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Effectiveness of Teams: An Investigation of Teacher Team Learning in the Context of Educational Innovation

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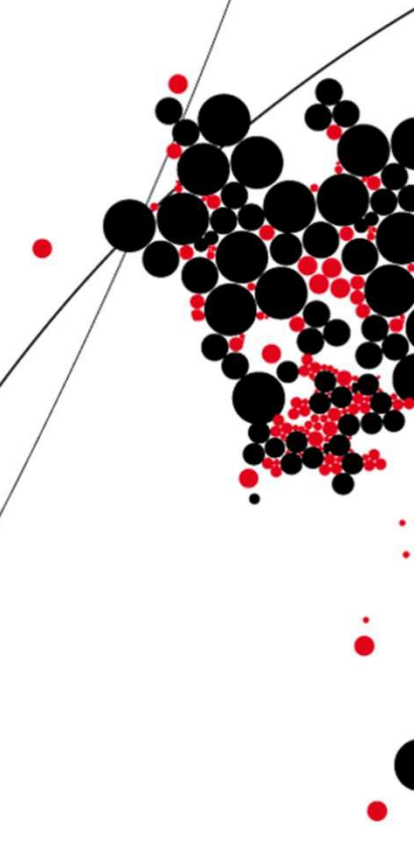

Abstract

Teams are getting increasingly important in today's organizations. In order to adapt to the fast-changing environment, the need of team learning increases. To gain insight into the team learning processes that promote team effectiveness, this research questioned which aspects of team learning lead to an effective team. The present cross-sectional study provides a multidimensional view on higher education teacher team learning. By including multiple measures of team effectiveness, this research offers a broad picture of the concept and is therefore a useful addition to existing research. Additionally, it investigated interaction effects from inter-team learning on the relation between intra-team learning and team effectiveness. The effects of different team learning behaviors on team effectiveness were measured with a questionnaire that was filled in by 342 participants from 108 different teacher teams in a higher education context. Using a multiple regression analysis, the results imply that sharing, co-construction, constructive conflict and inter-team learning do not always predict team effectiveness. The analysis showed that not all team learning variables had an effect on the same team learning outcomes. Constructive conflict had a negative effect on team performance, whereas it showed a positive effect on student satisfaction. Furthermore we found a negative interaction effect from inter-team learning with constructive conflict on student satisfaction. Sharing information within a team was positively related to team performance and team viability, and a positive interaction effect was found from inter-team learning with sharing on team performance.

Keywords: Team learning, effectiveness, inter-team learning, intra-team learning

Abstract Dutch

Teams worden in de huidige tijd steeds belangrijker voor bedrijven. Om zich aan te kunnen passen aan de steeds veranderende omgeving, wordt teamleren steeds meer noodzakelijk. Om inzicht te krijgen in verschillende teamleerprocessen die de effectiviteit van teams vervoeren kijkt dit onderzoek erna welke aspecten van teamleren leiden tot een effectieve samenwerking van teams. Deze cross-sectionele studie geeft een multidimensionale kijk op teamleren in het hoger onderwijs. Door verschillende metingen van team effectiviteit te includeren biedt dit onderzoek een breed beeld van het concept en is daarom een zinvolle toevoeging aan bestaand onderzoek. Daarna wordt onderzocht of inter-team learning een interactie-effect op de relatie tussen intra-team leren en team effectiviteit heeft. De effecten van verschillende teamleergedragingen op team effectiviteit werd gemeten met een

vragenlijst die van 342 respondenten uit 108 verschillende teams uit het hoger onderwijs werd ingevuld. De uitgevoerde multiple regressie analyse toont aan dat niet alle variabelen van teamleren een effect hebben op dezelfde uitkomsten van teamleren. Constructive conflict had een negatief effect op de team performance, terwijl het een positief effect heeft op de studententevredenheid. Bovendien werd een negatief interactie-effect gevonden van inter-teamleren met constructive conflict op de studententevredenheid. Sharing is positief gerelateerd aan team performance en team viability, en er werd een positief interactie-effect gevonden van inter-teamleren met sharing op de team performance.

Keywords: Teamleren, effectiviteit, inter-team leren, intra-team leren

Introduction

Since teams have become increasingly important in today's organizations in order to deal with a fast-changing environment, it becomes more and more important for organizations to improve the effectiveness of teams. Organizations rely increasingly on teams to manage complex problems (Van den Bossche, Gijselaers, Segers, Woltjer & Kirschner, 2011). In more than 80% of the medium-sized and large organizations at least parts of the work is done in teams (Gordon, 1992). In order for the organization to react flexibly to the changing environment and to enhance individual learning as well as team effectiveness, the teams in organizations have to learn (Decuyper, Dochy & Van den Bossche, 2010). It has been conjectured that team learning advances the development and creativity of the team and promotes group performance (Wong, 2004). According to Senge, "team learning is vital because teams, not individuals, are the fundamental learning unit in modern organizations" (1990, p. 10).

