark, instead of using the weighting factor.

## 8.5    Summary

This Chapter analysed the results of the supplementary experiments in the PDP module and a technical module, and proposed an improved approach to teamwork teaching.

It was found that self-selected groups had the lowest team peer rating score, and students also stated the disadvantage of self-selected groups in the interview.

In the supplementary PDP experiment, the "academic merit" group forming method (grouping students with the same academic rank) was found to be the most effective method in enhancing the team cooperation.

It was found in the technical module students did not have much spare time and effort to put towards the teaming process, even though they knew what they should do. More practical instruction should be given.

In the improved approach to teamwork teaching, it was suggested that students learn teamwork skills in the PDP modules in the first year, attend workshops for

practical instruction on transferring knowledge into action, and practise teamwork in group coursework within the technical modules.

# Chapter 9 Cultural analysis

Chapter 4 analysed the cultural and educational characteristics of China, and brought forward some questions and barriers that might be encountered. After nine years' running of the Joint Programme, the perspectives of students and parents have changed a lot. This Chapter attempts to answer the questions proposed in Chapter 4, using the data collected in the previous studies and the observation conducted through the development of the Joint Programme.

Phuong-Mai and colleagues also proposed 14 concrete principles to apply CL to Asian CHC students (Phuong-Mai et al., 2007). The hypothesis tested in this Chapter is that these 14 principles also apply to Chinese engineering students

*Q 1: Will students accept that the teachers are not the only source of knowledge, and they can also learn well through self-learning and cooperative interaction between themselves?*

*Q 3: Can the Chinese students be equipped with the independence and ability to learn by themselves and from school peers in a cooperative learning environment?*

At the beginning, when a group task was assigned, students and parents would complain that much of the knowledge and content that would be used in the coursework had not been taught by the teacher in class. Students wanted the lecturer to tell them which book and page they should read for each lecture; they also wanted specific exercises and standard answers for them to practise after class. This is typical teacher-teaches-students-learn model.

However, students have come to recognise that teachers are not the only source of knowledge; there are vast resources they can find from the library and online websites. They have learned how to find out what knowledge and skills they lack to complete the work, where to find them, and how to learn and use them.

It is found that students now have less of a problem to complete a project with some of the knowledge needed being introduced later or never within class. At least psychologically students do not repel from this learning process and challenge; indeed they welcome it. They have a strong sense of accomplishment from solving a problem cooperatively by themselves. This is actually an ability of self-learning and advocates life-long learning. To Question 1 and 3, the answer is yes; students agree with the concept and were equipped with self-learning ability quickly.

*Q 2: Will the Chinese parents and students accept the CL pedagogy and see its advantages without censuring the university?*

It is true that at first students and parents doubted or even disliked the cooperative pedagogy. They suspected that the school and teachers did not take full accountability. When confronted with team problems, students started to criticise the concept of group coursework and felt frustrated.

However, several years later, in a survey conducted in 2011 as explained in Chapter 6, almost all of the Yr1 and Yr3 students were satisfied or neutral about their experience of working in a team, with nearly 40% being very satisfied. Many students have got high Honours classification, have won top prizes in international high-level technical and innovative competitions, and have then gone on to postgraduate study at top universities round the world.. Their soft skills are highly rated compared with those students graduated from other Chinese programmes.

Parents and students are convinced by these achievements and acknowledge the innovative teaching. Such professional skills cultivated through cooperative learning cannot easily be measured, but it will raise the overall ability of the students and enable them to outperform others internationally.

*Q 4: Will Chinese students adapt to the shared leadership style in CL?*

No, they did not adapt to the shared leadership style. They were more used to the single leader, who not only manages the work but also the people within the group. Section 5.6 in Chapter 5 described the detailed result of an experiment on students' performance taking different team roles.

Phuong et al (Phuong-Mai et al., 2007) suggested appointing a formal group leader in CL with one of the criteria being competence in interpersonal relationships. However CL suggests shared roles, as every member needs be accountable for the final work.

Considering the cultural difference between Chinese students preferring single leadership and CL suggesting shared leadership, a hierarchy of leadership within team roles is suggested. This is actually what the students did in the experiment: although they were allocated different roles, they regarded the coordinator or the monitor as the group leader.

*Q 5: Will Chinese students actually cooperate with others to progress together without reservation?*

Chinese people need recognition from perceived authority very much: for example students need teacher's praise. People evaluate themselves against others through comparison but not against themselves. Everyone wants to exceed others and get the social recognition.

Phuong et al suggested (Phuong-Mai et al., 2007) to create the need for face-protection between groups and use inter-group assessment. This will shift the competition between individual students to the competition between groups. CL theory also advocates interdependence. By bringing the inter-group competition, all team members have the same objective. Everyone is motivated

and will not reserve knowledge or effort for their individual interests as the group interests aligns with their individual interests..

In one of the technical modules, Digital Circuit Design, the lecturer brought in an inter-group competition: every group designed a product and the groups who designed the best products got certificates signed by the Directors and won some other tangible little prizes (like a box of chocolate). Students all liked ceremonial recognition and worked hard for the group honour.

Inter-group competition can motivate Chinese students to with group mates. They work and learn even harder to win the game.

*Q 6: Is it possible for Chinese students to discuss and resolve conflicts openly?*

Unequal relationships, face-saving and harmony pursuit stop Chinese students from discussing frankly, openly and freely.

Phuong et al (Phuong-Mai et al., 2007) suggested that the teacher should show only a positive reaction and use no penalty during group discussion. Not only the teacher but also students should show a positive reaction to different ideas in a group discussion. CL advocates face-to-face promotive interaction that is to provide feedback, explain, discuss, teach and encourage others.

Pheong also advocated face-confirmation for each member within the group with the use of group accountability instead of individual accountability. Various techniques of face-confirmation were used, like using built-in conflict and blinding individual accountability.

These principles should be applicable to Chinese students too. Students write down their ideas and methods on paper before they come to the group meeting. During the group discussion, the group will be divided into two sides, and each side works out a scheme by summarizing the ideas. A debate will be set between the two sides with each side defending the other side's scheme and

against their own. Debate is an activity where nobody can be blamed for bringing conflict. Students also have to advocate others' work and find flaws in their own. Nobody's face will be violated. They might be more inclined to work out a well-considered and better solution.

Chinese students are more likely to avoid and tolerate the conflicts within a group. They avoid talking about the problems and expect the teacher to be the judge to spot the problems and give warning or penalty. No one wants to stand out to offend others.

Third-party help has been suggested by Pheong (Phuong-Mai et al., 2007). On one hand, Chinese students should be taught the assertive communication skills to express their feelings and to assert their rights while respecting the feelings and rights of others, together with the necessary conflict-resolution skills to solve the problems. On the other hand, a policy with potential solutions to common team problems should be made and acknowledged by all students. Potential problem students will be warned by the policy from hitch-hiking others' work, and other students will be assured the rights to deal with problem students. The reason to do so is that Chinese students avoid offending others, but if there is a policy they will follow that policy.

*Q 7: Will both genders in China be active participants in the group learning?*

It is often worried that female students, as the minority in engineering programmes, are not given equal opportunities, and are distrusted by male students. However in the JP, it is the female students who often lead or even dominate the group work.

In the JP, girls actually perform extremely well –they make up around 40% of the student population and outperform boys by a significant margin as shown in the table below.

Table 45 Honours Degree result of JP graduates in 2012

| Honours Degree | H6N2[18]-Female | | H6N2-Male | | H6NF[19]-Female | | H6NF-Male | |
|---|---|---|---|---|---|---|---|---|
| 1 | 81 | 70% | 82 | 39% | 20 | 36% | 18 | 18% |
| 2.1 | 28 | 24% | 71 | 34% | 27 | 49% | 40 | 40% |
| 2.2 | 5 | 4% | 37 | 18% | 4 | 7% | 31 | 31% |
| 3 | 1 | 1% | 6 | 3% | 1 | 2% | 3 | 3% |
| P | 0 | 0% | 0 | 0% | 0 | 0% | 1 | 1% |
| F | 0 | 0% | 12 | 6% | 3 | 5% | 8 | 8% |
| Total | 115 | | 208 | | 55 | | 101 | |

*Q 8: Can Chinese students adapt to the uncertainty style of cooperative learning?*

Students and parents wanted to see the concrete results from CL to prove what has been learned and achieved in each activity. Students wanted everything to be set down clearly for them, but they were also well aware that to make project objectives and plans was part of the work in industry. Therefore, students found that it is important, as part of the preparation for the work force, to adapt to the uncertainty style of CL.

