LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

WIRTSCHAFTS- UND ORGANISATIONSPSYCHOLOGIE
ECONOMIC AND ORGANISATIONAL PSYCHOLOGY
CHAIR: PROF. DR. FELIX BRODBECK

WOP Working Paper
No. 2010 / 1

Team Climate for Learning in Higher Education

Felix C. Brodbeck
Ludwig-Maximilians-Universität München

Yves R. F. Guillaume
Aston University

Martin Winkler
Ludwig-Maximilians-Universität München

Reference:
Brodbeck, F. C., Guillaume, Y. R. F., & Winkler, M. (2010). Team Climate for Learning in Higher Education. WOP Working Paper No. 2010/1. Retrieved from: www.psy.lmu.de/wirtschaftspsychologie/forschung/working_papers/index.html

Keywords:
Tteam climate, individual learning, performance, student learning groups

Author Note
Felix C. Brodbeck, Department Psychologie, Ludwig-Maximilians Universität München, München, Germany; Yves R. F. Guillaume, Aston Business School, Aston University, Birmingham, UK; Martin Winkler, Department Psychologie, Ludwig-Maximilians Universität München, München, Germany.
Financial support for parts of this research was provided by the University of Aston, Aston Business School, Birmingham, UK to the first author. Parts of this paper were presented at the bi-annual conference of the German Psychological Association (DGfP) in September 2010, in Bremen, Germany. We are thankful to Demetria Sofroniou who helped during data collection and categorization in the beginning phase of this project as part of her MSc Thesis and to Dorothee von Keyserlingk who prepared literature reviews in a later phase of this project as part of her Diploma Thesis. Both students were supervised by the first author.
Correspondence concerning this article should be addressed to Felix C. Brodbeck, Department Psychologie, Ludwig-Maximilians Universität München, Leopoldstr. 13, 80802 München, Germany. E-mail: brodbeck@lmu.de

Abstract

A new construct – team climate for learning (TCL) – was developed and validated with a mixed methods approach. In a qualitative study, 2,086 descriptions of student group functioning, that either fosters or inhibits individual learning, were collected from university students who participated in a 10 weeks work group exercise, and content analyzed thereafter. Nine categories that emerged could be related to commensurable constructs in the social interactive learning and work group climate literatures. A 65-item pool was constructed for measuring all nine categories. In three quantitative studies, two of which were longitudinal, data from altogether $N = 174$ student groups with a total of $N = 783$ students was collected. Results attest to the inductively and deductively derived nine-factor structure, to factor structure replicability and stability over time, to the multi-level nature of the construct (group vs. individual level of analysis), and to its predictive validity with respect to objective and subjective learning outcome measures. Potential applications of the new construct (and its final 33-item measure labeled TCL) are discussed together with implications for promoting social interactive learning in teams in higher educational settings.

Team Climate for Learning in Higher Education

The promotion of individual learning in groups can serve as an important driver of lifelong learning in both, higher education and work settings. In educational research, individual learning behaviors and learning outcomes are key variables, and they have been widely investigated in various social interactive learning arrangements. For example, cooperative learning arrangements are known to foster individual learning more than competitive or individualistic learning arrangements (e.g., Springer, Stanne, & Donovan, 1999; Slavin, 1996). Student groups are seen as an effective means to stimulate social interactive learning behaviors, like asking for and giving feedback, integration of contradicting perspectives, collective experimenting and reflection of results, or discussing individual errors and alternative actions (e.g., Johnson & Johnson, 2000). However, rarely are student teams investigated as a whole, in which task performance *and* learning take place, thereby addressing team processes as antecedents of individual learning outcomes (e.g., Brodbeck & Greitemeyer, 2000a, b; Lizzio & Wilson, 2005).

There is also a strong educational research tradition on learning environments in classrooms (for a seminal study see Walberg & Anderson, 1968), which has resulted in a rich set of instruments which measure students' perceptions of classroom environments from different angles (e.g., Fraser, 1998). However, student classes are social aggregates that differ in many respects from student teams (e.g., in size, form of social interactions possible, length and intensity of collaborative activity, group tasks, group longevity), which necessitates the study of student work groups as an environment for individual learning on its own.

Much of the work in organizations is accomplished by groups and reliance on them is growing (Ambrose & Kulik, 1999; Morgeson, DeRue, & Karam, 2010). Due to the uncertain and

changing nature of organizational environments, there is a managerial imperative to understand the factors that enable learning in groups (Edmondson, 1999). One of the key criteria for the effectiveness of groups at work is seen in the extent to which work groups contribute positively to the *individual learning* of their members (Hackman, 1987), which means not only a direct benefit to the individual, but also indirect benefits to the work group and the wider organization as a whole – in the form of better qualified members. However, in organizational research, individual learning has been mostly overlooked as an outcome variable of work group functioning. Learning in groups is usually conceptualized at the group level of analysis (cf. Edmondson, Dillon, & Roloff, 2007; Wilson, Goodman, & Cronin, 2007) and related to group level outcomes such as group performance (Edmondson, 1999), team innovation (Anderson & West, 1998; Brodbeck & Maier, 2001), or group performance increments over time (Argote, 1993). Only few experimental and even fewer applied group studies exist in that domain, that directly address individual learning outcomes as a function of team processes (e.g., Brodbeck & Greitemeyer, 2000a, b; Laughlin & Barth, 1981; Laughlin, & Jaccard, 1975).

As much as the primary focus in organizational research is on the work group as a whole, thereby mainly neglecting individual learning, the primary focus in educational research is on the individual, rather than on student teams and respective group level processes as antecedents of individual learning. We attempt to combine these two foci by developing a construct – team climate for individual learning – that helps to optimize group level functioning with respect to individual learning benefits in both educational and work settings. The focus of the present series of studies is on student groups in higher education.

