IMPROVING GROUP/TEAM ASSESSMENTS IN TECHNICAL EDUCATION: AN EMPIRICAL EXPERIMENT

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ABSTRACT
In the technical curriculum in general and in engineering curriculum in particular. most of the modules have group work for their projects/coursework. Group work plays an important role in team building, confidence and interpersonal skills and makes them fit from the industry perspective. As a teacher and assessor it becomes a challenge to assess the group work as a whole or on an individual basis as most of the time individual contribution of the student towards the project is unknown. The action research project focused on strategy and approaches to improve the group work assessment by implementing a rubric which consist of individual accountability of each student in a group work.
From the overall group work project evaluation it was seen that the action research project on the group work has helped the students to develop transferable skills, teamwork skills and social interactions as well as learning about beliefs and attitudes. Also the students agreed that their leadership skills increased which is imperative requirement of any industry. The curriculum product and process model along with constructive alignment theory has made students achieve their outcomes easily for their group work process.
Key words: Engineering curriculum, Group Work, Group Project Evaluation, Curriculum product and process model.

1. Introduction
Group work is a required skill in both learning and employ-related contexts, according to Davis (1993) research suggests that students learn best when they are enthusiastically involved in the process. Learning is always related to a curriculum and how well it is designed,   reflecting on curriculum we need to keep a number of things in our minds like, social and vocational needs, skills development, relevant subject specific knowledge, and the ability to apply this knowledge in a variety of situations. **Looking into various curriculum theories the "product" and the "process" model (Sheehan, 1986)** defined more of these skills learning activities. He explored the strengths/ weakness of product & process model and recommended that although the product framework may offer added structured measurement of results, the **process framework** would offer additional opportunities for learners to identify their learning requirements with prominence on learning abilities and reflection as part of the evaluation method. *To embed the above skills within a student proper activity need to be structured throughout the learning phases.* As per the **group work research by (Helle et al, 2006) states** that there are many interferences in establishing consistency of assessments in group work, while marking a group

work for example what are the evidence or criteria the grades will be based, additional challenge is how would the involvement of each team member be weighted in the grade, do all the members get equal ranking despite the fact that students put in effort differently in their project work? Based on these challenges an action research project is undertaken for assessing group works and it would be fascinating to discover the students and educators insights for these challenges.

The **curriculum** can also be seen an insight to **constructive alignment theory** (John Biggs, 2003) in which the learning outcomes are formulated first, then the assessment development followed by teaching and learning activities, the challenging part is the way they are assessed.

2. Literature review

Every programme is **based on a curriculum, as per Stenhouse (1975)** "A curriculum is an attempt to communicate the essential principles and features of an educational proposal in such a form that it is open to critical scrutiny and capable of effective translation into practice". There are many aspects relative to the description which provides it noteworthy feature like concentration on essential principles, reviewing and critically scrutinizing it from time to time, basically there are many curriculum models which can be suited as per the programme.

According to **(FEU 1980, London)** there are 7 variants of curriculum models as shown in figure 1 below. Every model has an assumption. In the 1st place **deficiency model** assume that students have learning deficits which need to be checked before proceeding further. The areas can be literacy, interpersonal, or lack of recognition. In the **competency model** practical aspects are considered. **Information based model** mostly related to the acquisition of knowledge. **Socialization** is alarmed with the introduction of the learner into the societal environment. It is categorized by the growth of values & behavior, and expectations related to the necessities of the industry, vocational and society matters. The 4 models which have just been defined in a brief are all **product models**, i.e. the importance is given to the result of a learning involvement.

The other group of model is a **process model**. In this the attention is on learning gained from work knowledge and real world experiences. It consists of open-ended activities for students for learning developments. The concentration is on the significance of the learning while it is happening instead of on preset results.
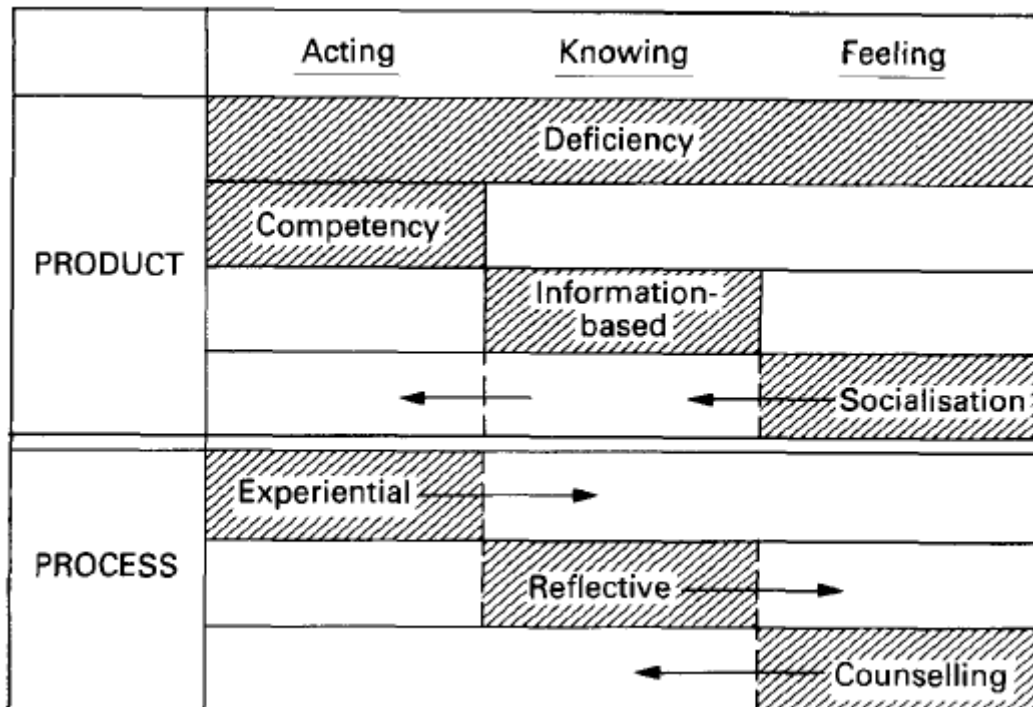
Figure 1: Models of the curriculum

Group projects / group-work are widely used in higher education, It is widely recognized that group-work has academic, practical and social benefits (e.g. Lee *et al*., 2015, Noonan, 2013). However there are many challenges including student perceptions of unfairness (MacFarlane, 2016; Rogers & Smith, 2014), exclusion (Noonan, 2013) and assessing (Lee *et al*., 2015). Group-work supports the development of key skills and

graduate attributes, however it is important to recognize that group-work *does not* automatically benefit students; to do this it needs to be well planned, structured and supported. This requires planning, input and support from the tutors. Evidence is clear that if group-work is to be successful, it needs to be facilitated and students need preparation and guidance (e.g. Noonan, 2013). Group-work that is not well planned and supported can impede learning, create a difficult social environment and cause students to experience stress and distress. Group-work, perhaps more than any other form of evaluation highlights the ethical issues inherent in evaluation (Noonan, 2013).

Unfortunately there is no simple formula for doing group-work well; there is no single 'best' approach to forming groups, managing the process and assessing. All approaches have advantages and disadvantages and need to be considered within the context of the programme, the stage, the nature of the assessment, student characteristics and so on.

2.1 Group Size
Group size plays a very important part in group work. As per (Beebe & Masterson, 2003) a small group should be of 3 or more people. Group of 2 is not encouraged because there are not enough members to exchange ideas (Csernica et al., 2002). As per (Davis, 1993) a group should comprise of at least 4 to 5 members.

2.2 Group Selection
Group selection can be either instructor based or self-select. Self-select groups often divert toward friendship (Csernica et al., 2002) and can lead to socializing with friends rather than concentrating on their group work (Cooper, 1990). Research suggests that groups which are assigned by the tutor have a tendency to accomplish in an improved manner than self-established groups (Felder & Brent, 2001).

2.3 Group process monitoring
According to (Davis, 1993) one method to monitor the group is to ask group device action plan. The action plan involved allocating roles and responsibilities among all the group members. Creating a consent form to help them write their goals and objectives for the group, another method is to ask them to have weekly or individuals for their works.

2.4 Assessing / Evaluation
Group work evaluation is not an easy task for the tutor, there should be a clear idea of how the group work is to be evaluated, the instructor need to decide what is to be evaluated, the process, product, or both. Sometime the same grade is assign to the whole group if contribution is not the same from all members which may promote unhappiness (Davis, 1993). If the entire group is graded as a total, then their presentation should add as a percentage in their final grade (Cooper 1990; Johnson & Smith 1991)

If the group process is assessed the student should be able to mention their efforts, their group member's efforts and the process as total. With respect to evaluation, it is important the students should know and understand how they will be assessed. One method is to have structured grading rubric for both the process and the product. The rubric not only lists the criteria by which the work is assessed but also the student's knowledge of the material (Finson & Ormsbee, 1998). Stevens and levi (2005) advice the use of rubrics because they convey prospects to the students and help to focus their efforts, improve student accomplishment and improve the efficiency of feedback. Additionally rubrics are useful beyond evaluation because it help students understand the assignments (Mckeown, 2011).

1. A Brief Review on Action research
Action research is result-oriented research i.e. group / personally owned and conducted. It is a helix cycles of research and action consisting of four major components: plan, act, observe and reflect The terms "action" and "research" highlights the important features of this method: trying the ideas in practice as a means of increasing knowledge and improving curriculum, teaching, and learning (Kemmis & McTaggart, 1988)
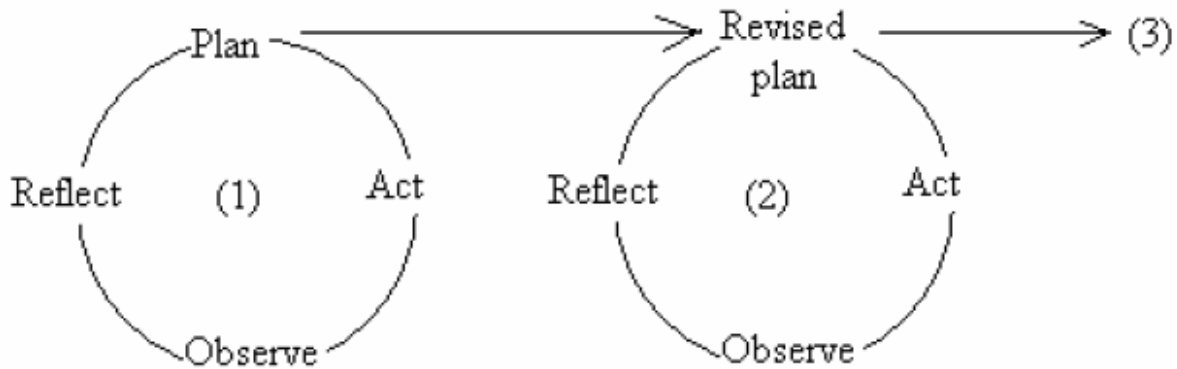
Figure 2: Action research cycle.

The concept of "action research" is focused not only on a learner acquisition of knowledge and understanding, but on that learner using this knowledge and understanding "wherein learners participate in studies both as subjects and objects with the explicit intention of bringing about change in the setting under study" (Raelin and Coghlan 2006, p. 671).

