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Student teams' development over time: Tracing the relationship between the  
quality of communication and teams' performance

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### **Abstract**

Current discussions in higher education and alumni training acknowledge the challenges training programs face in responding to the authentic needs of the labor market. In addition to academic knowledge, higher education institutions are expected to provide general 21st-century skills, such as problem-solving, critical thinking, collaboration, and interpersonal skills. To meet these challenges, many institutions utilize collaborative pedagogies such as learning in teams. However, teamwork in higher education tends to focus primarily on the task aspects of performance at the expense of the team aspects, and for educators, there may be no feasible way to assess whether the students are learning to work successfully as teams. This paper explores how new student teams ( $n = 3$ ) that simulate real business teams by taking a challenging entrepreneur assessment, developed over three semesters for general skills (i.e., communication), and whether the improvement in their communication also indicated the teams' improved performance (i.e., financial success). As an analytical tool, the study relies on initial parameters on teams' microdynamics of communication (Losada, 1999) normalized with fuzzy logic. In accordance with the current understanding of team development, the results did not show any linear improvement, but the quality of communication in the teams improved episodically. Further, the results provide evidence of the possible relationship between the improved quality of communication and the teams' collective financial success. However, in future work, due to the lack of sensitivity of the parameters in this context together with the recent criticisms of the mathematical basis of the patterns of team dynamics based on Losada's parameters, they will be reexamined with a Monte Carlo sensitivity analysis.

*Keywords:* higher education, teams, generic skills, communication, team performance

**Student teams' development over time: tracing the relationship between the  
quality of communication and teams' performance**

In the context of economic complexity, globalization, and rapid change, academic education practitioners must consider how to prepare students for the world of work where relationship-building and productivity seem to go hand in hand (Tsay & Brady, 2010). In addition to academic knowledge, higher education institutions are expected to enhance the development of students' general 21st-century skills, such as problem-solving, critical thinking, collaboration, and interpersonal skills (e.g., Ang, D'Alessandro, Winzar, 2013; Crebert, Bates, Bell, Patrick, & Cragolini, 2004). Accordingly, to meet these challenges, many institutions utilize collaborative pedagogies, such as working as student teams (e.g., Loughry, Ohland, & Woehr, 2014; Scott-Ladd & Chan, 2008).

Teamwork has many benefits for the challenges faced by instructors (De Hei, Strijbos, Sjoer, & Admiraal, 2014). For example, teamwork promotes collaboration and communication skills (Loughry et al., 2014). In addition, working in teams makes students more active participants in their education by providing favorable conditions and encouraging students to take ownership of their own learning (Scott-Ladd & Chan, 2008). According to contemporary learning theories, knowledge is constructed in social interaction or even as a by-product of social interaction (Wenger, 1998). Teamwork, in this regard, has a dual purpose and offers possibilities for constructing academic knowledge and for developing the generic skills appreciated by employers.

In spite of many promises, teamwork is often more difficult than working alone (Loughry et al., 2014; Scott-Ladd & Chan, 2008). One reason (Fransen, Kirschner, & Erkens, 2011) might be that in educational settings learning in teams tend to focus

primarily on the task aspects of performance at the expense of the team aspects. Although considered pedagogically beneficial, these general 'team skills' (De Hei et al., 2014) are difficult or even unnecessary to train. Moreover, for educators there may be no feasible method for assessing students' learning of teamwork skills, while the mastery of academic knowledge, for example, is easier to assess (Loughry et al., 2014).

In addition, teamwork can be understood in different ways and therefore approached from different perspectives for assessment. Sometimes, the focus is looking at the quality of individual members' contributions to the team, while in other instances, the focus may be on the overall team performance and the team's collective success, including the quality of the team performance (Fransen et al., 2011). This paper relies on the latter perspective. From this perspective, team development, referring to positive changes in knowledge, ability/skill, processes, etc., is described as process improvement (Edmondson, Dillon, & Roloff, 2007). Process improvement, therefore, is a possible indicator of the team's improved performance.

In addition, teams are rarely studied long term in educational settings, although it is a widespread practice in work organization research (Edmondson et al., 2007). The scope of research is often limited to particular courses or study modules instead of considering student teams as a design-level educational choice for long-term endeavors, as is often the case in work team literature (Edmondson et al., 2007). Given the lack of long-term research, developmental aspects are also mostly ignored. In addition, the conditions or premises for teams' performance, such as team composition, cannot always be controlled for in educational contexts (e.g., due to institutional regulations or types of

students enrolled; Fransen et al., 2011), which makes it more difficult to compare processes and outcomes across different student teams.

This paper is an attempt to respond to the challenges described. In this work, we focus on the team-related aspects of performance. We ask how three student teams, simulating real business teams, develop communication skills over time. In addition, due to the distinctive and challenging team entrepreneur assignments that aim at funding students' end-of-the-study trips around the world, we are interested in whether the development indicates student teams' improved financial performance, a comparative measure in this context. Relying on a long-term perspective of three semesters, we trace process improvements and teams' performance across three comparable student teams. High-quality communication is important in all stages of teamwork, be it related to the task or collaboration patterns (Fransen et al., 2011). Communication not only distributes necessary information within the team but also facilitates the ongoing construction of their shared task- and team-related mental models. In this paper, we draw on research on teams' dynamics, reflecting teams' microlevel communication quality (e.g., Losada, 1999; Losada & Heaphy, 2004), related to teams' efficient functioning (Luoma, Hämäläinen, & Saarinen, 2008), to trace the general qualitative development of communication in student teams over time. Furthermore, the development of the quality of communication is a possible contributor to student teams' performance (i.e., financial success).

### **The Microlevel Communication Quality in the Teams**

Communication is a general foundation on which teams' task- and team-related processes are built (Bradley, Baur, Banford, & Postlewhite, 2013). The quality of

communication improves team performance, for example, as information is shared and assessed in a collaborative climate (Woolley, Chabris, Pentland, Hashimi, & Malone, 2010). Researchers reflecting team dynamics and teams' microlevel communication quality and productivity of business teams (Losada, 1999; Losada & Heaphy, 2004) have sought explanations and deeper insights into high-performing teams by studying the quality of verbal communication among team members. These studies utilized three bipolar pairs of variables (inquiry/advocacy, positivity/negativity, and other/self) that together represent certain basic qualities of communication within teams. Losada (1999; Losada & Heaphy, 2004) allocated 60 business teams into three levels of business performance: high, medium, and low. The main allocation criteria included profitability, customer feedback, and a 360-degree evaluation. A team was assigned to the high-performance category if the team achieved a high rating in all three assessments, to the low-performance category if the ratings were all low, and to the medium-performance category if the ratings were somewhere in between these two. When the quality of the verbal communication in the teams was studied, the teams varied systematically by performance level and the three bipolar dimensions of verbal communication; certain ratios of the qualitative variables were attributable to high-, medium-, and low-performing teams, respectively (Losada, 1999; Losada & Heaphy, 2004).

**'Inquiry' versus 'advocacy' in team communication in view of learning.** In team communications, the 'inquiry/advocacy' pair is related to an ongoing process of reflection that includes asking questions and seeking feedback. Losada and Heaphy (2004) emphasized the balance between inquiry and advocacy in mature team communication. Advocacy refers to clearly communicating and standing up for what one

thinks and desires, whereas inquiry means exploring and questioning one's own reasoning and others' reasoning (Dewey, 1938). Friedman and Berthoin Antal (2005) noted that when interaction is balanced in this sense (high inquiry-high advocacy), participants clearly state what they think or want, explain the reasoning behind it, try to understand others' reasoning, and invite others to question their reasoning. When advocacy and inquiry are effectively combined, it has the potential to facilitate learning on all sides.

**'Positivity' versus 'negativity' in composing the team's communication atmosphere.** At the individual level, experiences of positive affect have been found to improve decision-making, integration of information, and problem solving in various contexts (Isen, 2000). At the team level, when team members collectively experience positive affect, their thoughts and actions expand allowing the team members to deal with a problem using wider range of perspectives (Shin, 2014). Negativity, in turn, is seen as narrowing the scope of attention, restricting emotional spaces, and closing possibilities for action (Losada & Heaphy, 2004). Rhee contended (as cited in Shin, 2014, p. 355) that negativity, when experienced collectively, may prevent team members from sharing ideas and inspiration, which are seen critical for being creative as a team.

**'Others' versus 'self' in a team's communication orientation.** Team development usually involves an external dimension or team orientation. That is, a team is required to attend events and consider trends outside the organization. The team must communicate and build mutual relationships and alliances with other teams or team members' and interact with individuals outside the team (Druskat & Kayes, 2000; Druskat & Pescosolido, 2002). Druskat and Kayes noted that this sort of intergroup

communication may allow the team to recognize their own strengths and weaknesses better. In addition, intergroup communication may provide information that is not routinely provided by the broader organization to which the team belongs (Druskat & Kayes, 2000).

Albeit based on research on business teams and laboratory observations of the teams, the basic qualities of teams' microlevel of communication are by no means task- or organization specific. Thus, we expect that they are relevant general indicators that assess the development of student teams' communication quality and therefore are applicable to the context of this study as well, in which students worked in long-term student teams with real-life business projects and responsibilities. In this paper, the following questions were investigated: (a) How does the quality of communication develop in the teams over time? (team development in terms of process improvement) (b) How successful are the teams in financial terms (i.e., revenues)? (team performance) (c) Does higher-quality communication indicate higher revenues for the teams? (process improvement as a possible indicator of the teams' improved performance)

## **Method**

### **Participants and Context of the Study**

The research involved three comparable student teams composed of 13–20<sup>1</sup> first-year students in a Finnish business school. These teams were long-term independent workgroups jointly pursuing a 3.5-year bachelor degree in business management and entrepreneurship. Accordingly, the team entrepreneur program, established in 1993, and, which was adapted to 20 other business schools in seven other countries worldwide, aims

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<sup>1</sup> All the teams started with 19–20 students; during the study, Team A lost six of its members.

to mimic real work teams by relying on learning methods with cornerstones such as learning by doing (Roberts, 2012), utilizing dialogic approaches (Bohm, 1996) in a community of practice (Wenger, 1998). In the program, students work in team companies with real-life business projects and responsibilities. Thus, the transition from the school environment to the world of work (students becoming entrepreneurs) is expected to take place smoothly during the studies.

In the beginning of the first semester, all students are divided, by the school organization, into similarly structured teams based on Belbin's team role test (e.g., van Dierendonck & Groen, 2011), which is designed to identify people's behavioral strengths and weaknesses to compose the most effective teams. A gender balance in the teams is also a goal. The student teams rely on an idea of collective leadership called 'friend leadership' (Kouzes & Pozner, 2007). Student teams are thus democratic units, in which all the members, together with the formal executive group, are expected to participate equally in the collective processes. The executive groups consist of four students (with the assigned roles of team leader, customer manager, financial manager, and communication manager) selected by the team members for a fixed term of approximately 1 calendar year (i.e., two to three semesters).

During the program, the student teams are supported by team coaches, experienced senior costudents, and an alumni network. In the training program, lectures are replaced with training sessions held twice a week, in which the team coach is present. The students follow a personalized reading program, and essays based on the books from the recommended reading list replace exams. In this regard, theory and practice are

combined as students' reading programs are designed to support their practical work projects in the teams.

From the beginning of the program, the student teams run varied authentic customer projects as cooperatives at their own offices separated with division and office furniture from the business school's open-plan office space. This open learning environment is expected to encourage cross-team collaboration and improve communication between the teams. The student cooperatives are registered in the official trade register, and each team has a full and shared financial responsibility for their business. In addition, the teams are accountable to the school organization for the overhead costs of the cooperatives, such as office rent. The teams' tasks differ in terms of duration and scale. In addition, some of the projects are carried out only as subteam and others as whole-team endeavors. The teams traditionally have one challenging long-term task to accomplish: financing and taking a trip around the world at the end of their studies. This task is a tradition of the business school and is expected to motivate the student teams to run their cooperatives as profitably as possible.

### **Data Collection**

The method included long-term data collection over a period of the first three semesters of the three student teams' lifespan of seven semesters. First, to assess the teams' development in terms of process improvement over time in terms of the qualitative development of communication within the teams, the study involved five assessments conducted during training sessions. Each assessment lasted for 60 to 90 min. The first three assessments took place during the first semester (approximately at the beginning, halfway, and end of the semester), the fourth assessment was conducted in the

middle of the second semester, and the fifth in the middle of the third semester. For the data collection, a three-semester period was chosen under the assumption that this period would be long enough to observe any major development trends in the teams. Further, this period would cover the nomination and first 'term in office' (about 1 calendar year) of the teams' first executive groups. The data were collected by the first author in collaboration with the school's organization partners and staff of the communication applications. In addition, outside the videotaped sessions, to obtain a more holistic view of the teams' everyday practices the first author observed the weekly training sessions of one of the teams (Team A). The executive members of Team A were interviewed, and team members' written reflections on their learning processes over time were collected. In this article, the emphasis is on the video data.

The physical setting for the assessments comprised classrooms with circular arrangements called 'dialogue circles,' which allowed the team members to see each other face-to-face and participate easily in interactions. Therefore, in order to cover this O-shaped space, the training sessions were recorded using a 360-degree video camera; the participants were observed anywhere within its circular range, and a panoramic view of all participants simultaneously was presented. To make the recording situations as normal as possible, the teams opened their training session in their usual way, without being disturbed by the camera, and they first got used to its presence. For this reason, the recordings were mostly from the last 2 h of each of the 4-h training sessions. The researchers were not present during these sessions.

Second, to examine whether team progress in terms of communicative development indicates improved performance as assessed by the teams' business success,

the first author received monthly reports from the teams' financial managers. The numeric data included the teams' financial indicators as revenue. In this context, in which the students were expected to finance their end-of-the-study trips around the world, financial success was a qualified measure.

### **Data Analysis**

First, to assess the teams' progress in terms of process improvement, the qualitative development of communication in three student teams (Teams A, B, and C) was analyzed over the course of five assessments. Two independent evaluators conducted a time series analysis based on the video recordings utilizing VideoWarp Director® analysis software for 360-degree video together with mobile software tailored for these purposes. Communication application experts first trained the evaluators and the first author with several data examples to control the allocation of the data into the categories used in this study, and if any problems occurred, they were jointly discussed. The interrater reliability was estimated as a correlation between the ratings of the two independent evaluators for the first three data sets collected from one of the three teams. The reliability was 95% on average.

In the analysis, the participants' speech acts, utterances, or phrases from the video-recorded team meetings were coded for three bipolar pairs of variables (inquiry/advocacy, positivity/negativity, other/self) (Losada, 1999; Losada & Heaphy, 2004). A speech act or utterance was coded as inquiry if it included an open question, or widened, or elaborated a topic of discussion. Advocacy involved a speech act that was telling a team member's own opinion or argument in favor of the speaker's point of view. A speech act was coded positive if it expressed support, encouragement, or appreciation.

Negative speech acts, in contrast, exhibited sarcasm, cynicism, or other signs of disagreement. An utterance was coded as other if it referred to someone or something outside the team. Correspondingly, an utterance was coded as self if it referred to the person speaking or to another member of the team. Furthermore, each speech act, utterance, or phrase could be coded according to all three dimensions. In this procedure, each code was marked with a time stamp.

To provide a general level for the communication in Teams A, B, and C over the course of the five assessments, the ratios of different pairs of variables were calculated. However, the initial results caused problems since the numerical scaling was different for each pair of variables. Therefore, to better facilitate comparison of the qualitative development of communication within the teams, the initial data were normalized using the Matlab fuzzy logic toolbox. The toolbox applies fuzzy classification methods (Zadeh, 1965) for standardizing data. The rules of fuzzy logic classification were defined according to Losada's (1999; Losada & Heaphy, 2004) initial classification parameters (Table 1). This also allowed us to calculate the mean value,  $\bar{x}$ , and the standard deviation,  $\sigma$ , more accurately for the combination of the three pairs of variables. Mean values would provide us with information regarding the general quality of communication in terms of the three pairs of variables, whereas the standard deviation would highlight the balance of the three different pairs of variables in the studied communications. In the standardized index, the quality of communication is described on a sliding scale of 0–100%, where the team's communication quality can improve linearly from low (0%) to medium (50%) to high (100%).

Table 1

*Losada's Initial Classification Values*

	Inquiry/Advocacy	Positivity/Negativity	Others/Self
High-performance teams	1.143	5.614	.935
Medium-performance teams	.667	1.855	.622
Low-performance teams	.052	.363	.034

Second, to analyze the teams' performance in terms of financial success, the revenues were calculated. Third, the linear relationships between the quality of communication (from the first phase of the analysis) and the teams' revenue were calculated. The revenues were chosen from dates that matched the video-recorded training sessions. However, when the relationship was calculated, the first assessments of the teams' communication data and the revenues of that month were left out of the analysis, since the first month of the teams' life cycle was expected to be time for organizing the teams' working processes. To analyze the relationships, a linear correlation,  $r^2$ , between the quality of communication over the four assessments (assessments 2–5) and the revenues was estimated (Agresti & Finlay, 1997).

## Results

### The Teams' Learning in Terms of Process Improvement: The Qualitative Development of Their Communication over Time

The results of the first phase of the analysis (Table 2) provided us with information on the development of the quality of communication in three new student teams (Teams A, B, and C) in five assessments over a time period of three semesters. Table 2 shows results for the three bipolar pairs (I/A, P/N, O/S), the mean values,  $\bar{x}$ , and the standard deviation,  $\sigma$ , of these variables over the five assessments.

Table 2

*Teams' Communication Quality over the Course of Five Assessments (Normalized Data)*

Team	Assessment Point	I/A	P/N	O/S	SD	Mean
A	1	39	42	44	7	42
	2	39	62	49	23	50
	3	45	94	13	81	51
	4	27	59	37	39	41
	5	38	60	82	37	60
B	1	36	50	47	16	44
	2	41	58	47	17	49
	3	39	21	0	98	20
	4	31	56	45	28	44
	5	38	84	50	41	57
C	1	42	25	0	95	22
	2	43	52	24	37	39
	3	40	57	3	82	34
	4	38	43	47	10	43
	5	41	75	39	40	52

In general, in all three teams, in spite of two anomalies, as shown by the mean values  $\bar{x}$ , the results indicated constant and identical performance ratings (close to the medium level). In Team A, the communication quality ratings ranged from 41 to 60. In Team B, the ratings ranged from 44 to 57 over the course of the four assessments excluding Assessment 3. In the third assessment, however, Team B showed a clear decrease in performance level (20). In Team C, the results also indicated a stable performance over the course of the last four assessments (values varying between 34 and 52). In the first assessment, however, the team showed a lower level of performance (22).

In the third assessment, the standard deviation,  $\sigma$ , indicated uneven communication among all three teams (Team A  $\sigma = 81$ , Team B  $\sigma = 98$ , Team C  $\sigma = 82$ ). In this third assessment, the relative value for the others/self variable suggested a clear lack of external orientation in all three teams' communications: Team A = 13, Team B = 0, and Team C = 3 all indicate a low level of communicative quality. In Team A, this lack

of external orientation was also combined with high positivity (94) and in Team B, with relatively high negativity (21). In Team C, communication was moderately positive (57).

By the same token, the overall results revealed that with the exception of the fourth assessment of Team A (27), the inquiry/advocacy ratios remained stable (values ranged from 38 and 45) over the course of the five assessments. In Team B, the ratings for the inquiry/advocacy variable varied between 31 and 41. In Team C, similarly to Team A and B, the inquiry/advocacy variable remained stable over the course of the assessments, with no clear changes (ratings ranged from 38 to 43).

In Table 3, the differences between the first two and the last two assessments are presented in absolute and relative terms. The absolute mean values show by how many percentage points the teams' communication quality improved over the course of the assessments, whereas the relative mean values (percentages) indicate the improvement ratio in comparison to the baseline.

Table 3

*The Absolute and Relative Improvements of Teams' Communication Between First (Two) and Last (Two) Assessments (Team A, B, and C)*

Team	Absolute improvement (% units)		Relative improvement (% units)	
	First and last assessments	First two and last two assessments	First and last assessments	First two and last two assessments
A	19	5	45	11
B	13	4	29	9
C	29	17	132	54

Taken together, the results regarding the qualitative development of communication across the three teams and the five assessments did not show linear improvement. However, when the first two and the last two assessments were compared,

the quality of communication showed an improvement for all three teams in terms of the absolute and relative mean values,  $\bar{x}$ . Team C showed the greatest improvement in terms of the absolute and relative mean values.

### The Teams' Performance and the Connection to the Quality of Communication

The teams' performance in terms of financial success, manifested in revenue, is presented in Table 4. The results show that Team C made the highest financial profit, with a clear lead over the other two teams, with revenue of €105,384.85. Team B came second with revenues of €44,258.70, while Team A collected revenue of €32,624.40.

Table 4

#### *Monthly Revenues and Communication Quality of the Teams over Time*

		Team A		Team B		Team C	
	Month	Revenue	Quality	Revenue	Quality	Revenue	Quality
1	0909	€0.00	42	€0.00	44	€2,650.57	22
2	1009	€840.00		€223.50		€951.00	
3	1109	€2,048.30	50	€1,713.96	49	€3,111.30	39
4	1209	€3,979.10	51	€2,819.01	20	€10,349.62	34
5	0110	€2,538.00		€6,758.67		€1214.93	
6	0210	€3,398.00		€5,807.89		€7,307	
7	0310	€3,553.00		€8,721.67		€3,987	
8	0410	€2,995.00	41	€4,774.00	44	€4,000	43
9	0510	€5,340.00		€7,262.00		€7,222	
10	0910	€7,933.00	60	€6,178.00	57	€64,591.43	52
		€32,624.40		€44,258.70		€105,384.85	

When the relationship between the quality of communication and revenue across the three teams was analyzed, the results showed a linear positive correlation,  $r^2$  (a linear dependence), between these factors (Team A,  $r^2 = .63$ ; Team B,  $r^2 = .24$ ; and Team C,  $r^2 = .65$ ). Thus, in Teams A and C the correlation was close to strong (i.e., within the range .60–.79). In Team B, there was a positive but weak correlation (.20–.39) between the quality of communication and the revenue.

### **Discussion**

As shown previously, the results of our analyses of the quality of communication did not show linear development, but when we compared the first two and the last two assessments, each team improved. Although scholars may not agree on the specific stages of team or group development, there is a general understanding that groups change during their evolving processes and accumulating experiences over time (Arrow, Poole, Henry, Wheelan, & Moreland, 2004). The results are in line with the current understanding that teams do not progress linearly and systematically, as posited by earlier theories, but the change might be discontinuous (Arrow et al., 2004). In this sense, in striving for mature teamwork, a smooth passage is not even expected.

According to the results, in all the teams, the ratios of inquiry/advocacy remained under the medium level with hardly any change over time. Unbalanced communication (more advocacy than inquiry) signaled the undeveloped, individually oriented nature of communication, which indicates stressing one's own point of view instead of exploring the perspectives of other team members (Friedman & Berthoin Antal, 2005). However, for new teams that consist of young, inexperienced students, acquiring a balance between inquiry and advocacy, as emphasized by Losada, might be challenging as was also emphasized in the students' reflections. Therefore, to improve their practices, new teams should be encouraged to appreciate dialogue as a means for revealing potentially diverse meanings, and in the same vein, to learn to treat differing viewpoints as opportunities for generating a wider range of ideas, which would be beyond the resources of any party alone (Rowe, 2008).

The positivity/negativity variable is related to aspects of the teams' communication atmosphere. In all teams, in spite of two anomalies (Assessment 3 of Team B, Assessment 1 of Team C), the ratios indicated relatively positive communication. Although negative communications hinder individuals' aspirations to seek learning opportunities within the team (e.g., Lee, 1997), in contrast to Losada's view, the absence of conflicts can be attributable to new, inexperienced teams that prefer compromise to conflict, whereas more experienced teams may react more creatively to conflict situations and actually perform better (Bradley, White, & Mennecke, 2003). According to Edmondson and colleagues (2007), better teams are more likely to report errors than to hide them. Therefore, presenting conflicts as healthy processes for improving student teams' practices and, in particular, providing them with appropriate tools for managing the conflicts, are essential (Scott-Ladd & Chan, 2008). However, as the students described in their reflections, they also needed some time to get acquainted with their teammates to have the encouragement to fully express their ideas and inspirations in front of the team. These reflections are closely related to the concept of team psychological safety (Edmondson, 1999; Edmondson et al., 2007), that is, shared confidence among the members that the team is safe for interpersonal risk-taking.

In the third assessment, there was a clear disparity in these communication aspects in all the teams, particularly for the others/self variable, which is related to the teams' orientation as expressed through their communication patterns. In this regard, all the teams showed improvement in the following assessments. The others/self pair is important in view of the business school's basic principles, working culture and working spaces, which seek to encourage student teams in open-minded transfers and exchanges

in a broad community of practice. Generally, in the long run, a lack of external orientation in team communication can have a negative impact on the team's functioning (Druskat & Kayes, 2000). Particularly, if the team's work calls for innovation, as is the case here, together with learning from interactions as a group, the team should actively draw on external learning resources, to seek ideas, help, and feedback beyond the team boundaries (Edmondson et al., 2007). According to the students' reflections, the students were motivated to communicate and build relationships with other teams and individuals and to attend to events and follow trends outside the educational organization.

In addition, our analysis showed a positive linear correlation between the development of the quality of communication and revenue in all three teams. Interestingly, Team C, which showed the greatest improvement in terms of the quality of their communication, showed also the highest financial success. Although the correlation was positive and strong, as in Team A and Team C, it can be taken only as evidence of a possible connection, not as a causal relationship between the team's improved communicative processes and the team's performance. Accordingly, learning gains are not always evident. The underlying reasons for the relationship may be hidden or indirect, pertaining to the nature of the team-specific tasks (Edmondson et al., 2007). We lack detailed information about the teams' subprojects that yielded the team companies' monthly revenue. Based on the observation data and students' reflections for Team A, the teams experienced different challenges (e.g., the level of discretion, knowledge intensiveness, degree of interpersonal risks) and profitability of the workload and risk-taking, for example. In addition, the work context and the resources available for the teams may have had a considerable effect on their learning (Zellmer-Bruhn & Gibson,

2006). That is, whether and how the increased familiarity and organizational experience of working together helped the teams to access and utilize the support available (i.e., team coaches, senior students, alumni network).

Team management processes related to team formation, use of team members' abilities, and team leadership, for instance, affect team performance (Fransen et al., 2011; Scott-Ladd & Chan, 2008). In this study, the student teams' heterogeneous composition sorted by the school organization was based on the identification of team members' behavioral strengths and weaknesses by the team role tests. Although the students were aware of their teammates' role test results, they did not receive direct instructions about how these roles could be distributed and utilized in their working practices. Studies have shown evidence of the positive effects of role clarification on team learning (e.g., Strijbos, Martens, Jochems, & Broers, 2004). This unstudied factor requires further investigations by opening the group level discussions for reanalysis. In addition, it could be questioned how permanent such roles are (Hugh & Jones, 2011). Also, the large size of the teams ( $n = 13-19$ ) may have affected the student teams' performance, since smaller group size have been found to be more favorable in terms of managing the work (e.g., Scott-Ladd & Chan, 2008). Also, the importance of team leadership has been widely studied (e.g., Zaccaro & Klimoski, 2002), and learning teams whose members are equal in terms of status and expertise level seem to benefit from the model of shared leadership, like the idea of friend leadership in this case (see Fransen et al., 2011). However, we need further analysis whether and how the loose power relations in the student teams influence the teams' learning processes and collective performance.

Taken together, across the five assessments, the evident differences between the teams were small. We thus wondered whether Losada's classifications were suitable and sensitive enough to evaluate new teams that run start-up businesses in an educational context. There are questions, particularly, regarding the positivity/negativity variable. In general, the evaluators agreed well on the classifications, but when the codes given for the different bipolar pairs were compared, the positivity/negativity pair received considerably fewer (674 codes together) than the others did (inquiry/advocacy = 2,210, others/self = 2,091). Noticeably, many units of analysis were neutral. We ask whether positivity/negativity is less capable of registering small nuances in speech acts if compared to the other bipolar pairs of variables, particularly with new teams.

In future work, due to our initial results on the communication quality that call for more sensitivity of the parameters used, together with the recent criticisms of the mathematical basis of the patterns of team dynamics based on Losada's parameters (Brown, Sokal, & Friedman, 2013; see also Hämäläinen, Luoma, & Saarinen, 2014), we will reexamine the results utilizing Monte Carlo sensitivity analysis (e.g., Lorén, Johannesson, & de Maré, 2009). The analysis will estimate, for example, the most sensitive Losada's initial parameters, which make the normalized communication values too uniform or saturated in the context of new learning teams.

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