



Improving Soft Skills of University Students Through Software Development Team Projects

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Abstract

The success of a software project depends on many factors. It requires project team members to be well-equipped with technical knowledge and good soft skills. Among the many soft skills, the two basic soft skills that all project team members should possess are communication and negotiation skills. Today, communication skills are found to be lacking among the university graduates. This situation has resulted in the unemployment of 3 942 information technology graduates in 2006. A study was initiated to incorporate the teaching of communication and negotiation skills in the Project Management (PM) course through team projects undertaken by members of multi-racial composition. This paper presents feedback from 67 students on the teaching of communication and negotiation skills, and project management concepts through team projects.

Keywords: Communication skills, Negotiation skills, Software development, Team project, Project management course

1. Introduction

The successful development of software systems is often the result of software project team efforts. Thus, software projects require project team members who are not only knowledgeable in software development issues but are also good team player under the leadership of a competent project manager (Gorla & Lam, 2004). The attributes of a competent project manager include good technical software development knowledge, ability to communicate effectively and negotiate with customers and project team members to resolve project management issues and problems. Project managers who possess good communication and negotiation skills often complete software systems on time, within budget and fulfill software quality requirements (Marchewka, 2006; Brewer, 2005). According to the 2002 and 2004 statistics reported in two Malay newspapers, Utusan Malaysia and Berita Harian, a total of 24 728 and 48 100 Malay graduates were unemployed (Darwi, 2002; Razak, 2004). A report in a newspapers (Star, April 14, 2005), among the main reasons that caused their unemployment include poor academic results, poor attitude, poor English, poor interaction and communication skills (Omar, 2003; Pua, 2005). As at June 2006, 20 217 graduates who registered with the Malaysian Human Resource Ministry's Job Clearing System, were still unemployed. Out of this figure, 3 942 (19.5%) unemployed information technology (IT) or computer science (CS) graduates were also found to be lacking in technical and soft skills. Poor communication skills are also found to be one of the main reasons for their unemployment (Ram, 2006). Hence, incorporating some of the soft skills which can be taught in classes could be an effective solution to this serious unemployment problem.

In the computer science (CS) programme offered by the University of Malaya, students who specialise in software engineering (SE) are required to undertake the course Project Management (PM) as one of the core departmental courses in the second year. This course introduces practical project management theories and concepts to equip the students with fundamental project management knowledge and experience (Bachelor of Computer Science Programme Handbook, 2006). The PM theories and concepts are taught through lectures, followed by tutorial questions to enhance students' understanding. This lecture-tutorial based teaching method does not help to build up or enhance the communication and negotiation skills among the students.

In view of the serious unemployment problem which is partly attributed to poor communication skills among the CS graduates, the teaching of soft skills is now incorporated into the PM course. Two main soft skills – communication and negotiation skills are taught via team projects. The following sections explain the formation of project teams and the research methodologies used to conduct the study.

2. Formation of project teams

The PM course is a 3-credit hour course comprising two hours of lectures and one hour of tutorial. During lectures,

students are introduced to the theories and concepts of project management. During the tutorial session, the students are required to apply the PM theories and concepts to manage a software development project. In this study, the sixty-seven (67) students who registered for the PM course made up the study population. Although PM is a core departmental course for SE students, it is also an elective course for students in the information science (IS) major, and students of the Bachelor of Information Technology (BIT) programme (Bachelor of Information Technology Programme Handbook, 2006). In this study, two BIT students had registered for the PM course.

Students taking the PM course are second year students. Students who are extrovert often make friends and communicate well with students of other ethnic groups easily. On the other hand, students who are introvert may not know any student of other races even after studying the first year together. Also, students who are given the flexibility to form project teams, often team up with those of the same gender, thus, resulting in teams comprising male or female students only. Hence, before forming project teams, the students were given a list of software development project titles and team structure guidelines. After a student has decided on the project title, project teams with 9-10 members were then established. The project teams usually consist of students who have chosen the same project titles. Each team must comply with the guidelines for formation of the team structure with respect to ethnic and gender composition.

Figure 1 shows the team structure of the seven project teams established. There are four teams which have Chinese, Malay and Indian students (Teams 1, 2, 4 and 6), two teams with Chinese and Malay students (Teams 5 and 7) and one team (Team 3) with Chinese and students of other races (Bidayuh, from the Sarawak state of East Malaysia). The purpose of having this multi-racial team structure is not only to teach communication and negotiation skills to students of different races, but also to promote harmony among the university students. Also, based on the author's past experience, it is more effective to teach communication skills through interaction among students of different races in a project team. Each team selects one of their members to be the project leader.

