'TEAM LEARNING' AS AN INNOVATIVE PEDAGOGICAL TOOL: A STUDY AMONG *'EE GENERATION'* IN BANGALORE.

Dr.S. John Manohar.,
Professor – MBA,
BMS College of Engineering,
Bull Temple Road, Bangalore.
johnmanohar.mba@bmsce.ac.in

Abstract: The concept of team learning has gained greater importance in modern Engineering Education and there are many formal recommendations to adopt team culture so as to groom them to face the real life situations after they graduate from Engineering Educational institutions. A descriptive study regarding the usefulness of team learning among 137 Engineering Education (EE) students was undertaken. The focus of the study was on contextual variables. Chi-square tests were employed and it was found that there exists association between and among all the variables considered for this study. It is strongly recommended that the Engineering students be provided with these opportunities so as to enable them to have hands on experience on managing a team in real life situations.

Keywords: Engineering Education, formal recommendations, descriptive study, contextual variables, longevity, association of attributes.

INTRODUCTION

There has been an increased awareness in workplace regarding the importance of 'teams' and hence, managements have started to rely on TEAMS as a new culture to achieve the organisational goals, thereby create surplus (Fowler, A, 1995, Decker, R, 1995,). Hence, the concept of team learning has gained greater importance in modern Engineering Education and there are many formal recommendations to adopt team culture so as to groom them to face the real life situations after they graduate from Engineering Education institutions the future Engineers.

Based on this increased importance on team work in organisations, Engineering Education Institutions have now started imbibing the team culture among their students so as to properly equip them to face their exciting careers. Consequently, they have started providing opportunities to students to experience team work situations in their courses. For e.g. many Engineering Education institutions have been conducting "Cultural Fest" organized by the students of different teams under the guidance of faculty members. However, to date, not much empirical researches have been conducted on how this team culture has added any value to the strength of the students from their perception.

It is in this context, that the author has undertaken a descriptive research approach to study the usefulness of team learning in Engineering education. The focus of the study was on contextual variables like selection of team members, longevity of the team, team selection, team duration and the teachers' role in facilitating the students in accomplishing the tasks assigned.

BACKGROUND AND HYPOTHESIS

Even though many studies have been conducted already with reference to all the contextual variables mentioned earlier, the same have not been done in a student team context.

Method of Selecting Team Members:

Going by the available literatures, even though there are three methods of assigning students to team, the authors have considered only two methods namely *self-selection*, and *teacher selection* for this study (Hackman, J.R (Ed) 1990, Jaffe, E.D and Nebenzahl I.D, 1990).

Self-selection: In this method of selection, students are asked to form their own teams and this self-selection may offer higher cohesion. Studies have proved that cohesion has linkage to high performance (Burningham, C, and West, M.A. (1995, Comer, D.R, 1995). And some studies have also suggested that self-selection may even encourage student members of a team to take more ownership of group problems, and manage interpersonal conflicts more successfully (Bettenhausen, K.L, 1991, Witteman, H, 1991, Strong, J.T and Anderson, R.E, 1990). These self-selected team members quickly form a consensus about its team related norms, which facilitate productivity.

Dr.S. John Manohar.,
Professor – MBA,
BMS College of Engineering,
Bull Temple Road, Bangalore.
johnmanohar.mba@bmsce.ac.in

With regard to problems in self-selected teams, there appear to be a tendency for the team members to be overly homogenous and may also possess an inadequate skill set.

Selection by Teachers: Teachers follow various methods to form teams. E.g. if there are 60 students, the teacher follows a method in which every 12th student is selected as a member of a team i.e. the students with roll nos. : 1, 11, 21, 31, 41 and 51 become one team of 6 members. However in this method of forming a team, there lacks cohesion and the student members not initially take ownership of the group problems which leads to interpersonal conflicts. Based on the above, the following hypothesis has been proposed:

HYPOTHESIS-1 *"In team learning process, Self-selection is much preferred by the students than the teacher selection of members*".

Duration of Team Existence:

Many literatures suggest that a team undergoes four phases of development during its existence.