Student Groups in Higher Education

Lizzio and Wilson (2005) argue that there is a type of cooperative learning arrangement, which is similar to work groups in organizational settings, that is increasingly used in higher education. These learning groups, although explicitly designed to facilitate individual learning outcomes, operate like self-managed work groups in organizations, which aim primarily for higher productivity, innovation or staff commitment (Lawler, 1998). In a semi-autonomous manner, group tasks and learning contents (the 'what') are specified by staff, and learning tasks and processes (the 'how') are managed collectively by the students themselves. Such learning groups, by which for example project work, group presentations or business game exercises are accomplished over a longer period of time (about 10 to 30 weeks), are frequently found in higher education at business schools and universities (Byrne, 1995).

With few exceptions, the various strands in the literature on social interactive learning in education focus on objective and observable characteristics of the learning environment, for example, task characteristics and reward structures. Rarely are the group processes themselves or individual perceptions of the group processes studied that are postulated to bring about the individual learning benefits expected from social interactive learning behavior in cooperative learning arrangements (for an overview see Slavin, 1992; for a meta-analysis see Springer et al., 1999). There is a particular need for more systematic investigations of the students' perceptions of the group processes underlying social-interactive learning benefits or handicaps. While objective and observable characteristics of the learning environment are well recognized, and usually taken into account when group learning arrangements are designed, complaints from group members about unfavorable learning conditions *within* their groups, and dissatisfaction with the extent to which the group processes contribute to their individual learning (Baldwin,

Bedell, & Johnson, 1997) should be taken seriously, for example, by considering group member evaluations about the extent to which their group's functioning fosters or inhibits their individual learning efforts.

In line with reasoning and empirical findings put forward by the literatures on individual learning transfer from training (which is facilitated by a *learning culture* within the work environment, cf. Tracey, Tannenbaum, & Kavanagh, 1995), on group learning in organizations (which is facilitated by a *climate of psychological safety*, cf. Edmondson, 1999), and on innovation at work (which is facilitated by a *team climate for innovation*, cf. Anderson & West, 1998; Brodbeck & Maier, 2001), we hypothesize, that among other factors external to group processes, such as task characteristics or reward structure, it is mainly a team's climate for learning that determines the extent to which group members actually profit from their group work experience in their individual learning outcomes.

The here reported series of studies of team climate for individual learning in the above described types of semi-autonomous groups is meant to promote effective social interactive learning behaviors in student groups in higher education and also in work group contexts in organizations. Because learning groups in higher education prepare future employees to participate in 'real' teamwork in organizations, positive implications for group and organizational learning are also to be expected from this research. Furthermore, many work group settings in organizations are similar to the learning group settings studied here, thus the studies' results may also inform group researchers and practitioners about how individual learning can be promoted within work groups in organizations.

Concepts of Climate

Two approaches to the conceptualization of climate have received considerable attention (for reviews see Anderson & West, 1998; Parker et al., 2003; Schneider & Reichers, 1983): the cognitive schema approach, conceptualizing climate as individual cognitive representations of a work environment, and the shared perceptions approach, which addresses the importance of the *shared* nature of individual perceptions among members of a team, unit, or organization ("the shared perception of the way things are around here", Reichers & Schneider, 1990, p. 22).

The two approaches are compatible and not mutually exclusive. For the study of group members' subjective perceptions of their learning group and their reactions to them – thereby addressing individual differences in cognition or behavior, the former approach is more suitable. For the study of group members' reactions as a whole to the mutually shared perceptions and beliefs among group members – thereby addressing differences between teams, the latter approach is more suitable. In the present series of studies we adopt the former approach for determining individual cognitive structures of a team's climate for learning (i.e. what and how students think about their learning group and its effectiveness with respect to their individual learning outcome). The latter approach is adopted for determining the relationship between team climate for learning as a group level construct and individual learning outcomes as an individual-level construct. This implies a multi-level approach.

In line with Anderson and West (1998, see also Hosking & Anderson, 1992) we argue that sharedness evolves in proximal work groups, which are defined as "the permanent or semi-permanent team to which individuals are assigned, whom they identify with, and whom they interact with regularly in order to perform work-related tasks" (p. 236). In these work groups individuals have the opportunity to interact and to co-construct shared perceptions within their

immediate social environment. Thus, an appropriate level of analysis at which to examine shared perceptions of climate is the proximal work group – which, in our case, refers to semi-autonomous and semi-permanent student learning groups in higher education.

This type of learning groups has not been a frequent subject of scientific interest so far. Exceptions are Watson, Johnson, and Zgourides (2002) and Brodbeck, Guillaume, and Lee (in press), who examined the effects of ethnic diversity on student learning in teams, and Lizzio and Wilson (2005) who aimed to identify students' perceptions of self-managed learning groups, and how these relate to task, educational, and personal outcomes. The aim of the four studies presented here is to establish team climate for individual learning as a robust team level construct that predicts individual learning profit from student group working.

Facet Specific Team Climate for Learning

In line with Schneider's (1975) and Schneider's and Reichers' (1983) reasoning that it is meaningless to apply the concept of climate without a particular referent, we adopt the notion of '*climate for something*' (or 'facet specific climate', cf. Rousseau, 1988). There has been a growing interest in how particular types of climate, for example for "service" (Schneider, White, & Paul, 1998), "innovation" (Anderson & West, 1998; Brodbeck & Maier, 2001), "safety" (Zohar, 1980; Zohar & Luria, 2005), or interactions between two different climate facets, for example, safety and active learning climates (Katz-Navon, Naveh, & Stern, 2009), lead to particular types of work group outcomes (e.g., customer satisfaction, innovation, accident avoidance, or errors). The advantage of splitting a general climate construct into specific facets is that each facet can capture a climate aspect which is directed toward a particular bundle of referent behaviors and outcomes. Our conceptualization and measure of team climate is tied to the criterion of interest in the learning domain studied here, which is the social interactive

learning behaviors and cognitions from which student group members profit in their individual learning outcome.