As there were seven project teams, three separate tutorial classes were formed and run on non-parallel sessions. There are two teams in each tutorial class except for the third tutorial class which has three teams. During the tutorial session, the team leader will lead the project discussions and distribute the workload among the project teams. The teams carry out project management tasks/activities assigned to them after each lecture. Each project team was also given opportunities to clarify doubts about the lectures, if any, and the project leader was required to give a brief report on the progress of the project during the tutorial sessions. This is aimed at monitoring the project progress and to observe the communication and negotiation skills among the seven project team members.

3. Research methodology

The methodologies used to conduct this study include observation, questionnaire survey and analysis of the questionnaires using a statistical package. Observations were made during the tutorial classes. Generally, all seven teams showed cooperation and good teamwork within each team. As all seven project leaders were highly concerned about their team's image, none of them expressed unhappiness or gave adverse comments about their team members.

The questionnaire survey was chosen to obtain feedback from each student as this method allows the students to express themselves freely on paper regarding their opinions, feelings, and comments about themselves and other team members. During the last tutorial session, each student was given a questionnaire to answer. The questionnaire was aimed at getting feedback from the students pertaining to their communication and negotiation skills, their relationship with other team members, and the learning of practical project management concepts through the team project. A sample of the questionnaire is given in Appendix A. The returned questionnaires were checked for completeness prior to data coding. After coding, the data were entered and analysed using SPSS® for Windows Release 13.0 (SPSS® 13.0 for Windows, 2004). The results of data analysis are presented in the next section.

4. Analysis of survey outcomes

In this survey, 67 sets of questionnaires were distributed and used for analysis. Of the 67 students, 34 (51.0%) are male students and 33 (49.0%) are female students, respectively (Figure 2). The students comprise 46 (69.0%) Chinese, 10 (15.0%) Malays, 9 (13.0%) Indians, and 2 (3.0%) from other ethnic group (Figure 3).

4.1 Opinions on communication skills

As software project managers need to communicate with customers, project team members, vendors and top management personnel, the ability to communicate well is one of the important soft skills that good project managers must possess. Every one of us exhibit communication skills when we communicate daily with people in our neighbourhood, study environment and workplace. The communication skills of a person depend on how well he/she interacts with others. According to Jeffrey L. Brewer (2005), communication skills can be taught in classes. Hence, this study was initiated in 2006 to investigate the opinions of the 67 students with poor communication skills before they were involved in a team project but who have shown improvement in their communication skills after completion of the team project.

Table 1 shows the crosstabulation of the students' opinions on communication skills before participating and at the end

of the team project, according to project team number. One student each from team 3 and team 6 indicated that they disagreed that they have poor communication skills before taking part in the team project. This implies that they do possess communication skills and they strongly agreed that the team project helped them to improve those skills. In analysing and summarising the results of the crosstabulation, 33 (49.3%) students from the seven teams disagreed or strongly disagreed that they have poor communication skills. The remaining 34 (50.7%) students agreed or strongly agreed with having poor communication skills. Irrespective of their communication skills before taking part in the team projects, 55 (82.1%) students agreed and strongly agreed that the team project helped them to improve their communication skills. Only 12 (17.9%) students disagreed or strongly disagreed with the opinion. Overall, team projects do help the majority of students (82.1%) to improve their communication skills.

4.2 Opinions on negotiation skills

Software project managers often need to negotiate with customers when software project problems arise. These problems include cost overrun, or the inability to deliver software system on time. The project managers will have to negotiate for additional costs or extension of delivery date. Besides, negotiation skills are also needed; to deal with difficult project team members who refuse to perform the tasks assigned or to work overtime; to negotiate with vendors on cost of project resources or rental of equipment/machinery; and to negotiate with top management personnel for management support in prioritising projects (Gray & Larson, 2006). Hence, negotiation skills are important soft skills that good project managers must possess. All of us possess negotiation skills as we have to deal with various people to get tasks/jobs done everyday. The negotiation skills of a person depend on the persuasiveness of a person. Negotiation skills can also be taught in classes (Brewer, 2005). This study investigates the opinions of the 67 students with poor negotiation skills before they were involved in a team project but who have shown improvement in their negotiation skills after completion of the team project.

Table 2 shows the crosstabulation of the students' opinions on negotiation skills before their participation and at the end of the team project according to project team number. Two students indicated that they disagreed (from teams 5 and 6) and strongly disagreed (from teams 3 and 6) that they have poor negotiation skills before taking part in the team project, respectively. This implies that they do possess negotiation skills and they strongly agreed that the team project helped them to improve those skills. In analysing and summarising the results of the crosstabulation, 30 (49.3%) students from the seven teams disagreed or strongly agreed that they have poor negotiation skills. Thirty-six (53.7%) students agreed or strongly disagreed with having poor negotiation skills. One (1.5%) student indicated that the team project did not have any impact on his negotiation skills before participating in the project or at the end of the project. He indicated in the questionnaire form that he was the project leader of team 1. His team members were helpful and cooperative, hence, he did not have to negotiate/persuade them to perform the tasks assigned to them. As he has no opportunity to exhibit his negotiation skills, he indicated in the questionnaire form that negotiation skills as Not Applicable to him. Irrespective of their negotiation skills before taking part in the team project, 59 (88.1%) students agreed and strongly agreed that the team project helped them to improve their negotiation skills. Only 7 (10.4%) students indicated that they disagreed or strongly disagreed with the opinion. One (1.5%) student indicated Not Applicable as explained above. Overall, the team projects do help the majority of students (88.1%) to improve their negotiation skills.

