Collaborating Virtually: Concepts and Applications

Tomas Blomquist, Andreas Nilsson and Markus Hällgren

Umeå School of Business and Economics Umeå University S - 901 87 Umeå Sweden

Published in:

Blomquist, T., Hällgren, M., & Nilsson, A. (2006) Development of Virtual Teams and Learning Communities. In Tripathy, K. L ed. *Collaborating Virtually: Concepts and Applications*, Ch 10, pp. 121-130, (Reprint) ICFAI Press, Punjagutta, India.

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Development of Virtual Teams and Learning Communities

Tomas Blomquist*, Markus Hällgren and Andreas Nilsson

Students of an Internet-based course in project management worked during a 20-week period in teams of 4-6 persons. The course consisted of Swedish students living in Sweden or abroad, which made it impossible for many of the teams to have any face-to-face interaction. During the course, the teams were assigned a series of discussion questions and cases. The study, based on a survey of 287 students who participated in the course, examined their experience of teamwork and showed that many of the classical team development issues also evolve in a virtual team. Furthermore, the study showed that students considered their teamwork was efficient and that being able to communicate, discuss and share experiences was essential for developing a positive learning community.

Introduction

In recent years, the Internet has found its way into the classroom and education at the university level. Research on the theme of online and Internet teaching is

Corresponding author: e-mail - tomas.blomquist@fek.umu.se.

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growing and there is today a range of resources on the Internet dealing with online education as well as books and journals specializing in the area. The use of online courses is something that has developed over many years. Even so, there are still many aspects of online teaching that need to be examined. One possible approach to gaining a better understanding of the educational issues and also virtual teams in organizations is through investigating the experiences of virtual teams in online courses [1].

The purpose of this study is to study such virtual teams. More precisely, it is to investigate if virtual teams develop over time and what variables may affect efficient performance and the creation of a strong collaborative learning community. The investigation is based on a large group of students divided into virtual teams of four to six people. Each team was assigned a number of cases and discussion exercises over a twenty-week period. The results of this study have theoretical implications for how virtual teams develop as well as for the understanding of what are important in creating communities and collaboration in virtual teams. Practical implications will be for successful virtual team development and most importantly for educational purposes, on how online courses could be set up.

Development of Virtual Teams

While discussing teams, it is vital to distinguish between different kinds of teams and their characteristics. Teams and groups are often seen as different labels for the same thing but teams have been distinguished from groups by their cooperation, inter-dependency of tasks and responsibility for outcomes [2]. Hence, a team is one kind of a group but not all groups are teams since-groups may either not perform effectively or they may lack the skills needed to reach a specific goal through cooperation.

In this paper virtual teams are of interest. Virtual teams are defined as geographically distributed groups where the team members communicate through electronic media to achieve a task [3]. Collaboration and the use of information communication techniques are thus essential for virtual teams to work and solve tasks.

Following the reasoning above, teams do not just appear out of the blue, they develop over time. There are several models or theories describing how this development occurs. Commonly they describe different phases through which the team develops starting with a phase, sometimes referred to as the forming phase, where the members of the team try to get to know each other, while being polite to each other. When the team members have learned to know each other they start to question the others and the storming phase begins. Then follows the norming phase where the rules and the roles of the team and its members are set. Finally, in the performing phase the team members can focus on the job and actually get it done [4].

Virtual teams, like other teams, develop over time, meaning that performance and efficiency for virtual teams would be likely to increase over time. The first hypothesis to test is:

H1: Performance of virtual teams develops positively over time.

Gersick [5] suggests a slightly different framework for the development of teams. She suggests that the timeframe for a task is crucial for the performance of the team. If the timeframe is divided into five parts, it is the middle or the mid-point that is critical. It is at this point the teams reassess the situation their goals and strategies. If the team gets through this punctuated equilibrium, they will perform in accordance with Tuckman's [4] performing phase [1].

Johnson et. al., [1] develop Tuckman's model into a loop of Forming, Norming, Performing and Conflict resolution. However, teams that do more than one task will get into this cycle more than once. With this argument, teams would perform better at the end of an online course than in the beginning or middle. The second hypothesis to test is thus:

H2: Performance of virtual teams develops over time and after a number of tasks.

As the virtual team develops, aspects of what factors affect their development become of interest. Earlier studies on virtual teams point out a number of factors influencing the development of the team and how they work [3], [6]. The process is both dependent on the socio-emotional processes of relationship-building, cohesion and trust as well as task processes related to communication, coordination and the fit between task, technology in use and team structure [3].