Having established this focus, we describe the validation of the construct of work group climate for individual learning. A respective measure (labeled Team Climate for Learning, TCL*)* is developed alongside, which is specifically designed to elicit team members' perceptions of an array of team climate dimensions which are hypothesized to relate positively to social interactive learning behavior and individual learning outcome.

Overview of Studies

Altogether, four studies were conducted (for an overview, see Table 1). Study 1 served to identify domain specific team climate aspects which are relevant for individual learning in student groups (Sample A). Results were integrated with concepts and constructs from the literatures about social-interactive learning, team learning, and team innovation that are identifiably relevant for individual learning outcomes. Based on the inductive approach taken in Study 1 and on the deductive approach taken in the literature review, a pool of 65 items was constructed. The aim of Study 2 was to identify a factor structure in accord with the categories obtained in Study 1, as well as item selection and modification according to psychometric testing (Sample B). Altogether 33 items were retained, organized in nine factors. Two longitudinal studies, Study 3 (Sample C_1 and C_2) and Study 4 (Sample D_1 and D_2), were conducted in order to cross-validate the initial nine factor solution, to establish the factor structure's stability over time, and to obtain replicated construct and criterion validity pertaining to the multi-level nature of the constructs measured.

Table 1

Scale Development and Validations: Overview of Studies and Samples

Study	Sample	Sample size	Participants	Analysis performed
1	A	$N_{individuals} = 61$ $N_{groups} = 19$	Students enrolled in a business game group work exercise contacted 13 weeks after the beginning of the academic year (M_{age} = 20.42 years, 51.0 % female)	Content analysis Frequency entries
2	B	$N_{individuals} = 213$ $N_{groups} = 43$	Students registered in an organizational behavior module as part of a variety of different business related programs at a large international British business school: Week 3 of the term (M_{age} = 27.32 years, 51.5% female)	Exploratory factor analysis Reliability analysis Item-total correlations Scale inter-correlations
3	C_1	$N_{individuals} = 220$ $N_{groups} = 42$	Students registered in an organizational behavior module as part of a variety of different business related programs at a large international British business school: Week 3 of the term (M_{age} = 25.38 years; 48.7% female)	Confirmatory factor analysis Reliability analysis Scale inter-correlations Multi-sample confirmatory factor analysis
	C_2	$N_{individuals} = 168$ $N_{groups} = 40$	Students registered in an organizational behavior module as part of a variety of different business related programs at a large international British business school: Week 9 of the term (M_{age} = of 25.05 years; 53.3% female)	ICC1, ICC2, *F*-test and $r_{WG(J)}$ Test-retest reliability Multi-level criterion validation
4	D_1	$N_{individuals} = 289$ $N_{groups} = 71$	Students registered in an organizational behavior module as part of a variety of different business related programs at a large international British business school: Week 3 of the term (M_{age} = 25.13 years; 50.5% female)	Confirmatory factor analysis Reliability analysis Scale inter-correlations Multi-sample confirmatory factor analysis
	D_2	$N_{individuals} = 224$ $N_{groups} = 70$	Students registered in an organizational behavior module as part of a variety of different business related programs at a large international British business school: Week 7 of the term (M_{age} = 25.95 years; 50.4% female)	ICC1, ICC2, *F*-test and $r_{WG(J)}$ Test-retest reliability Multi-level criterion validation

Study 1: Identification of TCL Dimensions by Induction (Sample A) and Deduction from the Literature

The purpose of Study 1 was to gain an understanding of students' perceptions and experiences of the range of team climate dimensions that foster or inhibit individual learning. The findings are used to inform the development of an item pool, grouped into empirically and theoretically distinguishable categories by also drawing on previously published constructs and concepts which identifiably pertain to a team climate that fosters individual learning.

Method

Sample and procedure. Forty six men and 47 women (M_{age} = 20.42 years, SD = 2.04) enrolled in a 24 week business game group work exercise at a large international business school in the United Kingdom, were contacted 13 weeks after the beginning of their academic year. Student work groups (between four and six persons) were formed at the beginning of an academic year and the group members stayed together throughout their studies. The students performed group tasks which were task and reward interdependent, comprising a variety of projects, such as solving case studies, developing business plans or marketing strategies, and they engaged in various group discussion exercises administered to foster individual learning. All 93 participants were asked to fill in a questionnaire which included open-ended questions about characteristics that facilitate or inhibit their individual learning within their respective work group. Participation was voluntary. Altogether, 61 students from 19 work groups completed the questionnaire.

Analytical strategy. Rather than using a predetermined coding scheme, emergent theme analysis by content (Holsti, 1969; Weber, 1990) was employed to identify clusters of facilitating and impeding characteristics that constitute different facets of a team climate for learning. The

first categorization was conducted by a student researcher, who was uninformed about the theorizing underlying this paper (see Authors Note). Two further raters, the first author of this paper and another psychologically trained researcher, inspected all category descriptions and characteristics obtained for adequate categorization and for the need to exclude or collapse certain categories. Discrepancies were discussed until agreement was reached. Less than 1% of the disputes remained unresolved. The respective cases were excluded from further analyses. Frequency entries by category were calculated to assess the relative importance of the categories found.