4.3 Opinions on the understanding and application of practical project management concepts

In the study, feedback was also obtained from the students on their understanding of practical project management concepts through the team projects. Throughout the team projects, students are required to apply various project management concepts that they have learned from the lectures. These include preparing the work breakdown structure (WBS), flexibility matrix, responsibility matrix, estimating project time and cost, drawing of network analysis diagrams, planning risk management, performing project progress and performance measurement and evaluation using tracking techniques and earned value analysis, and carrying out project audit and closure (Gray & Larson, 2006). As shown in Figure 4, 13 (19.4%) students and 49 (73.1%) students, respectively, strongly agreed and agreed that they understood and were able to apply the practical project management concepts through the team project. Only 2 (3.0%) students and 3 (4.5%) students, respectively, disagreed and strongly disagreed that they learned practical project management concepts through team project. Overall, based on the positive feedback from 62 (92.5%) students, team project is an effective way to introduce and help students to learn the practical project management concepts.

4.4 Opinions on understanding and applying management skills in software development

In the team project, students communicate with team members through discussions, and apply their negotiation skills when they were unable to complete project development tasks on time. Besides, the project leaders also have the opportunity to develop or enhance their leadership skills. Feedback from the students show that the project management course has helped them to understand and apply management skills in software development. This is reflected by 19 (28.3%) students and 46 (68.7%) students, who strongly agreed and agreed with the statement, respectively (Figure 5). However, 1 (1.5%) student disagreed and another student (1.5%) strongly disagreed with the statement. Further analysis on these two students revealed that both of them indicated that they did not communicate well with all the project team

members. This implies that they do not have good relationship with other team members and hence, they could not work well with the team to apply the management skills taught in the PM course.

4.5 Opinions on the need to have team project

The students were also asked to comment on the need to have team project in the PM course. Out of all 67 students, 66 (98.5%) students strongly agreed and agreed that there is a need to have team project in the PM course (Figure 6). Only 1 (1.5%) student disagreed with the statement. Further analysis on the team project and the final examination results of this student shows that she performed poorly in both the assessments. Obviously, her negative comments imply that she did not understand project management concepts and was not able to apply PM knowledge and management skills in the team project.

4.6 Project management course assessment and performance of students

To investigate if the students have gained practical PM knowledge and acquired the two soft skills through the team project, assessment was made based on project presentation, project report and a final examination paper. The project presentation and report contributed 10% and 30%, to the overall course assessment, respectively. The project presentation aims to assess the verbal communication skills among the project team members. On the other hand, the project report is used to assess the written communication skills (writing skills) of the students on their understanding and application of practical PM concepts to manage the development of a software system. The final examination, which contributes 60% of the overall assessment, examines the understanding of the students on the PM concepts and theories and their ability to apply these knowledge in solving management problems. Table 3 shows details of the PM course assessment.

The final results of the 67 students were crosstabulated with their opinions on the understanding and application of practical PM concepts through team project. Table 4 shows that some students agreed that it is necessary to have team project but disagreed that team project could help them to understand and apply practical PM concepts in software development. Despite having such opinions, these students performed well in the PM course. This is reflected by 1 student (1.5%) who scored grade A, 2 students (3.0%) who scored grade A- and 1 student (1.5%) who scored grade B+. Only 1 student (1.5%) who agreed with similar opinions did not perform well in the PM course (scored grade C+). This situation could possibly be due to the fact that they agreed with the need to have team project, but this alone is not sufficient to make them understand and be able to apply practical PM concepts in software development.

From the survey, there are students who strongly agreed and agreed to the team project and also strongly agreed and agreed that team project helped them to understand and apply practical PM concepts in software development. Despite their support of the team project, these students did not perform well in the course. This is reflected by two students who scored grade C+ and two students who scored grade C. On further investigation, these four students see the effectiveness of team project in helping them to understand and apply practical PM concepts in software development, but they did not perform well in the final examination.

Interestingly, there is one conflicting opinion from one student who agreed that team project helped her to understand and apply practical PM concepts in software development, but disagreed with the need to have team project in the PM course. Further analysis on the feedback indicated that she was shy and unable to communicate fluently with other team members in English. Hence, she disagreed on the need to have team projects in the PM course. Obviously, her poor command of English could also possibly be the reason for not performing well in the final examination of the PM course, as she scored a grade C.