In the context of education it also became increasingly important to enhance group performance among teachers, since research indicated that student learning can be increased by strong professional communities of teachers (Newmann, King & Youngs, 2000). Educational reforms were implemented in elementary schools in order to improve instructional quality and student learning. These reforms focused increasingly on collaborative practices among teachers (Goddard, Goddard & Tschannen-Moran, 2007) and the integration of sciences in order to enhance students' learning (Stalmeijer, Gijselaers, Wolfhagen, Harendza & Scherpbier, 2007). According to Stalmeijer et al. (2007) this integration of sciences requires multidisciplinary teams of experts that design and implement educational innovations.

However, existing research only refers to elementary schools when it comes to teacher team learning (e.g. Newmann, King & Youngs, 2000; Crow & Pounder, 2000; Meirink, Imants, Meijer & Verloop, 2010). The University of Twente is an example of a higher education institution that implemented a new model that focuses on the project-based integration of courses and the collaboration of teachers in teams (Universiteit Twente, 2012). This research focused on the link between certain basic team learning processes and team learning outcomes of teacher team learning in the context of innovation in higher education. Research showed that there are several team learning processes and variables that influence the effectiveness of teams (e.g. Campion, Medsker & Higgs, 1993; Decuyper, Dochy & Van den Bossche, 2010; Knapp, 2010; Zellmer-Bruhn & Gibson, 2006), but existing research does not often take different dimensions of team learning into account and if it does, it only

measured the effects on one team learning outcome (e.g. Chan, Pearson & Entrekin, 2003; Bresman, 2010; Mesmer-Magnus & DeChurch, 2009). By taking different team learning processes into consideration, this research provides a multidimensional view on higher education teacher team learning. It also includes multiple measures of team effectiveness, considering both objective and subjective results of team learning. That makes it possible to get a broad picture on team effectiveness and how it is influenced by different team learning variables.

The goal of this study was to examine the influence of team learning on team effectiveness. It can help to gain insight into which team learning processes serve to increase team effectiveness.

Theoretical Background

In this paper the terms "group" and "team" were used as synonyms, according to the definition from Sessa and London (2006) of teams being a collection of individuals who are responsible for outcomes together. They are also interdependent from each other in their tasks, and see themselves and are seen by others as a social unit and are part of larger social systems. Team learning was defined many times and in many different ways. Nevertheless these definitions often share certain aspects. Druskat and Kayes (2000) defined team learning as a collectivity of individual learning, whereas Agrote, Gruenfeld and Naquin (2001) saw teams as interdependent and dynamic systems that are learning. In these definitions team learning consists of different processes that occur within the team. It is seen as individual team members acquiring new knowledge, skills or information (Druskat & Kayes, 2000), and as a process whereby the team is seeking feedback, reflecting upon actions and adapting in order to improve (Drach-Zahavy & Somech, 2001; Edmondson, 1999). It can also be seen as a process whereby the team members have to organize with the actions of other members and trough that they have an effect on the others again (Argote, Gruenfeld & Naquin, 2001). Sessa and London combined these views and defined team learning as a process whereby individual members of a team create and acquire new knowledge and share that with their team members, but it also means that teams reflect on actions and make changes to improve (Sessa & London, 2006). In this paper we refer to team learning as defined by Sessa and London (2006) as this interpretation is mainly consistent with the definitions of team learning provided by Decuyper, Doschy and Van den Bossche (2010) and Wong (2004) that are presented in the following paragraph.

Team learning can be divided into certain basic processes that occur within the team. This learning within the team is called intra-team learning and consists of three basic process variables that are the basis of intra-team learning: sharing, co-construction and constructive conflict. Decuyper, Doschy and Van den Bossche (2010) considered intra-team learning the basis of team learning. When sharing occurs in groups, the members communicate knowledge, competencies, opinions or creative thoughts among each other. Co-construction in groups involves developing shared knowledge and building shared meaning. It is seen as a mutual process that can take place by refining, constructing on or adjusting an original idea. Team members "engage in repeated cycles of acknowledging, repeating, paraphrasing, enunciating, questioning, concretizing and completing the shared knowledge, competencies, opinions or creative thoughts" (Decuyper, Dochy & Van den Bossche, 2010, p. 116). Constructive conflict is a process whereby team members participate in negotiations or dialogues that unravel differences in identities, opinions, etc. from team members. This ultimately leads to some kind of agreement (Decuyper, Dochy & Van den Bossche, 2010). Team members that engage in intra-team learning are learning within their group which leads to shared understanding of the task and encourages collective actions. Additionally, intra-team learning was found to have a positive effect on team efficiency (Wong, 2004). In order to successfully meet the goals of a team, constructive conflict is considered the most important process within intra-team learning (Van den Bossche, Gijselaers, Segers, Woltjer & Kirschner, 2011).

Besides the learning that is taking place within the team, there are also learning processes that occur between the team and external parties. This is called inter-team learning and it includes learning that occurs outside of the own group. Edmonsdon (1999) defined inter-team learning as seeking information and feedback from customers and others, for example managers. Bresman (2010) identified two types of inter-team learning activities, which are vicarious learning activities and contextual learning activities. When engaging in vicarious learning activities teams can learn from others that have already acquired experiences that are similar to the key aspects of its task. When engaging in contextual learning activities a team can learn from external sources about important aspects of its context. Both vicarious and contextual learning activities have a positive effect on team performance. However, in the absence of intra-team learning vicarious learning activities can inhibit team performance (Bresman, 2010). Inter-team learning was found to be positively related to team performance (Chan, Pearson & Entrekin, 2003), helps the group to acquire and develop new knowledge and is positively related to team innovativeness (Wong, 2004).

