

Online Collaboration: Individual Involvement Used to Predict Team Performance

Walkyria Goode and Guido Caicedo

ESPAE-ESPOL, Guayaquil, Ecuador
{wgoode, caicedo}@espol.edu.ec

Abstract. Social media – with its collaborative and interactive functionalities – is an ideal platform for collaboration. Several teams were asked to create material using a content management system. Log records were analyzed to measure group and individual participation. Direct and indirect measures of involvement are used as predictor variables. A model is proposed that uses system-tracked data to forecast team performance.

Keywords: collaboration, collaborative computing, team performance.

1 Introduction

Educators and researchers have been experimenting with social media technologies (e.g. blogs, wikis) for collaborative learning. Social media stimulates knowledge construction by emphasizing collaboration and interaction. Active learning is accomplished through dialogue and connections within online communities, information is exchanged and content is collaboratively created [3].

An advantage of using social media tools in a team oriented educational environment is that these tools record logs of individual team member involvement. Educators usually rely on peer- or self-reports of team members' participation. The logged data can be used to establish the degree of team participation. This note is a first step into investigating the relationship between team participation and team performance in an online learning setting.

1.1 Collaboration and Teams

A team is a group of people with complementary skills that are committed to a common goal, performance objectives and a process that holds them mutually responsible [6]. Team members need to understand the skills required to create effective and synergistic results. Attributes of successful teams include outcome interdependence and participation [10,6].

Outcome interdependence involves the encouragement of all team members to contribute. Personal benefits depend on successful goal achievement by the rest of the team members. Interdependence leads individuals to share responsibilities and increases collaborative social interaction [12]. A synergistic environment is created

when – through collaboration – individuals achieve goals at a superior level. Research on student groups in an international business degree program found that interdependence predicts team learning behavior [11].

Effective team participation entails equitable sharing of information and workload that promotes the exchange and integration of information. Studies have shown that participation fosters learning by acquiring, sharing and constructing knowledge [4,7]. Teams with unequal participation or teams with instances of social loafing / free riding produce lower quality results and poor satisfaction [8]. Fair workload distribution is positively related with performance and satisfaction [10].

It is hypothesized that effective team participation will contribute to higher team performance. Students will value outcome interdependence.

1.2 Background

The study was performed as part of a graduate business course assignment. Teams of students were assigned to collaboratively author blogs related to class material.

2 Study

2.1 Method

Using regression analysis, the study evaluates the contribution of team participation to the prediction of team performance. Performance is measured by the grade each blog entry received. Team participation is represented by direct and indirect measures. The number of edits made in a blog and participation rates are considered direct measures. A participation rate indicates the proportion of team members that worked on each specific blog. Indirect measures for team participation are the number of views and comments made by team members in their blogs. The model proposed is represented in Table 1.

Table 1. Model for Team Performance

Model	$TP = \alpha + \beta_1 PR_i + \beta_2 E_i + \beta_3 C_i + \beta_4 V_i + \varepsilon_i$	
Dependent Variable	TP: Team Performance	
Independent Variable	Direct Measures	PR: Participation Rate
		E: Number of Edits
	Indirect Measures	C: Number of Comments
		V: Number of Views

2.2 Participants

The sample for this study consisted of 21 students enrolled at the final year of a MBA program. There were 10 females and 11 males. The average age was 31, with a standard deviation of 4.9 years. Sixteen students worked full time and all possess an

undergraduate degree. Group size ranged from 3 to 5 students. There were a total of 5 groups. Students stayed in the same group throughout the course.

2.3 Materials

The instructor created team blogs in a content management system using the WordPress platform (<http://wordpress.com>). This system allows collaborative authoring and recognizes three types of roles: (i) An Editor can publish, edit, and delete any posts, moderate comments, upload files/images and manage categories, tags, and links, (ii) An Author can edit, publish and delete their posts, as well as upload files/images, (iii) A Contributor can edit their posts but cannot publish them. All team members were assigned Author roles and one member in each team was designated Editor.

2.4 Procedure

Teams published a weekly blog during an eight-week period. Entries were concise essays of a topic of interest covered in class. To promote creative and associational thinking, each entry had to include three references to relevant articles or websites. Requirements specified word count, type of reference (one academic and two non-academic) and proper use of APA style [1]. All members were expected to contribute.

