# Assessing Groupwork Activities in Engineering Education

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***Abstract:*** Engineering curricula worldwide have emphasized on the usage of groupwork as one method of improving the interpersonal and teamwork skills among the graduates. These activities, in which students teach and learn from each other, provide ways for students to explore new paths and consolidate understanding. Hence, a study was carried out to assess the practice of groupwork among lecturers and final year undergraduate students at the Faculty of Chemical and Natural Resources Engineering, Universiti Teknologi Malaysia. The study was conducted using two set of questionnaires. The scores of the Reliability Index for both sets of questionnaires were above 0.8. Results showed that lecturers and students of the faculty had positive perceptions towards groupwork activities. Around 57% of the lecturers at the faculty were practicing groupwork in teaching in order to improve the learning outcomes of students and to develop transferable skills. Only a small percentage (28%) used groupwork to cope with increasing workload. The study also compared the perceptions of lecturers and students on the effectiveness of social, cognitive and assessment procedures. The primary difficulties identified on groupwork activities involved the 'free-rider' problem.

## 1.0 Introduction

Classroom instruction which involves groupwork is appealing for many reasons. First of all, working effectively with others is an important skill throughout life. It is a classroom lecturer's responsibility to provide opportunities in which students may practice and develop collaborative skills. Students learn easily from one another. Difficult material, concepts, and points (which only the lecturer may find obvious) can be taught and learned effectively in small groups. The diversity in the classroom becomes an asset rather than liability when groupwork is employed. Such groups can provide additional opportunities for students to interact with one another, to share their own rich perspectives, and to assist others who may not at the moment be "at speed" with the material [1][2].

Face to face interaction demands the attention and response of others. Students care very much about evaluations of classmates; they do not want to let the group down by refusing to participate. Groupwork helps students to learn and care about others. Working effectively with others is a skill many lecturers want to see in their students.

## 2.0 Issues in Groupwork Activities

The benefits of groupwork or collaborative learning have been demonstrated in countless studies and several metaanalyses [1][2][3][4][5]. Compared to students taught traditionally, students taught in a manner that incorporates small-group learning achieve higher grades, learn at a deeper level, retain information longer, are less likely to drop out of school, acquire greater communication and teamwork skills, and gain a better understanding of the environment in which they will be working as professionals.

These benefits are not automatic, however. Being part of an ineffective or dysfunctional team may well be inferior to independent study in promoting learning and can lead to extreme frustration and resentment. Students are not born with the project management, time management, conflict resolution, and communication skills required for high performance teamwork. Groupwork is not effective for every instructional objective or as a part of every lesson plan. Some lesson objectives might be better fulfilled employing more solitary activities.

If group assignments are to be given, explicit steps should be taken to help students learn those skills and to equip them to deal effectively with the logistical and interpersonal problems that commonly arise in collaborative efforts.

The practice of groupwork comes with many constraints. It requires explicit instruction, ongoing monitoring, and appropriate time allotments. It can be easily abused by students, who will stray off task into casual conversation and visiting.

The measurement of the student's ability to work in a group is not commonly appreciated in many academic settings. There is some question as to whether cooperative behavior can be more than subjectively measured. It might be said that the group's success or failure is peculiar to the group member's individual perceptions. In many universities, the measurement of groupwork is markedly superficial and problematic. The impermanence of groupwork

makes documentation and measurement all more difficult.

Students and lecturers fail to appreciate or place great worth to groupwork because no measurement of the process is commonly taken. As a result, this highly effective classroom strategy fails to receive the validation a distinct and well-articulated assessment strategy might provide.

## 3.0 Methodology

The subjects of the study are lecturers and final year engineering students at Faculty of Chemical and Natural Resources Engineering (FKKKSA), Universiti Teknologi Malaysia. The questionnaires were distributed to sixty four lecturers and 390 final year students in semester 1 session 2003/04. The total number of respondents was fifty two lecturers and 261 students.