Generally, students who strongly agreed or agreed with the need to have team project and strongly agreed or agreed that team project helped them to understand and apply practical PM concepts in software development show good performance in the PM course. This is evident from the results of 17 (25.3%) students, 12 (17.9%) students, 10 (14.9%) students, 14 (20.9%) students, and 4 (6.0%) students, who scored grade A, A-, B+, B and B-, in the PM course, respectively (Figure 7). In this study, only 5 (7.5%) students who indicated similar opinions did not perform well in the PM course, with a grade of C+ (3 students, 4.5%) or C (2 students, 3.0%) . Overall, it can be concluded that the team project is an effective learning method which has helped 57 (85.0%) students to understand and be able to apply practical PM concepts in software development and to achieve good performance in the PM course.

5. Discussion and conclusion

The outcomes of the survey reveal aspects related to the opinions and results of the students on the teaching of the Project Management course through team project. Opinions expressed by the students indicate that the team project helps to improve the communication and negotiation skills of the students. Besides, team project also helps the majority of students to understand and be able to apply project management concepts in software development. The practical contents of the Project Management course have helped students to understand and be able to apply management concepts and skills in software project development.

Based on the students' feedback, the multi-racial composition of the team has a significant impact on improving the communication and negotiation skills of the students. It is, however, also important to investigate why the team structure did not help to improve the soft skills or performance in the course for a minority of students. Also, conducting

a follow-up study on the 67 students after their graduation will provide good indicators if the teaching of communication and negotiation skills via team project is effective in overcoming the unemployment problem among the computer science graduates. Comments from the employers should also be sought to find out the quality of these students as well as their satisfaction with regard to their employer communication and negotiation skills. The results of such study will provide good guidelines to further improve on the implementation of teaching communication and negotiation skills via team projects. Based on the outcomes of this study, it can be concluded that the team project is an effective way to help alleviate the unemployment problem that resulted from poor communication skills. This study also shows that communication and negotiation skills can be taught effectively in a course through team project with multi-racial team members.

Acknowledgement

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Table 1. Team No. * Poor Communication Skills (Before Taking Part in the Team Project) * Team Project Helped to Improve Communication Skills Crosstabulation

Team Project Helped to Improve Communication Skills			Poor Communication Skills (Before Project)				Total
			Strongly Agree	Agree	Disagree	Strongly Disagree	
Strongly Agree	Team No.	3			1	0	1
		6			1	1	2
	Total				2	1	3
Agree	Team No.	1	2	3	2	1	8
		2	1	2	3	2	8
		3	1	4	1	1	7
		4	0	6	2	1	9
		5	0	5	4	0	9
		6	0	1	2	0	3
		7	0	4	1	3	8
	Total		4	25	15	8	52
Disagree	Team No.	1	1	0	0		1
		3	0	1	0		1
		4	0	1	0		1
		6	0	1	0		1
		7	0	0	2		2
	Total		1	3	2		6
Strongly Disagree	Team No.	2		0	1	0	1
		3		1	0	0	1
		5		0	1	0	1
		6		0	1	1	2
		7		0	1	0	1
	Total			1	4	1	6

This table shows the opinions of students pertaining to their communication skills before and after the team project. Their opinions are grouped according to project team number.

Table 2. Team No. * Poor Negotiation Skills (Before Taking Part in the Team Project) * Team Project Helped to Improve Negotiation Skills Crosstabulation

Team Project Helped to Improve Negotiation Skills			Poor Negotiation Skills (Before Project)					Total
			Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable	
Strongly Agree	Team No.	1		1	0	0		1
		3		0	0	1		1
		5		1	1	0		2
		6		0	1	1		2
	Total			2	2	2		6
Agree	Team No.	1	1	2	1	2		6
		2	0	3	2	2		7
		3	0	7	0	1		8
		4	3	6	0	1		10
		5	0	3	4	0		7
		6	0	2	1	1		4
		7	0	2	8	1		11
	Total		4	25	16	8		53
Disagree	Team No.	1		1				1
		2		1				1
	Total			2				2
Strongly Disagree	Team No.	2		0	1			1
		3		1	0			1
		5		0	1			1
		6		2	0			2
	Total			3	2			5
Not Applicable	Team No.	1					1	1
	Total						1	1

This table shows the opinions of students pertaining to their negotiation skills before and after the team project. Their opinions are grouped according to project team number.

Table 3. Project Management Course Assessment

a. Project Presentation (10%)		
Greetings, introduction and conclusion (2%)	Facial expressions, eye-to-eye contact and hand gestures (5%)	Ability to articulate facts to audience and engage audience's attention (3%)
b. Project Report (30%)		
Contents – application of PM concepts in software development (20%)	Report arrangement, illustrations using tables, figures and charts, etc. (5%)	English grammar, formatting, citation of references, etc. (5%)
c. Final Examination (60%)		
Examine the PM issues pertaining to strategic planning, project costs estimation, project scheduling, risk management, and resource management.		