The purpose of this action research project will be to identify and implement a strategy or an approach to improve group work in engineering by considering the curriculum models for this approach.

2.   Action Research Methodology on Group Work

As mentioned in the introduction, group work is a required skill in both learning and employ-related contexts, according to (Davis, 1993) research suggests that students learn best when they are enthusiastically involved in the process. As group work assessment is a difficult process and there are no proper guidelines involved for the assessment.

In past teaching, I have found that its difficult to convince students to get involved in the group work, because some students think their contribution will not be seen in the group work, marks allocation will be same as other whether you are actively involved or not, and there are free riders who take advantage of the process as a result it becomes more complex to assess group as a whole and individually.

The action research project was implemented on level 5 mechanical engineering students; module AME5005 for coursework 1with 24 students registered for the module, it has group work as summative assessment for 50% weightage of the entire module. Apparently no further guidelines is provided how the group work assessment will be done, this creates a challenge to the educators how they will frame and evaluate the group work which take care of both the group marks and their individual marks.

In this project I focus my attention how the group work experience can be improved so each student can get benefit of their contribution. Based on information obtained from above review of action research and past experience, developing a simple and practical action research plan for the project.

Phase I. Plan
1. Designated class activities.
•   Initially the module was discussed with the help of module guide and students were communicated with the aims and objectivities of the activities.
•   Initial student survey questionnaire was developed through Google forms (Appendix 13.1) to understand their response towards group work. It was found that most of the students had worked in the group for more than 3 to 4 times, so students were allowed to form their own group with their prior experiences. 4 to 5 students were only allowed to be in a group
•   Simultaneously tutors experienced were also recorded via a Google form (Appendix 13.2).
•   Rubric was clearly explained to the students via the information provided on the board and it was clearly communicated that the rubric was divided into 2 parts, one part takes care of group activity for 50 marks and other part takes care of preparing individual report and individual presentation
•   The group activity consists of in class activities and visit to industries where live data can be collected about the product which need to be designed.
2. Implementation.

The above activities will be applied during the lectures and tutoring. Basically, the implementation will include building of a cordial and responsive learning community. During the teaching, the activities will be carefully monitored, observed and recorded. Actions will be revised and new actions will be added as the enactment progresses.

3. Evaluation and reflection

Feedbacks data will be analysed. Issues will be identified. Data will be collected to measure students' reaction to the plan based on:

- Students interactions in the lecture
- Student-Tutor interactions each week in the lecture
- Students initiating interactions each week in the lecture
- Students getting involved in group activities each week in the lecture
4.   Revising the plan and repeating the plan based on the above feedbacks

Phase II. Action

In action phase, I started implementing class activities and strategies selected in the planning phase. I started with the design activities in the class, students started sitting in their assigned groups, in class activity and tutorials were provided, students started brainstorming each other to do the activities, students started filling their team contract in the first week and started assigning the roles and responsibilities to their team, formats provided in Appendix 13.3 & 13.4, students started maintaining their weekly logs.

In the initial weeks, students haven't got familiar well and were a bit shy, I have to help them a bit to get them involved into problem solving tasks in classroom and have to build trust of a cooperative working culture, making them understand the importance of communication within the group, sharing ideas, participating in group activities and discussions. After some weeks of teaching, the collaborative culture has been successfully developed in the class; students are much more quick to respond to class activities than they were in the beginning of the semester.

Phase III. Evaluation and Reflection

In this phase, the data I collected during the teaching was evaluated to improve the plan.

Group evaluation was done based on several factors like.

1)   Self and peer assessment by their own group.
2)   Marks obtained in individual report writing.
3)   Individual Marks from the group grade.
4)   Overall group work performance of all groups.
5)   Overall project evaluation using mean and standard deviation.

All together 21 feedbacks were collected in the overall project evaluation using the qualitative data analysis method. An overall project analysis was done on various factors like Development of skills, Attitudes towards group work and Attitudes towards assessment for any improvement is done with the implementation of the strategy using mean and standard deviation approach. The results were plotted in the graphs.

Phase IV. Revise plan and repeat the cycle.

Based on the qualitative feedbacks, some of the actions planned in the beginning of the semester have been revised, adjusted or added to improve the class activities. Specific measures are as following

- Demonstration of procedure of each task during the process of lecturing
- Discussing and summarizing at the end of lecture.
- Breaking up groups of same members and restructuring groups so responsive and slow students are better mixed up
- Encouraging more students to visit tutor for discussing about their

problems, concerns and issues in the study

3.   **Data Collection**

3.1 Analysis of student's perception of group work from the questionnaire

Total of 23 students took group work and the questionnaire was responded by 19 students (82.60%), from the responses **73.7%** have chosen the group with the prior experience of working in the group with the members, 52.6% students have work more than 5 times in a group, 52.6% found very good working in a group, **73.3% prefer to work in group assignments,** 52.6% prefer to splitting up the work in the group. when it comes to implement strategies for encouragement of group work **73.7%** prefer having meetings, 63.2% prefer helping

each other, **52.6%** prefer sharing workloads and sharing information. When it comes to skill development in a group work, 68.4% assumes it will improve team work skills, 47.4% assumes improve communication skills. **42.1%** feel the biggest drawback of working on group assignments is to rely on others.

3. 2 Analysis of instructor's perception of group work from the questionnaire

The questionnaire was sent 10 instructors of different subject area and level which has experience in group work, out of 10 instructors 9 responded to the questionnaire, some uses group work because it is a summative assessments or it is in their curriculum, some use it as a formative assessment. Some instructors responded that group work develop confidence, communication and leadership skills. Some assess student's group work as group and individual, some via blogs and some via Q & A sessions, some via peer review of students. As per some instructors some issues student group confront are uneven participation, role clarity, individual participation and performance in group, social loafing.

4.   Analysis of group work
4.1 Analysis based on Skills

At the end of the group work for about 7 weeks students were asked to fill a group work project evaluation survey , the survey was marked on a scale of 1 to 5 (1= Strongly disagree, 5= Strongly agree), out of 24 students, 21 students filled the survey.
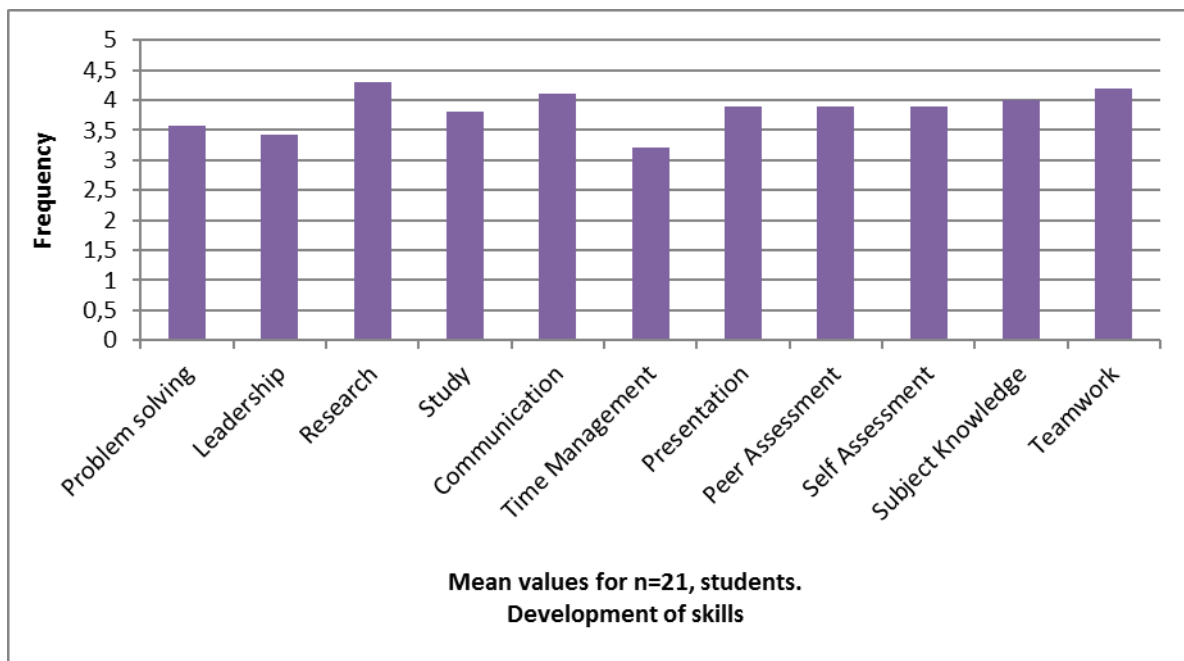

Graph 1 Development of skills

Development of skills

On a survey scale of 1 to 5 we can observe from above graph 1 that most of the skills were improved during the group work, the above graph illustrate that students research work, their communication skills, teamwork skills were improved a lot, problem solving, leadership, time management, self and peer assessment were also enhanced.
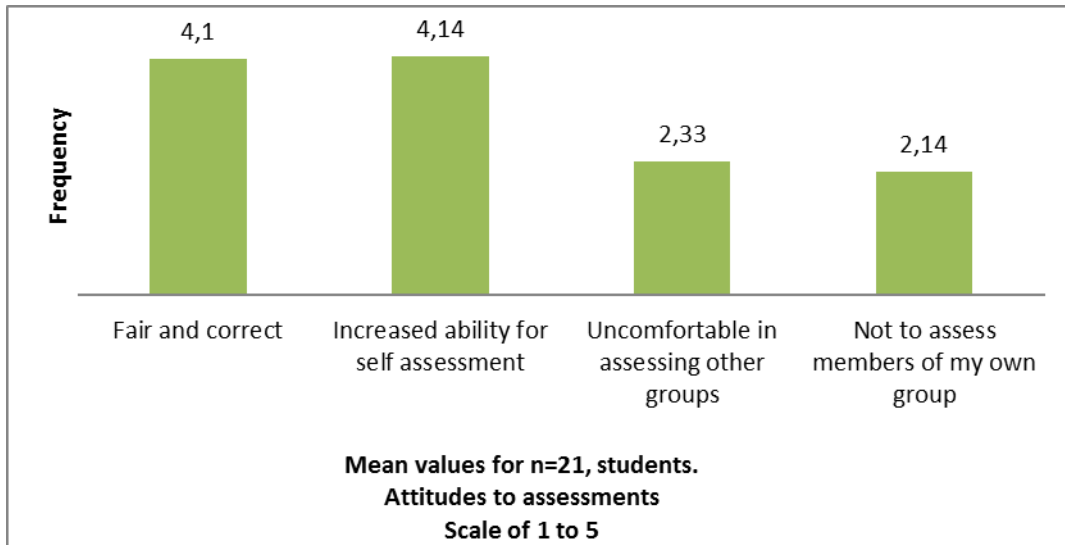
Graph 2 Attitudes to Assessments