Results and Discussion

A total of 2,086 (1,104 facilitating, 982 inhibiting) descriptions of team characteristics fostering or inhibiting individual learning were obtained. From the 13 categories derived (see Table 2), three categories were excluded due to containing characteristics that do not directly describe team climate aspects (i.e. member traits, features of the physical environment, group size). These characteristics may serve as context factors that have an impact on the team climate for learning, but they are different from the other categories in that they do not directly embody characteristics of group processes that form the basis for shared perceptions of the team climate for learning. Furthermore, due to a low frequency count, Team Adaptability was collapsed into the related category, Open Exchange. Both categories share the common content of "openness to the new". Altogether nine distinguishable categories comprising facilitating and impeding characteristics of team climate for individual learning remained in the further analysis. In the following we reflect upon each of the nine categories by relating it to concepts and constructs from the literature relevant for the relationship between the group processes addressed in each category and individual learning benefits.

Table 2

Categories Derived in Study 1 with Frequency Counts of Characteristics that Facilitate or Impede a Team's Climate for Individual Learning

Category	Examples [c]	*N* of Facilitators	*N* of Inhibitors	Sum
Regular contact and communication	Communication, regular meetings, (-) 'absenteeism'	273 *(25%)*	186 *(19%)*	459 *(22%)*
Mutual trust	Mutual trust, understanding, (-) 'group politics'	101 *(9%)*	197 *(20%)*	298 *(14%)*
Open exchange	Idea expression from all, open exchange, (-) 'arguing'	126 *(11%)*	148 *(15%)*	274 *(13%)*
Cooperation	Cooperation, give and take, (-) 'individualistic behavior'	139 *(13%)*	55 *(5%)*	194 *(9%)*
Individual member traits [a]	Intelligence, good listener, (-) 'selfish', (-) 'stubborn'	112 *(10%)*	74 *(8%)*	186 *(9%)*
Support for individual learning	Availability of help, diverse resources, (-) 'low skill level'	72 *(7%)*	107 *(11%)*	179 *(9%)*
Team management	Time management, division of labor, (-) 'poor leadership'	101 *(9%)*	53 *(5%)*	154 *(7%)*
Motivation and interest	Motivation, enthusiasm, (-) 'uninterested'	71 *(6%)*	82 *(8%)*	153 *(7%)*
Specific, clear and shared goals	Shared vision, goal clarity, (-) 'misfit indiv./group goals'	44 *(4%)*	26 *(3%)*	70 *(3%)*
Dominance (-)	Exclusion of members, dominance, (+) 'participation'	24 *(2%)*	42 *(4%)*	66 *(3%)*
Team adaptability [b]	Openness to change, adoption of new ways	32 *(3%)*	0 *(0%)*	32 *(2%)*
Physical environment [a]	Size of room, lighting, furniture, (-) 'noisiness'	9 *(1%)*	9 *(1%)*	18 *(1%)*
Group characteristics [a]	Group size	0 *(0%)*	3 *(0%)*	3 *(0%)*
Sum		1104	982	2086

Note.
[a] Member traits, characteristics of physical environment and group size were excluded from further analysis.
[b] Team adaptability was collapsed into the category open exchange.
[c] (-) refers to inhibitors.

Regular contact and communication. Communication, regular contact and group meetings were mentioned most frequently as key factors facilitating (or undermining, if practiced infrequently) individual learning in groups. This is in line with research demonstrating that interaction and communication constitute core elements of effective group functioning. They strongly relate to group cohesiveness (Festinger, 1954) and familiarity among group members (Henderson & Clark, 1990), which provide the social-emotional basis for exchange of information. Altogether, regular contact and communication provide group members with opportunities to receive and share knowledge that is potentially new to them, which is a precondition for the type of social interaction to occur that can foster individual learning.

Mutual trust. The second dimension that emerged from our analysis was mutual trust. The importance of trust in groups has long been noted (Kramer, 1999). Trust can be defined as the expectation that others' future actions will be favorable to one's interest, such that one is willing to be vulnerable to those actions (Mayer, Davis, & Schoorman, 1995). Trusting relationships serve as an essential foundation of a felt climate of participative safety, which stimulates interactive learning behavior (Edmondson, 1999). Trust is also an essential ingredient of collaborative effort, for example, Costigan, Ilter, and Berman (1998) show that a climate of trust enables group members to surface their ideas and feelings, use each other as resources, support each other, and learn together. It is therefore proposed that a climate of mutual trust facilitates individual learning in groups.

Open exchange. The third category that emerged was the open sharing of ideas. Edmondson (1999) showed that whole work groups profit from open exchange, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors freely. When valuable information stays privately or is discussed outside the group individual

group members are less likely to profit in their individual learning. From 'hidden profile' research it is known, that groups tend to share information that members hold in common. Groups have difficulties to realize the major benefit of having multiple members pooling their different information and viewpoints (for reviews, see Brodbeck, Kerschreiter, Mojzisch, & Schulz-Hardt, 2007; Hinsz, Tindale, & Vollrath, 1997). The more open information exchange is, the more likely it is that individual group members actually learn information that is new to them. Therefore, we propose that open exchange of ideas and viewpoints is a team climate factor that facilitates individual learning in groups.

Cooperation. The fourth category we have identified was cooperation. The literature on cooperative learning demonstrates that positive interdependence among members of a group makes them interact in ways that promote common goals and they resolve issues for mutual benefit (Slavin, 1992; Springer et al., 1999). In return they are more likely to share information, explain their ideas, and support each other's achievements. In line with this literature, we suggest that perceptions of cooperative behaviors in a group, rather than individualistic or competitive behaviors, relate positively to individual learning.