There were two sets of questionnaire which was divided into three parts and both have a total of 30 questions each. The first part of the questionnaire covers the respondents' data while the second part covers the perception of respondents on the effectiveness of group work on cognitive and social skills and assessment procedures. The final part covers the problems faced in conducting group activities.

The first set of the questionnaires was given out to the lecturers while the second was intended for the students. The Alpha Cronbach reliability index of 0.85 and 0.92 were obtained for the first and second set respectively.

## 4.0 Results

For the first set of questionnaire, 69.2 % of the respondents had served the university for more than 10 years and the remainder (30.2%) served less than five years. 32.7% of them were either Associate Professors or full Professors. As for the second set of the questionnaire, the distributions of the academic achievement of the respondents are as follows: 25.5% with CPA $\geq$ 3.0, 51.3% with 3.0 > CPA $\geq$ 2.5 and 22.2% with CPA < 2.5.

Both groups of lecturers agreed on the importance of groupwork activities in classrooms. However, 57.7% said the activities were meant for the students interest, 28.85% said it was for the lecturers, and 7.7% said it was for the job market as shown in Figure 1.

Figure 2 shows students' perception on groupwork in which majority of them (96.2%) agreed on its benefits. Lecturer's and students' perception on the effectiveness of groupwork on cognitive skills is shown in Figure 3. Both groups agreed on the positive effect of the group work with percentage of agreements of 71.37% and 69.86% for lecturers and students respectively. The percentage of undecided is slightly higher for the students but the disagreement on the effect is quite high for the lecturers which made up 11.75% compared to 0.15% for the students.

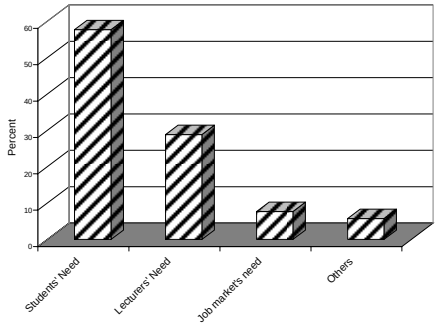


Figure 1. Purpose of groupwork to lecturers

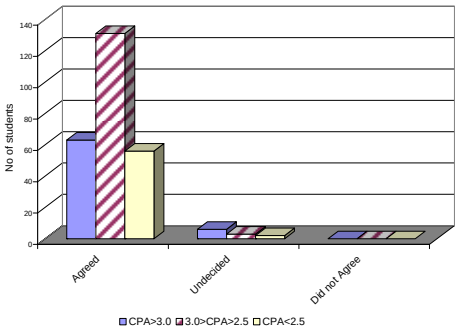


Figure 2. Students' perception on groupwork

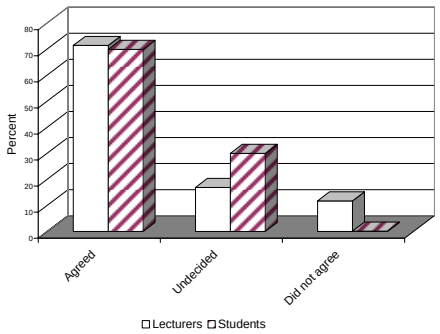


Figure 3. Perception on the effectiveness of groupwork on cognitive skills

The perceptions of each group on the individual item of the cognitive skills are given in Tables 1 and 2. Both groups agreed on the improvement of the understanding of materials through discussion, solving assignments, and increasing memory retention and thinking skills. 50% of lecturers and 66.67% of students believed groupwork could bring better understanding compared to individual learning. An interesting observation is to see 32.7% of lecturers believed the students should have equal understanding in groupwork and individual learning as compared to only 12.64% of students who thought likewise.