According to Decuyper et al. (2010), inter-team learning is a facilitating process variable in the process of team learning, hence it can promote successful team learning. It is also related to perceived effectiveness. The more inter-team learning occurs in a team the more efficient and innovative it gets (Decuyper, Dochy & Van den Bossche, 2010). Additionally, Wong (2004) found that inter-team learning encroaches on the effects from intra-team learning on team effectiveness when it occurs in a team. Thus, inter-team learning can change the effects of intra-team learning on team effectiveness. Therefore, inter-team learning was taken into account as a moderator in this research.

The purpose of teams however is not learning itself, but producing some kind of outcome with the group, whether it is creating a product, solving a problem or making decisions (Sessa & London, 2006). This leads to several group outcomes that were written up in the Figure 1. These group outcomes are generally consolidated into the term "team effectiveness". Team effectiveness consists of team performance and team viability. Team performance describes the degree to which a team meets its goals and how well its output actually fulfills the group's task (Zellmer-Bruhn & Gibson, 2006). However, this does not take the possibility into account that teams are at some point not willing to work together any longer (Kozlowski & Bell, 2001). Therefore, it is also important to take team viability into account in order to predict what it takes for a team to continue to be effective in the future (e.g. Guzzo & Dickson, 1996; Sundstrom, De Meuse & Futrell, 1990). It describes the collective sense of belonging from the team members to their group or the extent to which individuals wish to remain members of the team (Mathieu, Maynard, Rapp & Gilson, 2008). It is a feeling of affective commitment to the group, influenced by the social identification of people that leads to a certain behavior of group membership (Ellemers, Kortekaas & Ouwekerk, 1999).

As mentioned above, Wong found that inter-team learning and intra-team learning can have different influences, depending on the goal of a team and the context in which a team is working: Inter-team learning is positively related to team innovativeness and intra-team learning is positively related to team efficiency. This implies that groups should engage more in inter-team learning when they are learning-oriented and their focus is on developing new competencies and engage more in intra-team learning when they are mastery-oriented and their focus is on perfecting current competencies (Wong, 2004). That shows that there is not only one distinct outcome of team learning, which emphasizes the importance of taking more than one outcome of team learning into account in the analysis.

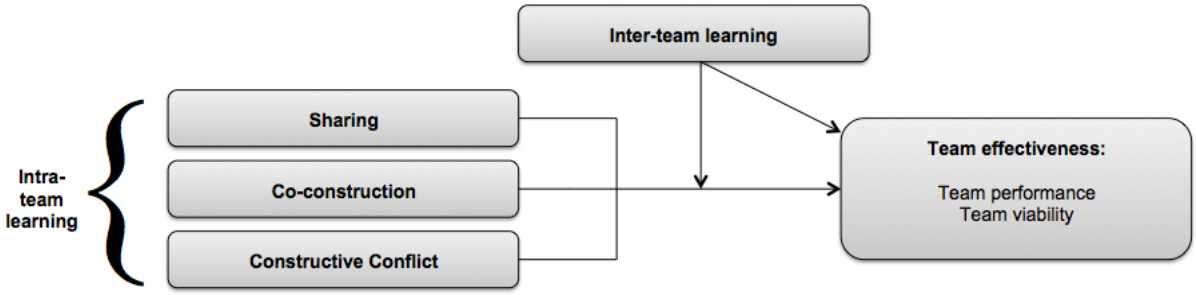

Figure 1. Model of relations between team learning and team effectiveness.

Influences on team learning.

Besides the variables which team learning consists of that were described above, there are also a number of other variables that were found to have an influence on team learning and team effectiveness. Van der Vegt, Van de Vliert and Oosterhof (2003) showed that the concepts of task interdependence and goal interdependence also have an influence on team performance. Task interdependence is described as the extent to which a team member needs information, materials or support of fellow team members to successfully complete the task. Goal interdependence describes the extent to which team members think that they have a group goal or get group feedback that can only be satisfied when the team performs well. Van der Vegt et al. (2003) stated that congruent combinations of task and goal interdependence (high-high and low-low) have a positive effect on team performance, whereas incongruent combinations (high-low and low-high) have a negative effect on team performance.

Additionally, team heterogeneity was positively related to team performance, especially when the given task is diverse because different competencies are needed to successfully fulfill the task or when the task is disjunctive, because the team performance depends on the most competent team member. Team heterogeneity refers to the different abilities and experiences that different members of the group have (Campion, Medsker & Higgs, 1993).

Finally, research also showed that (perceived) team efficacy had a positive influence on both teacher collaboration and student achievement in the context of primary education. Team efficacy refers to the beliefs of team members about the functioning of the team in the future concerning a specific situation (Moolenaar, Slegers & Daly, 2012). Bandura (1997) defined team efficacy as the group's shared belief that they can organize and perform the actions that are necessary in order to deliver a certain performance.

The general question that we aimed to answer in this paper is "to what extent do the different team learning processes have an influence on the different dimensions of team effectiveness?". In view of the fact that existing research often did not include different

dimensions of team learning and multiple team learning outcomes, this study provides a new view on the effects on team effectiveness as we included multiple measures of team learning and team effectiveness.