This table shows the assessment schemes of the Project Management Course. The assessment is classified into: project presentation (10%), project report (30%) and final examination (60%).

Table 4. Necessary to Have Team Project * Team Project Helped to Understand and Apply Practical Project Management Concepts in Software Development * Final Grade Crosstabulation

Final Grade			Team Project Helped to Understand and Apply Practical Project Management Concepts in Software Development				Total
			Strongly Agree	Agree	Disagree	Strongly Disagree	
76-100 (A)	Necessary to have Team Project	Strongly Agree	1	4		0	5
		Agree	2	10		1	13
	Total		3	14		1	18
72-75 (A-)	Necessary to have Team Project	Strongly Agree	2	5	0	0	7
		Agree	0	5	1	1	7
	Total		2	10	1	1	14
68-71 (B+)	Necessary to have Team Project	Strongly Agree	0	3	1		4
		Agree	1	6	0		7
	Total		1	9	1		11
64-67 (B)	Necessary to have Team Project	Strongly Agree	1	7			8
		Agree	2	4			6
	Total		3	11			14
60-63 (B-)	Necessary to have Team Project	Strongly Agree	1	2			3
		Agree	0	1			1
	Total		1	3			4
55-59 (C+)	Necessary to have Team Project	Strongly Agree	1	1		1	3
		Disagree	0	1		0	1
	Total		1	2		1	4
50-54 (C)	Necessary to have Team Project	Strongly Agree	2				2
	Total		2				2

This table shows the opinions of students on the need to have team project, and opinions on team project to help them understand and apply practical project management concepts in software development. Their opinions are grouped according to their final grade obtained in the Project Management course.

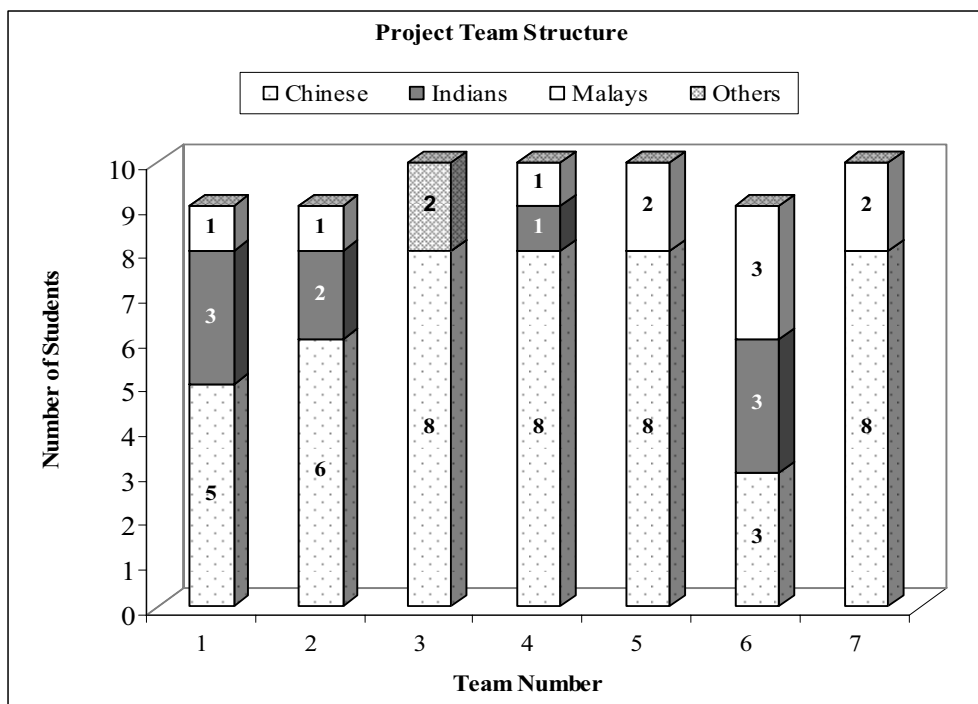


Figure 1. Distribution by Races in Project Teams

This figure shows the team structure among the students taking the project management course.

