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Assessing Individual Student Performance in Teams

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Abstract

The use of teamwork in industry is a major thrust in an attempt to stay current in a highly competitive and rapidly changing world market economy. The use of teamwork in industry has shown growth in product lines, improvements in quality, increases in flexibility, and higher employee satisfaction. New and innovative management concepts such as total quality management (TQM) and employee empowerment have their foundations strongly rooted in effective teamwork. Many articles have been produced to show the positive effect of teamwork in industry, which is being closely matched by articles in the field of education. Total Quality Education (TQE) has also shown great promise by incorporating team teaching and student teamwork. Higher education, however, appears to have greater difficulty implementing teamwork in the classroom for both students and instructors. There have been various arguments for and against the implementation of teamwork in the classroom. These arguments appear to focus around one primary issue and many secondary issues. The primary issue is the assessment of individual student performance while working in teams for the purpose of grading. Secondary issues included team building, time constraints, and/or organizational limitations. This paper addresses the advantages of teamwork and the reasons and methods for determining individual student performance in teams. The investigation is supplemented with data on the method discussed which was collected for over four years, among nine classes and 164 students.

Introduction

The use of Total Quality Management (TQM), resulting in teamwork in industry has had a profound effect on the ability of companies to produce a higher quality of goods and services in an increasingly competitive global marketplace. Total Quality Management Student Teams (TQMST) in the classroom may have a similar effect by being able to produce a higher quality of goods (students) and services (experienced-based knowledge) through participative classroom experiences. The purpose of this paper is to investigate the use of TQM teams in higher education, particularly industrial technology programs with the focus on assessing the performance of individual students working in quality teams. The report is substantiated by research performed on Total Quality Management Student Teams at both California State University, Los Angeles, Department of Technology in TECH 488—Fluid Power Technology and Iowa State University, Industrial Education and Technology Department in ITEC 244 Fluid Power Technology. The findings support the method used for determining individual performance in teams with a strong correlation to other indicators of individual performance. The experiment was repeated at least twice per class, in nine classes, consisting of four to five students per team, with a total of 164 students over a period of four years.

Teams

There are many arguments focused around the implementation of teams in industry and the classroom. Some of these arguments are based on strong foundations while others are weak. The strongest argument for the development of teams in education is supported by several respected publications such as Work Place Basics (Carnevale, Gainer, Meltzer, 1988) which states that industry wants individuals that can work in teams. It is implied that education should teach students how to work effectively in teams, thereby producing individuals with team experiences prior to entry in the world of work, which will most likely include teamwork.

Other arguments in support of student teamwork state that teamwork builds student social skills while heightening motivation, consequently increasing the quantity and quality of material covered, all transpiring while altering the instructor's traditional workload. The alteration in instructor workload by incorporating student teams, in many instances, removes or severely limits the effectiveness for the instructor in determining individual student performance. Due to this difficulty, in many cases, teamwork is not incorporated or all team members, within the team, are assigned the same grade.

Evaluation

It is interesting to note that the literature is quite equally divided in the use of evaluation of teams in industry. The discussion arises about how to evaluate teams and/or individual contribution. Some literature (English & Hill 1994; Hallstein, 1994) notes that a team should be rewarded for performance as a whole with each individual receiving equal share, thus equal compensation. Other reports (Kagan, 1995; Wynne, 1995; Kennedy, 1995) state that rewards for performance should be based on individual

contribution within the team and divvied out accordingly. Both sides support strong arguments for and against equal and unequal rewards. In higher education, one finds similar arguments arise in the use of student teams, but with perhaps a stronger lean towards the determination of individual performance of students working in teams. Furthermore, academia fosters the use of individual performance, making the use of teamwork more difficult to apply. For example, how often are scholarships offered to a team of students for their teamwork? Or, when has the admissions department admitted a student team altogether? Or, when were students allowed to take the "holiest" of all evaluation instruments-the final exam-in teams?