Before deadline, the instructor would comment on the blog providing feedback regarding requirements. Each entry was graded. Students were allowed to comment on their own blogs and enter additional references.

Towards the end of the course, students filled out a peer evaluation form as part of their team project and a survey for extra credit. The survey was used to evaluate several social media tools used in the classroom.

3 Results

Teams varied in group size. Participation rate is not affected by group size. However, the total number of edits, comments and views can be influenced by group size. These measures were evaluated as both totals and weights (i.e. total number of edits versus number of edits weighted by group size). Both analyses resulted in similar tendencies. For ease of comprehension, totals will be reported in this note.

All team members were expected to participate in the creation of each blog entry. However, this was not the case, resulting in different participation rates per blog within each team. Figure 1 uses a modified version of a treemap to graphically represent how team members contributed to each of the eight blog entries. Contribution is defined as the number of edits a team member made. A treemap is space-constrained display of data as nested rectangles [9]. Each post is given a rectangle (B1, B2, etc.) and is tiled with smaller rectangles representing the individual contribution of each team member (P1, P2, Q1, Q2, etc.), individual contributions are measured in percentage and add up to 100%. In Teams P, S and T, all team members

participated to a certain degree. In Team Q, team member Q2 did not contribute at all. In Team R, team member R3 published almost all posts. These different rates of contribution are expected to affect a team’s performance.

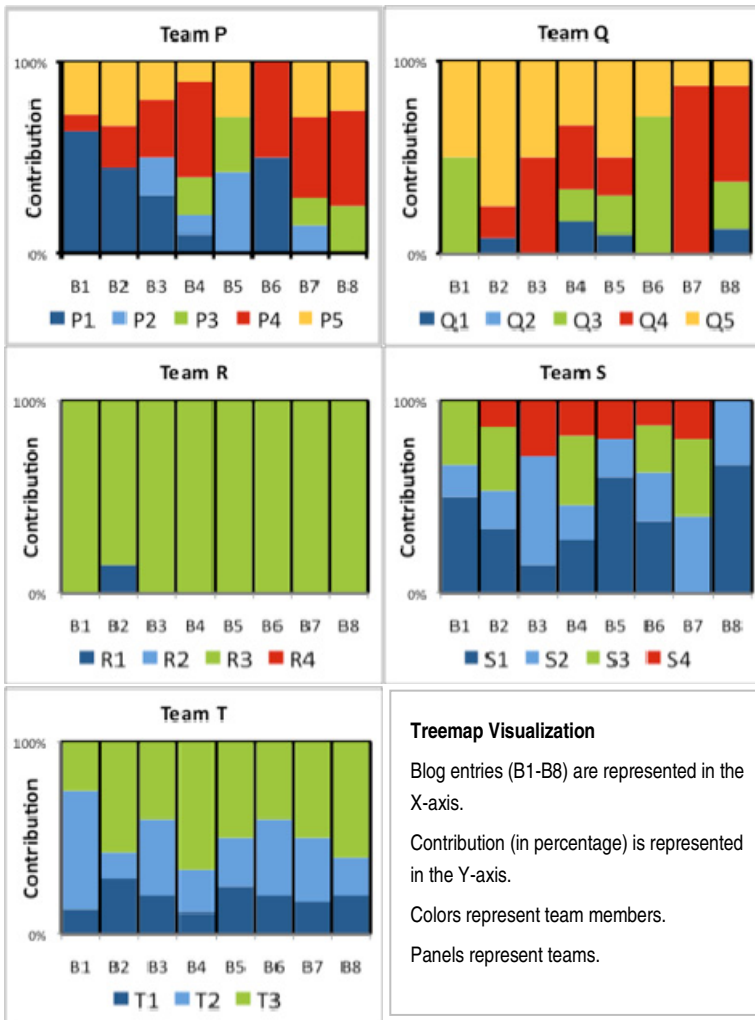


Fig. 1. Team Member Contribution per Blog Entry per Team

A multiple regression analysis was used with blog entries as the units of analysis (i.e. the grade of an entry is the dependent variable). There were five groups and eight entries per group (See Table 2). Two models were compared:

$$\text{Model 1: } TP = \alpha + \beta_1 PR_i + \beta_2 E_i + \beta_3 C_i + \beta_4 V_i + \varepsilon_i \tag{1}$$

$$\text{Model 2: } TP = \alpha + \beta_1 PR_i + \beta_2 E_i + \beta_3 C_i + \varepsilon_i \tag{2}$$

Model 1 (proposed in Table 1) yielded an R² of .291. Although, the Number of Views was not significant, it slightly increases the model’s explained variance (R²). A new model – Model 2 – without this variable was analyzed and resulted in an R² equal to .283. Both models were statistically significant.