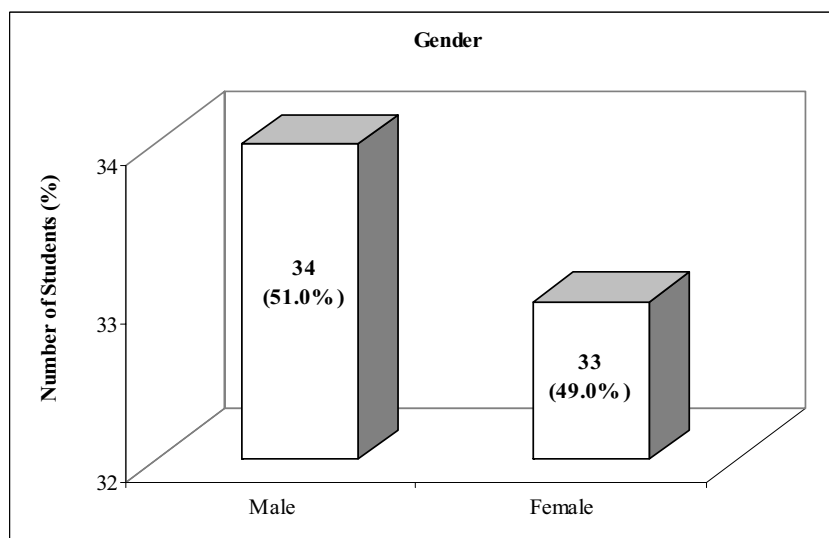


Figure 2. Gender of Students

This figure shows the distribution by gender among the students taking the project management course.

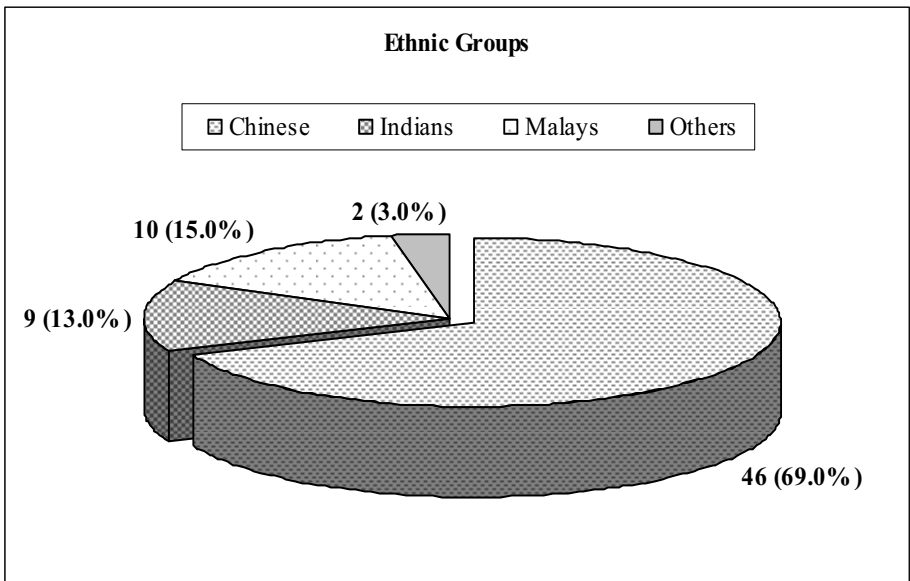


Figure 3. Distribution by Ethnic Groups Among Students

This figure shows the distribution by ethnic groups among the students taking the project management course.

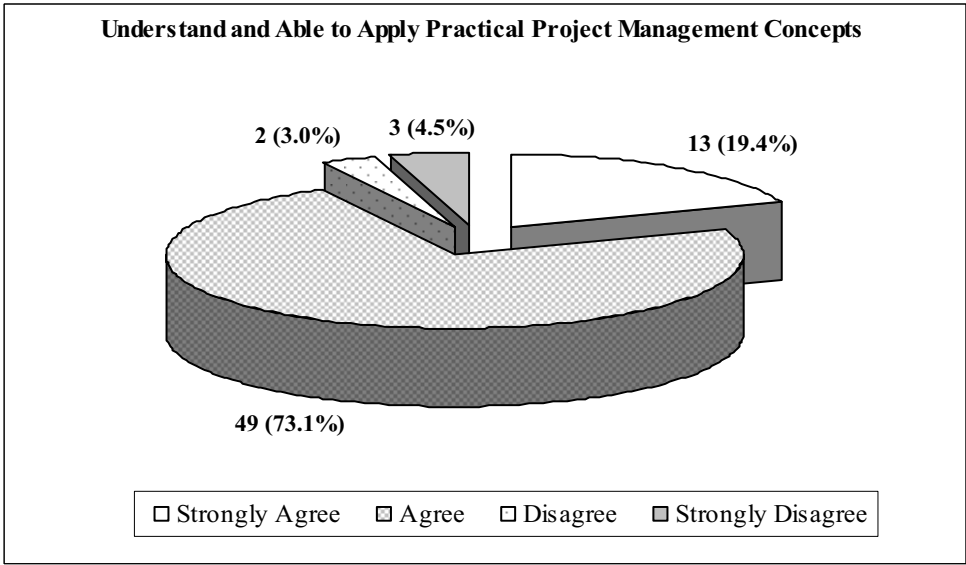


Figure 4. Understanding and Application of Practical Project Management Concepts Through Team Project

This figure shows the opinions of the students on their understanding of practical project management concepts through team project.