Method

Context description

The University of Twente in Enschede, The Netherlands, implemented a new model of education in 2013, naming it the Twente Education Model (TEM). The first of the two main reasons to introduce the model was to react on the fast-changing society, in which flexibility is an essential characteristic for the students in order to work in a more complex and fast-changing environment. The second reason was to increase the successful completion of the study in reaction to financial pressure from the government concerning the dropout rate and long-term students (Universiteit Twente, 2012). One academic year is divided into four quarters that are called modules. In each of these modules the students can earn 15 ECTS. Prior to the introduction of this model the curriculum was divided into smaller courses where every teacher was responsible for his or her own course only. With the TEM, each of the modules is now seen as a whole, consisting of different subparts. The focus lies on a project for which, in order to succeed, the students need the knowledge they gain from the other subjects within the module. In order to meet the requirements of the model to create coherent modules, teacher teams that work together to ensure a good integration of the subjects were established (Universiteit Twente, 2015).

Design

In order to analyze the effectiveness of teams a quantitative research was conducted and a cross-sectional survey design was employed. There was no random assignment but the analysis has been performed on the already existing teacher teams of the modules. There were three dependent variables (team performance, team viability and student satisfaction), four main independent variables, (sharing, co-construction, constructive conflict, and inter-team learning) and four background variables (task interdependence, goal interdependence, team heterogeneity and team efficacy). Additionally, the interaction effects from inter-team learning on sharing, co-construction and constructive conflict on the three dependent variables were included into the analysis.

Participants

The participants that took part in this research were teachers of every undergraduate programme from the University of Twente. As mentioned before, the teachers work together in teams in order to design the modules cohesively with their specific subparts. The questionnaire was sent to 689 respondents from 131 teams. Ultimately 130 teacher teams took part in this research and 440 teachers in total filled in the questionnaire, from which 342respondents from 108 teams filled in the survey completely. Incomplete data were not taken into account in this study. 233 men and 109 women participated in this research with an average age of 46.23 years, ranging from 22 to 72 years. On average 4.22 members of each team filled in the questionnaire, varying from 1 to 11, from teams that have 6.06 members on average, ranging from 2 to 12.

Also, as one of the dependent variables was student satisfaction, students who completed the modules took part in this research by giving feedback on the modules as a whole and on different components of the modules. In total there were 3242 student evaluations taken into the analysis.

Instruments

The analysis was based on questionnaires that were filled in by the teachers. The teachers were asked to respond to the statements in the questionnaire using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The complete questionnaire can be found in Appendix A.

The materials that were used to determine the student satisfaction were the student evaluation forms that measured the student's opinions about the modules. The part that was used from the student evaluation form to determine the student satisfaction was the question "In summary, I give the module the following grade. 1 = very poor; 10 = excellent".

Intra-team learning,

Five questions were used to measure the extent to which sharing takes place in a team ($\alpha = .81$). Three of them were measured with the items from the questionnaire developed by Van den Bossche et al. (2011). In order to get more reliable results, we also added two items based on a scale developed by Van Offenbeek (2001). These items were adapted to the situation of the participating teams. Co-construction was measured with six questions ($\alpha = .85$), where again three were measured with the items from the scale of Van den Bossche et al. (2011) and the remaining three were based on a scale developed by Visschers-Pleijers et al. (2004). These items were also adapted to the situation of the participating teams, e.g.

"Members of this team ask proper questions in order to see through each other's information". Constructive conflict was measured by means of seven questions (α = .89). Again, three were measured with the items from the scale from Van den Bossche et al. (2011), the other four were based on De Groot (2002), but were adapted to a formulation on team level, e.g. "In this team we ask critical questions when someone tells something new".

Inter-team learning.

We measured inter-team learning with seven questions (α = .88) that were based on scales developed by Wong (2004) and Bresman (2010), e.g. "This team is looking for ideas and expertise from persons from outside the team".

Other influences on team learning.

Team heterogeneity was measured with three questions each (α = .46), all measured with the scale developed by Campion, Medsker and Higgs (1993). Because of the low reliability of this scale we left out one item ("The members of my team have skills and abilities that complement each other") in the analysis, what resulted in a higher reliability (α = .61). Team efficacy was measured with five questions of Moolenaar, Sleegers and Daly (2012), e.g. "In our team, teachers are able to design a module that challenges students to learn" (α =.77). Task interdependence was measured with four questions (α = .85) based on a scale developed by Van der Vegt, Van der Vliert and Oosterhof (2003), e.g. "In order to carry out our tasks, we need information from each other". Goal interdependence was also measured with four questions (α = .78), based on the same scale as task interdependence, e.g. "In this team we all want to reach the same goals".

Team effectiveness.

As already mentioned above, team effectiveness consists of two different variables: team performance and team viability. The team performance was measured in two different ways. On the one hand we measured the perceived team performance based on the data retrieved from the questionnaire that the teachers filled in themselves, which made it a more subjective measurement. Team performance was measured with five questions (α = .84), e.g. "In this team, we perform well". Three of the items used here were based on the scale developed by Zellmer-Bruhn and Gibson (2006) and the other two were based on a scale from Van Woerkom and Croon (2009). On the other hand we also got an objective measurement of team performance that was specifically applied to the context of this research that was measured with a questionnaire for student satisfaction. This survey was filled in by the students of the participating teachers from this study. Team viability was measured with three

questions (α = .87) based on a scale developed by Ellemers, Kortekaas and Ouwekerk (1999), e.g. “I would like to continue working with my group”.