Attitudes to Assessments

On a survey scale of 1 to 5 and from above graph 2 we can observe that students agree that assessments were fair and correct and increased their ability for self-assessments, some students felt uncomfortable in assessing other as well as own members of the groups. More awareness has to be developed within the students for the self and peer assessments.
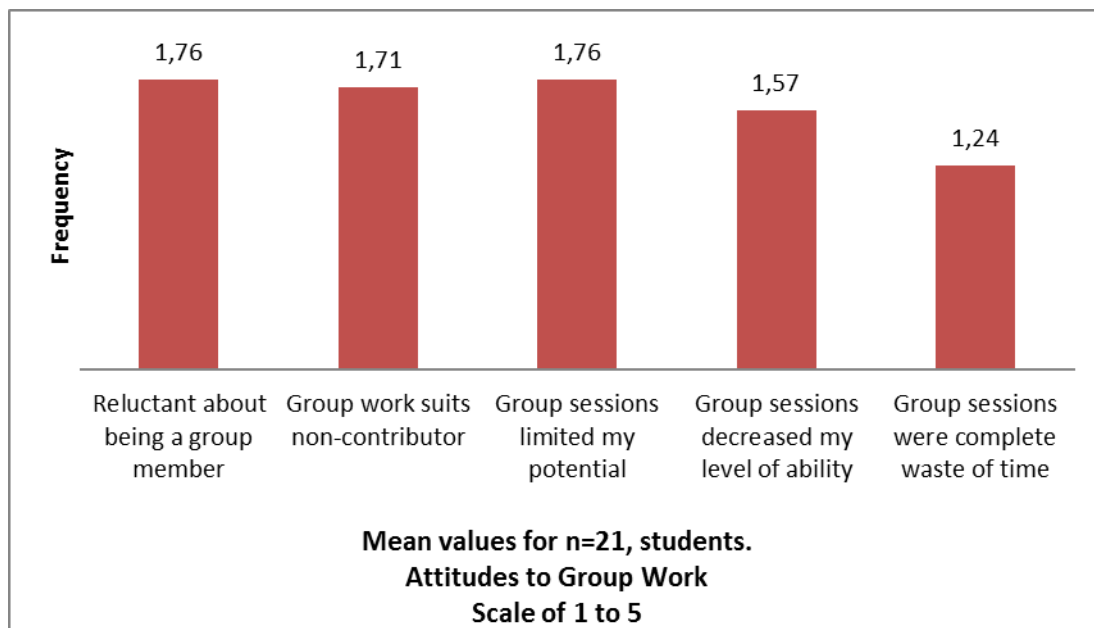

**Graph 3 Attitudes to Group Work**

Attitudes to Group Work

On a survey scale of 1 to 5 and from above graph 3 we can see that students did not feel reluctant being a group member, they did not feel that group work suits only for non-contributors; they did not feel that group work sessions were complete waste of time. Overall the students were very positive with the group work activities.

Measuring the 21st Century Skills
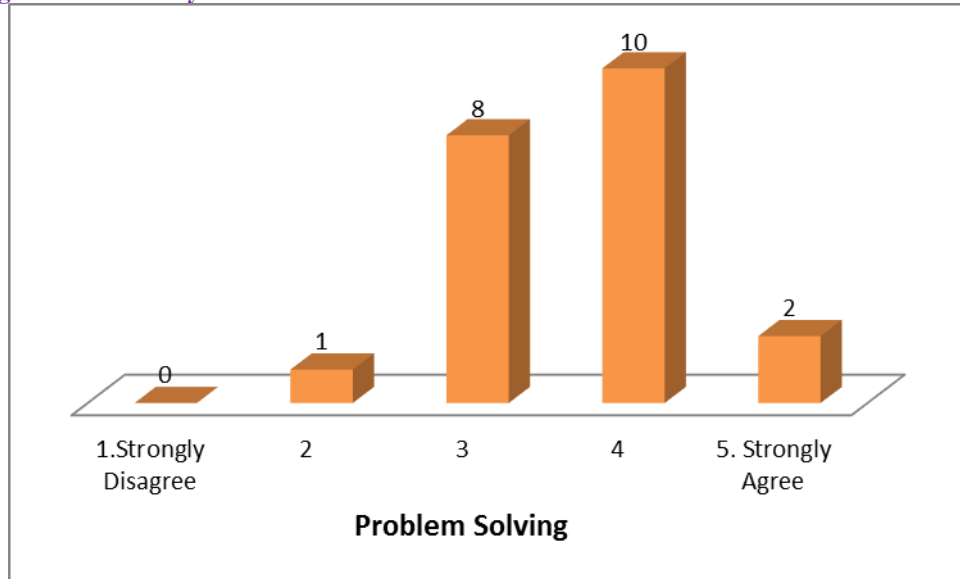

Graph 4 Problem Solving

From the above graph 4 we can observe that 47.61% agree that their problem solving skills has increased considerably, 38% were in a 50-50 decision, 9.5% strongly agree that their problem solving skills in group work has increased. This shows a positive outcome on one aspect of group work workings.
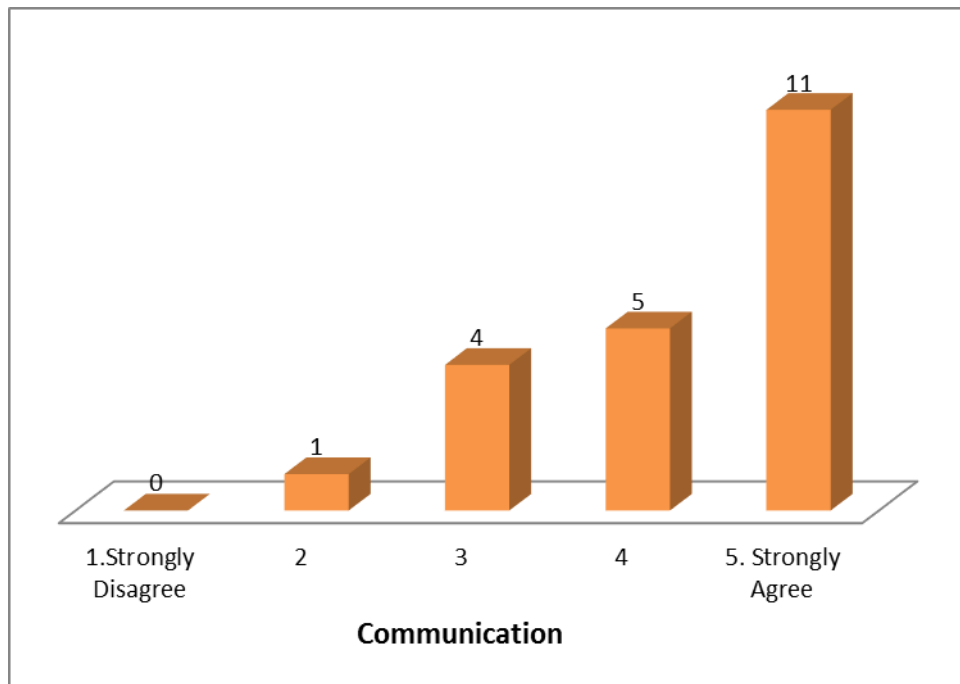
Graph 5 Communication skill

Communication plays a very important role in our day to day life as is one the important criteria of industry as a 21st century skills which employer looks at, from the above graph 5 we can observe that 52% strongly agree that their communication skills has been increased in group work, 23% agree for the improvement in the skills and 19% are in the mid decision, as a positive outcome none of the students strongly disagree about the communication skills in the group work.
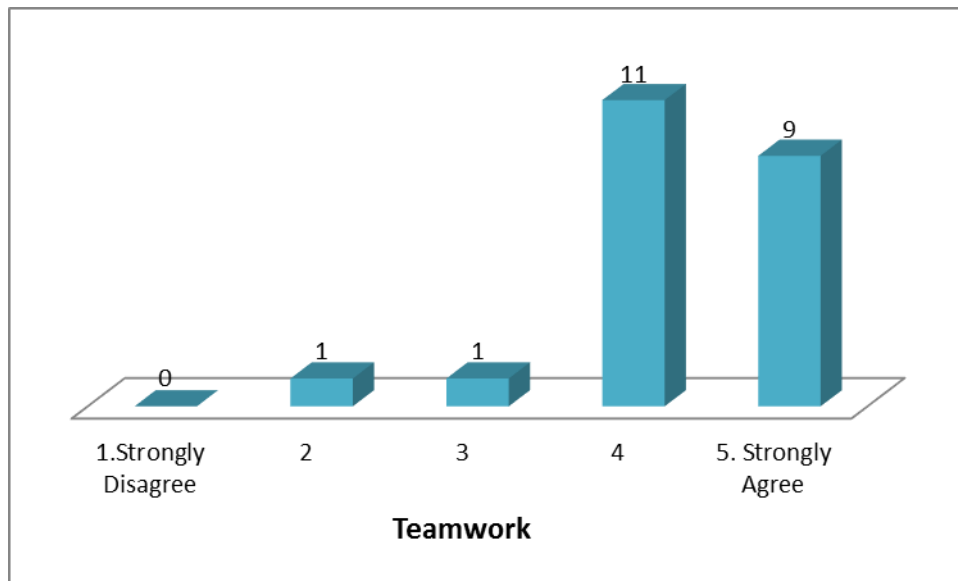
Graph 6 Teamwork Skill

Regarding teamwork skills from the above graph 6 we can observe that 42% strongly agree, 52% agree that their teamwork skills has increased a lot working in group work which is a positive sign for the skill improvement in a student working in groups.
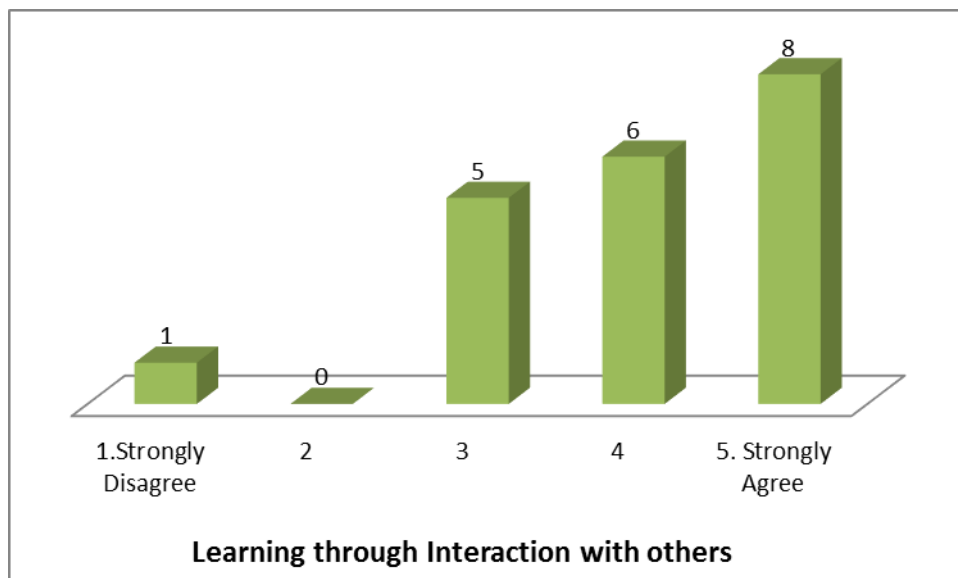
Graph 7 Learning through interaction with others.