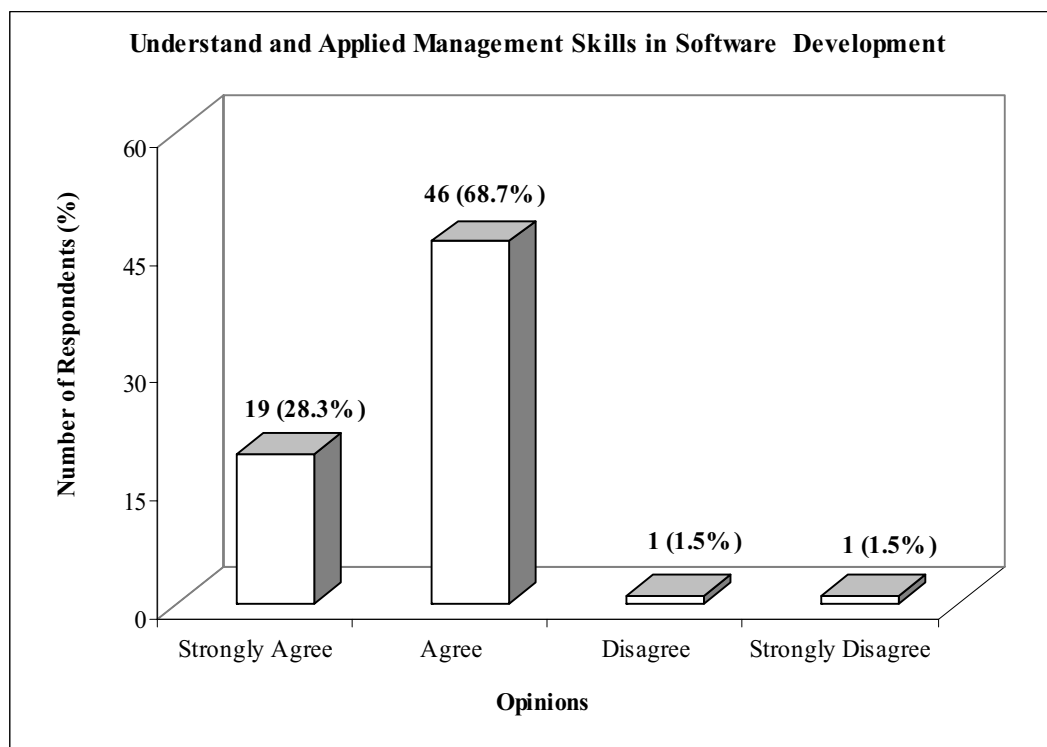


Figure 5. Understanding and Application of Management Skills in Software Development Through Team Project

This figure shows the opinions of the students on their understanding and application of management skills in software development through team project.