Procedure

In order to get permission to carry out the questionnaire, the programme directors from the different studies were informed about the research and with their permission the module coordinators were contacted afterwards. From the module coordinators information about which teachers are working in their team and their respective email addresses had been retrieved. Additionally, the module coordinators were asked if their team had had at least one team meeting. The teams that did not have one team meeting received a questionnaire without the intra-team learning scales. Two weeks before the start of the module the questionnaire was sent to the teachers via e-mail with the friendly request to fill it in. Also, a digital reminder was sent two times whenever a participant did not fill in the questionnaire yet. The questionnaire was available both in Dutch and English.

The student evaluation forms for each module were collected according to the standard procedure of the university. The questions from the evaluation forms that were taken into account for the analysis in this research were the same for each module. We received the completed questionnaires via the person that is responsible for the student evaluations at the University of Twente. In total 3242 students filled in the student evaluation forms, on average 30,3 students per module.

Data analysis

To analyze the influence of the independent variables on the dependent variables and therefore to be able to make a statement about their importance for the effectiveness of teams, first the outcomes from the questionnaires were fed into the computer program SPSS for statistical data analysis. In order to be able to make a statement about the influence of the different independent variables on team effectiveness, multiple regression analyses have been conducted on team performance, team viability and student satisfaction. To test the interaction effects of inter-team learning with the influence from intra-team learning on team effectiveness, inter-team learning was included in the analysis as a moderator.

Results

In order to answer the research question, a multiple regression analysis has been conducted. The main aim was to investigate the influence of four variables – sharing, co-construction, constructive conflict and inter-team learning – on team effectiveness. Since we

measured team effectiveness as team performance, team viability and the average grade that students gave the module, three individual multiple regression analyses have been performed. In SPSS aggregated variables were created to conduct the analysis on team level since we wanted to know what influences the effectiveness of teams. The results of the regression analyses are presented in Table 2.

Looking at the descriptive statistics, it appeared that the teachers themselves reported that their teams were very heterogenic (M = 4.20, SD = .52) and very interdependent in their tasks (M = 4.05, SD = .45). Also, the data analysis showed that the teachers thought they had a good collective efficacy (M = 3.92, SD = .34) and engaged a lot in sharing (M = 3.87, SD = .46). The lowest scores were found in inter-team learning (M = 3.09, SD = .48), co-construction (M = 3.64, SD = .41) and goal interdependence (M = 3.70, SD = .45). High scores were also found concerning the team learning outcomes. Teachers seemed to have a high feeling of team viability (M = 4.23, SD = .50) and they thought they perform well (M = 3.81, SD = .41). Table 1 shows the correlations between the different variables and their significance.

The models that were used in this research displayed that the predictors were highly accountable for the variability in the outcomes. The variability of team performance could be predicted by the model with 64% and the variability of team viability could be predicted with 54%. The model could explain the variability of student satisfaction somewhat less good, but still with 12%.

Table 1
Pearson Correlations between all variables including interaction effects

	TP	TV	SS	ITL	SH	ITL* SH	CO	ITL* CO	CONF	ITL* CONF	TI	GI	TE	TH
TP	1.00*													
TV	.66*	1.00*												
SS	.01	.01	1.00*											
ITL	.34*	.31*	.08	1.00*										
SH	.64*	.61*	.05	.31*	1.00*									
ITL* SH	.15*	-.05	.14*	.20*	.02	1.00*								
CO	.54*	.51*	.02	.34*	.82*	.10*	1.00*							
ITL* CO	.17*	.01	.02	.18*	.10*	.80*	.19*	1.00*						
CONF	.46*	.52*	.09*	.32*	.69*	.03	.81*	.08	1.00*					

ITL* CONF	.12*	-.01	-.05	.07	.03	.70*	.08	.86*	-.01	1.00*				
TI	.32*	.32*	.00	.09*	.51*	.10*	.62*	.20*	.57*	.10*	1.00*			
GI	.62*	.53*	-.03	.30*	.66*	.16*	.65*	.25*	.54*	.17*	.66*	1.00*		
TE	.67*	.59*	-.00	.35*	.50*	.03	.52*	.13*	.57*	.04	.48*	.62*	1.00*	
TH	.02	.15*	-.14*	.04	-.08	.01	.08	<.01	.13*	-.06	.21*	-.03	.25*	1.00*

* $p < .05$
Note. TP=Team performance; TV=Team viability; SS=Student satisfaction; ITL=Inter-team learning; SH=Sharing; CO=Co-construction; CONF=Constructive conflict; TI=Task interdependence; GI=Goal interdependence; TE=Team efficacy; TH=Team heterogeneity

