Issues in Information Systems
Volume 23, Issue 2, pp. 200-214, 2022

DOI: https://doi.org/10.48009/2_iis_2022_117

Does hybrid working promote collaboration and creativity? An empirical study

Abhijit Chaudhury, *Bryant University, achaudhu@bryant.edu*
Pi-Sheng Deng, *CSU Stanislaus, pdeng@csustan.edu*

Abstract

The last few years have forced organizations to look for novel methods of collaborative work in the constrained environment of the pandemic. Much research is underway to evaluate these new modes of working, as productivity and creativity continue to be critical to firms even in this new environment. This research focuses on how trust and cohesiveness within a team interact with information technology features in a hybrid environment to impact their group processes, promoting creativity. We use an Activity Theory framework to model the relationship between digital platform features, collaborative processes, and creative outcomes. The findings tentatively establish the basic hypothesis of the research that in a hybrid environment, the relational and trust capital of a team and an appropriate digital platform can promote healthy collaborative processes leading to creative outcomes. The study can help guide the design of technology platforms that are conducive to productive collaborative activities and creative learning.

Keywords: Hybrid working, Collaboration, Creativity, Digital Platform, Activity theory, Relational capital

Introduction

Large firms have been conducting studies as to how remote and hybrid work have impacted productivity within firms. Microsoft looked at its 61,000 workers in the US and found that remote work made employees more siloed in their communication and made it harder to share information (Ferrell, 2021). However, the report also noted employees worked more hours in the remote and hybrid environments. Looking to the future, Microsoft intends to embrace hybrid working to combine the best features of both. However, a RingCentral report titled "Is Remote Working Sustainable?" noted that "many observers were frankly surprised at how productively a wholly remote workforce could operate" (Heiken, 2021). Similarly, another study conducted by Texas A & M found that working from home does not hurt productivity (Lloyd, 2022). Factors considered in these studies included communication, collaboration technology, trust, and cohesiveness, among others. According to a report by Bolla (2022), Etienne Grass, an expert in the digital transformation of organizations, commented in the French financial newspaper *Les Echos*, "Indeed, the next challenge for companies could be to give their teams a creative boost. Could they reduce meeting times? Create idea workshops? Better combine the physical with the virtual worlds?" Our paper has a similar goal: to study how team creativity and productive collaboration are facilitated by relationships among team members and technology platform features. As such, this is one of the early efforts to examine how technology features shape collaborative processes in a hybrid environment, which in turn shape team-level creativity.

Research Background

Group creativity and productivity is an important theme in computer-supported collaborative learning (CSCL) and organizational creativity support systems (OCGS). CSCL is a growing area in the field of team learning on digital platforms. While it is part of the larger study of how technology promotes learning (Gribbins et al., 2007), the focus of CSCL research is on establishing the efficacy of different approaches and the role played by supporting factors such as computer-led evaluation and document repositories (Resta and Laferriere, 2007, Popescu 2014). Digital tools such as social media and Web 2.0 tools have come to play a critical role in making collaborative learning practical and efficacious (Resta and Laferriere, 2007). In the field of CSCL research, one area that has escaped attention is group processes among participants and the facilitating role of a technology platform as opposed to individual discrete technologies. There is a substantial body of knowledge on collaborative learning in face-to-face settings, but less is known about the collaborative aspects (Jeong et al., 2014). "Despite numerous studies on social interactions in collaborative learning, little is known about interactions in successful computer-supported collaborative learning situations," writes Vuopala et al. (2016). Similarly, in the design of online environments, much attention has been paid to interface design, but much less to designing forums where participants can interact, according to McLoughlin and Marshall (2000).

OCGS focuses on "acquiring, collecting, storing different information resources and discovering how they promote discovering new knowledge and its dissemination" (Olszak, Bartus, and Lorek, 2018). According to Cooper (2000), while there is much evidence that information technology promotes efficient retrieval and sharing of information, there is little evidence of it promoting creative thinking. According to Olszak et al. (2018), the research in the field is fragmentary, and there is a need for a "more systematic and deliberate study of information systems design." In this paper, the authors seek to fill knowledge gaps in the fields of CSCL and OCGS regarding group processes during collaboration in different work environments such as work-from-home (WFH) and hybrid and how group processes interact with different features of the technology platform to promote creative outcomes.

In this paper, we use the Activity Theory (AT) framework (Kapetilinin and Nardi, 2018). In the simple version of AT, the basic elements are a *subject* that is engaged in manipulating an *object* using a *tool,* which results in an *outcome* (Figure 1). The tool we focus on here is the IT platform, which facilitates video communication, exchange of ideas, and mutual editing; the object here is the group process relating to coordination and cohesion, and the result is a creative outcome. By identifying the nature of the IT platform in terms of the above capabilities and the nature of group processes in terms of their goals, and measuring the impact of the former on the latter, this paper can provide valuable guidance to developers of platforms for hybrid work. It is one of the few papers that focuses on the interaction between technology features and group processes in the context of hybrid work.

Research Questions

Our quest is to identify how information technology (IT) promotes collaborative processes in the context of hybrid work and whether that leads to creative learning. The following research questions were studied for that purpose:

1) Does the relational capital of a hybrid working team, in terms of trust and familiarity, promote collaboration?
2) Do features of a digital platform such as openness to both proprietary and open source systems and compatibility with current software tools used by team members in a hybrid working environment promote collaboration?
3) Do collaborative processes relating to the integration of diverse skills, task coordination, and group solidarity lead to creative outcomes?

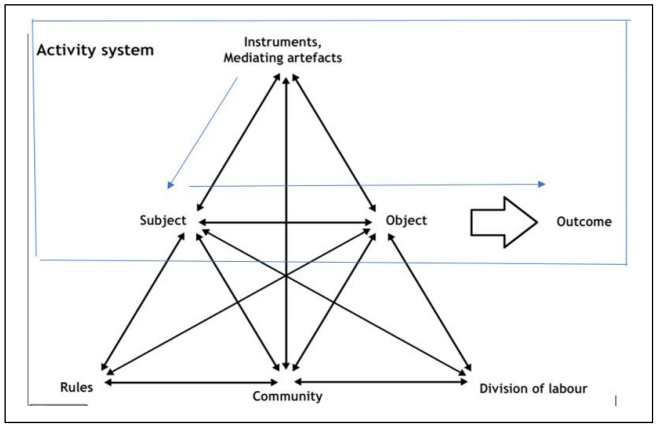
The rest of the paper is organized as follows: the next section sets out our theoretical framework, followed by the research model, data analysis, and finally a summary.

Theoretical Framework

We use Activity Theory (AT) to frame our research. Figure 1 describes AT, and Figure 2 shows our research model based on these theories.

Activity Theory: Leontev (1978) and Vygotsky (1978) pioneered the development of AT, in which all human activity is viewed as a social phenomenon where the individual is also socially situated. AT is a meta-theory or framework rather than a predictive theory. It considers an activity system where an individual subject is manipulating an object, which is the goal or the subject matter that the subject is engaged with, using a tool (figure 1).

Figure 1: Activity Theory



Engeström (1987) introduced the concept of an activity system model, which added more components—community, rules, and roles—to Leontiev's (1978) "subject-object" model. As Engeström (1993) has noted, AT does not offer "ready-made techniques and procedures" for research; rather, its conceptual tools must be "concretized according to the specific nature of the object under scrutiny," which is what we do in our research.

In the field of information systems, AT became popular in human-computer interface (HCI) studies, where researchers recognized quite early the importance of social context and human agency and motivation. Kaptelinin and Nardi (2012) and Nardi (1996) employed AT to claim that in designing computing technology, it is critically important to take into account that people act *through* technology, rather than interact with it. According to Kaptelinin and Nardi (2018), "It has been argued that one of the major contributions of the Activity Theoretic analysis for IS research is that it brings technology (tools) and the context together into the unit of analysis (the activity). Therefore, it does not privilege the social over the technical or overly emphasize technology, but rather offers a socio-technical perspective."

Our basic model of research is outlined in figure 2.Relational capital is concerned with the nature of relationships between organizations. It describes the trust between individuals in a team and their commitment to each other (Wasko and Faraj, 2005). Relational capital allows organizations to share knowledge willingly and openly without concern for opportunistic behavior by their counterparts (Tsai and Ghoshal, 1998). It also motivates organizations to absorb acquired knowledge once they have confidence in the competency of the knowledge source which increases the effectiveness of knowledge sharing (Levin and Cross, 2004). Thus, relational capital provides the social and cultural environment in which knowledge management occurs, and the authors posit,

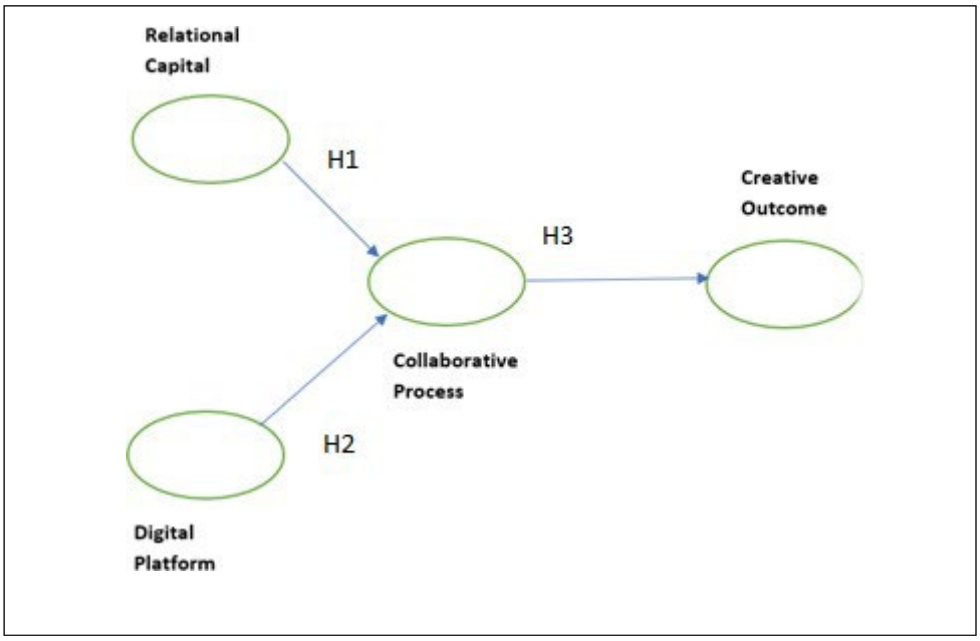
H1: A higher level of relational capital of a team in a hybrid working environment is associated with more effective collaborative processes.

Hypothesis 1 is related to our research question 1. AT is much in use in the HCI world, where the user in a social context is much emphasized. The focus of such research is the use of IT tools in the context of a social world. Group Decision Support Systems (GDSS) also focus on the central theme of how IT promotes productive work, such as group decisions. The features identified in the HCI, IS, and GDSS worlds include friendly and interactive user interfaces, synchronous and asynchronous communication links, modeling, and decision support (Chen et al., 2018; Candea et al., 2016; Straub and Beauclair, 1998) as groups negotiate a mutually agreed solution to "unstructured, nebulous and ill-defined problems" (Applegate et al., 1986). Underlying GDSS research is the basic theme of the performative and communicative capability of IT promoting effective group work. Hence, we propose that:

H2: A convenient and novel digital platform with features such as openness to both proprietary and open source systems and compatibility with existing applications will positively influence collaborative processes related to tasks, coordination of tasks, and integration of skills.

Hypothesis 2 is related to our research question 2. It has previously been observed that group process features of task and group solidarity positively influence learning outcomes related to creativity and academic competence. Doolan and Gilbert (2017) and Doolan (2013) found evidence that tools such as WhatsApp, Skype, StudyNet, and Google Drive helped individuals "to plan our meeting and plan our work" and also "increased productivity and friendship," and were used for "discussing ideas" and to go into the computer screen of another and do joint work. Similarly, Miyazoe and Anderson (2010) found strong evidence that using Web 2.0 tools, team members were able to develop collaborative spaces where they could read, edit, and reflect on each other's work, which they found useful. Hence, we propose that:

Figure 2: Basic Model of Research



H3: Learner-perceived collaborative process features of task coordination, skill integration, and group solidarity will positively influence learning outcomes related to creativity.

Hypothesis 3 is related to our research question 3

Methodology

Research Method

We chose to test our theoretically derived research model with survey data collected from undergraduate students in business schools in New England and the Midwest. The demographic characteristics are shown in Table 1. In our research and survey, the unit of analysis is the individual engaged in an activity in a group setting assisted by technology. In socio-cultural theories, the unit of analysis is groups of individuals participating in broad systems of practices (Lave and Wenger, 1991). Socio-constructivist theories, on the other hand, focus on individual students and view learning as an act of participation in society (Palincsar, 1998).

Measures

Key definitions of our measures are as shown in table 1:

Table 1: Measure Definitions

Digital Platform	The digital platform is measured as a composite of four capabilities and characteristics: compatible with other software tools that students use in their study, allows novel functions, convenient to use, and compatible with open-source items (Song et al., 2018).
Collaborative Process	The process is measured in terms of goals: promotes individual participation, integration of diverse skills, group interactions relating to socio-emotional expressions such as expressing cohesion, and coordination of group activities (Vuopola et al., 2016; West, 2002).
Creative Outcome	Outcome related to creativity and high-quality ideas (Vuopola et al., 2016; Anders and Rolland, 1994). Team creativity is taken as the generation of novel and appropriate ideas and solutions in the context of team objectives.
Relational Capital	Measured as the willingness of team members to keep promises to each other, avoid free-riding, and know one another on a personal level (Yli-Renko, 2003).
Hybrid Teams	Teams where individual participants are free to decide on the mix of working together face-to-face and using a shared digital communication platform.

We developed instruments by adopting and adapting existing measures from previous research (see Table 7 for details for the survey questions and their references).

Data Collection

Table 2: Sample Demographics

	% Respondent	Respondents	% Respondent
Male	81	5.2222	1.31992
Female	83	5.2319	1.16267
Total	164	5.2271	1.23901

The unit of data collection in our research is a single student. Undergraduate students at a business school in New England were surveyed. Seven sections were involved, and they were all sections smaller than 30 students each. Over 150 responses were received, out of which about 25 were rejected. Student groups of 3-5 members worked on a design and analysis project that lasted several weeks. The projects allowed for many good solutions, and students had to decide on their own as to the depth and breadth of investigation needed to execute the project. Students within the same team often belonged to different majors, and the project allowed their inputs to be used. The instructor took a "hands-off" approach, with groups occasionally meeting with him to get his verbal feedback. Students could meet face-to-face but mostly used WhatsApp, Zoom, shared Google Drives, and the university learning management system. Sample demographics is as shown in table 2.

Results

The structural and measurement models were evaluated by the partial least square (PLS) approach using SMART-PLS software (Ringle et al., 2005). According to Heneseler et al. (2009), this is appropriate for exploratory research, and the PLS approach uses both formative and reflective constructs, which is a strength of this approach.

Assessment of Measurement Model

Reflective Constructs: The psychometric properties of the constructs included in this research are shown in Table 2. As per Barclay et al. (1995), we investigate the convergent reliability, individual item reliability, composite reliability, and discriminant reliability of the measurement model. The convergent validity using factor loadings and cross-loadings of the indicators, their reflective constructs, average variance extracted (AVE), and composite reliability were studied. As per Table 3, all the AVE values were above 0.5. The Cronbach's alpha deficiency and composite reliability are required to be above the threshold of 0.7 as per Yi and Davis (2003). The Cronbach's alpha for relational capital was 0.69, which is close to 0.7. According to Nunally and Bernstein (1994), "values should not be lower than 0.6," and that is what we have achieved in this exploratory study. The cross-loadings for non-formative constructs are shown in Table 5. The values ensure the scale reliability and the internal consistency of the construct in our research model.

Table 3: Psychometric Properties of reflective and formative constructs

Constructs	CR	CA	AVE	Indicator	Loading(reflective)/ weight(formative)	VIF
Digital Platform (Formative)	n/a	n/a	n/a	DP1	0.32	1.6
				DP2	0.04	1.4
				DP3	0.32	1.6
				DP4	0.81	2.0
Collaborative Process (formative)	n/a	n/a	n/a	CP1	0.50	1.5
				CP2	0.43	1.5
				CP3	0.12	1.8
				CP4	0.20	1.6
Creative Outcome	0.82	0.91	0.85	CO1	0.93	1.9
				CO2	0.91	1.9
Relational Capital	0.69	0.82	0.62	RC1	0.85	1.4
				RC2	0.78	1.4
				RC3	0.71	1.4

The square roots of the AVEs were compared with correlation scores in the correlation matrix. As per Table 4, none of the non-diagonal entries that represented construct correlations exceeded the square root of AVEs, the diagonal entries. According to Fornell and Larcker (1981), this ensures the discriminant validity of the constructs in the research model.

Table 4: Square root of AVE and Latent Variable Correlation

	Collaboration	Creative Outcome	Digital Platform	Relational Capital
Collaboration	NA			
CreativeOutcome	0.55	0.92		
DigitalPlatform	0.39	0.3	NA	
RelationalCapital	0.55	0.4	0.07	0.78

Variance inflation factor (VIF) is used to measure the multicollinearity among constructs, according to Diamantopolous and Siguaw (2006). VIF for formative constructs varied from 1.4 to 2.0. The threshold value for VIF is 3.3. This shows that multicollinearity is not an issue with this model.

Formative Constructs: The authors assess the formative measurement model differently. The validity of formative constructs is assessed at two levels: the indicator level and the construct level. According to Chin (1998), indicator validity is assessed by indicator weights being significant at the 0.05 level and also having VIF values below 10 (Gujarati, 2003). Inter-construct correlations were used to assess the formative construct at the construct level, and their correlations were less than 0.7 (Table 4) (Henseler et al., 2009). At the construct level, nomological validity is ensured by having a relationship among formative constructs as justified in terms of prior literature, which is also the case here (Henseler et al., 2009).

Table 5: Loadings and Cross Loadings

	Collaboration	Creative Outcome	Digital Platform	Relational Capital
CO1	0.538	**0.931**	0.306	0.412
CO2	0.478	**0.912**	0.261	0.315
CP1	**0.830**	0.434	0.298	0.505
CP2	**0.805**	0.479	0.390	0.361
CP3	**0.681**	0.399	0.196	0.401
CP4	**0.650**	0.324	0.208	0/429
DP1	0.139	0.116	**0.351**	0.108
DP2	0.120	0.218	**0.305**	0.089
DP3	0.295	0.220	**0.747**	0.128
DP4	0.359	0.315	**0.908**	0.081

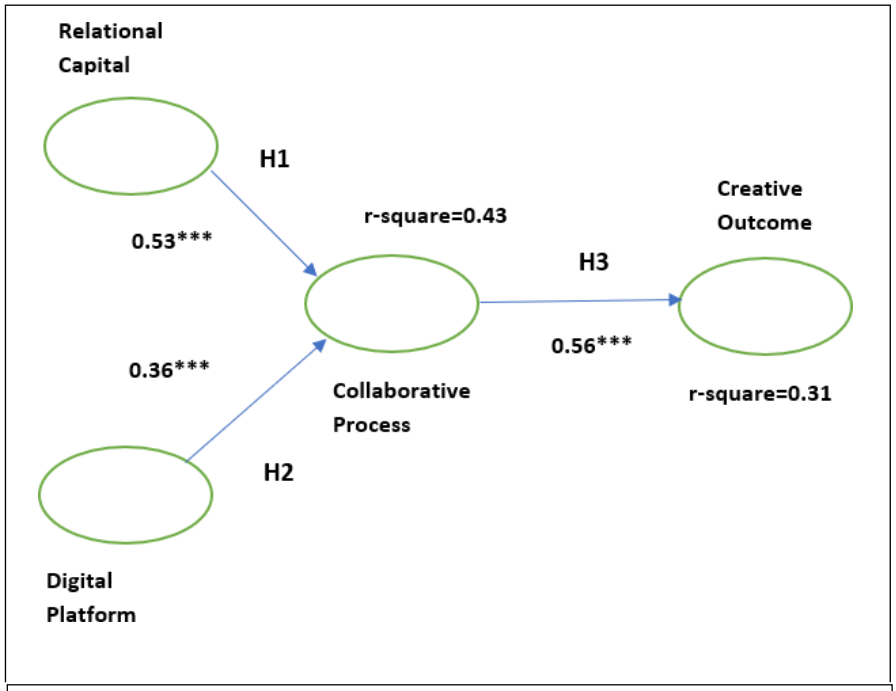
Table 5 (Continued)

	Collaboration	Creative Outcome	Digital Platform	Relational Capital
RC1	0.507	0.240	0.054	**0.848**
RC2	0.423	0.414	0.170	**0.791**
RC3	0.358	0.3055	0.056	**0.716**

Assessment of Structural Model

The authors analyzed the structural model in several steps. The path coefficients needed to be significant at the 0.05 level and the path weights to be more than 0.10 (Urbach and Ahlemann, 2010). Figure 3 and Table 6 display the PLS structural model. The research model accounts for 43% of the variance in collaborative process and 31% in the creative outcome. According to Figure 3, the effect of relational capital on the collaborative process was significant and positive (β = 0.53, p < 0.001), supporting the H1 hypothesis. Likewise, the effect of the digital platform on the collaborative process was significant and positive (β = 0.36, p < 0.001), supporting H2. The effect of the collaborative process on creative outcome was also significant and positive (β = 0.56, p < 0.001), thus supporting H3. The R-square of each of the endogenous latent variables was determined. The R-square for the collaborative process was found to be 43%, and for the creative outcome, it was 31%. Please refer to figure 3 and table 6

Figure 3: PLS test of the proposed structural model



***p< 0.001; **p<0.05

Table 6: Test of Hypothesis

Collaborative Process Rsquare=0.43 CreativeOutcome Rsquare=0.55	Path Coefficient	TStatistics	P value/Result
H1; Relational Capital → CollaborativeProcess	0.53	8.4	.0001/*** significant
H2: DigitalPlatofrm→ CollaborativeProcess	0.36	8.7	.0001/*** significant
H3: CollaborativeProcess-> CreativeOutcome	0.56	6.3	.0001/*** significant

Summary

The context of our research is hybrid work where participants get to choose the mode of interaction, including face-to-face as well as interaction over a digital platform. The purpose of our research is to explore the impact of an appropriate digital platform and the relational capital of a team on collaborative processes and the impact of such processes on the creative outcome. Our quantitative study was theory confirming and using panel data collected through a web survey. The research as conducted here has some limits to its generalizability. It is based on respondents only in the US at private universities, which are generally attended by students from high-income groups. High-income groups relate to technology differently than low-income groups (Cjoi and DiNitto, 2013). More research is needed to establish the sequence of processes in a causal model and the individual- and team-level mechanisms through which creative learning proceeds. Our focus is on the level of small groups and teams. The findings establish the basic hypothesis of the research: that the relational capital of a team and an appropriate digital platform promote healthy collaborative processes leading to creative learning outcomes. In future research, we will formalize the notion of a work environment and its features. One reason why we have conflicting accounts of how work from home impacts productivity and creativity is that the environments are different in different studies.

Table 7: Indicator Sources and Survey questions

Indicator	Survey Item	Reference
PT1	The digital platform is compatible with all other software tools we use	Song et al, 2018
PT2	The digital platform increasingly has novel functions	Song et al, 2018
PT3	The digital platform has convenient features	Song et al, 2018
Pt4	The digital platform is increasingly compatible with open source systems	Song et al, 2018
CP1	Through collaboration, our team promotes individual participation	Vupola et al 2016; West 2002
CP2	Through collaboration, our team is able to integrate our different skills	Vupola et al 2016; West 2002
CP3	Through collaboration, our commitment to our group objectives is increased	Vupola et al 2016; West 2002
CP4	Our table is able to coordinate our individual work	Vupola et al 2016; West 2002
RC1	In our team, we keep promises to each other	Yli-Renko et al 2001
RC2	In our team, we do not take advantage of others	Yli-Renko et al 2001
RC3	In our team, we know each other at a personal level	Yli-Renko et al 2001
CO1	Through collaboration, we were able to develop many new ideas	Anders & Rolland 1994
CO2	Through collaboration, we were able to develop high-quality ideas	Anders & Rolland 1994

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Appendix

Table 6: Indicator sources and definitions

PT1	The digital platform is compatible with all other software tools we use	Song et al., 2018
PT2	The digital platform increasingly has novel function	Song et al., 2018
PT3	The digital platform has many convenient features	Song et al., 2018
PT4	The digital platform is increasingly compatible with open source systems	Song et al., 2018
CP1	Through collaboration our team promotes individual participation	Vuopala et al 2016; West 2002
CP2	Through collaboration our team is able to integrate our different skills	Vuopala et al 2016; West 2002
CP3	Through collaboration our commitment to our group objectives is increased	Vuopala et al 2016; West 2002
CP4	Our team is able to coordinate our individual work	Vuopala et al 2016; West 2002
RC1	In our team we keep promises to each other	Yli-Renko *et al*. 2001
RC2	In our team we do not take advantage of each other	Yli-Renko *et al*. 2001
RC3	In our team we know each other on personal level.	Yli-Renko *et al*. 2001
CO1	Through collaboration we were able to develop many new ideas	Anders & Rolland 1994
CO2	Through collaboration we were able to develop high quality ideas	Anders & Rolland 1994