Accountability

The need for individual performance accountability in higher education is perhaps much more important and difficult than in industry due to the environment. Experience tells us that when students work in teams outside of the instructor's view, it is difficult to accurately determine who did the work in the team, who deserves the credit, and who gets what grade. Sometimes instructors default and give the same grade to the whole team or group. However, significant amounts of research show that there are far greater ramifications of the group grade, which will significantly damage the whole reason that teamwork is being sought. According to Kagan (1995), "group grades undermine the positive outcomes of cooperative learning" (p. 68).

Level of Performance

In any student team, level of performance along with individual contributions vary widely. For example, since skills vary widely, one individual who has effective problem-solving skills may find answers more rapidly than the others but may lack the creative skills to apply the answers to solve the problem, or produce the components to check the answers. In this case contributions may be equal and the students can effectively learn skills from one another, thus earning equal grades.

However, another case, which probably occurs more often, is that some members of the group contribute more and some less. When equal grades are given out for all members of this team, the students who contributed feel short-changed while those who did not contribute feel they got "off the hook". Nevertheless, it is reinforcing to the contributors that teamwork requires more work, while the slackers may perceive that teamwork requires less work. This could result in motivating the slackers to want teams while motivating the contributors to avoid teamwork. It may have a negative effect on developing student social skills. If the development of social skills is the desired result of implementing student teams, Kagan (1993) reports that "there are far more efficient ways to accomplish these goals" (p. 69).

Another problem that the instructor implementing teamwork needs to be aware of is that difficulties may arise in accurately assessing individual student performance in teams is if one of the team members misses a team meeting or cannot contribute an equal share due to absence from field trips in other classes or illness, work schedules, etc.

Evaluation techniques

Many techniques have been discussed relating to the evaluation of individual performance in teams in education and industry. Some of these, however, may be more effective than others. Before individual performance assessments can be accomplished, attention to team building must be addressed. There are several valuable resources available on this topic (Thor, 1993).

One item that requires special attention in reference to student teams is that the instructor must be involved, not as a leader or threat but as a facilitator or coach (McKay, 1995). It may be best to visit with each team to observe their behavior, ask questions about who is involved in which activities of the project, and how they are coming along. It also helps to offer assistance with difficulties by asking questions, not just giving answers or telling.

Assessment of Evaluation Methods

Team leader selection

The first method that was investigated to determine the performance of individuals working in teams was by the use of a team leader. In a study by Persons (1987) of teamwork in a graduate level agricultural course, leaders were elected from the class by the class. The choice of team leaders was decided by the whole group and then it was divided into teams, with the team leader responsible for judging the individual performance of members. This method may be similar to some industrial settings using teamwork, but may have inherent flaws, especially when employed in an educational setting. The greatest of these flaws is that the team leader may show favoritism to friends potentially leading to the giving of unfair grades that are not based on team contribution or performance. This difficulty could also exist in industry.

Another limitation occurs when the team leader, who was elected from the class, may have won a popularity contest yet may not be an effective leader. The team leader may also be unfamiliar with evaluation techniques and leadership principles. Furthermore, grading team leaders was not addressed in Person's (1987) study and may present a problem along with the possibilities of internal power struggles between students.

Rating versus ranking

Rating Another grading method (Miller, 1996) used a process in which team members would *rate* each others' performance and contributions, with percentages that would add up to 100%. Another way of quantifying the process would be to "pay" an individual a certain number of dollars out of a $1,000 contract for his or her contributions and performance. This method also supports the belief that ratings should be done in the absence of peer pressure. A possible downfall to this approach is that "calculations" are easier if all numbers are the same. In other words, if there are five members on the team and each one is assigned 20% or $200 regardless of his

or her contributions just to save time and brain power. Unfortunately, this method may lead to a group grade or "bad data" and reinforces resistance to the use of student teams.