The first multiple regression analysis was employed to ascertain the prediction of team performance from sharing, co-construction, constructive conflict and inter-team learning, and a significant model was observed ($R^2 = .64$, $F(11, 330) = 52.85$, $p < .01$). A significant positive influence on team performance was found from sharing ($\beta = .43$, $p < .01$) and from sharing moderated by inter-team learning ($\beta = .19$, $p < .01$). In addition, a negative significant influence was found from constructive conflict ($\beta = -.13$, $p = .04$), and from co-construction moderated by inter-team learning ($\beta = -.17$, $p = 04$). Thus, the more teams engaged in sharing the better they performed and the more teams were involved in inter-team learning, the more important sharing got for team performance. On the other hand teams performed worse the more they engaged in constructive conflict and the more they engaged in inter-team learning the less important co-construction became for the teams' performance. Regarding the background variables, a positive influence was found from goal interdependence ($\beta = .24$, $p < .01$) and team efficacy ($\beta = .48$, $p < .01$). The analysis showed that task interdependence has a negative effect on team performance ($\beta = -.24$, $p < .01$).

In a second model, the influence of sharing, co-construction, constructive conflict and inter-team learning on team viability was tested ($R^2 = .54$, $F(11, 330) = 34.65$, $p < .01$). The analyses showed that sharing ($\beta = .49$, $p < .01$) and constructive conflict moderated by inter-tam learning ($\beta = .16$, $p = .03$) were significantly positively related to team viability. Consequently, the more team members engaged in sharing the more they felt affection to their team. Furthermore, the more teams engaged in inter-team learning, the more important constructive conflict got for team viability. From the background variables, goal interdependence ($\beta = .22$, $p < .01$), team efficacy ($\beta = .26$, $p < .01$) and team heterogeneity ($\beta = .18$, $p < .01$) were found to have a positive correlation with team viability, and task interdependence had a negative influence on team viability ($\beta = -.19$, $p < .01$).

Table 2
Multiple regression test statistics

	Dependent variables								
	Team performance			Team viability			Student satisfaction (grade)		
	T	*β*	*p*	*T*	*β*	*p*	*T*	*β*	*p*
Sharing	6.68	.43	<.01	6.82	.49	<.01	.94	.09	.35
Co-construction	.55	.04	.59	-1.93	-.17	.06	-1.50	-.18	.13
Constructive conflict	-2.06	-.13	.04	1.82	.13	.07	2.20	.21	.03
Inter-team learning	-<.01	<.01	.99	1.44	.06	.15	.55	.03	.58
Task interdependence	-4.69	-.24	<.01	-3.22	-.19	<.01	1.07	.09	.29
Goal interdependence	4.03	.24	<.01	3.27	.22	<.01	-2.17	-.20	.03
Team efficacy	9.86	.48	<.01	4.66	.26	<.01	.59	.05	.56
Team heterogeneity	.25	<.01	.80	4.14	.18	<.01	-3.42	-.20	<.01
Inter-team learning*Sharing	3.35	.19	<.01	-1.09	-.07	.28	4.26	.38	<.01
Inter-team learning* Co-construction	-2.1	-.17	.04	-1.76	-.16	.08	-.22	-.03	.82
Inter-team learning* constructive conflict	1.27	.08	.21	2.15	.16	.03	-2.58	-.27	.01

The third multiple regression analysis was conducted to ascertain the prediction of student satisfaction by sharing, co-construction, constructive conflict and inter-team learning ($R^2 = .12$, F (11, 328) = 4.12, $p = .01$). In this model, constructive conflict showed a significant positive influence on student satisfaction ($\beta = .21$, $p = .03$) as well as sharing moderated by inter-team learning ($\beta = .38$, $p < .01$). Constructive conflict moderated by inter-team learning was found to have a significant negative influence on student satisfaction ($\beta = -.27$ $p = .01$). Therefore, the more teams were involved in constructive conflict, the more satisfied the students were with the module. Additionally, the more teams engaged in inter-team learning the more important got sharing and the less important got constructive conflict for student satisfaction. Two of the background variables also had a negative influence on student satisfaction, which were team heterogeneity ($\beta = -.20$, $p < .01$) and goal interdependence ($\beta = -.20$, $p = .03$).

Discussion

The principal goal of this study was to determine to what extent the different team learning processes have an influence on the different dimensions of team effectiveness. Former research suggested, that sharing, co-construction, constructive conflict and inter-team learning have a positive influence on team performance (e.g. Wong, 2004; Decuyper, Dochy & Van den Bossche, 2010; Bresman, 2010; Chan, Pearson & Entrekin, 2003). This investigation showed that there were several variables that predicted team effectiveness significantly, however we also found that the significance of the team learning processes strongly depends on the outcome variable.

To begin with, the analysis demonstrated that teams that engaged more in sharing performed better. This result is consistent with the findings from Mesmer-Magnus and DeChurch (2009), who found that the uniqueness of information sharing (how many team members have access to a piece of information) and openness of information sharing (a broader exchange of information, e.g. communication related to goals, progress and coordination) in a team are great predictors of team performance. Furthermore, the results showed that it is important to share information that comes from external sources within the team in order to perform better. Additionally, co-construction itself did not predict team performance significantly, whereas the less teams received information and feedback from outside the team, the more important co-construction became for team performance. Surprisingly, we also found that, the more teams engaged in constructive conflict, the poorer their performance became. That is in contrast with the work of Van den Bossche et al. (2011) who considered constructive conflict the most important aspect of intra-team learning. A possible explanation therefore could be that the subjective measurement of constructive conflict was not beneficial in order to get a better picture of the concept. For further research it is suggested that constructive conflict is measured objectively, e.g. by observation.