Table 1. Lecturers' Perspective on Cognitive Skills

| | Lecturers (%) | | |
|---|---|---|---|
| | **DA** | **U** | **A** |
| Better understanding | 0 | 23.1 | 76.9 |
| Good for problem solving assignments | 0 | 21.15 | 78.85 |
| Increase memory retention and thinking skills | 0 | 21.15 | 78.85 |
| Equal understanding in groupwork and individual learning | 50 | 17.3 | 32.7 |
| Easy understanding of new concept | 0 | 21.15 | 78.85 |
| More confidence in doing assignments | 3.85 | 13.46 | 77.31 |
| More deep learning | 0 | 11.54 | 88.46 |
| Success of groupwork depends on students' attitude | 0 | 25 | 75 |
| Difficult to make decision | 51.92 | 7.7 | 40.38 |

DA – Did not Agree; U – Undecided, A – Agreed

Table 2. Students' Perspective on Cognitive Skills

| | Students (%) | | |
|---|---|---|---|
| | **DA** | **U** | **A** |
| Better understanding | 1.2 | 7.6 | 91.14 |
| Good for problem solving assignments | 2.68 | 10.34 | 86.98 |
| Increase memory retention and thinking skills | 2.68 | 10.34 | 86.98 |
| Equal understanding in groupwork and individual learning | 66.67 | 20.69 | 12.64 |
| Easy understanding of new concept | 2.23 | 14.56 | 83.21 |
| More confidence in doing assignments | 3.83 | 7.66 | 88.51 |
| More deep learning | 8.43 | 49.04 | 42.53 |
| Success of groupwork depends on students' attitude | 1.15 | 9.58 | 89.27 |
| Difficult to make decision | 43.3 | 15.33 | 41.37 |

DA – Did not Agree; U – Undecided, A – Agreed

Both groups agreed groupwork could help students to understand new concept easier (78.87% lecturers and 83.21% students) and should enhance students' self-assurance in doing class assignments. 88.46% of the lecturers said groupwork should help students for deep learning compared to only 42.53% of the students. Interestingly, 49.04% could not decide on this question and this could be due to misunderstanding of the term deep learning.

If only 75% of the lecturers believed the success of any groupwork was depended on the students' attitude, 89.27% of the students believed their attitude was significant. When it comes to making decision, 51.92% of the lecturers and 43.3% of the students thought groupwork did not cause problem in reaching a consensus. However, 40.38% of the lecturers and 41.37 % of the students believed students could face problems in coming up with an agreement.

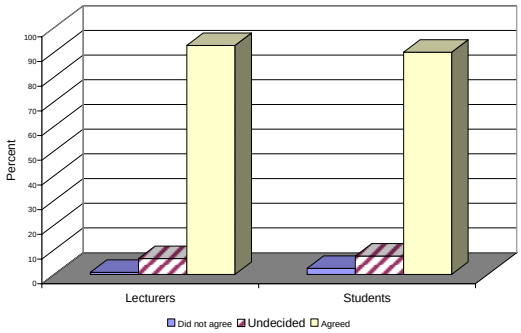


Figure 5 Perception social skills

Table 3. Lecturers perspective on social skills

| | Lecturers (%) | | |
|---|---|---|---|
| | **DA** | **U** | **A** |
| Encourage active learning and improve oral communication skills | 0 | 5.77 | 94.23 |
| Encourage lifelong learning | 0 | 7.70 | 92.3 |
| Encourage effective communication | 3.85 | 3.85 | 92.3 |
| Built self confidence | 0 | 7.7 | 92.3 |
| Improve creativity | 0 | 0 | 100 |
| Good leadership training | 0 | 3.85 | 96.15 |
| Improve self esteem | 3.85 | 19.23 | 76.92 |
| Improve sense of responsibility | 0 | 3.85 | 96.15 |
| Improve problem solving skills | 0 | 5.77 | 94.23 |

DA – Did not Agree; U – Undecided, A – Agreed

As for the social skills, 92.74% of the lecturers and 90.02% of the students believed groupwork could enhance the skills on students as shown in Figure 5. Lecturers and students perceptions on each item of the social skills are given in Tables 3 and 4. Both groups highly agreed on the benefits of groupwork that could encourage active learning and the opportunities of improving communication skills.