1. *Forming* wherein members get acquainted with each other and orient themselves to the team task and the team's expectation of them.
2. *Storming*, where in individual roles and personalities emerge and conflict occurs about the team norms
3. *Norming*, wherein the conflicts in the team are resolved, members agree on team norms and cohesiveness is established and
4. *Performing*, wherein the members focus on productive interaction and accomplish the task assigned.

However, in a four year Engineering programme under semester system, where every semester the subjects offered are different and the teachers are not same, the duration of the team existence cannot be taken into account far beyond the course period of four years. Hence, for the purpose of this study a period of four months i.e., one semester as a minimum and a maximum of 4 semesters have been taken into consideration as duration of Team existence, thereby only students of third year and fourth year are considered for this study and the hypothesis for the same is:

HYPOTHESIS-2 *"The duration of the team existence is significant in better performance of the team".*

Marks to team assignment:

Since the author is of the strong opinion that performance is influenced by rewards and the students consider marks / grades for team assignments as prime rewards, it is expected that the students will perform better on those elements of the course that have greater impact on the overall final course marks i.e., if the percentage of the course marks associated with team assignment is quite low, it is assumed that some students may neglect this team assignment altogether (Gosenpud, J.J and Washbush, J.B., 1991). Hence, for the purpose of this study, the author has taken into consideration only the assignments which are of prime importance and holds higher weightage in terms of marks. The hypothesis for the same is being set as:

HYPOTHESIS-3 *"Higher weightage in terms of marks for a team assignment is a significant factor in motivating the students in getting involved in team assignment".*

Team Size:

It is a well-accepted fact that the team size should be kept as small as possible. In a team where the number of members is in large, the performance may decline due to lack of co-ordination. More so, when the individuals feel that their individual contributions are not identifiable and thus not contributing to the performance of the team. Also, the individual may feel that others in the team still be able to execute the work better than they will and so still feeling dispensable to the team, they reduce their effort. It has also been concluded by many researchers that dissension among team members increased with team size (Gentry, J.W, 1980), The size of the team enhances the performances of the team learning process (Mello, J.A, 1993). Hence, the author has considered only teams of size small (less than five members) and large (five and more than five members) as sizes for the purpose of this study and the hypothesis for the same is:

HYPOTHESIS-4 *"Size of the team plays a significant role in enhancing the performance of the team.".*

Instructions by Teachers:

There have been many literatures which suggest that a clear team vision or at least clear team objectives should be there for the teams to work towards. In the absence of clear team vision/objectives, the team members may ponder over as to what the team should be doing. When the teacher has very clear idea about what the team should produce and how the team should go about in achieving the objectives, the same should be clearly communicated to the team members. It is in this context that the author has made an earnest attempt to study whether the expected outcome of the team exercise and the process of achieving this outcome are being communicated to the team members by the teachers. The hypothesis for the same is being set as:

HYPOTHESIS-5 *"Teachers' role in terms of the process and expected outcome of the team assignment helps the team in achieving the objectives of the team assignment".*

METHOD & INSTRUMENT:

The study undertaken by the author focuses on contextual variables explained earlier and how these variables are associated with the team performance. Hence, a questionnaire was developed keeping in view all the variables and the same was administered to the samples selected by the author.

SAMPLE:

The survey was conducted among the students pursuing Engineering Programme in both University Affiliated institutions and Autonomous institutions in Bangalore City. For samples selecting the samples from both, convenience sampling design was adopted, covering the entire length and breadth of the city.

RESULTS:

Among students surveyed 113 students i.e. 82.5 percent were male students and the remaining 24 students i.e. 17.5 percent were female students. Regarding the year in which they are pursuing their engineering programme, 67 were in 3rd year and the remaining 70 students were in their fourth year. With reference to the status of their institutions, 75 were from Autonomous institutions and the remaining 62 were from University affiliated institutions.