Ranking This researcher perceives a more accurate determination of individual performance may be achieved by requiring all team members to *rank* individual performance and also the contributions of themselves and their teammates. Even though Deming, the father of TQM, warns about the use of a ranking process of team members or team leaders ranking each other's performance, if done correctly, it could be a very effective method to determine individual student performance in teams. In order to perform evaluations correctly, student need to be assisted and taught how to evaluate individual and team performance.

Summary This researcher is in favor of not assigning team leaders. Rather, natural leaders tend to form within a team depending on different strength areas. This allows all members to potentially lead the team related to their individual contributions, or strength areas. To assist the students initially, instruction and a worksheet should be provided to demonstrate what types and levels of contributions should exist and are acceptable within the team.

Furthermore, other teams should be allowed to *rate* the student's team performance, based on guidelines for grading. An example of a *ranking* sheet to determine individual performance of team members and a *rating* sheet to determine team performance in fluid power technology courses is enclosed (see Appendix A and B). In an attempt to reduce the influence of peers, ranking and ratings should be done privately, with the same security as one would have with an exam. Statistically, this process would increase the accuracy of the individual performance assessment through the reduction of sample bias, an increase in sample size, and the law of averages. This method would be more accurate than the instructor attempting solely to determine individual assessment of individual performance. It eliminates individual bias, increases sample size, and the evaluation is being done by members who have the opportunity to observe the participants closely. In addition, providing students with some evaluation criteria may further improve the process and accuracy of the results.

Peer evaluation

The next step is to include peer evaluation of student presentations or work. This process allows all individuals to contribute to the process of grading. The process accentuates the accuracy of the grade by further increasing the sample size while reflecting on the appropriateness of the presentation for the audience. A sample of grading criteria for fluid power lab presentations is included that shows seven categories of performance (see Appendix B). The comments section is also to be completed, with at least two strengths and two weaknesses given for the team presentation. These ratings and comments were given to the presenters in a typed form to protect the anonymity of the grader.

During this researcher's observations, the effects of peer pressure were extremely high if students were allowed to share during the ranking process. Evaluations were affected by the students who figured out that everyone could get the same grade if all team members' scores averaged the same within the team. It was observed on a few occasions that the greatest pressure to average (equal) the grade was applied mostly by the individuals who contributed *least*. However, when the students were separated and requested to re-rank the team members' performance and contributions, unsurprisingly, the numbers for some teams changed dramatically while others didn't. The teams whose scores for all members did not change dramatically were the ones, from observations and questioning, were working effectively together and contributing equally. The law of averages protected their grades, as individual team members perceived almost equal performance, thus the ranking averaged out. The teams whose ranking changed dramatically pointed out the contributors and the slackers in the team and were more representative of their performance from observation, questions, and past individual evaluation techniques. The results from the private student team member ranking showed a positive correlation to performance in other areas of the course based on solitary contributions. Solitary contributions consisted of exams, quizzes, and homework.

Data

The data shown in the chart (on page 5) is the compilation of 164 students comparing individual performance to team performance. The data was collected twice per class, in nine classes over a period of over four years. The correlation coefficient of the data is approximately 82%.

Conclusion

Total Quality Management has had a dramatic effect on the ability of industry to succeed in a world market economy. Total Quality Management Student Teams may have a similar effect by allowing students to succeed in achieving a higher quality education and applied experience in TQM, thus providing a greater opportunity to become a competitor in a world wide job force. Some methods of determining individual student performance while working in teams were discussed in an attempt to promote Industrial Technology Instructors and Departments to lead research in this area to further develop and refine the educational process of TQMST and effective methods of determining individual student performance.

Industrial technology prides itself in the development of industrial practices and the teaching of TQM and teamwork. Since most of practitioners in this field wholeheartedly believe that people learn through doing, industrial technologists should be first to rigorously apply the principles of TQM/TQE in the industrial technology classroom. Total Quality Management Student Teams could be an extremely effective method to increase student learning while preparing individuals for the TQM world of work.