Table 4. Students perspective on social skills

| | Students (%) | | |
|---|---|---|---|
| | **DA** | **U** | **A** |
| Encourage active learning and improve oral communication skills | 1.53 | 4.60 | 93.87 |
| Encourage lifelong learning | 0.77 | 6.90 | 92.33 |
| Encourage effective communication | 3.45 | 8.43 | 88.12 |
| Built self confidence | 0.77 | 8.43 | 90.8 |
| Improve creativity | 1.15 | 4.21 | 94.64 |
| Good leadership training | 1.53 | 7.66 | 90.81 |
| Improve self esteem | 3.07 | 8.05 | 88.80 |
| Improve sense of responsibility | 0.77 | 8.05 | 91.18 |
| Improve problem solving skills | 1.92 | 10.73 | 87.35 |

DA – Did not Agree; U – Undecided, A – Agreed

92.3% of the lecturers and 92.33% of the students believed groupwork could encourage lifelong learning and both groups strongly agreed through group discussion students could enhance their effective communication.

Table 5. Perception of students on assessment

| | Students (%) | | |
|---|---|---|---|
| | **DA** | **U** | **A** |
| Importance of lecturer's feedback | 0 | 3.07 | 93.93 |
| Assessment clarified early in the semester | 0.77 | 4.60 | 94.63 |
| Checklist on assessment criteria | 0.77 | 46.15 | 53.08 |
| Formative assessment to overcome free rider | 1.53 | 6.13 | 92.34 |
| Important to have self evaluation | 1.53 | 8.43 | 90.04 |
| Provide training in groupwork activities | 2.3 | 7.3 | 90.4 |
| Assessment considered process and not only results | 3.07 | 11.49 | 85.44 |
| Peer group assessment | 4.60 | 13.41 | 81.99 |
| Assessment based on product is best for individual grading | 74.33 | 13.03 | 12.64 |

DA – Did not Agree; U – Undecided, A – Agreed

The results of the survey proved the benefits of groupwork on social and generic skills as cited by many studies[1][2][7][8][9][10][11]. Both groups agreed groupwork has positive effects on self confidence, creativity, leadership training, self esteem, sense of responsibility and problem solving skills.

Perception of both groups on the assessment of groupwork activities are tabulated in Tables 5 and 6. Both agreed on the importance of lecturer's feedback to improve the success of groupwork. 94.63% of the students and 82.7% of the lecturers believed on the importance of clarifying the assessment criteria early in the semester. However, 88.46% of the lecturers and only 53.08% of the students believed on the importance of knowing the checklist of assessment criteria. Both groups seem to agree on formative assessment, self evaluation, and importance of peer assessment being carried on groupwork activities.

Training on managing groupwork activities are the main concern of both groups as they believed this could improve the quality of learning. While 85.44% of the students believed assessment should consider the process and not the results alone, only 65.45% of the lecturers think likewise. As for grading, 74.33% of the students as compared to 51.92% of the lecturers did not agree on grading the product as the best method for individual assessment. Only 12.64% of the students agreed on this approach but 32.7% of the lecturers thought likewise.

Table 6. Perception of lecturers on assessment

| | Lecturers (%) | | |
|---|---|---|---|
| | **DA** | **U** | **A** |
| Importance of lecturer's feedback | 0 | 0 | 100 |
| Assessment clarified early in the semester | 0 | 17.3 | 82.7 |
| Checklist on assessment criteria | 3.85 | 7.69 | 88.46 |
| Formative assessment to overcome free rider | 0 | 7.69 | 92.31 |
| Important to have self evaluation | 3.85 | 7.69 | 88.46 |
| Provide training in groupwork activities | 11.54 | 13.46 | 75 |
| Assessment considered process and not only results | 11.54 | 23.01 | 65.45 |
| Peer group assessment | 15.38 | 7.69 | 76.93 |
| Assessment based on product is best for individual grading | 51.92 | 15.38 | 32.7 |

DA – Did not Agree; U – Undecided, A – Agreed

From the results of the survey, the biggest problem of conducting groupwork activities (38.46%) to the lecturers was the assessment process i.e. to determine the contribution of individual for each assignment. Monitoring the process of groupwork activities is another major problem (34.62%) to the lecturers. This includes group coordination, job assignment, group member assignment, students' attitude and managing big classroom. Another 26.92% of the lecturers thought knowledge and techniques of handling groupwork are another problem that needs to be tackled. This seems to be a major problem to the younger lecturers.