*Q 9: Can Chinese people overcome the fluid time habit to deal with the strict time pressure in group learning?*

Yes, they can deal with the time pressure and coordinate with several tasks at the same time after some practice. But they still often delay the work to near the deadline. Regular checks on the progress of the project are recommended.

Pheong et al (Phuong-Mai et al., 2007) advocate equality-based reward and group-based comment. However in the experiment undertaken in 2011, students did not show differences in either team performance or academic

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[18] Telecommunication Engineering with Management

[19] E-Commerce Engineering with Law

achievement between equality based reward and individual reward by peer rating, as described in Chapter 5.

Pheong (Phuong-Mai et al., 2007) also advocates the affinity-based grouping method and connection between social identity and group identity. In the survey, the Chinese students also show a high percentage of preference for the self-selection method. However, in the experiment, self-selected groups did not perform better, and were even worse than other groups formed by different methods. In the interview of the Yr 3 students after the group project of a technical module, they stated that they did not like self-selection of group members, because they could not choose members as they liked for fear of hurting other's feeling, especially hurting their friends. Furthermore, in the work place, they cannot select who they work with and their friends and family members are not necessarily in the same company.

# Chapter 10   Conclusion and future work

## 10.1   Conclusion

This thesis researches effective ways to teach technical teamwork skills to large cohorts of engineering students in China. The work studied the applicability of successful cooperative learning practices from the West to China, and proposed an improved approach to teamwork teaching and learning in China.

It was suggested that students learn teamwork skills in the PDP modules in the first year, attend workshops for practical instructions to transfer knowledge into action, and practise teamwork in group coursework of the technical modules.

The tested cooperative learning mechanism was shown to be effective with Chinese engineering students. The improved approach has taken into account cultural aspects. Chinese students preferred sole leadership over shared leadership. The work results demonstrated that self-selected groups were not the most effective groups for Chinese engineering students.

The approach identified shows more concern about students' perspectives of teamwork learning, and it is more effective and practicable in engineering education in China. However, more guidance and feedback from the instructors is required.

Students were satisfied with the group experience and expected more practice opportunities. It is more practicable to set workshops to transfer the knowledge into action, and to add peer rating only in the group assignments in technical modules. Setting a small percentage of marks to teamwork rating instead of adjusting marks using a weighting factor in a technical module coursework is more appropriate. The technical modules have a higher weighting in the final degree calculation, so more consideration and caution should be given.

## 10.2 Future work

One aspect in this work that can be extended is to apply the peer rating system in a technical module to investigate how students would complete the peer evaluation, whether they would collude to get high marks or take it seriously to rate according to the real situation. In the future work, the perspectives of instructors and administrative staff could also be investigated and studied.

The Chinese students have been aware of the importance of team working and showed positive and constructive attitude in relating with others in the group, but their inherent cultural values and norms may influence their judgement and preferences. The cultural hypothesis and proposals have been discussed in this thesis. Another addition would be designing the workshop contents to practice the teamwork skills and overcome the cultural obstacles and barriers.

This study might also be beneficial to educators in the UK (and elsewhere), not only in reflecting on the effective strategy for teamwork teaching to engineering students in their context, but also in managing Chinese students who come to the UK. Chapter 4 and Chapter 9 would give the educators a good perception on how Chinese students think and perform from the angle of cultural influence, and an understanding of the characteristics of contemporary Chinese students and their growth and educational background. The experiment results and investigation into students' perspective can be used by the educators for reference when they design group work for Chinese students.

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# Appendix

**Peer Rating of Team Members**

*Rating team citizenship*  Your Name  _____  Your Team  _____

Please write the names of all the members of your team, INCLUDING YOURSLEF, and rate the degree to which each member fulfilled his/her responsibilities in completing the team assignments. Such responsibilities include:

      1. Attending scheduled meetings.

      2. Contributing to discussions.

      3. Attempting to communicate clearly and with civility.

      4. Listening effectively.

      5. Accepting criticism gracefully.

      6. Completing tasks fully and on time.

Your responses are confidential. The possible ratings are:

| | |
|---|---|
| Excellent | Consistently went above and beyond; tutored teammates, carried more than his or her fair share of the load. |
| Very good | Consistently did what he or she was supposed to do, very well prepared and cooperative. |
| Satisfactory | Usually did what he or she was supposed to do, acceptably well prepared and cooperative. |
| Ordinary | Often did what he or she was supposed to do, minimally well prepared and cooperative. |
| Marginal | Sometimes failed to show up or complete tasks, rarely prepared. |
| Deficient | Often failed to show up or complete tasks, rarely prepared. |
| Unsatisfactory | Consistently failed to show up or complete tasks, unprepared. |
| Superficial | Practically no participation. |
| No show | No participation at all. |

These ratings should reflect each individual's level of participation, effort, and sense of responsibility to achieving team goals, not his or her academic ability. DO NOT LEAVE ANY COMMENTARY BLANK!

| Name of team member (including yourself) | Rating (Use words from the list, i.e., excellent, very good, satisfactory, ordinary, and so forth.) | Commentary (DO NOT LEAVE BLANK!) |
|---|---|---|
| | | |
| | | |
| | | |

**Team Knowledge Test**[20]

This test will help you to find your understanding of team skills in four domains: team process, decision making, communication, and conflict resolution.

This is a formative test, which does not take percentage of the final course grade. Please answer the questions according to your real understanding and preference. If you take this test seriously and honestly, you will be giving yourself the best chance and benefit.

**Instructions:**
You will be asked to answer each question twice. Firstly select what you **THINK** is correct, then select what you would choose to **DO** normally (this can be different from what you think is right).

Select the answer you THINK is correct:

Select the answer you would choose to DO normally:

1. When there is a disagreement or difference of opinion in your team, it is generally best to
A. find some way to minimize the significance of it so as not to draw attention to it.
B. address the disagreement directly and supportively, even if there is a risk of conflict.
C. try to ignore it altogether.
D. point out that disagreement is harmful to a team.

2. When you are listening to other people offering their ideas, it is useful to
A. plan your response so as not to lose time.
B. look for the weaknesses in the argument to facilitate the team's work.
C. determine if the idea is the same as yours.
D. maintain eye contact with the person.

3. Your team leader comes to your scheduled meeting without an agenda. What should you do?

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[20] Adapted from Sims-Knight, J. E., Upchurch, R. L., Powers, T. A., Haden, S., & Topciu, R. (2002). Teams in Software Engineering Education. Paper presented at the 32nd ASEE/IEEE Frontiers in Education Conference, Boston, MA.

A. Make your first agenda item developing an agenda as a team.
B. Let the meeting proceed without an agenda.
C. Tell the team leader to write out an agenda right now and take the rest of the team for coffee until s/he is done.
D. Suggest the meeting be postponed until the team leader gets his act together.

4. When dealing with a team member, who is not doing his/her fair share of the work, it is best to

A. have a team meeting at which the norms of the team are discussed in a frank and open manner.
B. try to ignore it, because these things usually work out in the end.
C. have the team query the member at the next meeting.
D. go straight to the instructor and have him/her handle it.

5. The single agenda item for your next team meeting is to generate ideas for a project. You decide to use the brainstorming technique. Which of the following should you do?
A. As each idea is generated, one team member should take it as his role to develop and defend it, so that "ownership" results.
B. During the meeting there should be no format or agenda.
C. The process of generating ideas should be separated from the process of evaluating ideas.
D. The team should rate the goodness of each idea as it is generated by going through the team members in a round-robin fashion.