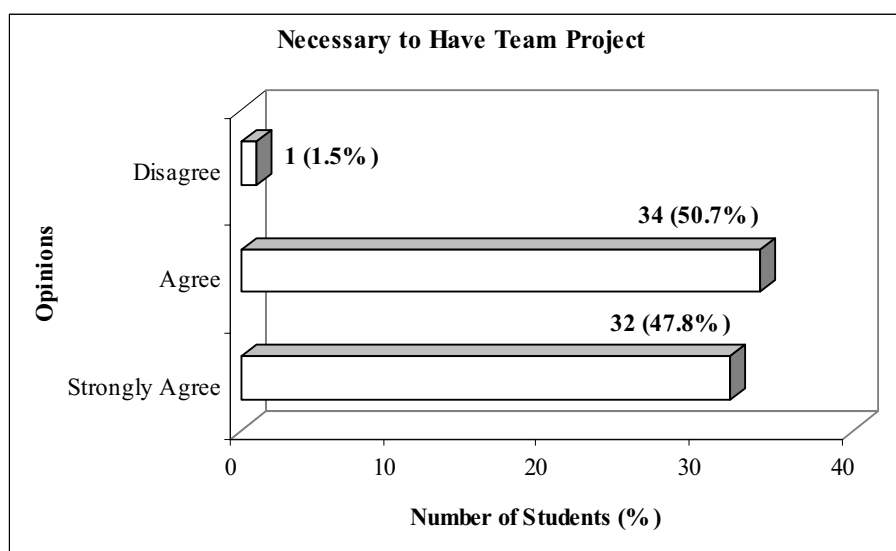
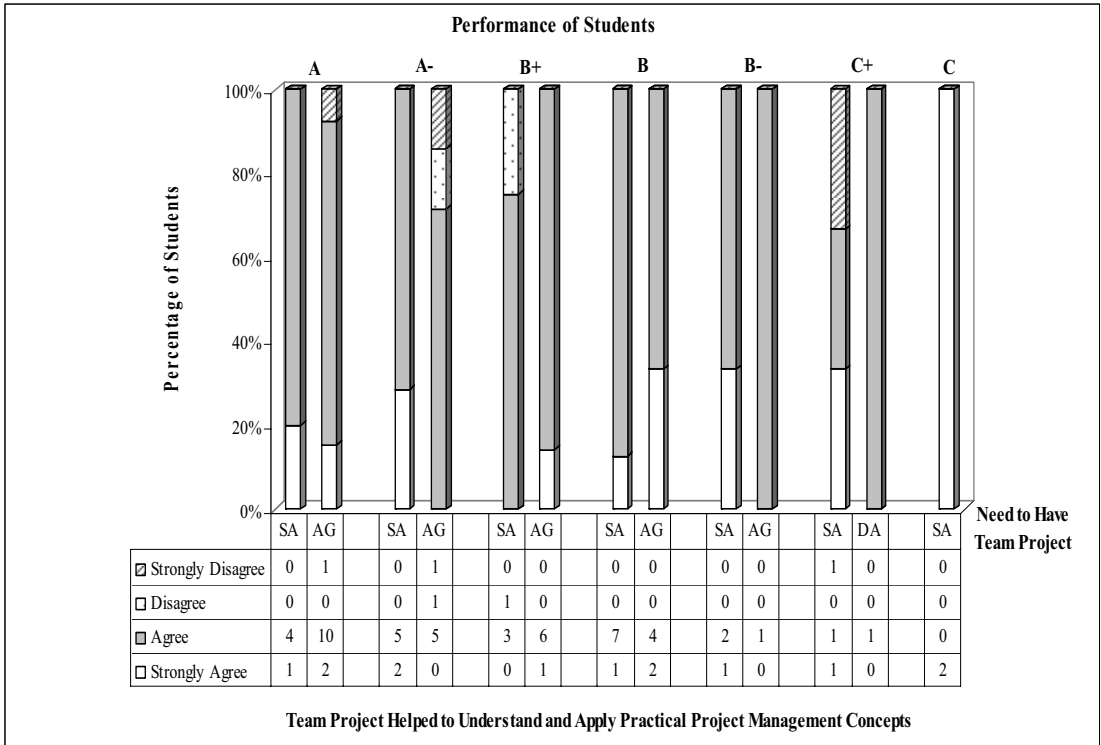


Figure 6. Opinions on the Need to Have Team Project

This figure shows the opinions of the students on the need to have team project in the project management course.



Keys: SA – Strongly Agreed AG – Agreed DA – Disagreed

Figure 7. Performance of Students in the Project Management Course

This figure shows the performance of the students according to grades together with their opinions on the need to have team project, and their opinions on team project to help them understand and apply practical project management concepts in software development.

APPENDIX A

**Faculty of Computer Science & Information Technology
University of Malaya**

Fill in your particulars or tick (✓) one of the options provided.

Name: _____ (optional)

Date: _____

Matriculation No.: _____

Team No.: _____

Position in the Team: Team Leader ☐ Team Member ☐

Gender: Male ☐ Female ☐

Race: Malay ☐ Chinese ☐ Indian ☐ Others, please specify: _____

Feedback – Course Contents and Team Project for WKES2202

OPTIONS

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree
5. Not Applicable

Instructions:

Evaluate this course by reading the following statements, and then choosing the option that is closest to your experience. Be as honest as you can: if your answer is *Strongly Agree*, write 1 in the box provided; if it is *Agree*, write 2 in the box provided, and so on. If the question is irrelevant to you, write 5 in the box provided.

	Answer
1. I'm afraid to speak in English at the beginning of this course.	
2. My communication skills are poor / unsatisfactory at the beginning of this course.	
3. My negotiation skills are poor / unsatisfactory at the beginning of this course.	
4. I like to work with my team members.	
5. I communicate well with all my team members.	
6. Occasionally, there are conflicts among team members during project discussions.	

- | | |
|--|----------------------|
| 7. We use English during project discussion. | <input type="text"/> |
| 8. The team project has helped me to improve my communication skills. | <input type="text"/> |
| 9. The team project has helped me to improve my negotiation skills. | <input type="text"/> |
| 10. The team project has helped me to understand and be able to apply practical project management concepts in software development. | <input type="text"/> |
| 11. The team project has helped me to understand and apply management skills in software development. | <input type="text"/> |
| 12. It is necessary to have a team project in this course. | <input type="text"/> |
| 13. The multi-racial team structure is good. | <input type="text"/> |
| 14. The multi-racial team structure has helped me to establish good relationship, friendship and team spirit with other races. | <input type="text"/> |
| 15. I understand the course contents clearly. | <input type="text"/> |

Please provide comments or suggestions to improve the teaching of this course (if any):

Thank you for your participation and cooperation.