Table 2. Regression analysis examining the contribution of team participation on team performance (N=40)

	Model 1		Model 2	
	Strd. Coeff.	t-Statistic	Strd. Coeff.	t-Statistic
Participation Rate (PR)	.446*	2.62	.431*	2.58
Number of Edits (E)	-.390*	-2.34	-.357*	-2.27
Number of Comments (C)	.479**	2.89	.514**	3.33
Number of Views (V)	.102	.62	-	-
R ²	.291		.283	
F-Statistic	3.59*		4.73**	

** , * Statistically significant at the 1% and 5% levels, respectively.

Model 1 is equivalent to the Model in Table 1.

Model 2 does not include Number of Views (V).

The two direct measures of team participation – participation rate and number of edits – were significant. Participation rate is positively related to team performance (See Figure 2(a)). If more team members contribute, the higher their team performance. The number of edits is negatively associated with team performance (See Figure 2(b)). Blogs that incorporated numerous edits resulted in lower team performance.

The number of comments produced by team members was a significant indirect measure of team participation. Although, comments were not part of the grading policy, higher performance appears to be positively related to active commentary (See Figure 2(c)). The other indirect measure of team participation – the number of views – was dropped in Model 2. Number of views is positively – but not statistically significant- related to team performance (See Figure 2(d)).

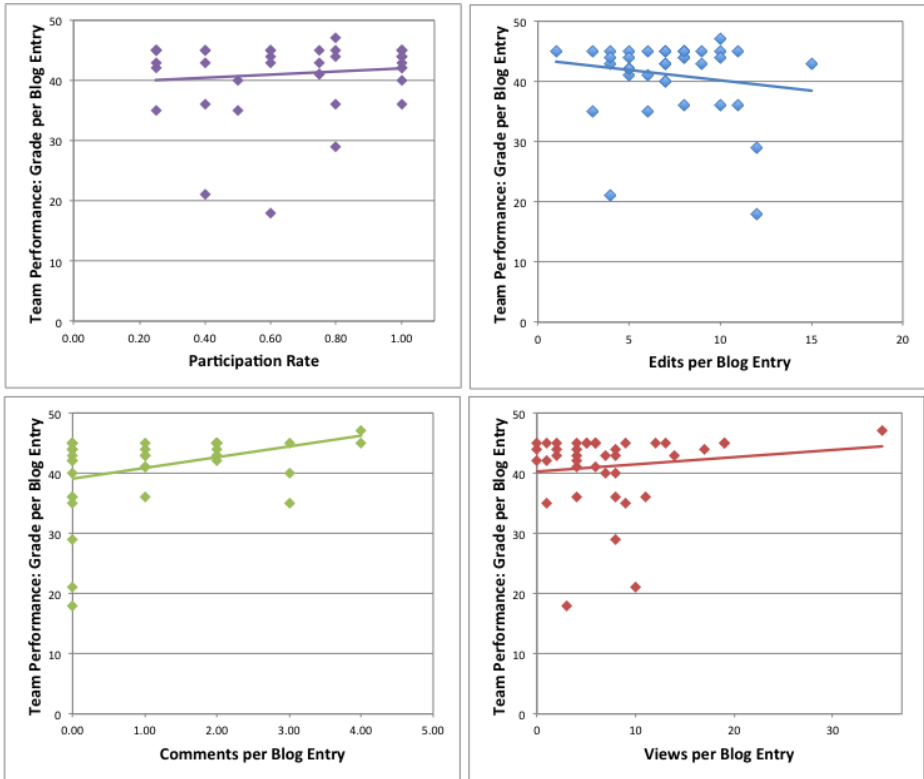


Fig. 2. Team Performance: Grade per Blog Entry (50/50) by (a) Participant Rate, (b) Edits per Blog Entry, (c) Comments per Blog Entry, (d) Views per Blog Entry