Support for individual learning. This category covers descriptions about how much support, help and resources for optimizing one's own individual learning one receives from others within the group. It reflects to some extent what Johnson and Johnson (1998, 2000) refer to as "promotive interaction", which occurs when individuals encourage and facilitate each other's efforts to reach the group's goals, by giving help, exchanging resources, influencing each other's reasoning and behavior, thereby educating each other about better ways of doing things. We therefore propose that perceived support for individual learning within groups improves individual learning outcomes.

Team management. The sixth category that emerged from our analysis was team management. It reflects a form of team or shared leadership (Watson et al., 2002; Pearce, 2004; Pearce & Conger, 2003; see also Lizzio & Wilson, 2005) by which members of semi-autonomous learning teams can distribute roles, manage time, structure their work, and follow up on agreed responsibilities, actions, and deliverables. In line with Edmondson (2002, see also Wageman, Hackman, & Lehman, 2005) we suggest that team management facilitates individual goal alignment, the exchange and elaboration of information relevant to the group tasks, and accordingly leads to individual learning about the tasks performed by student learning groups.

Motivation and interest. This category covers descriptions about the motivation, enthusiasm, and interest of group members to work on the group task and engage in respective learning behaviors. Motivation loss (for a review see Shepperd, 1993) is a commonly known phenomena in student work groups (Lizzio & Wilson, 2005) which is of great concern to individual group members, because their grades depend to some extent on the motivation and effort brought to bear on the group tasks by other group members. The more group members witness behavioral correlates of a relative absence of motivation losses and of high interest and enthusiasm in the given sets of facts and ideas, the more likely it is that they also contribute to the group efforts and engage in individual learning (i.e. a reduction in the 'sucker effect', Kerr, 1983).

Specific, clear, and shared goals. This category contains descriptions about the clarity of tasks and goals redefined by the group, on the basis of the group learning task provided by staff, and the extent to which the group's vision is shared among group members. Goal setting is a well established motivational technique in management, not only for improving individual performance, but also for improving team performance (Durham, Knight, & Locke, 1997; Guzzo

& Dickson, 1996; Matsui, Kukayama, & Onglatco, 1987; Weldon & Weingart, 1993). Positive goal setting effects for groups are most reliable when the goals are clear, specific and sufficiently difficult, and when there is a "shared vision" among group members, which is "a valued outcome which represents a higher order goal and a motivating force at work" (West, 1990, p. 310). It is therefore proposed that specific and clear learning goals and a shared vision about the group learning task facilitate individual learning.

Dominance. The last category that emerged was dominance of individual group members on the cost of others. Dominant leadership practices discourage members from sharing the information they possess and in effect impede the learning process in teams (Edmondson, Bohmer, & Pisano, 2001). Research about leadership styles (directive versus participative) in decision making groups shows consistently, that when directive leaders (equivalent to dominant group members) prefer suboptimal decision alternatives, group decision quality deteriorates significantly below the level of groups headed by participative leaders (Cruz, Henningsen, & Smith, 1999; Larson, Foster-Fishman, & Franz, 1998). Thus under conditions of more or less equally partial knowledge about the domain of study (which is usually the case in student learning groups) participative forms rather than directive or dominating forms of leadership are more likely to result in individual learning benefits than dominating forms.

The categories Motivation and Interest (7%), Team Management (7%), Mutual Trust (14%), Cooperation (9%), and Open Exchange (13%) overlap with categories identified in Lizzio and Wilson's (2005) qualitative study, in which 446 descriptions about within-group processes in semi-autonomous learning groups were analyzed. With our somewhat larger pool of more than 2000 descriptions some further categories were identified: Regular Contact (22%), Support for Individual Learning (9%), Dominance (3%), and Clear, Specific, and Shared Goals (3%). While

in Lizzio and Wilson's study a purely inductive approach was taken, each of the inductively generated nine categories in our study was shown to correspond with concepts and constructs from the team climate, cooperative learning and group learning literatures. Thus, we decided to submit all nine categories to further quantitative analyses.

Study 2: Exploration of TCL Factor Structure and Item Modification (Sample B)

The aim of Study 2 was to explore a nine factor structure of the TCL in accord with the nine dimensions obtained in Study 1. Furthermore, items were selected and modified according to psychometric testing.

Method

Item construction. A pool of 65 items was constructed to reflect the nine categories described in Study 1. For each item a 7-point Likert-type response scale was used (1 = *strongly disagree*, 2 = *mostly disagree*, 3 = *slightly disagree*, 4 = *uncertain*, 5 = *slightly agree*, 6 = *mostly agree*, 7 = *strongly agree*). Two further items were constructed. The first item asked respondents to rate the overall team climate for individual learning in the group. The second item asked respondents to indicate how much they profited so far from being a member of their group for their individual learning. Both items were rated on a 10-point Likert-type response scale ranging from 1 (*very low*) to 10 (*very high*). We used them as subjective criterion variables during the validation process.

Sample and procedure. The initial 65-item version of the TCL was administered to all MBA/MSc students registered in an organizational behavior module as part of a variety of different business related programs at a large international British business school during Week 3 and again during Week 9 of the first term. Participation in the research was voluntary. No extra credit was awarded for participation. Student work groups consisted of between four and eight

students and were randomly formed at the beginning of the academic year. The group members stayed together throughout their studies. They performed group tasks which were task and reward interdependent, comprising a variety of collaborative projects, such as solving case studies, preparing and giving a presentation, writing a case report, and group discussion exercises.