The author first conducted a preliminary analysis among a small group of higher semester students, to better understand the factors associated with team performance and the students experience in terms of team learning. It is at this stage the researcher could fine tune the data collection instrument before carrying out the final survey. Using the data collected, the testing of hypothesis and statistical analysis were carried out. The discussion on analysis and recommendations are presented under separate heading. Before proceeding further with data analysis, association of attributes test was conducted and found that there exists association between:

1. Students' preference of selection method and their performance output,
2. Duration of the team and the performance of the team,
3. Size of the teams and the performance of the teams,
4. Weightage assigned to the assignments and the involvement of the students in the team assignments and
5. The involvement of the teachers and the performance of the teams in team assignments.

ANALYSIS:

Out of 150 questionnaires distributed, only 137 completely filled up questionnaires were returned, thus making a response rate of 91.3 percent. The author has used Chi-Square ('χ^2') test at 5% level of significance and found that the *hypothesis – 1* on selection of team members is accepted i.e. in team learning process, students' selection of team members is much preferred by the students than the teacher selection of members.

Regarding duration of team existence i.e., longevity , 108 students in 5th and 7th semester of their Engineering programme have exhibited a high performance by scoring higher marks in team assignments and maintaining a cordial and casual relationship with their team members. This has also been established by using χ^2 test at 5% level of significant and the hypothesis-II is accepted.

With regard to marks to team assignment, as has been discussed earlier, the performance is influenced by rewards and the students do really consider marks for team assignments as prime rewards. This has been supported in this study that 63.5 % of the students have secured high marks in their assignments and hence are of the opinion that higher the weight age of marks to a team assignment, higher will be the involvement of the students.

Table 1. Percentage Analysis

Sl. No	Variables	Attributes	Frequency	%
1	Gender	Male	113	82.5
		Female	24	17.5
2	Year which the respondent is pursuing	Third Year	67	48.90
		Fourth year	70	51.10
3	Status of the Institute	Autonomous	75	54.75
		University Affiliated	62	45.25

The Hypothesis - III, using 'χ^2' test at 5% level of significant, is accepted to support the view that weightage to the team assignment is a significant factor in motivating the students in getting involved in team assignments.

Regarding the team size, **87** students out of **137** securing high marks in their assignments, have expressed that an ideal team size for achieving high performance should have 5 students and the hypothesis - IV, using χ^2 test at 5% level of significant to this effect, that the size of the team plays a significant role in teams achieving high performance is accepted.

With regard to teachers' role and involvement in achieving the objectives of the team, 96 students have expressed that the teacher should very clearly make the process and expected outcome known to the students in team assignment, without which the teams will not be able to take the direction the teacher wants them to do. Test result of Hypothesis - V, with 'χ^2' at 5% level of significant, subscribes to the fact that Teachers' role in terms of the process and expected outcome of the team assignment helps the team in achieving the objectives of the team assignment.

Likewise, as can be inferred from the analysis that weightage of marks/grades assigned to team assignments has got an influence in motivating the team members to get involved in the team in accomplishing the assignments, as the same has got an average score of (**4.01**).However, the students do not perceive any need for a team leader

since team members had sense of belongingness to the team as the same has been subscribed by the fact that the need for a leader has been given a very low average score(**1.34**).

As has been highlighted and proved by Chi-square test (Hypothesis-I), the students prefer the self-selection method than the teachers' selection method for forming their teams as the same has been given a very high average score (**4.48**). Moreover, the students prefer to have a mix of students from varied backward as the same has been given a high score (**4.32**).

Regarding the Team duration, the students are of the opinion that the teams once formed should continue till the end of the course (**4.30**), as the duration of the team members' association with each other helps the members in getting the work done easily & smoothly and with the time being not wasted on forming the team norms, resolving the conflicts as in the case of new teams etc.,. However, changing of team members during every assignment (**1.98**) and every subject (**1.98**) was not favoured by the students.

With regard to the teachers' role in team assignment, the factors favoured by the students are: objective evaluation by the teachers (**4.02**), attention to individual members (**4.06**), interest shown by the teachers during the assignment period (**4.00**), preparation by the teachers (**4.02**) and teachers' clarity of the assignment (**4.18**) by the teachers. However, the students have not favoured factors such as timely feedback (**2.05**) and discussion with the students regarding evaluation criteria (**2.18**).