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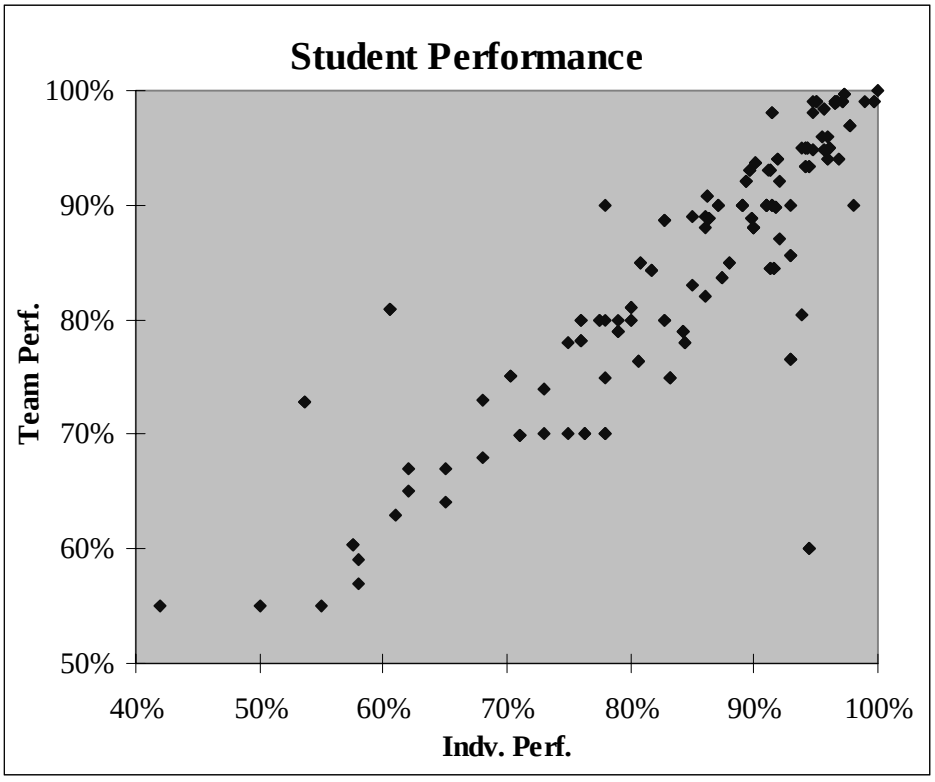

APPENDIX A: STUDENT TEAM RANKING SHEET

TECH course XXX Confidential Team Member Evaluation Sheet

Name: _____ Team Name: _____ Lab # _____

Please **RANK** your performance along with that of your team members. Include contributions to the project. (Full credit is a score of 100%).

NAME	CONTRIBUTION(S)
110%. _____	
105%. _____	
100%. _____	
95%. _____	
90%. _____	
85%. _____	
80%. _____	
75%. _____	
70%. _____	
65%. _____	
60%. _____	
55%. _____	

APPENDIX B: STUDENT TEAM RATING SHEET

TECH Course XXX Confidential Team Presentation Evaluation Sheet

Name: _____ Team Name: _____ Lab # _____

Please evaluate the performance of your classmates by circling the appropriate letter grade for the appropriate category. (A being excellent, D being poor)

TEAM NAME: _____

Does the circuit demonstrated have a USEABLE APPLICATION?

A A- B+ B B- C+ C C- D+ D

Did the circuit WORK CORRECTLY?

A A- B+ B B- C+ C C- D+ D

Did the demonstration BENEFIT YOUR LEARNING?

A A- B+ B B- C+ C C- D+ D

Perceived EFFORT of the team

A A- B+ B B- C+ C C- D+ D

Team PRESENTATION of information (slides, schematics, and organization: clear and accurate)

A A- B+ B B- C+ C C- D+ D

DIFFICULTY or APPROPRIATENESS in comparison to other labs

A A- B+ B B- C+ C C- D+ D

OVERALL performance of the Team

A A- B+ B B- C+ C C- D+ D

OBSERVATION AND COMMENTS: