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Exploring the Effect of Different Team Compositions on Team Motivation, Student Satisfaction and Performance in Team Practical Activities

Pedro J.M. Moreta[1], Susana Lopez-Querol[2*]

[1] College of Engineering, Design and Physical Sciences, Brunel University, London, England
[2] Department of Civil and Environmental Engineering, University College London, London, England

Email Address

pedro.martin-moreta@brunel.ac.uk (Pedro J.M. Moreta), s.lopez-querol@ucl.ac.uk (Susana Lopez-Querol)
*Correspondence: s.lopez-querol@ucl.ac.uk

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Abstract:

The main source of diversity in engineering education usually is the distinct level of motivation, which sometimes causes lack of engagement. Working in motivated teams is likely to enhance the overall performance of the whole group. The aim of this paper is to find the best composition of teams in practical activities proposed in the classroom for engineering students to enhance team motivation. The experience with a group of Civil Engineering students at the University of West London is presented as a case study. This group was very diverse in the level of individual motivation. In this experiment, the whole group was split in two subgroups, and each one divided in teams of 3 people. For one of the subgroups, the distribution in teams was forced by the lecturer, while for the second one the students were allowed to freely distribute themselves. All teams were requested to solve a practical activity, consisting of the classification of several soils according to three different systems, based on experimental data equally provided to all the students. The different results obtained for both configurations of teams show an overall better performance for the "forced" composition, with a higher level of student satisfaction on the activity and on their achieved learning.

Keywords:

Team Motivation, Engineering Education, Teaching Methods

1. Introduction

Among all the possible sources of diversity in the classroom, motivation is one of the most relevant ones, since it directly affects the overall performance of a whole group, along with the average level of the student satisfaction. Practical activities proposed to engineering students, especially during the first years of their degrees, usually improve their experiences and motivation [1]. Additionally, if these activities

are to be carried out in teams instead of as individual work, they are demonstrated to be an excellent way to enhance the social aspects of the students' engagement at the university, allowing them to strengthen personal relationships between them as well as with the academics [2]. Moreover, if the students work in teams, the most motivated students can enhance the motivation of the others. This is the idea of team motivation, as employed in the context of the present research [3].

When a team activity is proposed in the classroom, the composition of the groups has been recognized as a key aspect, which plays a significant role in the overall performance of each team. It the students are who decide the mates they want to work with in their teams, they usually try to join friends or some other students with similar skills and background. Conversely, if the composition of the team is adequately established and balanced, the proposed activities can usually be undertaken from more different angles and perspectives, with a better outcome as final result [4].

In the present project, team motivation in practical sessions carried out in the module Geology and Elements of Soil Mechanics (2nd year, BEng Civil and Environmental Engineering, University of West London, academic year 2014/2015) will be explored. It was a very diverse group attending to several criteria, but mainly due to an evident different motivation levels, with a small proportion of students highly motivated (participating, discussing and collaborating), and another small proportion of them who were totally disengaged (arriving late or not turning up, chatting, texting, neither participating nor contributing). This project consisted on creating a certain combination of all types of students in several teams, while some others were freely organized by the students themselves. All the teams were provided with the same set of documents to analyze different types of soils, according to different systems and standards. The different performance of both sets of teams ("forced" and "free"), as well as the perception of the students after this activity, based on a survey, is presented and explored. The question to be solved in this research is if it is possible, or not, to improve the overall motivation in the classroom by means of team motivation in "forced" groups.

This paper starts summarizing the literature review on motivation of engineering students, defining the concept of team motivation, and presenting several examples of different types of practical activities which can be proposed in the classroom. After that, the methodology for the present research is provided, where the practical proposed activity is described along with several details on the composition of the teams. The obtained results, showing both team performances and students' satisfaction levels, are presented and discussed. Finally, the main conclusions are summarized.

2. Literature Review

A main and very frequent problem for engineering students during the first years of their degrees is their lack of motivation, which can be due to several reasons (Figure 1): abundance of extremely theoretical contents, without a clear immediate practical application [1,2]; not enough social activity between the students and with academics [5,6,2]; few time spent in the campus, doing activities not directly related to the courses [7]; and scarce involvement of the students in their learning process [8].

Practical team activities are a good way to improve the student motivation in highly diverse classrooms, as they are very often found, for example, in UK [1,9]. In these cases, diversity can be understood as an advantage, more than as a countermeasure,

since the more diverse a group, the richer it will be in different skills, and the more angles and perspectives the team would have to face any particular problem [3]. Thus, if practical team activities are proposed in the classroom, it is of paramount importance to guarantee a balanced composition of the teams [4]. In the context of the present work, team motivation is understood as the enhancement of the overall motivation of a group by means of the effect that highly motivated students exert on the less motivated ones [10].

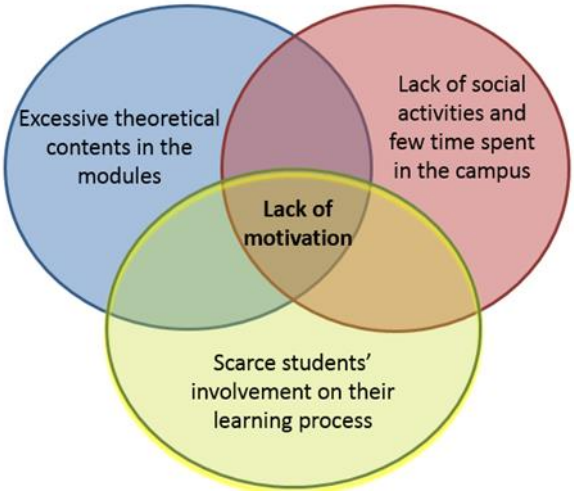

Figure 1. *Main reasons for lack of motivation in engineering students.*

There are plenty of successful experiences on practical activities in the classroom for engineering students reported in the literature, as a logical way to apply student centered teaching techniques [11]. Among all of them, Project Based Learning (PjBL) seems to be one of the most effective ones, requiring a huge effort in coordination among the modules delivered at the same time though, because a practical activity (usually a real project) must be the main task for the students during each term [11-14]. Some other reported experiences are based on activities proposed in a single module, isolated from the others [15]. In these cases, the activity is easier to organize because less or no coordination with other modules is usually required. It is very important to pay special attention to the way in which the students are assessed in these team works, because the energy and efforts that the students put in them is directly related to the marks they can achieve [16]. Public presentations of their works in front of mates and a panel, along with discussions among all the other teams, are usually helpful to capture the students' attention in this kind of activities [17].

3. Methodology

As previously mentioned, the present research consisted of a practical team activity proposed in the classroom to the students of the module entitled Geology and Elements of Soil Mechanics, included in the second year of the BEng in Civil and Environmental Engineering at the University of West London (academic year 2014/15). This was a quite diverse group, formed by 22 students, just 3 of them female, and most of them full time (only 3 of them were enrolled as part time). Their original nationalities were extremely diverse as well. English was not the main language for approximately the third part of the group. Their ages were also very different, ranging from twenty to thirty five years. Moreover there was a group of five or six not very motivated students, who either did not turn up or systematically did it late, and who did not want to participate in the classroom and did not interact at all

with their mates. Conversely, there were around 5 highly motivated students, who usually discussed the contents within the classroom, who made their own research on relevant information related to the subjects, and who even sometimes tried to encourage the less motivated students to participate and collaborate.

As part of this module, there was a topic dealing with classification of soils for construction purposes. This classification is done by means of the experimental results obtained in the laboratory, namely 1) evaluating the soil particle size distribution and 2) how the soils behave in contact with different amounts of water (plastic and liquid limits). There are several classification systems, and in the theoretical sessions, the students were trained to employ three of them, namely USCS, AASHTO and British Standards. Previously to this activity, the students attended a couple of mandatory sessions in the lab to learn the procedures to undertake this experimental testing and to elaborate a report with the most important results.

The whole practical activity proposed to the students lasted for two hours, and it was run in two different days, because the whole group was split in two subgroups. 21 students participated in this activity, 12 for the first group and 9 for the second one. At the beginning of each session, the teams were formed (with 3 students each team). After that, a number of experimental results were given to them, and they were requested to classify the soils using the 3 mentioned classification systems, in close interaction with the lecturer. They were also requested to critically evaluate the suitability of those materials for road construction purposes. No communication among the teams was allowed. The last half an hour of the session was dedicated to publically present the results of the classification by all the teams, to discuss and solve the discrepancies found among them, as well as to give justification on their best and worst suitable soils for construction purposes.

For the first subgroup, the composition of the teams was established by the academic, attending to diversity criteria (mainly by mixing highly and less motivated students), while in the second subgroup, the teams were freely formed by the students themselves.

The result of this activity was evaluated, on the one hand, through the qualitative impression from the lecturer on the performance of each team as demonstrated in the presentation and discussions. On the other hand, a survey was proposed to the students who were requested to take it individually and anonymously, aiming to evaluate their degree of satisfaction, as well as their impression on their engagement with the other members of their teams. All the students participating in this activity took the survey.

The survey was proposed two weeks after the activity. At the beginning, they were informed about the questions, the reason to propose them, as well as the use to be given to these results, guaranteeing them that this information was going to be anonymous at any case. 22 the students took it, although 1 of them, who did not attend the practical sessions, did not respond any question, so his/her responses have not been taken into account in the analysis. Thus, the total cohort was limited to 21 students. This is a small number and does not allow us to generalize the achieved conclusions in a quantitative manner to any other cases. However, although limited, the obtained results are relevant to the purpose of the present research.

The questions for the survey proposed to the students can be seen in Table 1.

Table 1. *Questions for the survey taken by the students.*

Questions	**Possible answers**
1. On the practical sessions on soil classification in the classroom (team work activity):	a) I attended the first session (12/03/2015 – Group 1) b) I attended the second session (19/03/2015 – Group 2) c) I did not attend
2. Did you find the session interesting and complementary to the theoretical contents delivered in previous sessions?	a) Yes b) No c) If no, please, briefly explain why
3. Do you think you would have learnt more in this session if it would have been individual work?	a) Yes b) No c) I would have learnt the same d) I prefer not to say
4. Did you feel integrated in your team?	a) Yes b) No c) If no, please, briefly explain why
5. What do you think it could be done to improve this activity in the future?	

4. Results and Discussion

In the qualitative perception on the performance of the activity by the lecturer, if was found a much better overall performance during the first session, with the "forced" teams. Most of the groups determined correct final classifications for the soils according to all the requested methodologies. Majority of the students participated in the final discussion, and in global the session was very active, funny and engaging. However, it must also be pointed out that, in the teams, not all the students contributed in common work although they all were encouraged to do so. Some of these "less participating" students were requested by the lecturer to answer questions on their team work in the final part of the session, and in general their responses were scarce or inaccurate. It is worth mentioning, however, that several of the "less motivated" students contributed in the work developed by their teams, as demonstrated by their participation in the final discussion after request from the lecturer.

Conversely, in the second session, with a "free" composition of the groups, 2 of them performed fine, while the other almost did not get any significant result at the end of the session, with very limited participation in the final discussion.

As a first conclusion from this analysis, it seems that the team motivation was qualitative better in the "forced" configuration of teams, although for some of the less motivated students, limited engagement and scarce contribution to their teams was observed.

All the 21 students responded a) to question 2, independently of the session they attended ("forced" or "free"). It demonstrates that all these students were willing to participate in practical activities solved in teams in the classroom, ratifying the information found in the literature in this regard.

The main differences in the responses are observed in question 3. Most of the students in both groups responded b) to this question, demonstrating the overall satisfaction with the team work in the classroom. However, for the first group ("forced" teams), 25% of the students responded that they would have learnt more if

this activity would have been proposed individually, while in the second group ("free" teams), the 33% opted for this option. This fact demonstrates that for the "free" composition of the teams, the students have worse perception of the achieved learning in this activity since they think it could have been doing it individually. 17% of students in the "forced" group stated that they would have learnt the same if the activity would have been proposed individually, while in the "free" group this value reaches 11% instead. This result seems to indicate that, in the "forced" group, more students have better perception on the activity itself, independently of if it was proposed individually or in teams. This again demonstrates a better perception of this session by this first group of students. A summary of these results is reported in Figure 2.