6. When receiving feedback from your team members, it is generally useful to
A. have an argument prepared ahead of time to defend yourself.
B. anticipate that people won't really understand where you are coming from and be ready to explain.
C. try to perceive the feedback as information that you can use, not an evaluation of you as a person.
D. anticipate what they will say and wait to hear it.

7. When expressing an idea or presenting some information, it is best to
A. let it flow naturally without preparation.
B. try to understand the listener's point of view, and tailor your presentation to what may be of use to the listener.
C. expect that other people see things the way you do.
D. focus on what is important to you.

8. You have been asked to review another team's process check. Which of the following would be the best response?

A. All excellent ratings, because that would show they know what they are doing.
B. Excellent ratings on task-related questions; the difficult questions don't matter.
C. Excellent ratings on the difficult questions, because if they got their processes correct, task excellence is sure to follow.
D. A variety of responses, some high and some low, because that would give pointers for improvement.

9. Your team is deciding how to solve a problem. Your three teammates all agree on a way to proceed, but you feel quite sure that your different approach is better.   What should you do?
A. Be quiet; majority rules.
B. Tell your teammates in no uncertain terms how stupid they are being.
C. Do a team building exercise.
D. Suggest that you try to find a middle ground by taking the best from each approach.

10.  When you and another team member are having trouble communicating,
 which is the worst thing for you to do?
A. Repeating what you think he said or meant to say
B. Planning your response while he is speaking
C. Taking notes
D. None of the above by itself; a, b, and c are all appropriate.

11. You have gotten quite angry in a team meeting.   Which of the following is the least productive thing you could do?
A. Excuse yourself to go to the bathroom.
B. Get it off your chest.   Everyone will feel better if you get it all out.
C. Explain that you are upset by using "I " statements
D. Figure out how you could alter the situation to reduce the anger-producing stimulus.

12. In order to increase the chances of everyone doing their fair share of work, a team ought to:
A. remove members who are not working.
B. assign specific tasks and   monitor progress.
C. have the productive members slow down to allow the others to catch up.
D. not be too concerned so long as the work is getting done.

13. The opinions of quiet members of a team are often not heard.   If you were meeting leader, what would you do about it?
A. Set up a specific order for everyone to speak and then follow it.

B. Leave it be.   If they don't want to talk, they shouldn't have to.

C. Ask them to adopt roles in the meetings, such as time-keeper and facilitator.

D. Ask them to write down their positions and give it to you anonymously after the meeting.

14. If a team member is expressing an opinion different from your own, it is generally helpful to

A. repeat your point.

B. politely provide a counterargument to each of her points.

C. listen carefully to what is being offered, even though you have an alternative way of looking at the issue.

D. look away from the team member to register your disapproval discretely.

15. A lot of time in your team meetings seems to be wasted due to conversations that seem beside the point.   This can be fixed by:

A. telling the offending team members to be quiet.

B. having the team leader determine what is relevant and prohibit the irrelevant discussions.

C. having a meeting agenda and sticking to it.

D. doing nothing.   It is probably better to just be quiet about it and take longer to get finished.

16.  When giving feedback to someone on your team, it is generally helpful to

A. only discuss the positive aspects of what she/he is doing.

B. get directly to what s/he needs to change to get the bad news over with.

C. be general.

D. offer some positive supportive comments and then propose specific, constructive suggestions for change.

17. You know consensus has been reached when

A. five to ten minutes has passed with no objections being raised.

B. a vote reveals that the majority of team members are in favor.

C. every team member feels that the decision is workable and defensible, even if not what s/he would have chosen on his or her own.
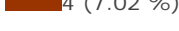
D. a vote reveals unanimity.

18. Effective discussions of team business are often made difficult by people who are argumentative or dominating or disorganized. No matter what their problem, to get the meeting moving forward you need to:

A. let them know that you have understood and appreciated their point.

B. make sure the meeting leader is assertive enough to insist that such members be quiet.

C. let them talk. Eventually they will run out of steam and you will still be on good terms.

D. Argue back until they realize that they are wrong.


19. If a member of your team is hostile or critical it is generally useful to
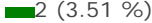
A. criticize him/her to let that person know how it feels.
B. try to find some area of agreement or acknowledge some truth in what he/she is saying to diffuse the attack.
C. threaten to "fire" the individual from the team if he/she does not stop the behaviour
D. try to ignore the behaviour and push on.


20. Two members of your team have a genuine disagreement (not just miscommunication or personality conflict). Which of the following would be most likely to lead to a resolution?

A. Ask questions to try to understand each person's position and look for solutions that both might like.
B. Ask each person to give up something.
C. Have the other team members come up with a third position they can agree on.
D. Take a vote among all the team members—winner takes all.

# Team Knowledge Test Results

| **(T2) Select the answer you THINK is correct: 2. When you are listening to other people offering their ideas, it is useful to** | |
|---|---|
| - A. plan your response so as not to lose time. (0): | 8 (14.04 %) |
| - B. look for the weaknesses in the argument to facilitate the team's work. (0): | 21 (36.84 %) |
| - C. determine if the idea is the same as yours. (0): | 2 (3.51 %) |
| - D. maintain eye contact with the person. (1): | 26 (45.61 %) |

**Average: 0.46**

| **(D2) Select the answer you would choose to DO normally: 2. When you are listening to other people offering their ideas, it is useful to** | |
|---|---|
| - A. plan your response so as not to lose time. (0): | 9 (15.79 %) |
| - B. look for the weaknesses in the argument to facilitate the team's work. (0): | 11 (19.30 %) |
| - C. determine if the idea is the same as yours. (0): | 15 (26.32 %) |
| - D. maintain eye contact with the person. (1): | 22 (38.60 %) |

**Average: 0.39**

| **(T6) Select the answer you THINK is correct: 6. When receiving feedback from your team members, it is generally useful to** | |
|---|---|
| - A. have an argument prepared ahead of time to defend yourself. (0): | 3 (5.26 %) |
| - B. anticipate that people won't really understand where you are coming from and be ready to explain. (0): | 3 (5.26 %) |
| - C. try to perceive the feedback as information that you can use, not an | 42 (73.68 %) |

| | |
|---|---|
| evaluation of you as a person. (1): | |
| - D. anticipate what they will say and wait to hear it. (0): | 9 (15.79 %) |

**Average: 0.74**

**(D6) Select the answer you would choose to DO normally: When receiving feedback from your team members, it is generally useful to**

| | |
|---|---|
| - A. have an argument prepared ahead of time to defend yourself. (0): | 4 (7.02 %) |
| - B. anticipate that people won't really understand where you are coming from and be ready to explain. (0): | 8 (14.04 %) |
| - C. try to perceive the feedback as information that you can use, not an evaluation of you as a person. (1): | 32 (56.14 %) |
| - D. anticipate what they will say and wait to hear it. (0): | 13 (22.81 %) |

**Average: 0.56**

**(T14) Select the answer you THINK is correct: 14. If a team member is expressing an opinion different from your own, it is generally helpful to**

| | |
|---|---|
| - A. repeat your point. (0): | 2 (3.51 %) |
| - B. politely provide a counterargument to each of her points. (0): | 11 (19.30 %) |
| - C. listen carefully to what is being offered, even though you have an alternative way of looking at the issue. (1): | 44 (77.19 %) |
| - D. look away from the team member to register your disapproval discretely. (0): | 0 |

**Average: 0.77**

**(D14) Select the answer you would choose to DO normally: 14. If a team member is**

| expressing an opinion different from your own, it is generally helpful to | |
|---|---|
| - A. repeat your point. (0): | 6 (10.53 %) |
| - B. politely provide a counterargument to each of her points. (0): | 10 (17.54 %) |
| - C. listen carefully to what is being offered, even though you have an alternative way of looking at the issue. (1): | 41 (71.93 %) |
| - D. look away from the team member to register your disapproval discretely. (0): | 0 |
| **Average: 0.72** | |