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The team development process is also a development of communities of practice (CoP). With a constructivist view, virtual teams are able to learn by sharing experience, collaborating and solving unstructured problems. The development of CoPs, or team communities, would thus be essential for knowledge creation and understanding of new subjects. This leads to the third hypothesis:

H3: There are common factors for virtual teams' development of team community.

The Course: Projects-Organizing, Leadership and Control

The course in the study was a basic project management course given in Swedish over a 20-week period. Over the years, it attracted more and more attention as shown by an increasing number of applications. By the third year, it was the course for which Umeå University had the most applications (435 first choice applicants). The purpose of the course was to teach students and practitioners basic project management techniques, including methods of organizing, leadership and control. The course exploited the Internet's capacity to overcome problems of time and space. The educational approach was new to the department, so there was no prior information or experience within the organization to utilize. However, support from management was very good. The Dean of the Umeå School of Business and Economics clearly stated that the new course had to be something different and not a two-dimensional flat copy of a campus course. There were also some supporting functions available at the university.

The educational platform that was chosen¹ was similar to many platforms on the market. It was provided by the university and contained functions such as library, lectures and different tools for communication. The communication area includes News, FAQ, Discussion Forums, E-mail, Chat and last direct messages. The platform allowed the course to be built around the interactions between students and teachers, involving different types of lectures, document-handling systems and discussion forums. It was in this environment students were supposed to participate and solve several cases in teams as well as individually. Some of the students had met on a four-hour introductory activity, but many of them only met on the Internet, including all of those working abroad, i.e., students living in Qatar, Brazil, the United States, Norway, Canada, South Korea and Germany.

Besides benefitting from independence from time and space, the Internet solution offered the possibility of having mostly external lecturers and expert contributors, "anonymous" discussion forums, simulations and virtual onsite visits. All of these features were used in order to widen students' perspectives of project management and project management skills and competencies. In addition, there was some literature requirements involved. The distinguishing features of the course are mentioned in Table 1.

Table 1: Distinguishing Features of the Course

Discussions: The discussions were built upon an educational approach called "Storyline". The discussions were first conducted on team level for preparation and then summarized on group level where the discussion between the teams continued. Due to the large number of students each year (roughly 120 persons), no organized discussions were held on course level, the number of discussions ranged between 5-8 over the years.

Team cases: Over time, the exact number of team cases varied between 3-5. These tasks were solved on team level, involving 4-6 persons. The level of difficulty for the cases was intentionally increased while the time allowed to produce a solution decreased. This created more pressure on the students and forced commitment.

Individual case: One individual case was given during the courses as a possibility to evaluate the single student.

Written exam: The exams were completed by the students individually over a time period of approximately one week.

Lectures: The lectures ranged between 3-15 minutes. The lectures were broadcasted using streaming technique, in order to make the unauthorized spread of the material somewhat more difficult. The lectures involved practitioners as well as academics from a wide range of business/organizations and schools, national as well as international.

Literature: 2 out of 3 books were in Swedish, while the third was an English textbook on project management.

The structure of the course is a setup on three levels. The highest level of participation, "Course level" contained all the students (about 130), the second highest level "Group level" contained 30-40 students, while the lowest level was the "Team level" containing 4-6 students. Apart from the overall course, access was only assigned to a specific team and a specific group, limiting the areas of discussion.

Research Methodology

The hypotheses proposed above were tested using data collected through an online survey on persons passing the online project management courses 2002, 2003 or 2004 at Umeå School of Business and Economics, Sweden. Using an online survey was necessary due to the population being spread around the world. Students are also used to working with online surveys as a part of evaluations of the course.

The survey was mailed to a list of 287 people who had passed the course. Of these e-mails, 38 addresses bounced back, reducing the sample to 249 persons. After four reminders, the number of respondents was 155 or equal of a response rate of 62%.

The survey contained questions on how students worked and communicated in the teams during the course. Data were also collected on how they perceived their work, in the beginning, in the middle and at the end of the course. Finally, demographic data on age, sex, educational background and work experience were collected.

There are five sets of independent variables. The first set of independent variables was the importance of different media for learning. Questions were asked about course literature; video clips (lectures); discussions with the team and the whole class; and about cases in general. Respondents were required to rank items on a 4-point scale from not important to very important. The second set of independent variables was three questions regarding group efficiency at three points-beginning, mid-course and at the end of the course. These questions were asked on a 5-point scale from very inefficient to very efficient. The third set was a single question on how often a person logged on to the educational platform. The fourth set of variables asked questions on how often individuals used different types of communication. The different types were physical meetings, phone calls, e-mails, discussions forums, direct messages and last chat, asked on a 5-point scale from never to always. The last set dealt with how the teams organized themselves in problem-solving, cooperation, communication, experience utilization, decision-making leadership and conflict resolution.

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The dependent variable 'team community' is an index describing how we group is working together. This variable is a summarized score of four ite measuring the extent to which the group experienced a social community, l willing to respond and did so promptly, shared knowledge and experience ϵ was closely united as a group. Together, the four items have a Crombach-alpha 0.879. A higher value on the team community variable indicates that the group has been more successful working together as a virtual team.

Analysis

The results are discussed in two parts. The first part gives a general description those answering the survey. The second part analyses the data on how sm groups have been working on an online course.

Looking at the data of those who answered the survey, a majority have educational background in social science and business (54%) or are from natuu science and engineering (34%). Areas such as education, humanities and medici have all three together only 13%. Combined data on work experience shows th 86% of respondents have a working experience of more than three years. Da describe that 60% were female and 40% were male. The average of the who group was 33 years.

Since the teams were put together by the teachers, the team members we unlikely to know each other before the course. Hence, they started to know eac other as they worked together on the assignments. Results indicate that tear efficiency improves over time as the members get to know each other.

Tests of the first and second hypotheses are done by comparing the level c efficiency experienced by the team members on two occasions. The method use for the test is a paired t-test. See Table 2 for the used pair. The paired t-test show that hypothesis H1 is confirmed and that group efficiency for virtual teams follow the same pattern as classical teams, that is, they become more efficient over time Hypothesis H2 is also confirmed since efficiency increases from mid-course to the end of course. This increase is achieved after the teams have finished severa discussion tasks and cases.

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Table 2: Occasions for Pair t-test								
Pair #	Occasion 1	Occasion 2	Occasion 3	Correlation	р			
Pair 1	Efficiency in the beginning	Efficiency at mid-course		0.548	0.000			
Pair 2		Efficiency at mid-course	Efficiency at the end	0.668	0.000			

The third hypothesis test regards the factors related to team community. The test measures how the level of team community is related to different media for learning; how often individuals log on to the educational platform, the type of communication and ways to organize the teamwork. A stepwise regression shows that some variables have a larger impact on the level of team community. The result of the analysis is shown above in Table 3.

Coefficients (a)	Unstand. Coeff.		Stand. Coeff.	t	р
	В	Std. Error	Beta		
(Constant)	-0.017	0.25		-0.067	0.947
Cooperation	0.16	0.088	0.155	1.822	0.071
Utilize experience	0.179	0.065	0.192	2.771	0.006
Leadership	0.223	0.068	0.242	3.293	0.001
Direct messages	0.146	0.039	0.205	3.715	0.000
Discussions in group forum	0.208	0.074	0.176	2.811	0.006
Problem solving	0.174	0.083	0.162	2.108	0.037

Discussion

In traditional campus courses, the teacher has a very active role. This is not the case in the reported Internet-based course. We argue that an e-learning course is largely dependent on virtual teams of students and their performance in sharing, communicating and exploring knowledge. The design and structure of an Internet-based course need to be on a peer-to-peer basis. Communication, trust and meaning are shared among students and the teacher becomes the facilitator of the peer-to-peer communication-acting as a sounding board and taking a more passive role.

Results from the regression (Table 3) show that virtual teams develop their team community for learning if they can sort out initial issues of cooperation, utilization of experiences, leadership and problem-solving. In doing so, teams hopefully develop trust between the team members as they know that other team members share their experience and contribute their knowledge for the good of the team. Development of the team increases team efficiency. The discussions in group forums and direct messages are important for decision-making and for the learning process.

As H1 and H2 suggest, virtual teams develop in the same way as regular teams. It could thus be suggested that more understanding of virtual teams may be gained from comparing them to theories of regular teams.

Looking on anecdotal evidence between the three years, it seems as though there need to be mechanisms facilitating the interaction between the different team members as well as between the different teams. In this case, the Storyline learning methodology was beneficial for interaction and discussion.

The process of developing a team community is essential for collaboration on a team level and it is also important for the whole course. We, therefore, suggest that further research focus on the identified variables suggested in Table 3 and develop understanding of what makes them more or less efficient.

Conclusion

Our aim in this paper has been to look at team development in virtual teams and what factors affect team community in an online course. Results indicate that team development follows the patterns of normal teams and that a number of tasks over a course make the team pass the punctuated equilibrium [5] more than once, thereby improving their performance. Furthermore, the development of team community is related to how the teams organize, communicate and collaborate.

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