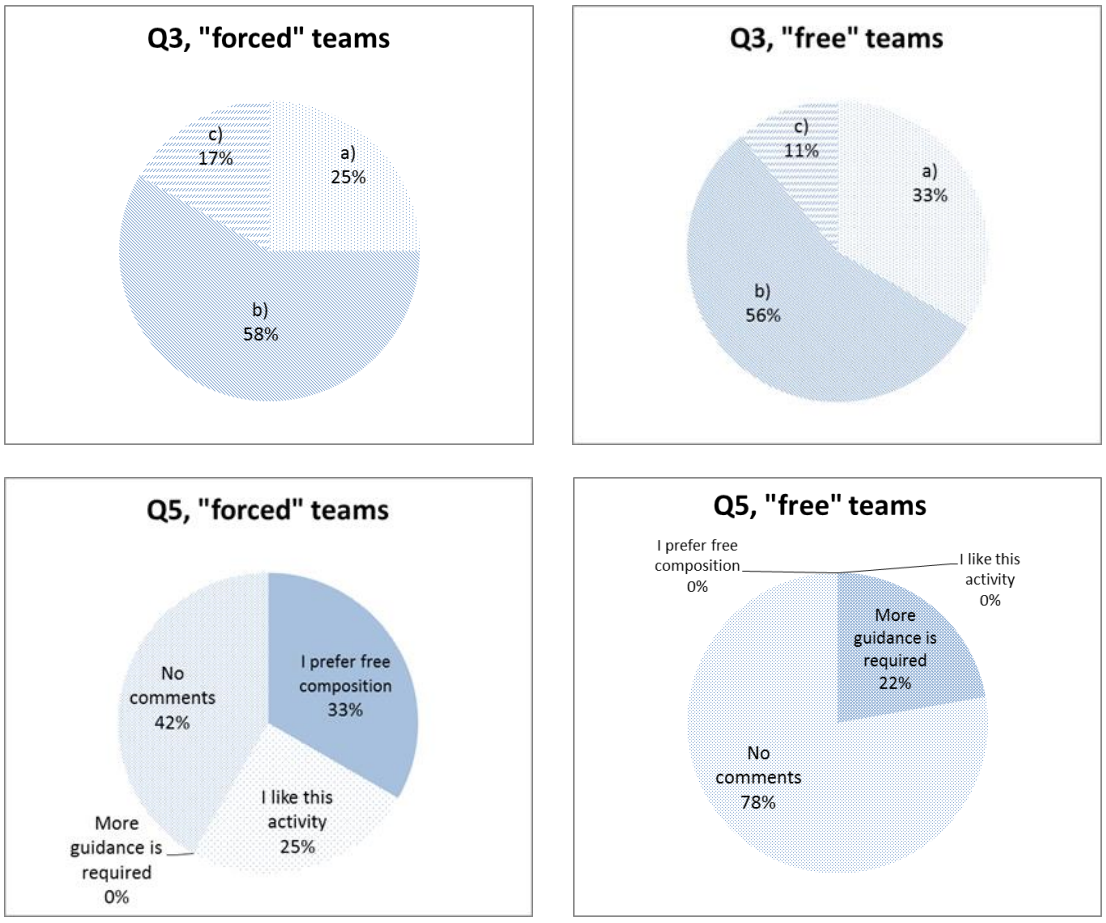

Figure 2. *Summary of the most relevant results obtained in the survey in questions 3 and 5, for "forced" and "free" teams.*

Response to question 4 was unanimous as well, since all the 21 students felt themselves integrated in their work teams. Therefore, no conclusion can be derived from this particular question, apart from again a good general perception about team works.

Also significant are the several responses received to question 5, about ways to improve this activity in the future. The nature of the responses was very different in both "forced" and "free" teams. For the first one, 33% of the students propose as an improvement to have the freedom to select the mates to work with in the team, while in the second group ("free"), no student gave any opinion against the composition of the groups. This fact demonstrates that the students are more comfortable it they are

free to create their teams, even if the final outcome from the activities are not very good. Conversely, in the first group, 25% gave a very positive opinion on the activity and the overall experience, requesting more sessions like that, while no student in the second group gave such positive comments in this question. The summary of these results is graphically reported in Figure 2 as well.

As previously mentioned, the cohort was not high enough to allow us getting a definitive conclusion on the optimal composition of the teams in this kind of activities. Although very significant from the qualitative point of view, this is the main limitation of this work. Repeating this experience in subsequent years would allow us to complete this information to arise more definitive conclusions.

5. Conclusions

This research explores the effect of different composition of team works in team motivation when practical activities are proposed to engineering students in the classroom. The scope of this research is restricted to practical activities in one single module. The main conclusions derived from this analysis are:

- The overall performance of the teams was much better in the case in which the composition of the teams was decided by the lecturer, trying to balance the diverse aspects in of the group, mainly its diversity in terms of motivation.
- Although, in the "forced" teams, most of the students were participating and contributing to the team works and final discussion (showing an improvement of the overall team motivation), still some individual students were disengaging with the activity.
- In terms of students' perception and satisfaction, all of them valuated very positively practical activities solved in teams in the classroom. A relevant proportion of (33%) of those students who participated in the "free" session considered that they would have learnt more if this activity would have been proposed individually, against a slightly smaller percentage (25%) in the "forced" teams. This datum demonstrated, for this particular case, some better perception for the activity as it was in the case of the "forced" teams.
- In spite of the best performance of the "forced" teams, 33% those students think that a free distribution of the teams would have been better.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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