**(T3) Select the answer you THINK is correct: 3. Your team leader comes to your scheduled meeting without an agenda. What should you do?**

| | |
|---|---|
| - A. Make your first agenda item developing an agenda as a team. (1): | 27 (47.37 %) |
| - B. Let the meeting proceed without an agenda. (0): | 6 (10.53 %) |
| - C. Tell the team leader to write out an agenda right now and take the rest of the team for coffee until s/he is done. (0): | 11 (19.30 %) |
| - D. Suggest the meeting be postponed until the team leader gets his act together. (0): | 13 (22.81 %) |

**Average: 0.47**

**(D3) Select the answer you would choose to DO normally: 3. Your team leader comes to your scheduled meeting without an agenda. What should you do?**

| | |
|---|---|
| - A. Make your first agenda item developing an agenda as a team. (1): | 22 (38.60 %) |
| - B. Let the meeting proceed without an agenda. (0): | 19 (33.33 %) |
| - C. Tell the team leader to write out an agenda right now and take the rest of the team for coffee until s/he is done. (0): | 6 (10.53 %) |
| - D. Suggest the meeting be postponed until the team leader gets his act together. (0): | 10 (17.54 %) |

**Average: 0.39**

**(T5) Select the answer you THINK is correct: 5. The single agenda item for your next team meeting is to generate ideas for a project. You decide to use the brainstorming technique. Which of the following should you do?**

| | |
|---|---|
| - A. As each idea is generated, one team member should take it as his role to develop and defend it, so that "ownership" results. (0): | ▬ 14 (24.56 %) |
| - B. During the meeting there should be no format or agenda. (0): | ▬ 3 (5.26 %) |
| - C. The process of generating ideas should be separated from the process of evaluating ideas. (1): | ▬ 22 (38.60 %) |
| - D. The team should rate the goodness of each idea as it is generated by going through the team members in a round-robin fashion. (0): | ▬ 18 (31.58 %) |

**Average: 0.39**

**(D5) Select the answer you would choose to DO normally: 5. The single agenda item for your next team meeting is to generate ideas for a project. You decide to use the brainstorming technique. Which of the following should you do?**

| | |
|---|---|
| - A. As each idea is generated, one team member should take it as his role to develop and defend it, so that "ownership" results. (0): | ▬ 10 (17.54 %) |
| - B. During the meeting there should be no format or agenda. (0): | ▬ 5 (8.77 %) |
| - C. The process of generating ideas should be separated from the process of evaluating ideas. (1): | ▬ 26 (45.61 %) |
| - D. The team should rate the goodness of each idea as it is generated by going through the team members in a round-robin fashion. (0): | ▬ 16 (28.07 %) |

**Average: 0.46**

**(T13) Select the answer you THINK is correct: 13. The opinions of quiet members of a team are often not heard. If you were meeting leader, what would you do about it?**

| | |
|---|---|
| - A. Set up a specific order for everyone to speak and then follow it. (0): | 27 (47.37 %) |
| - B. Leave it be. If they don't want to talk, they shouldn't have to. (0): | 1 (1.75 %) |
| - C. Ask them to adopt roles in the meetings, such as time-keeper and facilitator. (0): | 14 (24.56 %) |
| - D. Ask them to write down their positions and give it to you anonymously after the meeting. (1): | 15 (26.32 %) |

**Average: 0.26**

**(D13) Select the answer you would choose to DO normally: 13. The opinions of quiet members of a team are often not heard. If you were meeting leader, what would you do about it?**

| | |
|---|---|
| - A. Set up a specific order for everyone to speak and then follow it. (0): | 26 (45.61 %) |
| - B. Leave it be. If they don't want to talk, they shouldn't have to. (0): | 6 (10.53 %) |
| - C. Ask them to adopt roles in the meetings, such as time-keeper and facilitator. (0): | 15 (26.32 %) |
| - D. Ask them to write down their positions and give it to you anonymously after the meeting. (1): | 10 (17.54 %) |

**Average: 0.18**

**(T15) Select the answer you THINK is correct: 15. A lot of time in your team meetings seems to be wasted due to conversations that seem beside the point. This can be fixed by:**

| | |
|---|---|
| - A. telling the offending | 5 (8.77 %) |

| | |
|---|---|
| team members to be quiet. (0): | |
| - B. having the team leader determine what is relevant and prohibit the irrelevant discussions. (0): | 15 (26.32 %) |
| - C. having a meeting agenda and sticking to it. (1): | 37 (64.91 %) |
| - D. doing nothing. It is probably better to just be quiet about it and take longer to get finished. (0): | 0 |

**Average: 0.65**

**(D15) Select the answer you would choose to DO normally: 15. A lot of time in your team meetings seems to be wasted due to conversations that seem beside the point. This can be fixed by:**

| | |
|---|---|
| - A. telling the offending team members to be quiet. (0): | 5 (8.77 %) |
| - B. having the team leader determine what is relevant and prohibit the irrelevant discussions. (0): | 26 (45.61 %) |
| - C. having a meeting agenda and sticking to it. (1): | 24 (42.11 %) |
| - D. doing nothing. It is probably better to just be quiet about it and take longer to get finished. (0): | 2 (3.51 %) |

**Average: 0.42**

**(T9) Select the answer you THINK is correct: 9. Your team is deciding how to solve a problem. Your three teammates all agree on a way to proceed, but you feel quite sure that your different approach is better. What should you do?**

| | |
|---|---|
| - A. Be quiet; majority rules. (0): | 3 (5.26 %) |
| - B. Tell your teammates in no uncertain terms how stupid they are being. (0): | 3 (5.26 %) |
| - C. Do a team building exercise. (0): | 11 (19.30 %) |
| - D. Suggest that you try to find a middle ground by taking the best from each approach. (1): | 40 (70.18 %) |

**Average: 0.70**

**(D9) Select the answer you would choose to DO normally: 9. Your team is deciding how to solve a problem. Your three teammates all agree on a way to proceed, but you feel quite sure that your different approach is better. What should you do?**

| | |
|---|---|
| - A. Be quiet; majority rules. (0): | 12 (21.05 %) |
| - B. Tell your teammates in no uncertain terms how stupid they are being. (0): | 1 (1.75 %) |
| - C. Do a team building exercise. (0): | 9 (15.79 %) |
| - D. Suggest that you try to find a middle ground by taking the best from each approach. (1): | 35 (61.40 %) |
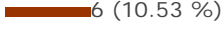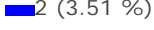
**Average: 0.61**

**(T17) Select the answer you THINK is correct: 17. You know consensus has been reached when**

| | |
|---|---|
| - A. five to ten minutes has passed with no objections being raised. (0): | 5 (8.77 %) |
| - B. a vote reveals that the majority of team members are in favor. (0): | 5 (8.77 %) |
| - C. every team member feels that the decision is workable and defensible, even if not what s/he would have chosen on his or her own. (1): | 43 (75.44 %) |
| - D. a vote reveals unanimity. (0): | 4 (7.02 %) |

**Average: 0.75**
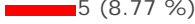
**(D17) Select the answer you would choose to DO normally: 17. You know consensus has been reached when**

| | |
|---|---|
| - A. five to ten minutes has passed with no objections being raised. (0): | 6 (10.53 %) |
| - B. a vote reveals that the majority of team members are in favor. (0): | 13 (22.81 %) |
| - C. every team member feels that the decision is workable and defensible, even if not what s/he would have chosen on his or her own. (1): | 36 (63.16 %) |
| - D. a vote reveals unanimity. (0): | 2 (3.51 %) |

**Average: 0.63**
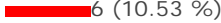
**(T8) Select the answer you THINK is correct: 8. You have been asked to review another team's process check. Which of the following would be the best response?**

| | |
|---|---|
| - A. All excellent ratings, because that would show they | 4 (7.02 %) |

| | |
|---|---|
| know what they are doing. (0): | |
| - B. Excellent ratings on task-related questions; the difficult questions don't matter. (0): | 5 (8.77 %) |
| - C. Excellent ratings on the difficult questions, because if they got their processes correct, task excellence is sure to follow. (0): | 11 (19.30 %) |
| - D. A variety of responses, some high and some low, because that would give pointers for improvement. (1): | 37 (64.91 %) |
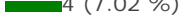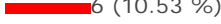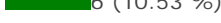
**Average: 0.65**

**(D8) Select the answer you would choose to DO normally: 8. You have been asked to review another team's process check. Which of the following would be the best response?**

| | |
|---|---|
| - A. All excellent ratings, because that would show they know what they are doing. (0): | 7 (12.28 %) |
| - B. Excellent ratings on task-related questions; the difficult questions don't matter. (0): | 6 (10.53 %) |
| - C. Excellent ratings on the difficult questions, because if they got their processes correct, task excellence is sure to follow. (0): | 10 (17.54 %) |
| - D. A variety of responses, some high and some low, because that would give pointers for improvement. (1): | 34 (59.65 %) |

**Average: 0.60**

**(T16) Select the answer you THINK is correct: 16. When giving feedback to someone on**
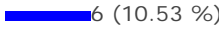
| **your team, it is generally helpful to** | |
|---|---|
| - A. only discuss the positive aspects of what she/he is doing. (0): | 2 (3.51 %) |
| - B. get directly to what s/he needs to change to get the bad news over with. (0): | 4 (7.02 %) |
| - C. be general. (0): | 4 (7.02 %) |
| - D. offer some positive supportive comments and then propose specific, constructive suggestions for change. (1): | 47 (82.46 %) |

**Average: 0.82**

| **(D16) Select the answer you would choose to DO normally: 16. When giving feedback to someone on your team, it is generally helpful to** | |
|---|---|
| - A. only discuss the positive aspects of what she/he is doing. (0): | 5 (8.77 %) |
| - B. get directly to what s/he needs to change to get the bad news over with. (0): | 6 (10.53 %) |
| - C. be general. (0): | 6 (10.53 %) |
| - D. offer some positive supportive comments and then propose specific, constructive suggestions for change. (1): | 40 (70.18 %) |

**Average: 0.70**

**(T7) Select the answer you THINK is correct: 7. When expressing an idea or presenting some information, it is best to**

| | |
|---|---|
| - A. let it flow naturally without preparation. (0): | 3 (5.26 %) |
| - B. try to understand the listener's point of view, and tailor your presentation to what may be of use to the listener. (1): | 52 (91.23 %) |
| - C. expect that other people see things the way you do. (0): | 1 (1.75 %) |
| - D. focus on what is important to you. (0): | 1 (1.75 %) |

**Average: 0.91**

**(D7) Select the answer you would choose to DO normally: 7. When expressing an idea or presenting some information, it is best to**

| | |
|---|---|
| - A. let it flow naturally without preparation. (0): | 7 (12.28 %) |
| - B. try to understand the listener's point of view, and tailor your presentation to what may be of use to the listener. (1): | 39 (68.42 %) |
| - C. expect that other people see things the way you do. (0): | 5 (8.77 %) |
| - D. focus on what is important to you. (0): | 6 (10.53 %) |
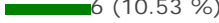
**Average: 0.68**

**(T1) Select the answer you THINK is correct: 1. When there is a disagreement or difference of opinion in your team, it is generally best to**

| | |
|---|---|
| - A. find some way to minimize the significance of it so as not to draw attention to it. (0): | 19 (33.33 %) |
| - B. address the disagreement directly and | 33 (57.89 %) |

| | |
|---|---|
| supportively, even if there is a risk of conflict. (1): | |
| - C. try to ignore it altogether. (0): | ▪0 |
| - D. point out that disagreement is harmful to a team. (0): | ▬5 (8.77 %) |

**Average: 0.58**

**(D1) Select the answer you would choose to DO normally: 1. When there is a disagreement or difference of opinion in your team, it is generally best to**

| | |
|---|---|
| - A. find some way to minimize the significance of it so as not to draw attention to it. (0): | ▬▬▬▬▬▬▬28 (49.12 %) |
| - B. address the disagreement directly and supportively, even if there is a risk of conflict. (1): | ▬▬▬▬▬▬22 (38.60 %) |
| - C. try to ignore it altogether. (0): | ▬3 (5.26 %) |
| - D. point out that disagreement is harmful to a team. (0): | ▬4 (7.02 %) |

**Average: 0.39**

**(T4) Select the answer you THINK is correct: 4. When dealing with a team member, who is not doing his/her fair share of the work, it is best to**

| | |
|---|---|
| - A. have a team meeting at which the norms of the team are discussed in a frank and open manner. (1): | ▬▬▬▬▬▬▬▬▬▬▬▬ 50 (87.72 %) |
| - B. try to ignore it, because these things usually work out in the end. (0): | ▪0 |
| - C. have the team query the member at the next meeting. (0): | ▬2 (3.51 %) |
| - D. go straight to the instructor and have him/her | ▬▬5 (8.77 %) |

| handle it. (0): | |
|---|---|

**Average: 0.88**

| **(D4) Select the answer you would choose to DO normally: 4. When dealing with a team member, who is not doing his/her fair share of the work, it is best to** | |
|---|---|
| - A. have a team meeting at which the norms of the team are discussed in a frank and open manner. (1): | 24 (42.11 %) |
| - B. try to ignore it, because these things usually work out in the end. (0): | 20 (35.09 %) |
| - C. have the team query the member at the next meeting. (0): | 7 (12.28 %) |
| - D. go straight to the instructor and have him/her handle it. (0): | 6 (10.53 %) |

**Average: 0.42**

| **(T10) Select the answer you THINK is correct: 10. When you and another team member are having trouble communicating, which is the worst thing for you to do?** | |
|---|---|
| - A. Repeating what you think he said or meant to say (0): | 16 (28.07 %) |
| - B. Planning your response while he is speaking (1): | 20 (35.09 %) |
| - C. Taking notes (0): | 4 (7.02 %) |
| - D. None of the above by itself; a, b, and c are all appropriate. (0): | 17 (29.82 %) |

**Average: 0.35**

| **(D10) Select the answer you would choose to DO normally: 10. When you and another team member are having trouble communicating, which is the worst thing for you to do?** | |
|---|---|
| - A. Repeating what you think he said or meant to say (0): | 18 (31.58 %) |
| - B. Planning your response while he is speaking (1): | 18 (31.58 %) |
| - C. Taking notes (0): | 6 (10.53 %) |

| - D. None of the above by itself; a, b, and c are all appropriate. (0): | 15 (26.32 %) |
|---|---|

**Average: 0.32**

**(T11) Select the answer you THINK is correct: 11. You have gotten quite angry in a team meeting. Which of the following is the least productive thing you could do?**

| - A. Excuse yourself to go to the bathroom. (0): | 15 (26.32 %) |
|---|---|
| - B. Get it off your chest. Everyone will feel better if you get it all out. (1): | 11 (19.30 %) |
| - C. Explain that you are upset by using "I " statements (0): | 7 (12.28 %) |
| - D. Figure out how you could alter the situation to reduce the anger-producing stimulus. (0): | 24 (42.11 %) |

**Average: 0.19**

**(D11) Select the answer you would choose to DO normally: 11. You have gotten quite angry in a team meeting. Which of the following is the least productive thing you could do?**

| - A. Excuse yourself to go to the bathroom. (0): | 15 (26.32 %) |
|---|---|
| - B. Get it off your chest. Everyone will feel better if you get it all out. (1): | 14 (24.56 %) |
| - C. Explain that you are upset by using "I " statements (0): | 12 (21.05 %) |
| - D. Figure out how you could alter the situation to reduce the anger-producing stimulus. (0): | 16 (28.07 %) |