Regarding team viability, we found that the more teams engaged in sharing, the more they felt affectionate towards their team. Furthermore the analysis showed that constructive conflict itself did not show a significant effect on team viability, whereas the more teams got information and feedback from outside the team, the more important constructive conflict became in order for the team members to feel affectionate towards their team. Thus, it is important to critically discuss information that comes from outside the team. That conjectures that there might be limits for discussing internal differences, whereas information that comes from external sources might get critically discussed easier as questioning information from

outside the team does not directly cut up team members. However, additional research is needed to verify that supposition.

Concerning the student satisfaction it was conspicuous that the students graded the modules better if the teams engaged more in constructive conflict. Moreover, the more teams asked feedback and information from outside the team the less important constructive conflict became with regard to the student satisfaction. That indicates that it is important that members of a team view topics from different perspectives and to ask critical questions, but it is less important if these different perspectives are coming from within the team or from external parties. Hence, if teams get a lot of information and feedback from others outside the team, it becomes less essential to discuss issues critically within the team and vice versa. However, further research is required to confirm that assumption.

Inter-team learning itself was not found to be a significant predictor of team effectiveness, whereas we found interaction effects with intra-team learning. That means that inter-team learning can strengthen or weaken the effects from intra-team learning on the effectiveness of teams. That is consistent with the findings of Wong (2004) who found that inter-team learning can affect the influence of intra-team learning on team effectiveness. Inter-team learning having no significant effects on team effectiveness is contradictory to the findings of Bresman (2010), Chan et al. (2003), Wong (2004) and Decuyper et al. (2010), who found that inter-team learning has a positive influence on team effectiveness. This indicates that there are other factors influencing the effect of inter-team learning on team effectiveness, but additional research is needed to further investigate the (inter) relations of inter-team learning and team effectiveness.

It is striking that not all team learning variables had an effect on the same team learning outcomes. Even more, we found that constructive conflict had a positive effect on student satisfaction, but a negative effect on team performance. Consequently, stimulating constructive conflict in teams would lead to a better student satisfaction, but also to a lower team performance. Deductively we do not have a complete picture about that component of team learning yet and additional research is needed to provide a broader understanding of the concept. In an attempt to get a broader picture of constructive conflict it might be helpful to include other measurements as well, e.g. observations and interviews as these are more indirect measurements of the concept.

Limitations

In this research we measured team performance in two different ways with the questionnaire from the teachers on the one hand and the student satisfaction on the other hand. That made this research rather unique, since there have not been subjective and objective measurements for team performance included in previous studies of the influences on team effectiveness. However, the other forms of team effectiveness were measured with the same instrument with which also the independent variables were measured. That might have led to common-method bias in this research. Therefore it is suggested that further research in this area is conducted with different methods, e.g. observations. Additionally, the analysis was conducted on aggregated data of the teams. The findings might have been different if the analysis had been conducted on individual-level data.

Furthermore, in this study the student satisfaction was an objective measurement of team performance, whilst the independent variables were measured with subjective data, which was a questionnaire filled in by the teachers themselves. Therefore, a possible explanation for the lower influence of the model on student satisfaction could be that students and teachers evaluated the performance of a team differently. Consequently, it could be useful to measure the independent variables objectively as well to see if the independent variables would have a greater influence on student satisfaction if measured objectively. Another possible explanation would be that the data from the teachers was collected at the end of the preparations for the module; the data from the students on the other hand was collected after completion of the module. For further research it is therefore suggested to apply a non-cross-sectional design or to conduct the questionnaire at the end of the modules just as student satisfaction. Additionally the difficulty of the modules might have influenced the students' responses in the questionnaire that are not associated with the preparation of the modules. Yet the model implicated that good team learning behaviors in the preparation time affected student satisfaction afterwards.

Conclusion

Seeing the results of this study that partly differ from the results of previous research, this study showed that it is important to take different team learning variables and team learning outcomes into account in order to learn more about what makes teams effective. Thereby it became clear that the different dimensions of team learning are interdependent with each other. In addition, we investigated team performance from two different perspectives that again were measured by two different instruments. It is outstanding that the

three different team learning outcomes were predicted by different variables, what confirms that it is important to take multiple measures of team effectiveness into account. Furthermore, inter-team learning itself did not show significant influences on team effectiveness, but it did show interaction effects with intra-team learning. Moreover, sharing enhanced team effectiveness and became more important for team performance to the amount that inter-team learning occurred in a team. Also, constructive conflict displayed a negative effect on perceived team performance and a positive effect on student satisfaction. It also became less important to the amount that inter-team learning took place in a team.

With the help of this research it is possible to gain more insight into the functioning of teams. However, research in this area remains important, as we did not come to know how the team learning processes work in order to make use of them for a practical application. Moreover, the different (inter-) relations of team learning and team effectiveness need further investigation in order for us to fully understand the influences on team effectiveness.

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Appendix A

Questionnaire team learning

Concept measured	Questions	Reference
Sharing	Team members are listening carefully to each other.	Van den Bossche et al. (2011)
	In this team, background information is spread among all team members.	Van Offenbeek (2001)
	If something is unclear, we ask each other questions.	Van den Bossche et al. (2011)
	In this team, we share all relevant information and ideas we have.	Van den Bossche et al. (2011)
	Members of this team ask each other for help and advice during the module work.	Van Offenbeek (2001)
Co-construction	Team members elaborate on each other's information and ideas.	Van den Bossche et al. (2011)
	Information from team members is complemented with information from other team members.	Van den Bossche et al. (2011)
	Team members draw conclusions from the ideas that are discussed in the team.	Van den Bossche et al. (2011)
	Members of this team ask proper questions in order to see through each other's information.	Visschers-Pleijers et al. (2004)
	Team members who formulate an explanation concerning the module ask in between times whether their explanation is right	Visschers-Pleijers et al. (2004)
	When a team member gives	Visschers-Pleijers et al. (2004)

	an explanation, other team members come up with complementary explanations.	
Constructive conflict	Opinions and ideas of team members are verified by asking each other critical questions.	Van den Bossche et al. (2011)
	This team tends to handle differences in opinions by addressing them directly.	Van den Bossche et al. (2011)
	Comments on ideas are acted upon.	Van den Bossche et al. (2011)
	In this team we ask critical questions when someone tells something new.	De Groot (2002)
	In a discussion, our team views a topic from different angles and brings those forward.	De Groot (2002)
	When different possible decisions about the module come forward in a discussion, team members ask additional questions.	De Groot (2002)
	When a team member has a divergent opinion during a discussion, he or she still says so.	De Groot (2002)
Inter-team learning	This team is looking for ideas and expertise from persons from outside the team.	Based on Bresman (2010) and Wong (2004)
	Members of this team review the work of persons from outside the team, in order to learn lessons for our own module.	Based on Bresman (2010) and Wong (2004)
	In this team, we look for persons from outside the team whom we can ask for advice about designing our module.	Based on Bresman (2010) and Wong (2004)

	This team invites persons from outside the team to join the discussion about how we can avoid pitfalls.	Based on Bresman (2010) and Wong (2004)
	This team evaluates its work together with persons from outside the team.	Based on Bresman (2010) and Wong (2004)
	Members of this team talk with persons from outside the team about mistakes that have been made, in order to improve the working process.	Based on Bresman (2010) and Wong (2004)
	This team reflects with persons from outside the team on what has worked for them in their module.	Based on Bresman (2010) and Wong (2004)
Team heterogeneity	The members of my team vary widely in their areas of expertise.	Campion et al. (1993)
	The members of my team have a variety of different backgrounds and experiences.	Campion et al. (1993)
	The members of my team have skills and abilities that complement each other.	Campion et al. (1993)
Team efficacy	In our team, teachers sometimes give up, when developing a part of the module does not work out.	Moolenaar, Sleegers & Daly (2012)
	In our team, teachers are able to design a module that challenges students to learn.	Moolenaar, Sleegers & Daly (2012)
	In our team, teachers really believe that we can teach every student something in our module.	Moolenaar, Sleegers & Daly (2012)
	In our team, we can design a module that motivates students.	Moolenaar, Sleegers & Daly (2012)

	In our team, we can design a module that is able to get through to difficult students.	Moolenaar, Sleegers & Daly (2012)
Goal interdependence	If members of this team reach their goals, it becomes easier for other team members to also reach their goals	Van der Vegt, Van de Vliert & Oosterhof (2003)
	In this team we all want to reach the same goals.	Van der Vegt, Van de Vliert & Oosterhof (2003)
	We agree about what quality means for our team.	Van der Vegt, Van de Vliert & Oosterhof (2003)
	If the work of this team does not meet the quality standards, a team member is called to account by other team members.	Van der Vegt, Van de Vliert & Oosterhof (2003)
Task interdependence	In order for this team to carry out our tasks, we need information from each other.	Van der Vegt, Van de Vliert & Oosterhof (2003)
	In order to do our job well, we have to collaboratie within our team.	Van der Vegt, Van de Vliert & Oosterhof (2003)
	The work of one team member influences the execution of tasks of other members of this team.	Van der Vegt, Van de Vliert & Oosterhof (2003)
	In order to do our job well, we have to gear our tasks to on another.	Van der Vegt, Van de Vliert & Oosterhof (2003)
Team performance	In this team, we perform well.	Zellmer-Bruhn & Gibson (2006), van Woerkom & Croon (2009)
	In this team, we spend our time well.	Zellmer-Bruhn & Gibson (2006), van Woerkom & Croon (2009)
	This team meets its expectations.	Zellmer-Bruhn & Gibson (2006), van Woerkom & Croon (2009)
	This team accomplishes its	Zellmer-Bruhn & Gibson

	objectives.	(2006), van Woerkom & Croon (2009)
	In this team, we work efficiently.	Zellmer-Bruhn & Gibson (2006), van Woerkom & Croon (2009)
Team viability	I would rather belong to an other group.	Ellemers, Kortekaas & Ouwekerk (1999)
	I dislike being a member of my group.	Ellemers, Kortekaas & Ouwekerk (1999)
	I would like to continue working with my group.	Ellemers, Kortekaas & Ouwekerk (1999)