Learning through interaction with each other will enhance learning in the group work from the above graph 7 we can observe that 38% strongly agree, 28% agree and 23% have 50-50 outcome, only 4% student strongly disagree with their skills improvement.

4.2 Analysis based on groups formed
For the entire class 5 groups were made, group vary in size with either 4 to 5 members. For keeping the students name as anonymous group were named as Group A, Group B till Group E, and members as 1A, 1B, 1C and so on.

Group analysis was done based on several factors like.
- Self and peer assessment by their own group.
- Marks obtained in individual report writing.
- Individual Marks from the group grade.
- Overall group work performance of all groups.

- Overall project evaluation using mean and standard deviation.

Content validity approach was used to check the validity of the questionnaire used, internal consistency reliability approach was used to assess different test which produce similar result.

4.2.1   Analysis as per Self and Peer Assessment

As per (Boud, 1990) self and peer assessment was "fundamental to all aspects of learning" and it inspires the growth of the student, who possess a good amount of individuality and who is ready to become a enduring learner, it reflects the rising need of the student and to give them an added dynamic role in handling their own learning and sufficing the requirement of industrial world for creativity, flexibility and can cope with any situation in the work place.

 All the students were assessed on six parameters mention below.
a)   Level of enthusiasm / participation
b)   Suggesting ideas.
c)   Understanding what was required.
d)   Helping the group to function well in a team.
e)   Organising the group and ensuring things get done.
f)   Performing tasks efficiently.

Refer to Appendix 13.6 for the self and peer assessment form
Table 1: Group A self and peer assessment marks

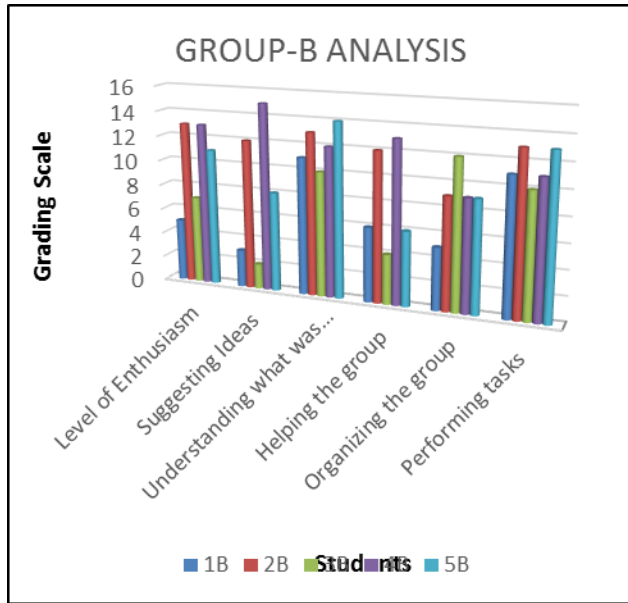| Self and peer assessment	Group-A			
Marks Awarded to:	Student -1A	Student -2A	Student -3A	Student -4A
Level of enthusiasm / participation	12	12	12	8
Suggesting ideas.	10	12	12	12
Understanding what was required.	10	11	8	12
Helping the group to function well as a team	12	11	12	12
Organizing the group and ensuring things got done	11	12	12	12
Performing tasks efficiently	12	12	12	12
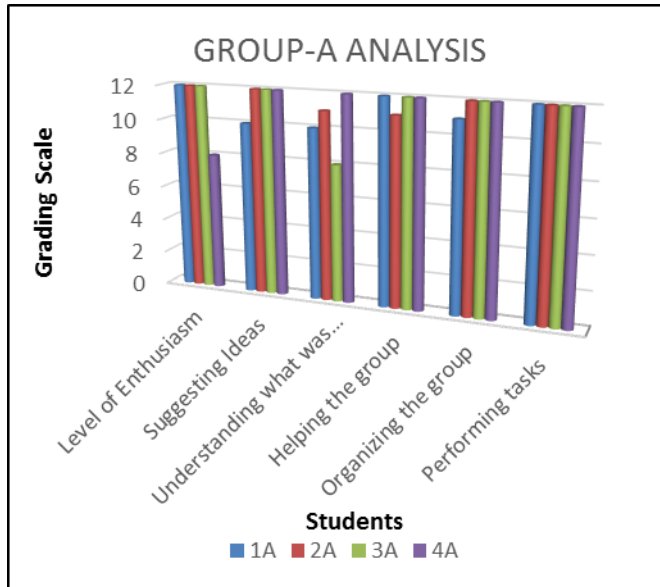
Graph 8, Group A self and peer assessment marks
As we can see from the marks and the graphs all the members of the group did extremely well in participating in all areas of the group work.

Table 2: Group B self and peer assessment marks

Self and peer assessment	Group-B				
Marks Awarded to:	Student-1B	Student-2B	Student-3B	Student-4B	Student-5B
Level of enthusiasm / participation	5	13	7	13	11
Suggesting ideas.	3	12	2	15	8
Understanding what was required.	11	13	10	12	14
Helping the group to function well as a team	6	12	4	13	6
Organizing the group and ensuring things got done	5	9	12	9	9
Performing tasks efficiently	11	13	10	11	13

GROUP-B ANALYSIS

Graph 9, Group B self and peer assessment

Very high variations seen in group B in all areas of work as per marks and graphs

Table 3: Group C self and peer assessment marks

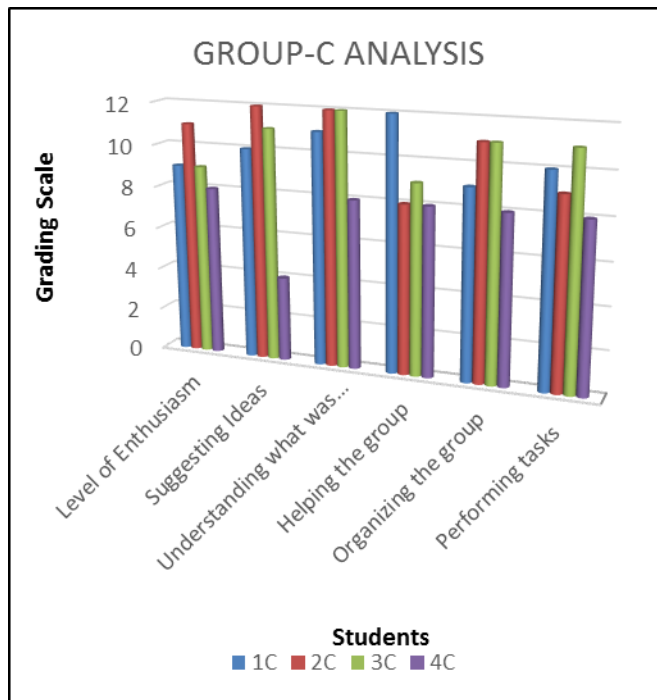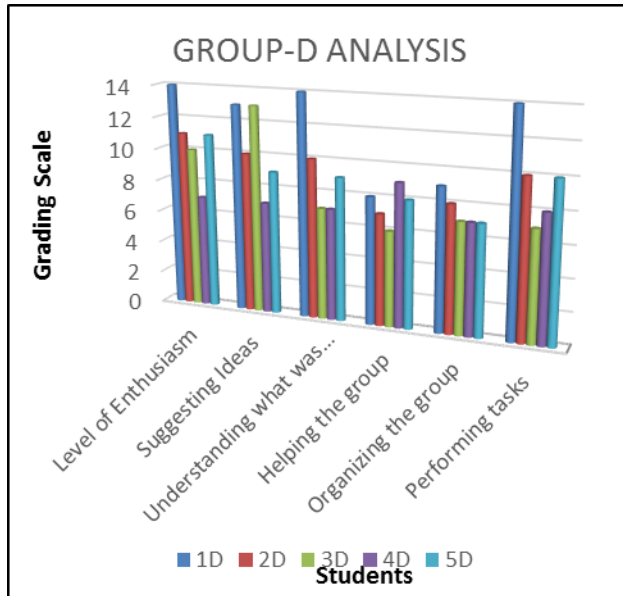| Self and peer assessment	Group-C			
Marks Awarded to:	Student -1C	Student -2C	Student -3C	Student -4C
Level of enthusiasm / participation	9	11	9	8
Suggesting ideas.	10	12	11	4
Understanding what was required.	11	12	12	8
Helping the group to function well as a team	12	8	9	8
Organizing the group and ensuring things got done	9	11	11	8
Performing tasks efficiently	10	9	11	9

Graph 10, Group B self and peer assessment

High variations seen in group C in all areas of work as per marks and graphs

Table 4: Group D self and peer assessment marks

Self and peer assessment	Group-D				
Marks Awarded to:	Student-1D	Student-2D	Student-3D	Student-4D	Student-5D
Level of enthusiasm / participation	14	10	10	7	11
Suggesting ideas.	13	10	13	7	9
Understanding what was required.	14	10	7	7	9
Helping the group to function well as a team	8	7	6	7	8
Organizing the group and ensuring things got done	9	8	7	7	7
Performing tasks efficiently	14	10	7	8	10

Graph 11, Group D self and peer assessment

**Very high variations seen in group D in all areas of work as per marks and graphs.**
We can see that student 1D has performed well in some areas apart from others.

Table 5: Group E self and peer assessment marks

Self and peer assessment	Group-E				
Marks Awarded to:	Student-1E	Student-2E	Student-3E	Student-4E	Student-5E
Level of enthusiasm / participation	8	9	10	5	11
Suggesting ideas.	9	9	9	7	12
Understanding what was required.	8	9	11	7	12
Helping the group to function well as a team	9	9	10	7	12
Organizing the group and ensuring things got done	7	9	9	7	7
Performing tasks efficiently	7	7	9	6	8
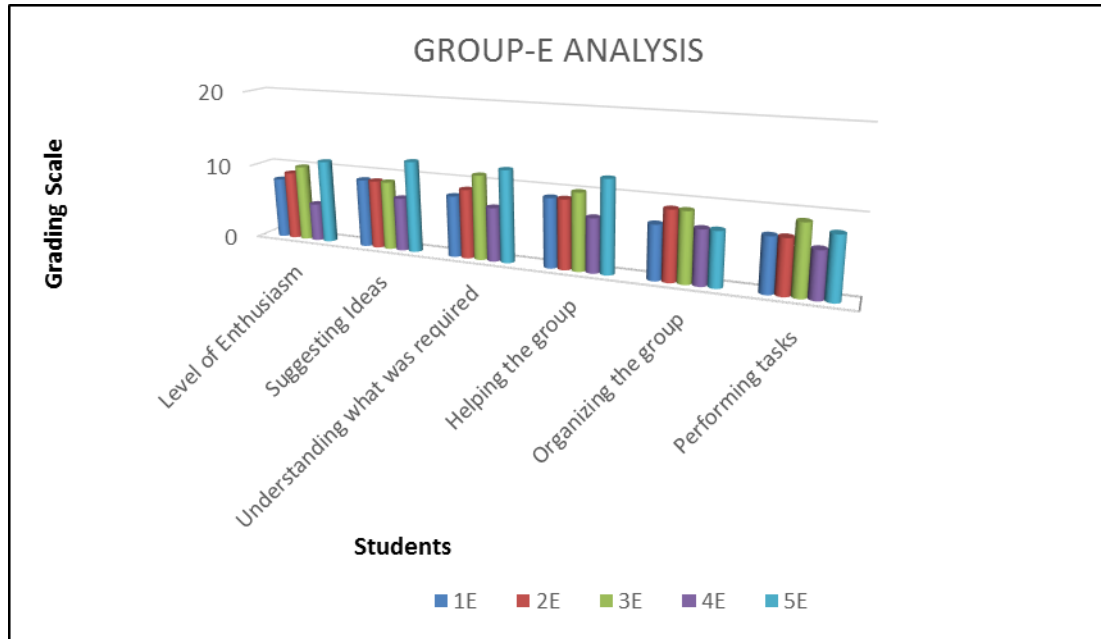
Graph 12, Group E self and peer assessment