**Average: 0.25**

**(T12) Select the answer you THINK is correct: 12. In order to increase the chances of everyone doing their fair share of work, a team ought to:**

| - A. remove members who are not working. (0): | 7 (12.28 %) |
|---|---|
| - B. assign specific tasks and monitor progress. (1): | 43 (75.44 %) |
| - C. have the productive members slow down to allow the others to catch up. (0): | 6 (10.53 %) |
| - D. not be too concerned so long | 1 (1.75 %) |

| as the work is getting done. (0): | |
|---|---|
| **Average: 0.75** | |
| **(D12) Select the answer you would choose to DO normally: 12. In order to increase the chances of everyone doing their fair share of work, a team ought to:** | |
| - A. remove members who are not working. (0): | 5 (8.77 %) |
| - B. assign specific tasks and monitor progress. (1): | 34 (59.65 %) |
| - C. have the productive members slow down to allow the others to catch up. (0): | 5 (8.77 %) |
| - D. not be too concerned so long as the work is getting done. (0): | 13 (22.81 %) |
| **Average: 0.60** | |

**(T18) Select the answer you THINK is correct: 18. Effective discussions of team business are often made difficult by people who are argumentative or dominating or disorganized. To get the meeting moving forward you need to:**

| | |
|---|---|
| - A. let them know that you have understood and appreciated their point. (1): | 37 (64.91 %) |
| - B. make sure the meeting leader is assertive enough to insist that such members be quiet. (0): | 12 (21.05 %) |
| - C. let them talk. Eventually they will run out of steam and you will still be on good terms. (0): | 6 (10.53 %) |
| - D. Argue back until they realize that they are wrong. (0): | 2 (3.51 %) |

**Average: 0.65**

**(D18) Select the answer you would choose to DO normally: 18. Effective discussions of team business are often made difficult by people who are argumentative or dominating or disorganized. To get the meeting moving forward you need to:**

| | |
|---|---|
| - A. let them know that you have understood and appreciated their point. (1): | 29 (50.88 %) |
| - B. make sure the meeting leader is assertive enough to insist that such members be quiet. (0): | 17 (29.82 %) |
| - C. let them talk. Eventually they will run out of steam and you will still be on good terms. (0): | 6 (10.53 %) |
| - D. Argue back until they realize that they are wrong. (0): | 5 (8.77 %) |

**Average: 0.51**

**(T19) Select the answer you THINK is correct: 19. If a member of your team is hostile or critical it is generally useful to**

| | |
|---|---|
| - A. criticize him/her to let that person know how it feels. (0): | 7 (12.28 %) |
| - B. try to find some area of agreement or acknowledge some truth in what he/she is saying to diffuse the attack. (1): | 42 (73.68 %) |

| | |
|---|---|
| - C. threaten to "fire" the individual from the team if he/she does not stop the behaviour (0): | 5 (8.77 %) |
| - D. try to ignore the behaviour and push on. (0): | 3 (5.26 %) |

**Average: 0.74**

**(D19) Select the answer you would choose to DO normally: 19. If a member of your team is hostile or critical it is generally useful to**

| | |
|---|---|
| - A. criticize him/her to let that person know how it feels. (0): | 12 (21.05 %) |
| - B. try to find some area of agreement or acknowledge some truth in what he/she is saying to diffuse the attack. (1): | 30 (52.63 %) |
| - C. threaten to "fire" the individual from the team if he/she does not stop the behaviour (0): | 1 (1.75 %) |
| - D. try to ignore the behaviour and push on. (0): | 14 (24.56 %) |

**Average: 0.53**

**(T20) Select the answer you THINK is correct: 20. Two members of your team have a genuine disagreement (not just miscommunication or personality conflict). Which of the following would be most likely to lead to a resolution?**

| | |
|---|---|
| - A. Ask questions to try to understand each person's position and look for solutions that both might like. (1): | 47 (82.46 %) |
| - B. Ask each person to give up something. (0): | 1 (1.75 %) |
| - C. Have the other team members come up with a third position they can agree on. (0): | 3 (5.26 %) |
| - D. Take a vote among all the team members—winner takes all. (0): | 6 (10.53 %) |

**Average: 0.82**

**(D20) Select the answer you would choose to DO normally: 20. Two members of your team have a genuine disagreement (not just miscommunication or personality conflict). Which of the following would be most likely to lead to a resolution?**

| | |
|---|---|
| - A. Ask questions to try to understand each person's position and look for solutions that both might like. (1): | 36 (63.16 %) |
| - B. Ask each person to give up something. (0): | 6 (10.53 %) |
| - C. Have the other team members come up with a third position they can agree on. (0): | 7 (12.28 %) |
| - D. Take a vote among all the team members—winner takes all. (0): | 8 (14.04 %) |

**Average: 0.63**

# Results of the Self-Assessment of the Communication Skills

## Results of the category "use common forms and tools"

| (Q28) 28. Demonstrate a mastery of the kinds of formal and informal communication most often used in the industry (email, bug reports, meetings, presentations to groups, one-on-one, teleconferences, code comments, documentation, requirements, and status reports | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 1 (2.22 %) |
| - Neutral (2): | 4 (8.89 %) |
| - Agree (3): | 30 (66.67 %) |
| - Strongly Agree (4): | 10 (22.22 %) |
| **Average: 3.09** | |

| (Q29) 29. Use digital tools that are beneficial for communication and teamwork (tools for document control, bitmap and vector illustrations, documentation, web pages, basic video/audio for presentations, intuitive GUI design, and project planning). | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 1 (2.22 %) |
| - Neutral (2): | 6 (13.33 %) |
| - Agree (3): | 26 (57.78 %) |
| - Strongly Agree (4): | 12 (26.67 %) |
| **Average: 3.09** | |

| (Q30) 30. Give effective and engaging presentations. | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 7 (15.56 %) |
| - Agree (3): | 23 (51.11 %) |
| - Strongly Agree (4): | 15 (33.33 %) |
| **Average: 3.18** | |

**(Q31) 31. Use email appropriately, demonstrating an understanding of what information should be included and what should not, of when to use "reply all," and of the necessity to read carefully before sending.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 1 (2.22 %) |
| - Neutral (2): | 2 (4.44 %) |
| - Agree (3): | 26 (57.78 %) |
| - Strongly Agree (4): | 16 (35.56 %) |
| **Average: 3.27** | |

## Results of the category "Communication professionally"

**(Q19) 19. Give opinions with a balance of confidence & humility.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 8 (17.78 %) |
| - Agree (3): | 24 (53.33 %) |
| - Strongly Agree (4): | 13 (28.89 %) |
| **Average: 3.11** | |

**(Q20) 20. Avoid complaining, by proposing a solution, fixing the problem, or remaining silent.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 8 (17.78 %) |
| - Neutral (2): | 11 (24.44 %) |
| - Agree (3): | 20 (44.44 %) |
| - Strongly Agree (4): | 6 (13.33 %) |
| **Average: 2.53** | |

| (Q21) 21. Be nice to others, through words and tone. | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 3 (6.67 %) |
| - Agree (3): | 20 (44.44 %) |
| - Strongly Agree (4): | 22 (48.89 %) |

**Average: 3.42**

| (Q22) 22. Manage non-verbal communication to avoid sending inappropriate messages. | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 6 (13.33 %) |
| - Neutral (2): | 13 (28.89 %) |
| - Agree (3): | 22 (48.89 %) |
| - Strongly Agree (4): | 4 (8.89 %) |

**Average: 2.53**

| (Q23) 23. Make own accomplishments known without arrogance. Communicate charismatically; be passionate / animated in order to influence people. | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 3 (6.67 %) |
| - Neutral (2): | 7 (15.56 %) |
| - Agree (3): | 24 (53.33 %) |
| - Strongly Agree (4): | 11 (24.44 %) |

**Average: 2.96**

| (Q24) 24. Mentor others and help them grow. | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 1 (2.22 %) |
| - Neutral (2): | 11 (24.44 %) |
| - Agree (3): | 28 (62.22 %) |
| - Strongly Agree (4): | 5 (11.11 %) |

**Average: 2.82**

| (Q25) 25. Communicate through transparency (make information openly available). | |
| --- | --- |
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 3 (6.67 %) |
| - Agree (3): | 26 (57.78 %) |
| - Strongly Agree (4): | 16 (35.56 %) |
| Average: 3.29 | |
| (Q26) 26. Inform managers and team members of potential problems before the problems become serious. | |
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 5 (11.11 %) |
| - Agree (3): | 18 (40.00 %) |
| - Strongly Agree (4): | 22 (48.89 %) |
| Average: 3.38 | |

Results of the category "receive communication"

| (Q15) 15. Solicit help, advice, or information. | |
| --- | --- |
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 11 (24.44 %) |
| - Agree (3): | 24 (53.33 %) |
| - Strongly Agree (4): | 10 (22.22 %) |
| Average: 2.98 | |
| (Q16) 16. Listen actively; ask clarifying questions. | |
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 1 (2.22 %) |
| - Agree (3): | 26 (57.78 %) |
| - Strongly Agree (4): | 18 (40.00 %) |
| Average: 3.38 | |

**(Q17) 17. Read with comprehension and evaluate information to determine what is credible and relevant.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 2 (4.44 %) |
| - Neutral (2): | 3 (6.67 %) |
| - Agree (3): | 26 (57.78 %) |
| - Strongly Agree (4): | 14 (31.11 %) |

**Average: 3.16**

**(Q18) 18. Adjust communication based on non-verbal reactions of the audience; solicit feedback about the effectiveness of the communication.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 2 (4.44 %) |
| - Neutral (2): | 13 (28.89 %) |
| - Agree (3): | 24 (53.33 %) |
| - Strongly Agree (4): | 6 (13.33 %) |

**Average: 2.76**

## Results of the category "design communication"

**(Q1) 1. Prioritize communication tasks to use time wisely.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 0 |
| - Neutral (2): | 6 (13.33 %) |
| - Agree (3): | 22 (48.89 %) |
| - Strongly Agree (4): | 17 (37.78 %) |

**Average: 3.24**

**(Q2) 2. Distinguish when it is more appropriate / effective to keep silent rather than to speak and to ask questions rather than to assert an opinion.**

| | |
|---|---|
| - Strongly Disagree (0): | 0 |
| - Disagree (1): | 8 (17.78 %) |
| - Neutral (2): | 8 (17.78 %) |
| - Agree (3): | 22 (48.89 %) |
| - Strongly Agree (4): | 7 (15.56 %) |

**Average: 2.62**

# Results of the category "discuss productively"

## (Q10) 10. Lead a productive group discussion.

- Strongly Disagree (0): 0
- Disagree (1): 1 (2.22 %)
- Neutral (2): 4 (8.89 %)
- Agree (3): 24 (53.33 %)
- Strongly Agree (4): 16 (35.56 %)

**Average: 3.22**

## (Q11) 11. Deal constructively with conflict: debate/discuss/negotiate/collaborate productively and respectfully.

- Strongly Disagree (0): 0
- Disagree (1): 2 (4.44 %)
- Neutral (2): 5 (11.11 %)
- Agree (3): 29 (64.44 %)
- Strongly Agree (4): 9 (20.00 %)

**Average: 3.00**

## (Q12) 12. Support the transition from debate to the formation of a decision;

- Strongly Disagree (0): 0
- Disagree (1): 2 (4.44 %)
- Neutral (2): 10 (22.22 %)
- Agree (3): 29 (64.44 %)
- Strongly Agree (4): 4 (8.89 %)

**Average: 2.78**

## (Q13) 13. Hear criticism as a constructive contribution to the outcome of a project without getting defensive.

- Strongly Disagree (0): 0
- Disagree (1): 8 (17.78 %)
- Neutral (2): 14 (31.11 %)
- Agree (3): 19 (42.22 %)
- Strongly Agree (4): 4 (8.89 %)

**Average: 2.42**

## (Q14) 14. Give criticism constructively and respectfully.

| | |
|---|---|
| - Strongly Disagree (0): | ■0 |
| - Disagree (1): | ■1 (2.22 %) |
| - Neutral (2): | ▬4 (8.89 %) |
| - Agree (3): | ▬▬▬▬▬▬28 (62.22 %) |
| - Strongly Agree (4): | ▬▬▬12 (26.67 %) |
| **Average: 3.13** | |

# Team Process Check results in the dimension of affiliation

**(Q1) 1. My team may agree on a solution but not every member "buys into" (i.e. accept an idea as worthwhile, believe in wholeheartedly) that solution.**

- Never (4):    1 (6.67 %)
- Rarely (3):    3 (20.00 %)
- Sometimes (2):    8 (53.33 %)
- Frequently (1):    3 (20.00 %)
- Always (0):    0
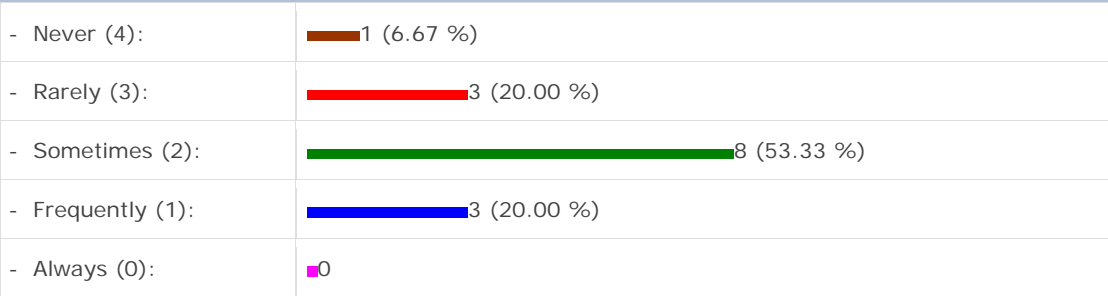
**Average: 2.13**

**(Q2) 2. When arguments break out, my team members are able to step back, calm down, and work out our differences.**

- Never (0):    0
- Rarely (1):    0
- Sometimes (2):    1 (6.67 %)
- Frequently (3):    8 (53.33 %)
- Always (4):    6 (40.00 %)
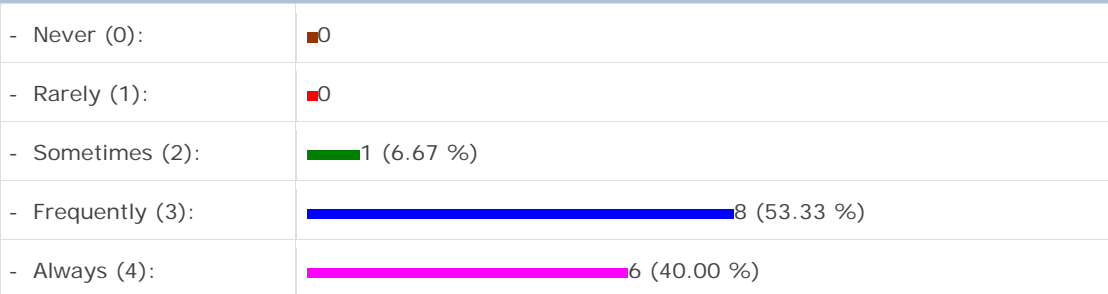
**Average: 3.33**

**(Q3) 3. My team members have difficulty listening to one another's ideas.**

- Never (4):    6 (40.00 %)
- Rarely (3):    8 (53.33 %)
- Sometimes (2):    0
- Frequently (1):    0
- Always (0):    1 (6.67 %)
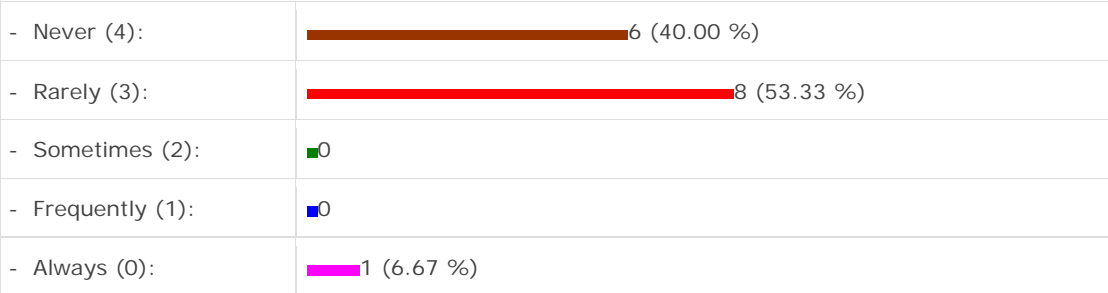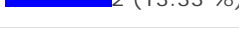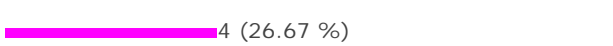
**Average: 3.20**

**(Q4) 4. My team members criticise ideas, not each other.**

- Never (0):    0
- Rarely (1):    4 (26.67 %)
- Sometimes (2):    2 (13.33 %)
- Frequently (3):    5 (33.33 %)
- Always (4):    4 (26.67 %)
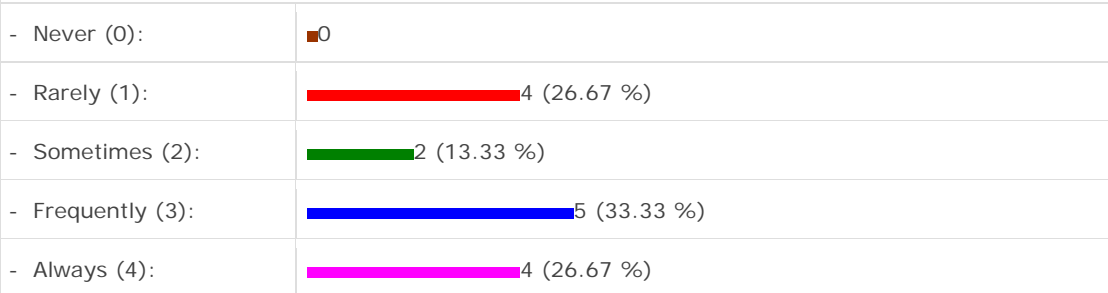
**Average: 2.60**

## (Q6) 6. My team members have trouble expressing their ideas clearly.

- Never (4): 3 (20.00 %)
- Rarely (3): 5 (33.33 %)
- Sometimes (2): 4 (26.67 %)
- Frequently (1): 2 (13.33 %)
- Always (0): 1 (6.67 %)

**Average: 2.47**

## (Q8) 8. My team ignores conflicts among team members.

- Never (4): 2 (13.33 %)
- Rarely (3): 9 (60.00 %)
- Sometimes (2): 3 (20.00 %)
- Frequently (1): 0
- Always (0): 1 (6.67 %)

**Average: 2.73**

## (Q12) 12. My team members make helpful and constructive comments on others' ideas.

- Never (0): 0
- Rarely (1): 0
- Sometimes (2): 2 (13.33 %)
- Frequently (3): 9 (60.00 %)
- Always (4): 4 (26.67 %)

**Average: 3.13**

## (Q16) 16. My team encourages differing opinions to be expressed.

- Never (0): 0
- Rarely (1): 0
- Sometimes (2): 4 (26.67 %)
- Frequently (3): 4 (26.67 %)
- Always (4): 7 (46.67 %)

**Average: 3.20**

## (Q17) 17. When conflict arises in the team, it is likely to be a battle or, at best, a waste of time.

- Never (4): 4 (26.67 %)

| | |
|---|---|
| - Rarely (3): | 5 (33.33 %) |
| - Sometimes (2): | 6 (40.00 %) |
| - Frequently (1): | 0 |
| - Always (0): | 0 |

**Average: 2.87**

### (Q19) 19. As a team, we find it difficult to accept criticism openly and non-defensively.

| | |
|---|---|
| - Never (4): | 1 (6.67 %) |
| - Rarely (3): | 10 (66.67 %) |
| - Sometimes (2): | 3 (20.00 %) |
| - Frequently (1): | 1 (6.67 %) |
| - Always (0): | 0 |
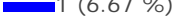
**Average: 2.73**

### (Q5) 5. My team tries to get everyone's ideas before making a decision.

| | |
|---|---|
| - Never (0): | 0 |
| - Rarely (1): | 0 |
| - Sometimes (2): | 2 (13.33 %) |
| - Frequently (3): | 6 (40.00 %) |
| - Always (4): | 7 (46.67 %) |

**Average: 3.33**

# Team Process Check results in the dimension of agency

## (Q5) 5. My team tries to get everyone's ideas before making a decision.

- Never (0): 0
- Rarely (1): 0
- Sometimes (2): 2 (13.33 %)
- Frequently (3): 6 (40.00 %)
- Always (4): 7 (46.67 %)

**Average: 3.33**

## (Q7) 7. We have difficulty staying focused and on track.

- Never (4): 1 (6.67 %)
- Rarely (3): 10 (66.67 %)
- Sometimes (2): 3 (20.00 %)
- Frequently (1): 1 (6.67 %)
- Always (0): 0

**Average: 2.73**

## (Q9) 9. My team members are clear about what is expected of them.

- Never (0): 0
- Rarely (1): 0
- Sometimes (2): 1 (6.67 %)
- Frequently (3): 11 (73.33 %)
- Always (4): 3 (20.00 %)

**Average: 3.13**

## (Q10) 10. We are careful to assign tasks to each of the team members when appropriate.

- Never (0): 0
- Rarely (1): 0
- Sometimes (2): 1 (6.67 %)
- Frequently (3): 6 (40.00 %)
- Always (4): 8 (53.33 %)

**Average: 3.47**

## (Q11) 11. My team tends to start working without an explicit plan.

| | |
|---|---|
| - Never (4): | 4 (26.67 %) |
| - Rarely (3): | 6 (40.00 %) |
| - Sometimes (2): | 3 (20.00 %) |
| - Frequently (1): | 1 (6.67 %) |
| - Always (0): | 1 (6.67 %) |

**Average: 2.73**

## (Q13) 13. Some people seem to do most of the team's work.

| | |
|---|---|
| - Never (4): | 2 (13.33 %) |
| - Rarely (3): | 8 (53.33 %) |
| - Sometimes (2): | 2 (13.33 %) |
| - Frequently (1): | 2 (13.33 %) |
| - Always (0): | 1 (6.67 %) |

**Average: 2.53**

## (Q14) 14. My team is able to generate potential solutions and evaluate them in an effective and systematic way.

| | |
|---|---|
| - Never (0): | 0 |
| - Rarely (1): | 0 |
| - Sometimes (2): | 2 (13.33 %) |
| - Frequently (3): | 7 (46.67 %) |
| - Always (4): | 6 (40.00 %) |

**Average: 3.27**

## (Q15) 15. Our team operates according to clear rules.

| | |
|---|---|
| - Never (0): | 0 |
| - Rarely (1): | 0 |
| - Sometimes (2): | 5 (33.33 %) |
| - Frequently (3): | 6 (40.00 %) |
| - Always (4): | 4 (26.67 %) |

**Average: 2.93**

| (Q18) 18. My team can assess itself and develop strategies to work more effectively. | |
|---|---|
| - Never (0): | 0 |
| - Rarely (1): | 0 |
| - Sometimes (2): | 0 |
| - Frequently (3): | 12 (80.00 %) |
| - Always (4): | 3 (20.00 %) |

**Average: 3.20**

| (Q20) 20. When someone is struggling to express his or her ideas, our team helps to get the ideas out. | |
|---|---|
| - Never (0): | 0 |
| - Rarely (1): | 0 |
| - Sometimes (2): | 4 (26.67 %) |
| - Frequently (3): | 5 (33.33 %) |
| - Always (4): | 6 (40.00 %) |

**Average: 3.13**

| (Q21) 21. We have difficulty completing our work efficiently. | |
|---|---|
| - Never (4): | 4 (26.67 %) |
| - Rarely (3): | 7 (46.67 %) |
| - Sometimes (2): | 2 (13.33 %) |
| - Frequently (1): | 1 (6.67 %) |
| - Always (0): | 1 (6.67 %) |

**Average: 2.80**