DISCUSSION AND RECOMMENDATIONS

Based on the study conducted and analysis made, the following recommendations are made :

1. Team Selection: Self-selection was associated with team performance and cooperativeness and the indispensability of the team members were rated high and this has led to the completion of the work assigned on time. On the contrary, teacher selected teams had faced lot of problems in terms of not accepting others as team members, not willing to contribute etc. Among self-selected teams, there are pre-established behavioural norms and commitment to group, which shows the existence of "meta-teams" i.e. social networks of students who choose to work together for all assignments till the completion of the course. However, poor contributors are not reselected in the meta team, thereby effectively punishing undesirable behaviour using established group norms. Hence, it is suggested that the students should be given the freedom of forming their own teams to avoid continual conflicts and exhibit a higher performance.

However, the author is of the strong opinion that in real life situations, the students will not always get opportunities to select their own team members. Hence, they should also be made aware of this fact and prepare themselves to accept team members as that of teacher selected.

2. Duration of Team Existence: The duration of the team i.e. team longevity was found to have association with the team performance. In order to give a fair chance to every team member to contribute equally to the performance of the team, to enable the teachers to study, give a feedback with regard to the quality of the work done by the team and recommendations for further improvements of the team, it is suggested that the team be given tasks immediately after the formation of the team. In order to gain most from the team learning experience, team assignments should be designed in such a way that the team continues to work together till the end of the course.

3. Marks Assigned to Members: The use of traditional method of evaluation wherein the team assignments are evaluated and equal marks are given to the respective members must be done away with. Instead, the teachers can adopt one of the following two methods:

- At the time of submission of the team assignments, a mock viva-voce be conducted by administering questions pertaining to the assignments to every individual members to ascertain the level of contribution. Also even individual can be asked to represent the contribution of every member by a pie chart. This has to be done in the presence of every one of the team and one should not discuss with others.
- The members as a team may be asked to present the assignment report and every member should be randomly selected for presentation. Even the topics for presentation by every member of the team should be announced only at the time of presentation.

The above two methods will enable the teacher to identify to what extend the student members have contributed individually towards the accomplishment of the task assigned to the team.

4. Set team size relative to the time and goals of the assignments: It has been found by the authors that there is a relationship between the size and the performance output of the team. However, it all depends upon the instructor's goal – what skill he expects the students to acquire. For e.g. if the instructors goal is to develop skills in coordinating a large team of people, by asking the members of the team to prepare a business plan within 24 hours, the size of the team can be as large as even 15 students. Therefore, once the pedagogical objectives are identified, the team size should be set at the optimal level so as to accomplish these objectives, thereby keeping in mind the active participation and interdependency of each member in the team.

5. Outcomes and processes: The teacher, on his part, should give the team a good description of what is expected of the team with reference to the team assignments. An adequate description of what exactly the team is required to submit and the process for the same are to be spelt out clearly by the teachers. The students should also be given a clear description of the pattern of the

evaluation. For the team learning exercise, the teachers have to be thoroughly prepared before even announcing team assignments. Moreover, a good time spent by the teacher before the announcement of the team assignment will widen the scope of the students creativity. An important distinction is to be drawn between assignment parameters and the directions and / or the expected outcomes. This will enable the students as a team to focus on the work outcome rather than trying to find out what the teacher wants.

6. Ways to improve the team learning: Recommendations given here may help the team learning to improve their team experiences:

- Enhance the team learning with team building activities.
- Ensure implementation of team learning in every term by every subject teacher.
- Emphasize more on topics like GD, developing a system of accountability and responsibility and also encompassing team interaction through regular team meetings.

CONCLUSION

It is imperative that the Engineering Educational Institutions have to provide this team learning opportunities to their students so as to enable them to have a hands on experience on managing a team, working with a team etc. By this method, although we cannot ensure success of every team, we can establish an environment conducive enough to lead them to real life team experiences.

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