Not much contribution was seen from all the students, students 3E and Student 5E did a consistent work in most of the areas

6.2   Observations for all groups

Table 6: Grading of all groups

	High	Medium	low
Level of enthusiasm / participation	A	E	B
Suggesting ideas.	A, C	D	B
Understanding what was required.	C	A	D
Helping the group to function well as a team	A	E	D
Organizing the group and ensuring things got done	A	C	D
Performing tasks efficiently	A	B	E

Group A- Highest performer as per self and peer assessment
Group E- Medium performer as per self and peer assessment
Group B & Group D- Lowest performer as per self and peer assessment

NOTE:
Self and peer assessment was done in front of the tutor in a closed room with one student at a time as well as other student were not able to see how much their group member has contributed .
**The format of self and peer assessment was adopted from Goldfinch (1994)**
**Refer Appendix 13.5 and 13.6 for further reference**

6.4 Students group marks comparison & Overall performance of groups.
In the below graphs we have compared the each groups report writing marks and individual marks obtained from the group grade.

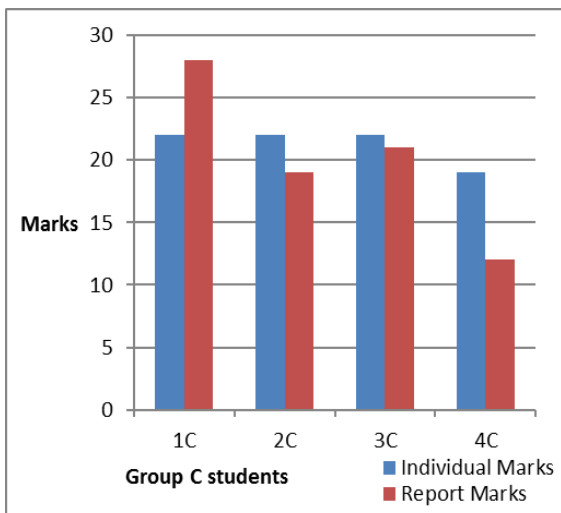From the below graphs we can see that group A has done excellent work in gaining individual marks as well as in report, group E has also shown good performance in both works, group C are the average performer and group B & D are the least performer.
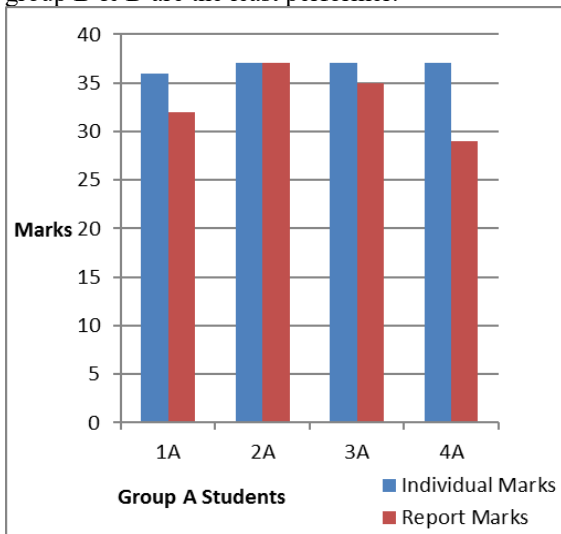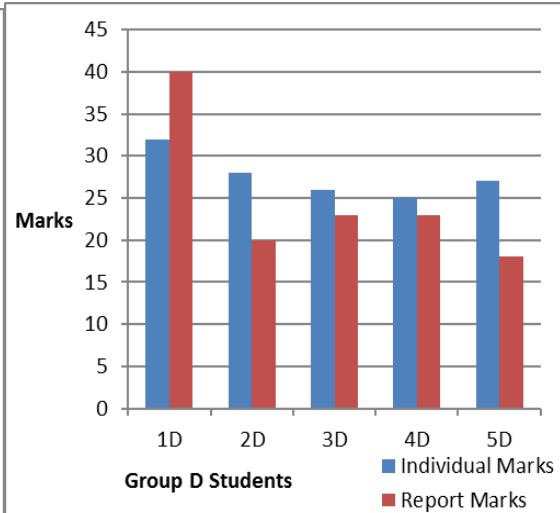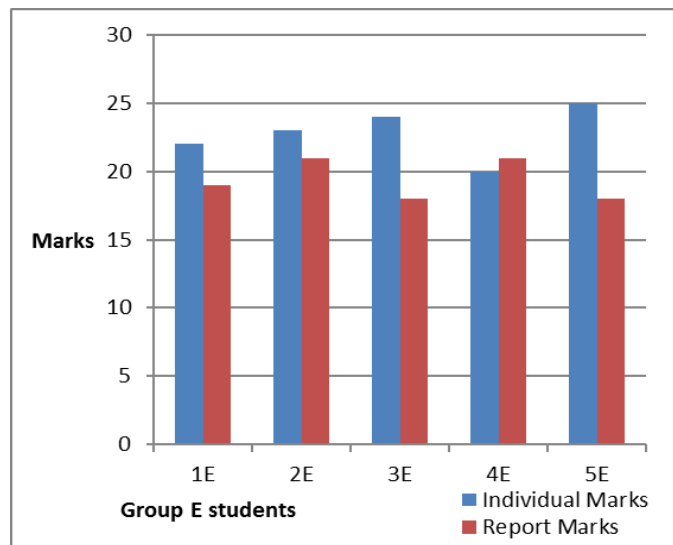

Graph 13: Group A marks
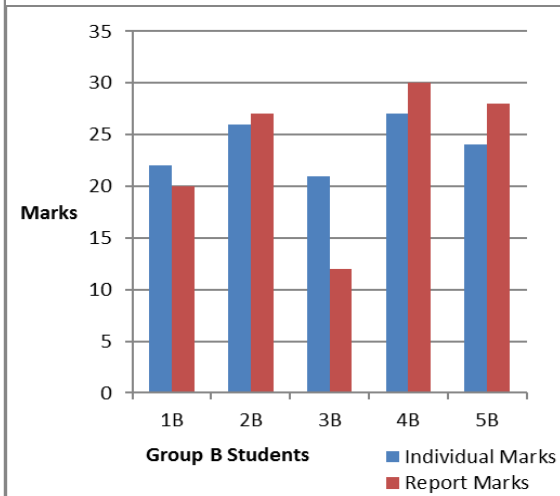
Graph 14: Group B marks

Graph 15: Group C marks

Graph 16: Group D marks

Graph 17: Group E marks

Overall Performance in group work
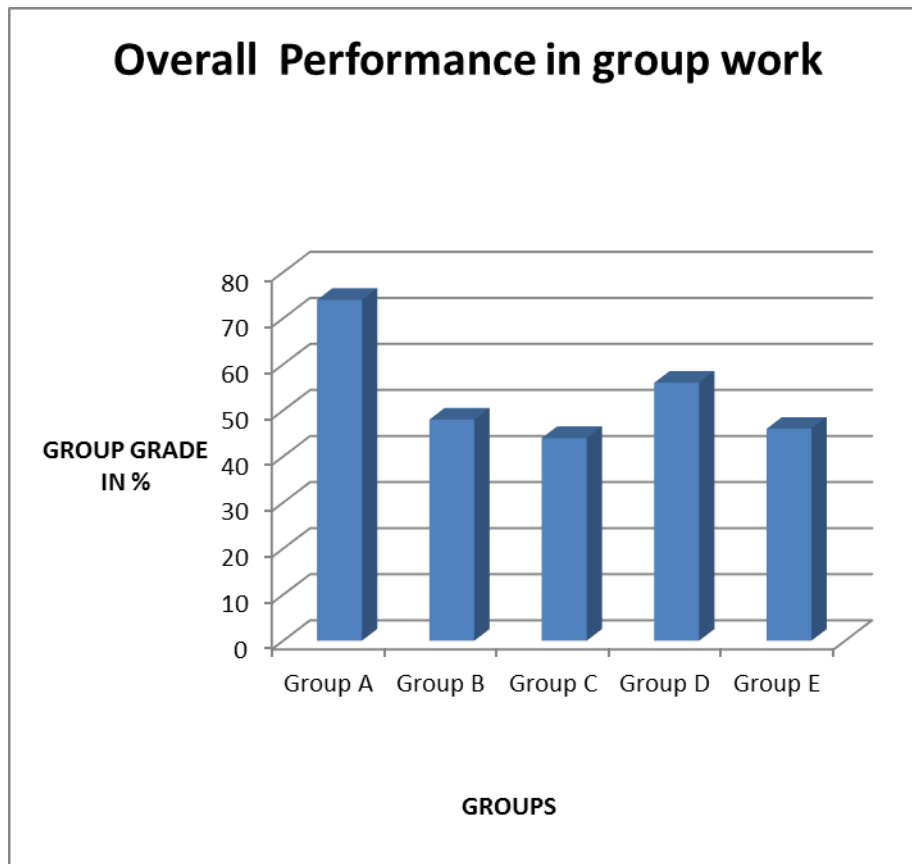
Graph 18: Overall group performance

In the overall performance graph, group A leads, following with group D, then group B & E showing equal performance with the least performance shown by group C

Note:
Refer Appendix 13.8 for overall group performance marks in detail.

7   Overall Project Evaluation
For evaluating the success of the project, the students n=21 completed a detail questionnaire as shown in the Table 1 below from total 23 students.
The questionnaire was built on three areas i.e.
a)   Development of skills
b)   Attitudes towards group work
c)   Attitudes towards assessment
For analysis purpose mean and standard deviation were calculated from all the 21 students' response.
The **mean** is the **average** of all the numbers, here n=21.
The **standard deviation** is a measure how spreads out numbers are across the mean.

Note:
All students' responses are scanned and attach in extra documents in the Moodle as a form of evidence.

Table 7: Group Work Project Evaluation questionnaire results, (n=21)

	Mean Rating	Standard Deviation
Developments of skills. (1= Strongly disagree, 5=Strongly agree)		
How do you feel the exercise has improve the following skills:		
Problem solving	3.5	0.74
Leadership.	3.4	0.92
Research	4.3	0.79
Study	3.8	0.98
communication	4.1	1.06
Time management	3.2	1.04
Presentation	3.9	1.02
Peer assessment	3.9	0.66
Self-assessment	3.9	0.92
Subject knowledge	4.0	0.65
Teamwork	4.1	0.79
Attitudes to Group work (1= Strongly disagree, 5=Strongly agree)		
It was easy to work collaborate in the group	3.4	1.59
I learned more through interaction with others	3.6	1.07
The group work sessions:		
(a) Were enjoyable	3.7	0.86
(b) Helped me to learn	3.9	0.95
(c) Enhanced my motivation/interest levels	3.9	0.92
(d) Help me integrate more with other students	4.1	0.95
I feel reluctant about being a group member	1.7	1.01
I feel that group work only suits the non-contributor	1.7	1.24
The group sessions:		
(a) Limited my potential	1.7	1.01
(b) Decreased my level of ability	1.5	0.84
(c) Were a complete waste of time	1.2	0.52
Attitudes to assessments (1= Strongly disagree, 5=Strongly agree)		
I felt the peer assessment was fair and correct	4.1	0.81
Group session increased my ability to assess myself And peers in a more analytical way	4.1	0.70
I felt uncomfortable about assessing other groups	2.3	1.08
I would prefer not to assess members of my own group	2.1	1.03

Adopted from: Paul Humphreys, Victor Lo, Felix Chan, Glynn Duggan (2001), Developing transferable group work skills for engineering students, International journal of engineering education, Vol 17, No 1, pp. 59-66

a)   Development of Skills

In terms of **development of skills,** the marks are ranging from **3.9 (peer assessment)** to *(teamwork-4.1)* with score averaging from 3.8 over the 11 categories specified in the development of skills category, a score greater than 3.0 can be seen as positive response to the skill development, the mean values rating suggest that the process adopted to develop transferrable personal skills to have been successful.

b)   Attitudes towards group work
In terms of **Attitudes towards group work,** a favorable reaction was attained for easy to collaborate in a group (3.43) and they learned more through interaction with others (3.62), it helped them to learn (3.9). The response also indicate the students were content in being a part of a group (1.7) and they do not feel that group work suits only non-contributor (1.7), the students feel that group sessions benefited and not a waste of time (1.2).

c)   Attitudes towards assessment
Attitudes towards assessment indicate that students felt that peer assessment was fair and correct (4.1), however with respect to applying peer evaluation they were indifferent to evaluating other groups (2.3) and to being evaluated by fellow students of their own group (2.1).
The overall standard deviation seen is very close to the mean in most of the cases.
From the above statistics we can say the process adopted for the group work was a success

8   Summary of the findings
As per the analysis done for all the group we have seen that all students participated in group work and found it very interesting, as per the findings seen in the table 7 for overall project evaluation we have seen that the students agree that their development skills has been increased because of group work, they were able to interact to each other and share their ideas in the group. Students had already worked in a group work but they found the current rubric very interesting because they were able to show their individual work through individual presentation, taking team roles for their work and participating in meetings for which students created a Padlet as evidence to upload their work.

Group A can be seen doing well in all the areas with all members actively participating in all the tasks followed by group D, Group A marks were extremely good and have shown proper response throughout the group work. Group D was the lowest performer in all the areas as we see the students were not able to keep a track of their work with poor meetings and unable to share their ideas properly within the group.
Some students feel reluctant to assess other groups as well their group members. With the help of mean and standard deviation values we can see that the standard deviation values are very near to the mean which indicates that the process adopted for the group work was a success.

9. Recommendations
Based on the data analysis and keeping in mind the limitations of this research project presented above, the following recommendations can be made.

Group formation— Current students had preferred forming their own groups based on friendship. However, working in the same group may not be very effective because of postponement of work. There are numerous methods in which groups can be assembled and several norms that can be used to form groups and assess your students' proficiency. One way is to create Tutor formed groups where in each group there will be a combination of students to include intelligent students with weak ones.

Record Group meeting — Many groups had not met frequently to discuss agenda and progress which then led to delay in tasks and incoordination. It is very difficult for students to organize their schedules.
Students need to know the importance of regular meetings with an agenda. Substantial extent of tasks can be completed in short durations, only if the group is familiar with what task is scheduled next. Hence groups should maintain a record of their meetings. The record should include the members present, date and time of meeting, discussion topic, outcome, and any problems faced, proposed solutions and when to meet next.

Interim reports and group progress feedback- It was observed that some groups were reluctant to discuss their group work progress on a regular basis. This affected the quality of work presented directly at the final stage.
Formative assessment marks can be included in the rubric for Interim Report submissions so that it will compel groups to meet the Tutor for group progress feedback and improve the quality of their work.

Team-building exercises to build cohesive groups— In the action research project no team building exercises were conducted. So it is recommended that activities like group discussion or debate, referring of books on Teamwork to students by Tutor should be conducted.

Importance of Self and peer assessment

Some students were reluctant to perform Self and Peer assessment. The students need to be enlightened about these areas since that would help them realize what they can learn from others and what they are themselves good at.

10.   Conclusions

From the overall group work project evaluation we have seen that the action research project on the group work has overall helped the students to develop transferable skills, teamwork skills and social interactions as well as learning about beliefs and attitudes. Also we can see that the students agree that their leadership skills has been increased which is the requirement of any industry, the curriculum product and process model along with constructive alignment has seen students achieving the outcomes very easy for their group work process.

As a tutor implementing a group work with the product and process method made me learn how student understand working in a group, how the development of rubric plays a very important role in group work and how important is for a student to achieve his own grade when working in a group, also I have seen that students are more reluctant to do self and peer assessment for themselves and for their group members as well as other groups, for the future works self and peer assessment awareness needs to be increased and should be adopted in all the works.to increase the comfort in evaluation.

11.   Further Study

From the current findings of the action research project and recommendations further study can be done in the following areas.

1) Various ways of Group formation methodology needs to be explored. Example tutor recommended groups.
2) Techniques and tools to perform Self and peer assessment can be probed.
3) Different Team-building exercises can further be investigated to build cohesive groups.
4) (Goldfinch,1994) method of transforming group grade to individual grade by integrating a weighted grade allocated by the tutor can be explored.
5) Making more improvement in the rubrics so that student has more accountability of their work in groups.
6)   SWOT analysis can be implemented in the group work at various intervals to understand the progress.

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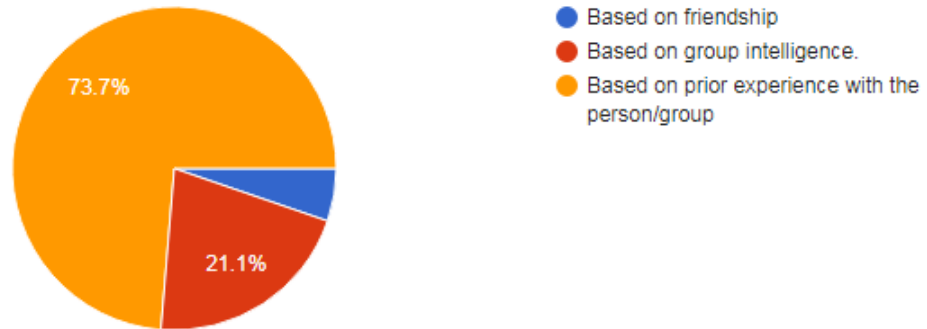
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12. **APPENDIX**

13.1 Initial Student Survey Questionnaire for Group Work

1) How do you choose group.

19 responses

- Based on friendship
- Based on group intelligence.
- Based on prior experience with the person/group

2) Have you work in the group projects before. How many times?

19 responses

- 0
- 1
- 2
- 3
- 4
- 5
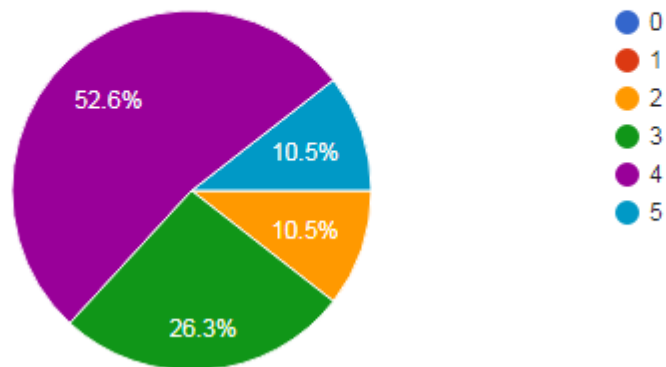
3) How do you find working in a group?

19 responses

- Good
- Very Good
- Not so Good
- Don't know
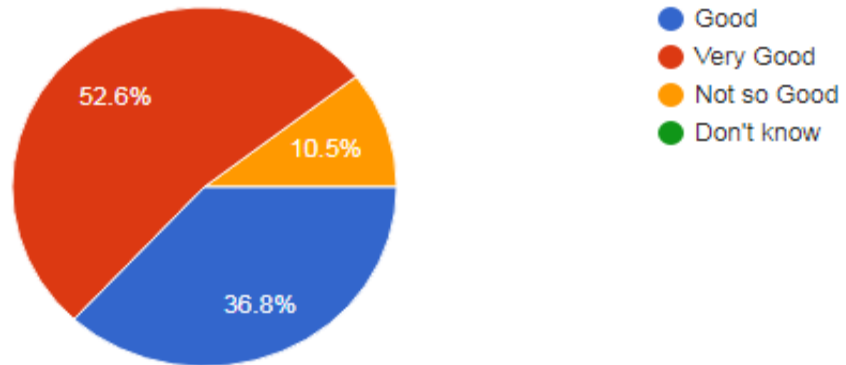
4) What do you prefer, individual or group assignments?

19 responses

- Individual
- Group
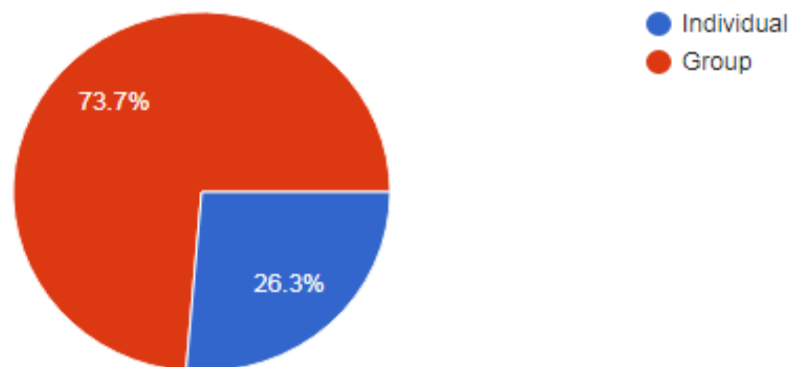
5) Which do you prefer when working on a group assignment?

19 responses

- ● Splitting up the work
- ● Working Together.

47.4%

52.6%
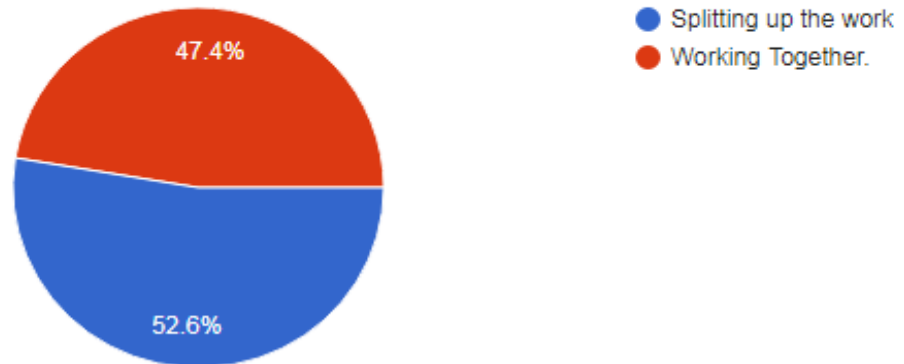
6) Which strategies will you use to encourage fair contribution from all members to a group assignment?

19 responses

- 10 (52.6%)
- 10 (52.6%)
- 7 (36.8%)
- 14 (73.7%)
- 4 (21.1%)
- 12 (63.2%)
- 8 (42.1%)
- 3 (15.8%)

Have meetings
Count: **14**
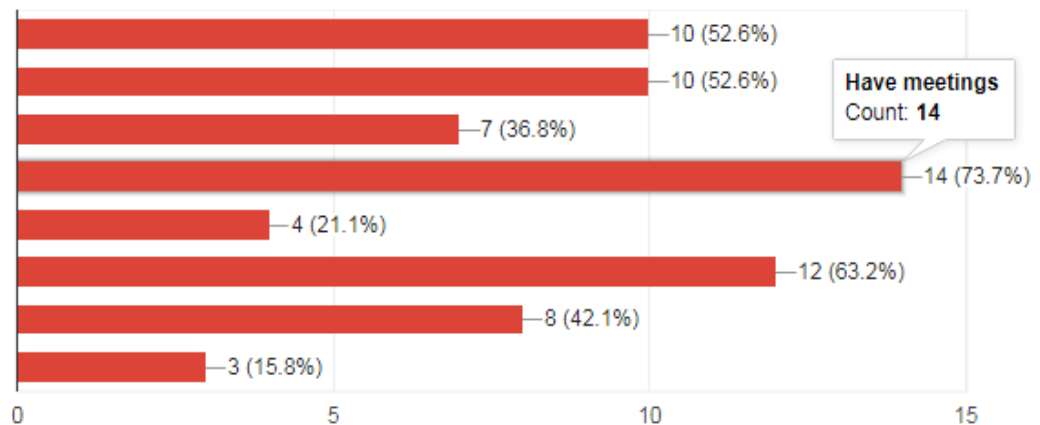
7) Which communication tools will you use for group communication if you are not physically together?

19 responses

- The University's e-mail system
- Phone and messaging
- Messaging only

84.2%

15.8%
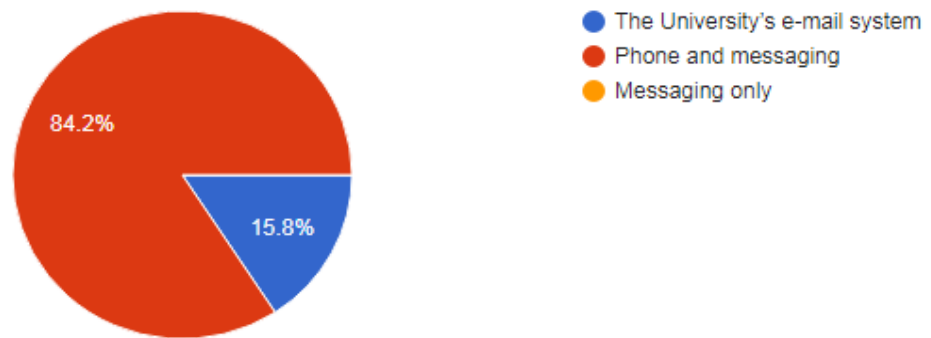
8) What skills do you feel you can develop when you work on a group assignment?

19 responses

Team work skills
Count: **13**
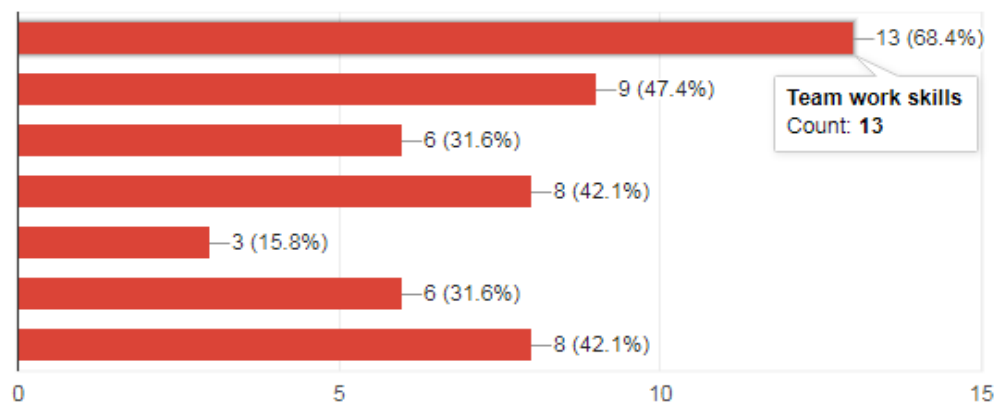
9) What do you feel is the biggest benefit of working on group assignments?

19 responses

- Good team-work skills
- Shared workload and ideas, and improve grades.

63.2%

36.8%
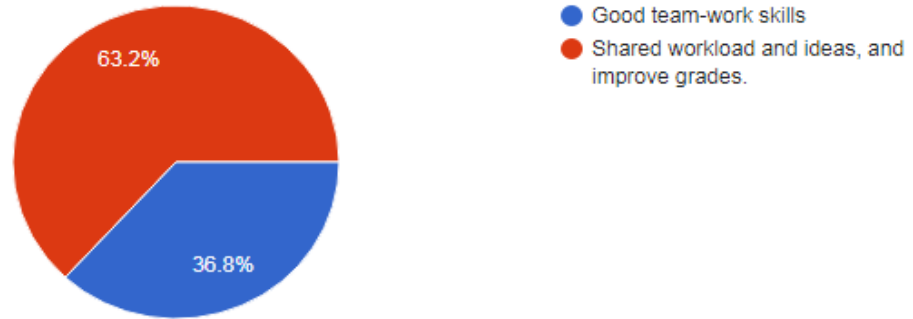
10) What do you feel is the biggest drawback of working on group assignments?

19 responses

- Uneven contribution,
- Rely on others,
- Poor commitment and attitude,
- Poor time management,
- low ability and contribution

15.8%
21.1%
15.8%
42.1%
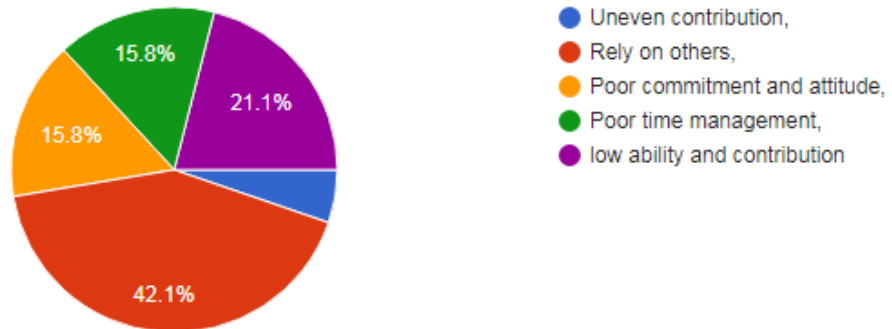
13.2 Questionnaires for Teachers/Tutors about their experience of Group Work

1. Which student groups do you work with (i.e. subject area and level)?

8 responses

Accounting
Level 4 & 5 Higher education
Mechanical Engineering - HEL4
Engineering Level 4 & 5
HE4,HE5,HE6
both
Subject area
Level 5 -Software Based System Analysis and Design

2. Why do you use group work with your students?

8 responses

Innovations
a. requirement of the module assessment. b. in skill-based curriculum team work is essential. So students are exposed to group work
Formative assessments
It is required in their curriculum
YES
group evaluation
As part of summative assessment
To encourage building up of ideas and the importance of team skills

3. What do your students gain from working in groups?

8 responses

Develop Teamwork skills

a. learning from each other in accomplishing a particular task
b. learn how to work in groups

Collaborative ideas, summarize/revise topics learnt, discuss/share information etc..

team work

CONFIDENCE,TEAM PLAY,LEADERSHIP SKILLS,COMMUNICATION SKILLS

group based learning

Working in cohesion, sharing knowledge, team work

1)They learn to support the ones who are weak, 2)they learn to respect others opinions and 3)understand how to come to a common solution despite of starting with different opinions.4) Collaborative thinking[One starts an idea, other builds around it]

4. What are the main group exercises and activities which you give students to perform?

8 responses

Report preparation

a. presentation
b. team-based projects and tasks

group discussion and presentation to the whole of the class

group projects

HANDOUT FOR EXERCISES IN CLASS,PROJECTS

project preparation, project presentation

case study discussions

Problem Analysis and Propose Solution.

5. What are the most useful group-work resources (e.g. books, websites etc.) which you use as a lecturer?

8 responses

Books, journals, websites
Belbin's team theory and assessment
journals, newspaper clippings, website resources
projects
WEBSITE
multiple
Books and websites
Books

6. What are the most useful group-work resources which you recommend to students?

8 responses

Books and journals
Belbin's team theory and assessment
websites
blog
WEBSITE
online
Books and websites
Books

7. How do you assess student groups and their work?

8 responses

Group and individual

Group output and individual participation

visual assessment on their participation, oral questionnaire etc..

blog and viva

YES

based on specific criteria

Individual contribution and Q&A sessions

The work is split in two Categories:Individual and Group work. In Group work, I check who brings forth which points/ideas.

8. What are the main issues which your student groups confront?

8 responses

Taking decisions

individual participation and performance within the group

uneven participation.

passive learners

FREE RIDERS IN A GROUP,MOTIVATION FOR SELF DIRECTED STUDY

role clarity

Social loafing and avoiding responsibilities

Some team members do not participate as much as others do.

9. What feedback have you received from students concerning their group work?

8 responses

Happy than individual work

Some do not like group work

same, complaints on uneven participation

some are inactive in the group

MORE ACTIVE IN A GROUP RATHER DOING ALONE

moderately ok

Lack of synergy, goal congruence, lack of participation

That some do not perform the given activity (sometimes activity dependency is present) which delays the entire assignment.

10. How do you prepare your students to undertake group work? What theories and concepts are they taught and what resources do they need?

8 responses

Theories of group behaviour

Familiarize them with group work concepts and application

usually they would be briefed about the general topic, they would be asked to research online for various sources, check if they are on right track, put specific questions to be discussed and later ask students to present before the class.

clear assignment tasks are given for group work

PLANNING,TIME MANAGEMENT

class lectures and preparatory sessions

Have yet to use or test theories. Specific guidelines and marking criterias are shared

They are advised to conduct meetings and record minutes of meeting. This helps to understand who are present and what work is achieved by whom by that time.
A Timeline Chart/ Gantt Chart also is helpful in this case.

11. What research would you like to see concerning student groups?

8 responses

Promotes students learning

how to assess accurately group work

to encourage even participation

how to bring passive learners to active in group

HOW TO ASSESS INDIVIDUAL CONTRIBUTION OF A GROUP WORK EFFECTIVELY

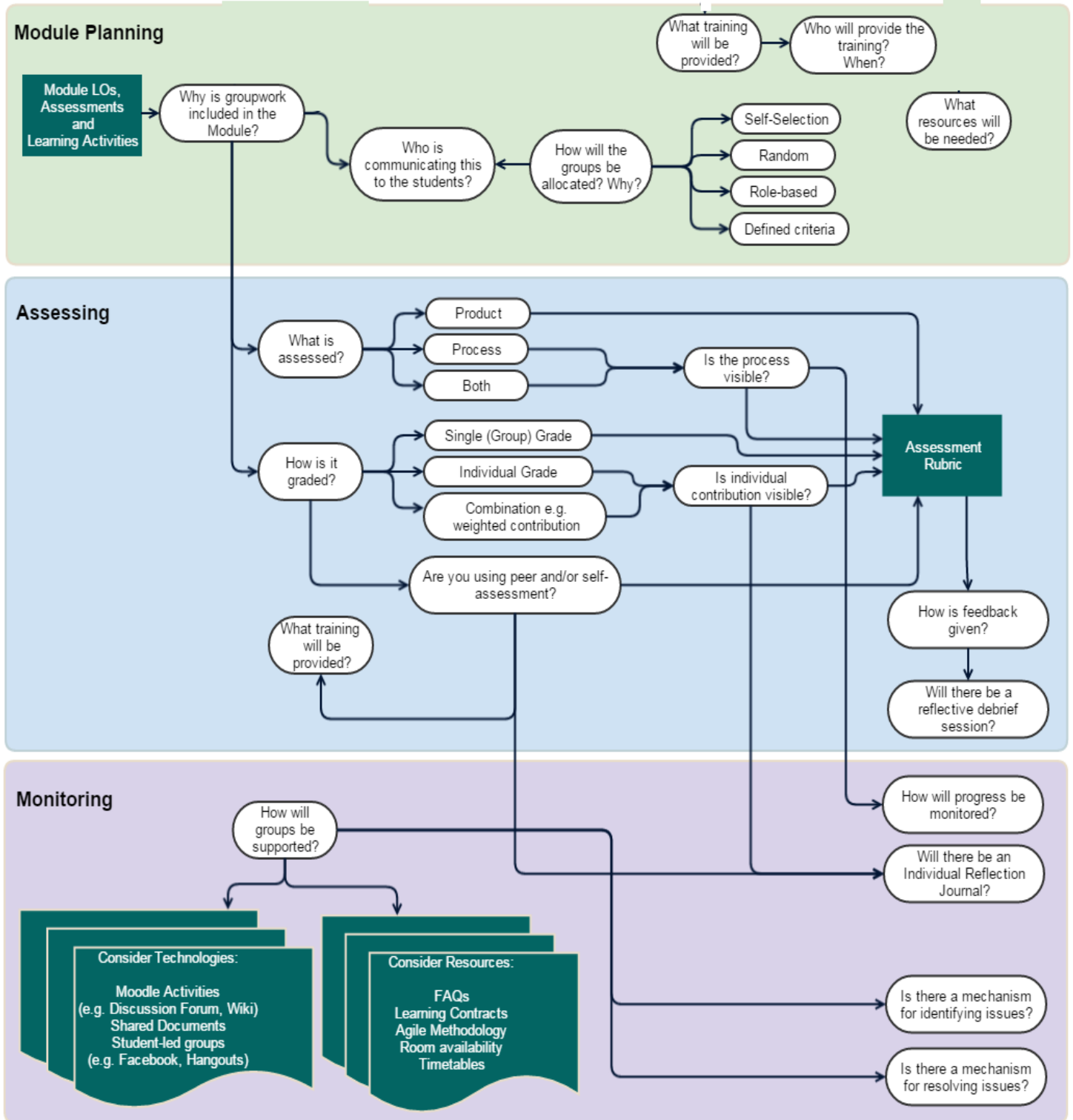individual contribution and individual learning from group work

Use of academic sources

I would like to undergo more training in assessing Group Work as to how to motivate each student to put in his best efforts.
The 5 and 6 question has brought forth a very insightful point. I would like to pursue these more to train students regarding Group related rules, ethics and guidelines.

13.3 Group work Framework

13.4 Methodology flowchart for group work assessment.

LEVEL 5-AME 5005
AUTOMOBILE / MECHANICAL DESIGN
COURSEWORK 1- 50 % (GROUP WORK)

SUMMATIVE ASSESSMENT

GROUP WORK RUBRIC

PRODUCT- 50 Marks

PROCESS- 50 Marks

5 Groups, Group size 4 to 5 students,

Grading / Evaluation

Group Work- 50 Marks   **Individual Report- 50 Marks**

Group Grade converted to Individual grade

Using Conway *et al.* (1993) and Goldfinch (1994) self and peer assessment approach

MONITORING THE PROCESS

1) Through Contracts.
2) Roles and Responsibilities assigned.
3) Meetings and Shared Discussion.
4) Maintaining work logs

13.5 RUBRIC PLANNING
13.5.1 Development of New Rubric for Group Work

No.	Criteria	Marks
I	**Individual Assessment**	**50**
1	Individual log sheet of meeting with tutor.	5
2	Individual report	
	• Introduction to the design assignment	5
	• Creation of PDS (Product Design Specification)	5
	• Calculations	10
	• Solid work part model	5
	• Solid work assembly	5
	• 2D drawings with Bill of materials.	5
3	Presentation The presentation should reflect your individual contribution towards the project.	10
II	**Team Assessment**	**50**
1	Allocation of work with consent.	5
2	Issues Identified about the system	10
3	Market research.	10
4	Proposed system design (at least 3 design)	5
5	Proposed material selections for the system design.	10
6	Minutes of meetings held by the group (Project log using Padlet)	10
	Total	**100**

13.5.2 Old Rubric of group work for the same class for different module

MARKING SCHEME & WEIGHTAGE OF ASSESSMENT

1. Group Presentation		**50%**
2. Individual Report		**40%**
Report will be marked out of 100marks		**Marks**
General presentation of report		10
Design		30
Manufacturing		20
Testing		15
General discussion and conclusions		15%
Overall clarity and lucidity of Report		10%
3. Blog		**10%**

13.6   Team Contract

Team Name: _____

Date:_____

GOALS: What are our team goals for this project? What do we want to accomplish? What skills do we want to develop or refine?

EXPECTATIONS: What do we expect of one another in regard to attendance at meetings, participation, frequency of communication, the quality of work, etc.?

POLICIES & PROCEDURES: What rules can we agree on to help us meet our goals and expectations?

CONSEQUENCES: How will we address non-performance in regard to these goals, expectations, policies and procedures?

We share these goals and expectations, and agree to these policies, procedures, and consequences.

_____

Team member name

_____

Team member name

_____

Team member name

_____

Team member name

_____

Team member name

13.7 Possible Roles on Teams

Student teams often function most effectively when members have designated roles. These can be instructor-determined or established by the groups themselves, e.g., by giving teams a list such as the one below and asking them to decide on and delegate appropriate roles within their group.

The roles you – or your students – assign will depend on the goals of the assignment, the size of the team, etc. They can be fixed or rotating. Here are some possible group roles, but the list is not exhaustive. Think creatively and come up with your own!

Facilitator:	Moderates team discussion, keeps the group on task, and distributes work.
Recorder:	Takes notes summarizing team discussions and decisions, and keeps all necessary records.
Reporter	Serves as group spokesperson to the class or instructor, summarizing the group's activities and/or conclusions.
Timekeeper	Keeps the group aware of time constraints and deadlines and makes sure meetings start on time.
Devil's Advocate	Raises counter-arguments and (constructive) objections, introduces alternative explanations and solutions.
Harmonizer	Strives to create a harmonious and positive team atmosphere and reach consensus (while allowing a full expression of ideas.)
Prioritizer	Makes sure group focuses on most important issues and does not get caught up in details.
Explorer	Seeks to uncover new potential in situations and people (fellow team members but also clients) and explore new areas of inquiry.

Innovator	Encourages imagination and contributes new and alternative perspectives and ideas.
Checker	Checks to make sure all group members understand the concepts and the group's conclusions.
Runner	Gets needed materials and is the liaison between groups and between their group and the instructor.
Wildcard	Assumes the role of any missing member and fills in wherever needed.

13.8 **Method of Deriving Individual Marks from a Group Grade**

Appendix 1. Details of Method 1—Conway *et al.* (1993) and Goldfinch (1994)

The method is based around the allocation of a group mark by the tutor to the work produced by the group and manipulation of this group mark to derive a mark for the individuals within the group. The formula adopted is as follows:

Equation 1: Individual student's mark = PA factor × Group mark

where PA stands for peer assessment.

The PA factor is further derived as follows:

Equation 2: PA factor = w% + (100% − w%) × PA score

w% is the percentage of an individual's mark which is taken directly from the group mark. Hence, if w% was 50%, the group mark would count for 50% of each student's assessment regardless of their contribution to the group. So, if a group received a group grade of 60%, every group member would be given 30% as of right, the remainder of their mark reflecting their contribution to the work. This latter contribution is obtained from the PA score.

The PA score is obtained by asking the students to assess each others' contributions on a peer assessment form. Each individual's scores are then added up to give an Individual PA total. This is then divided by the Average PA Total for the group to give the individual's PA score.

$$\text{Equation 3: PA Score} = \frac{\textit{Individual PA Total}}{\textit{Average PA Total}}$$

The PA score reflects the individual's effort in comparison with the other members of the group.

Conway *et al.* (1993) applied this method but used a value of 0% for w% in Equation 2. This means that a student's grade is made up *entirely* of a modification to the group grade to reflect their individual contribution. This modifies Equation 1 as follows:

Equation 4: Individual student's mark = PA Score × Group mark

13.9   Goldfinch (1994) self and peer assessment form example

Group members:

Grading Criteria:

0: Not Contributed;

1: Satisfactory Contributed;

2: Medium Contribution:

3: Full Contribution;

Marks Awarded to:					
Marks Awarded by:					
Level of enthusiasm / participation					
Suggesting ideas.					
Understanding what was required.					
Helping the group to function well as a team					
Organizing the group and ensuring things got done					
Performing tasks efficiently					
Totals					

-Adapted from Conway et al. (1993) and Goldfinch (1994)

;

13.10   Overall group performance marks

Group	Student	Group Grade in %	Individual Marks from Group Grade	Individual Report writing marks
A	1A	74 %	36	32
	2A		37	37
	3A		37	35
	4A		37	31
B	1B	48%	22	18
	2B		26	27
	3B		21	12
	4B		27	30
	5B		24	28
C	1C	44%	22	28
	2C		22	19
	3C		22	21
	4C		19	12
D	1D	56%	32	40
	2D		28	20
	3D		26	22
	4D		25	23
	5D		27	18
E	1E	46%	22	18
	2E		23	21
	3E		24	16
	4E		20	19
	5E		25	18