Students' response on their problems of working in a group is tabulated in Table 7. Their biggest concern is 'free-rider' (77.01%) followed by interpersonal communication (51.34%), personality conflicts (47.51%) and time management (45.98%). Unfairness of assessment (42.15%) and no knowledge of groupwork mechanism are another two major concerns.

Table 7. Problems faced by students

| **Problems** | **Percent of Respondents** |
|---|---|
| 'Free-Rider' | 77.01 |
| Personality conflicts | 47.51 |
| No knowledge in groupwork mechanism | 40.23 |
| Unfairness in job distribution | 32.57 |
| Time management skills | 45.98 |
| Unfairness of assessment | 42.15 |
| Logistic problems | 18.39 |
| Interpersonal communication | 51.34 |

Responses of the students on overcoming the 'free-rider' issue are shown in Table 8. 73.56% of the students like to have an open-and-direct communication with the group members at the beginning of the semester while 69.73% believed in meeting the offender face-to-face. Another effective method strongly supported by the respondents is peer assessment.

Table 8. Methods to overcome free-rider

| **Methods** | **Percent of Respondents** |
|---|---|
| Face-to-face communication | 69.73 |
| Open and direct communication | 73.56 |
| Punishing free-rider | 45.21 |
| Peer assessment | 62.84 |
| Self evaluation | 39.08 |

## 5.0 Discussion and Conclusion

The survey has explored the practice of groupwork on lecturers and final year engineering students in an engineering faculty and both groups agreed on its positive effects on cognitive and social skills development [12][13]. The main objective of carrying groupwork activities to the lecturers was for the needs of the students (57.7%) followed by the needs of the lecturers (28.85%) and finally for the preparation for the job market (7.7%).

The survey highlighted nearly 30% of the students still did not convince the benefit of groupwork on their cognitive skills. This could be due to their unsatisfactory experiences and not being informed on the benefits of groupwork. Hence, lecturers need to 'sell' the ideas that groupwork is one of the best strategies for achieving learning objective [14]. The study showed that more students believed (66.67%) groupwork should bring better understanding compared to individual learning. This fact agreed with findings which stated those who have experienced groupwork showed better understanding compared to traditional learning [15][16][17]. On the other hand, merely 50% of the lecturers thought likewise.

Another interesting observation is the relationship between groupwork and making decision. Higher percentage of lecturers (51.92%) compared to students (43.30%) disagreed with the statement "difficult to make decision in a group". However, the percentages of both groups agreeing to the statement are quite alarming; 40.38% for the lecturers and 41.37% for the students. This shows that some students and even lecturers still did not believe in sharing information, compromising and tolerating different opinions and consequently it would be difficult for them to make decision. This finding is in the contrary with other findings which stated sharing information through ideas and opinions will simplify problem solving [18]. Various ideas and opinions should stimulate the minds of the lectuers and the students in finding the best solution.

On the aspect of social skills, both groups agreed on the positive effect of groupwork. This proves that both students and lecturers preferred a cooperative learning environment [19]. Hence, the cooperative and collaborative mode of learning should be continued in the faculty.

In conclusion, groupwork activities in the faculty still need better planning and execution. This is shown by 69.23% of the lecturers who thought the execution of the groupwork still did not bring quality learning in the classrooms. Lecturers at the faculty need more exposure and sharing of information on the best approach of groupwork activities. More efforts should be done to improve their competencies in conducting groupwork. Their abilities to plan, to deliver and to assess groupwork are the three interrelated important

areas of effective teaching [20] that need to be given emphasized.

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