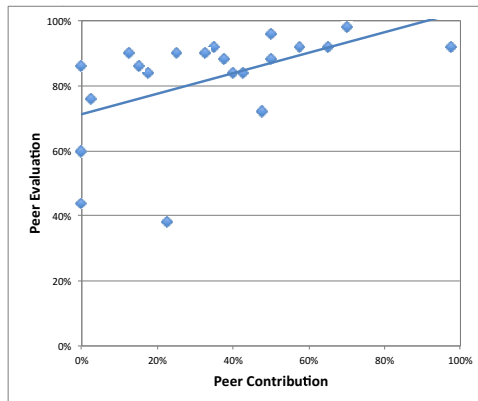


Fig. 3. Outcome interdependence: Peer evaluation by peer contribution

Outcome interdependence is evident in the positive relationship between participation and performance, as shown in Figure 3. The integration of more individual contributions results in blogs with higher grades. Students were intuitively aware of this outcome. Peer evaluation data is positively correlated with contribution, $r(21) = .51$, $p < .05$. Students gave higher ratings to team members with more contributions and punished free-riders with lower ratings.

4 Discussion

Team members were notified that participation was an integral component of the team project and that all individuals were expected to consistently participate. Nevertheless, teams showed different participation rates. Log data illustrate the presence of social loafing and the lone wolf phenomenon. A lone wolf is an individual that has a preference to work alone and dislikes group work. This individual is committed to achieve goals without the contributions of the rest of the team [5].

Although students generally do not endorse social loafing, fear of confrontation permits the existence of free-riders. Students mentioned that doing somebody's workload is easier than having an argument that could negatively affect team dynamics. In addition, the team usually does not trust the quality of work from a free-rider. A lone wolf considers the rest of the team to be subpar and prefers to not share the workload. The erroneous belief that a team product can be of high performance without the contribution of some team members is demonstrated in this study. Participation rate helps to predict team performance. Assignments developed by teams in which all or almost all team members contributed received higher grades than those by teams with poor participation rates.

An interesting finding relates to the negative relationship between the number of edits and team performance. It appears that the more effort teams put into developing their blogs, the lower grades these blogs received. This finding is based on quantitative data. The logs indicate the number of edits to a blog and not what type of edits were involved. A qualitative analysis has not been performed. Edits could have been directed towards the form and not the substance of a blog. It is believed that this is most likely the case. Teams showed concern towards the aesthetics of the blogs and were highly competitive on the type of media (images, slide shares, videos) their blogs contained.

The number of times members commented on their team blogs was considered as an indirect measure of team participation. Commentary is interpreted as an indicator of an individual's interest for the team product. Interest for a team product usually renders into active participation developing that product. The number of comments positively contributes to predict team performance. Blog entries with more comments received higher grades than those with fewer to no comments.

High outcome interdependence involves the encouragement of team members to participate. Teams reap from the benefits of their collective knowledge. Social loafing and the lone wolf phenomenon suggest that students are marginally aware of the benefits of outcome interdependence. However, the relationship between peer

evaluation and contribution implies that members internally developed a reward system of sorts. Hard working team members received higher ratings than those who do not contribute.

Teams that actively participated in content creation benefited from a richer collaboration environment. The quality of their blogs was superior and was reflected in their grades. Active participation – in this context – implies greater involvement from all team members. It does not equal more work. Blogs with many edits indicate team members putting considerable effort into their authoring. However, this effort was not focused and resulted in lower quality assignments.

The resulting model serves to forecast performance and collaboration in a social media setting. Team participation rates and interest (as measured by number of comments and possibly number of views) positively predict performance. Effort - as measured by number of edits – is negatively related to performance. Type of effort was not measured.

4.1 Limitations

There are several limitations that need to be acknowledged and addressed regarding the present study. First, the study analyzes a single course. A replication is scheduled to increase the statistical power of these results. Second, the author was the instructor for the course. A social desirability bias could have influenced student survey responses. Social desirability is the tendency of individuals to seek approval [2]. In an attempt to minimize this bias, the survey was part of a set of surveys administered for extra credit towards several courses. Third, the type and quality of effort should be included in the model. This data will be incorporated in subsequent analyses.

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