During Week 3 242 students from 43 groups participated in the study. There were 213 participants (88.0%) from 43 groups (4.95 member per group on average, *SD* = 1.25, range: 2–8 members) who provided complete data. The participants had an average age of 27.32 years (*SD* = 6.77, age range: 20–55 years) and 51.5% of the participants were female. With participants coming from 38 different countries, the sample was quite diverse concerning participants' ethnical background (54.0% born in the UK). Due to exam preparations and course work assignments response rate in Week 9 was too low (*N* = 103) for an exploratory factor analysis (EFA). Accordingly, we didn't include these data in our analysis.

Results and Discussion

We expected all dimensions (with items from the Dominance dimensions recoded and the dimension renamed into 'Democracy') to correlate positively to moderate extend, because although each of them measures a different component of group functioning, all of them measure aspects of an overall team climate for individual learning. Thus the initial 65-item TCL version was analyzed via a principal component analysis with direct oblimin method (oblique rotation) based on Sample B data (see Table 1). Additionally, reliability analyses and item-total correlations were calculated. These results, combined with item-content and item-wording inspection were used to reduce the number of items to a final 33-item pool. The nine-factor EFA solution for Sample B is presented in Table 3.

Table 3

Factor Structure of the Team Climate for Learning (Principal Component Analysis, Rotated Pattern Matrix)

Factor and Items	F1	F2	F3	F4	F5	F6	F7	F8	F9
Factor 1: Mutual Trust									
1 There is trust and friendliness among group members.	**.79**	.00	.03	.05	.03	-.13	-.06	-.11	.03
2 Among group members there is understanding and empathy.	**.74**	-.02	-.07	.05	.01	.15	-.12	-.09	.02
3 Among group members is a strong sense of helpfulness.	**.68**	.03	.02	.08	.00	.02	-.11	.06	.20
4 In group discussions members try to be sensitive to the feelings of others.	**.58**	.08	-.02	-.03	.07	-.07	-.06	-.39	-.15
5 There is lack of cooperation. (r) [a]	**.48**	.11	.23	-.04	.16	.22	-.01	-.02	.07
Factor 2: Goal Alignment									
1 I personally agree with the goals of my group.	.02	**.89**	.05	-.03	.02	-.11	-.08	-.08	.00
2 The goals of my group are useful and suitable.	.06	**.87**	.00	-.03	.01	-.01	-.13	.06	-.01
3 The goals of my group are realistic and achievable.	-.10	**.84**	.06	.07	.01	.08	.13	-.12	.07
4 As far as I know, the other team members agree with the goals of my group.	-.04	**.80**	.05	.03	.09	-.09	.05	-.15	.07
5 I am fully aware of the goals of my group.	.04	**.79**	-.03	.07	-.06	.12	-.07	.03	.00
6 We have clear group objectives.	.05	**.68**	-.14	.11	-.02	.17	-.11	.26	.03
Factor 3: Attendance									
1 There is marked absenteeism of group members. (r)	-.06	-.01	**.93**	.01	-.01	.00	-.05	.05	-.03
2 Absenteeism has become a problem in my group. (r)	.00	.00	**.91**	.00	-.05	.00	-.02	.00	.00

Factor 4: Regular Contact									
1	We hold (off-lecture) group meetings regularly.	-.08	-.04	-.08	**.86**	-.05	.01	-.11	.06	-.01
2	We are regularly in touch with each other.	.03	.01	.06	**.80**	.04	-.03	.14	-.10	.06
3	The group members meet frequently to discuss formal and informal topics.	.06	.04	-.07	**.78**	-.06	.09	-.09	.06	-.01
4	There is regular contact among group members.	.06	.12	.13	**.76**	.10	-.06	.05	-.01	-.08
Factor 5: Democracy										
1	One team member dominates the group. (r)	-.02	-.02	-.07	.04	**.98**	-.03	.00	.02	-.03
2	The leader in my group dominates other group members. (r)	-.03	.04	.00	-.03	**.94**	.03	-.01	.00	-.01
Factor 6: Team Management										
1	There is a lack of time keeping in group meetings. (r)	-.12	-.03	-.01	-.02	.00	**.89**	.02	-.12	-.07
2	There is poor organisation in my group. (r)	.10	.22	.03	.10	-.05	**.67**	-.06	.03	.02
3	There is lack of team member responsibility. (r)	.20	-.09	.17	-.04	.23	**.49**	-.08	.02	.18
Factor 7: Support for Individual Learning										
1	My group helps me to optimise my individual learning.	.08	.06	.06	-.06	.11	.01	**-.80**	.09	.07
2	My group provides me with useful ideas and practical support.	.20	.07	.07	.03	.05	-.04	**-.75**	.00	-.04
3	The group supports my creativity.	.01	.12	.00	-.03	-.03	.03	**-.67**	-.30	-.03
4	We pay attention to each other's work so that the work done remains at a high standard.	-.07	.01	.08	.19	-.02	.11	**-.63**	-.17	.14
Factor 8: Open Exchange										
1	Every opinion is heard, even if it is a minority opinion.	-.02	.04	.03	.06	.02	.08	-.05	**-.81**	.05
2	All opinions are listened to.	.14	-.01	-.01	.01	.05	.08	-.11	**-.77**	.08
3	All opinions are respected.	.19	.11	-.04	-.06	.03	.07	-.08	**-.75**	.01

Factor 9: Motivation and Interest									
1 Group members are interested in the topics of the lecture.	.04	.10	-.02	-.11	-.03	-.01	.08	.04	**.81**
2 It is a real concern for team members to achieve the highest possible achievement standards.	-.14	-.06	-.02	.12	.07	-.05	-.24	-.08	**.68**
3 Group members are enthusiastic.	.31	.10	.12	.03	-.02	.08	.01	-.10	**.59**
4 Group members are motivated.	.28	.12	.12	.09	.03	.09	.04	-.10	**.55**
Eigenvalues	11.34	3.39	1.86	1.77	1.59	1.38	1.31	1.20	1.02
% of variance	34.36	10.28	5.64	5.35	4.83	4.19	3.97	3.63	3.08

Note. $N_{\text{individuals}} = 213$. Principal component analysis with direct oblimin method of oblique rotation was used. Factor loadings > .40 are in boldface. (r) indicates that the items has to be recoded.

[a] Due to reliability considerations this item was moved to the factor Team Management.

Table 4

Means, Standard Deviations, Correlations and α-Reliabilities of the TCL (Sample B, individual-level)

Factor	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Mutual Trust	5.40	1.08	*(.86)* [a]									
2. Goal Alignment	5.31	1.13	.41**	*(.92)*								
3. Open Exchange	5.55	1.40	.65**	.35**	*(.91)*							
4. Support for Individual Learning	4.87	1.20	.61**	.49**	.57**	*(.87)*						
5. Regular Contact	4.97	1.36	.22**	.46**	.15*	.31**	*(.83)*					
6. Motivation and Interest	5.07	1.01	.55**	.48**	.46**	.53**	.28**	*(.80)*				
7. Team Management	4.90	1.27	.51**	.46**	.47**	.51**	.25**	.49**	*(.74)* [a]			
8. Democracy	5.04	1.60	.29**	.15*	.28**	.28**	.06	.22**	.27**	*(.89)*		
9. Attendance	5.60	1.50	.20**	.12	.18**	.23**	.09	.29**	.32**	.14*	*(.81)*	
10. TCL Global Score	5.19	0.81	.75**	.65**	.71**	.77**	.49**	.71**	.74**	.50**	.47**	*(.80)*

Note. $N_{\text{individuals}} = 213$; $N_{\text{groups}} = 43$. Figures in parentheses represent α-reliabilities.
[a] Results of reliability analysis after the item "There is a lack of cooperation." was moved to the factor "Team Management".
* $p < .05$. ** $p < .01$ (two-tailed).

Means, standard deviations, factor inter-correlations, and scale reliabilities of the TCL subscales and the TCL global score calculated at the individual level are presented in Table 4. Cronbach's alpha of the nine subscales ranged from .74 to .92, reaching the commonly agreed value of .70 (Nunnally, 1978), and thus indicating a sufficient level of internal consistency of the subscales. The reliability of the TCL global score, calculated as the mean of all nine factor values at the individual level of analysis, was $\alpha = .80$. The nine sub-factors of the TCL correlated moderately with each other (ranging from $r = .06$ to $r = .65$) and highly with the TCL global score (ranging from $r = .49$ to $r = .77$).

Overall the EFA delivered nine factors with Eigenvalues greater than 1.00 accounting for more than 75 percent of the total variance. Eight out of the nine factors match with commensurable categories identified in Study 1. The items from the remaining Cooperation category either loaded not sufficiently highly on any of the factors with Eigenvalues greater than 1.00 or on three other factors, namely Mutual Trust, Open Exchange, and Team Management. Note that the later dimension now hosts the item "There is lack of cooperation" (recoded). One additional distinctive factor, labeled "Attendance", emerged newly. Most factor labels correspond to the original category names, some were newly chosen. Two criteria guided our factor labeling, first, the labels had to match the content of the respective lead item(s) (see Table 3), and second, they had to represent core content of the original categories identified in Study 1.

The factor *Mutual Trust* measures whether there is trust, friendliness and a sense of helpfulness and empathy among group members, as well as sensitivity towards the feeling of others during group discussions. The factor *Goal Alignment* measures the extent to which objectives are clear, shared, perceived as useful and suitable, realistic and achievable, and whether all members are aware of the groups' goals and agree about the objectives. The factor

Regular Contact measures the extent to which there is regular contact and meetings among group members, and whether mutual exchange and discussion of formal and informal topics take place frequently and regularly. The factor *Attendance* consists of two items measuring whether absenteeism is within tolerable limits and does not create problems (both items recoded). Despite apparent conceptual overlap between the respective underlying categories, *Team Management* (measuring the extent to which time keeping is appropriate in group meetings, the team is well organized, and whether a high degree of cooperation can be found in the team as well as high team member responsibility) was empirically distinguishable from the factor *Democracy* (measuring the extent to which the team is dominated by one team member or whether the leader does dominate other team members; with both items recoded). The factor *Support for Individual Learning* measures the extent to which members are supported in their creativity and learning activities, whether team members mutually pay attention in order to achieve a high standard in their individual work, and whether the team provides useful ideas and practical support to individuals. The factor *Open Exchange* measures the extent to which all opinions of the team members are respected and listened to, even if they are minority opinions. The factor *Motivation and Interest* measures the extent to which team members are motivated, enthusiastic, and interested in the learning topics, and whether achieving high standards is perceived to be a real concern within the team.

The inductively obtained nine-categories solution from Study 1 is robust considering that eight out of the nine categories sustained in the factor structure obtained in the present study. The distribution of Eigenvalues suggests that also the second and further factors each explain relatively high amounts of the total variance. To further refine the measure we reworded items with ambiguous content (“I personally agree with these goals” -> “I personally agree with the

goals of my group"; "These goals are useful and suitable" -> "The goals of my group are useful and suitable") and changed the referent from "syndicate group" (the term used in the MSc and MBA programs of the Business school where our studies took place) to the more neutral term "group". One item addressing two distinct issues, "Group members are motivated *and* enthusiastic" was split into two items. Finally, on the basis of EFA results the item „There is lack of cooperation" was moved from the scale Mutual Trust to the scale Team Management thereby increasing the reliability of the later scale from α =.69 to α = .74 while maintaining high reliability of the former (from α =.87 to α = .86).

Study 3: Cross-Validation of the TCLs Nine-factor Structure (Samples C1 and C2)

Study 3 was conducted in order to cross-validate the nine factor structure obtained from Study 2 by using confirmatory factor analysis (CFA), and to assess the stability of the factor structure over time, to justify TCL as a group level construct (criterion validity, via $r_{WG(J)}$-, ICC1-, ICC2-values), and to assess the criterion validity with respect to objective and subjective measures of individual learning outcome, while accounting for the multi-level nature of the constructs measured (team climate = group level, learning outcome = individual level).

Methods

Sample and procedure. The 33-item version of the TCL plus the two additional items developed in Study 2 was administered to all MBA/MSc students registered in a subsequent organizational behavior module of the same British business school as in Studies 1 and 2. The questionnaires were again distributed twice, the first time during Week 3 and the second time during Week 7 of the first term (instead of Week 9, in order to reduce mortality rates, see Study 2). Participation in the research was voluntary. No extra credit was awarded for participation. Student work groups consisted of between 4 and 8 students, were formed at the beginning of an

academic year, the group members stayed together throughout their studies and performed collaborative tasks as described in Study 2.

During Week 3 232 students from 42 groups participated in the study. There were 220 participants (94.8%) from 42 groups (3–7 members per group, $M = 5.24$, $SD = 1.01$) who provided complete data (Sample C_1, see Table 1). The participants had an average age of 25.38 years ($SD = 4.86$, age range: 20–52 years) and 48.7% of the participants were female. The sample was quite diverse concerning participants' ethnical background (41.2% born in the UK). During Week 7 184 students from 42 groups participated in the study. There were 168 participants (91.3%) from 40 groups (1–6 members per group, $M = 4.20$, $SD = 1.27$) who provided complete data (Sample C_2, see Table 1). The participants had an average age of 25.05 years ($SD = 4.44$, age range: 21–40 years), 53.3% of the participants were female, and 40.0% were born in the UK.

Analytical strategy. The nine-factor model of the TCL was cross-validated with Sample C_1 and C_2 data. Confirmatory factor analyses were conducted using AMOS 17.0 (Arbuckle, 1999). A model assuming correlations between the nine factors was compared with an alternative model including a second-order factor comprised of the nine first-order factors, and compared with a baseline model assuming all items to load on a single factor. No cross-loadings were allowed.

To assess overall model fit, we followed recommendations by Kline (2005) and used multiple indices. In particular, we compared the models on Bentler's (1990) comparative fit index (CFI), Steiger's (1990) root-mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). According to Kline (2005), values larger than .90 for CFI and values below .10 for RMSEA and SRMR indicate acceptable fit. To compare

between model fit of nested models we calculated the difference in model chi-square and degrees of freedom, and compared the values with the χ^2-distribution (Hu & Bentler, 1995, 1998). We also compared the three different models on the Akaike information criterion (AIC, Akaike, 1987). This index can be used to select among competing models, whereby the model with the smaller AIC fits the data better (Kline, 2005).

Results and Discussion

Table 5 provides the results of the confirmatory factor analyses. The nine-factor model assuming correlations between the nine sub-factors showed acceptable and near to acceptable model fit values: for Sample C_1, χ^2 (459, N = 220) = 813.13, p < .001, AIC = 1017.31, CFI = .90, RMSEA = .059, SRMR = .053; for Sample C_2, χ^2 (459, N = 168) = 939.43, p < .001, AIC = 1143.43, CFI = .88, RMSEA = .079, SRMR = .068. The nine-factor model outperformed the alternative model including a second-order factor comprised of the nine first-order factors (Sample C_1: AIC = 1167.07; Sample C_2: AIC = 1291.96) and the further alternative model assuming all items to directly load on one single factor (Sample C_1: AIC = 1773.70, $\Delta\chi^2$ = 828.39, p < .001; Sample C_2: AIC = 2067.61, $\Delta\chi^2$ = 996.18, p < .001). In both samples, the item loadings were significant (p < .05) and for the exception of one item ("There is lack of time keeping in group meetings") were above .40 on their respective factors.

Means, standard deviations, factor inter-correlations, and scale reliabilities of the TCL subscales and the TCL global score calculated at the individual level for Sample C_1 and C_2 are presented in Table 6. For Sample C_1, Cronbach's alpha of the nine subscales ranged from .71 to .88, reaching the commonly agreed value of .70 (Nunnally, 1978), and thus indicating a sufficient level of internal consistency of the subscales. The reliability of the TCL global score, calculated as the mean of all nine factor values at the individual level of analysis, was α = .85.

Table 5

Confirmatory Factor Analysis: Fit Indices for the Alternative Models (Sample C_1 and Sample C_2)

Sample and Model	χ^2	*df*	χ^2/df	AIC	CFI	RMSEA	SRMR	$\Delta\chi^2$	Δdf
Sample C_1 ($N = 220$)									
Model 1 (nine factors correlated)	813.31***	459	1.77	1017.31	.90	.059	.053		
Model 2 (nine factors loading on a second-order factor)	1017.07***	486	2.09	1167.07	.86	.071	.119		
Model 3 (all items loading on a single factor)	1641.70***	495	3.32	1773.70	.69	.103	.081	828.39***	36
Sample C_2 ($N = 168$)									
Model 1 (nine factors correlated)	939.43***	459	2.05	1143.43	.88	.079	.068		
Model 2 (nine factors loading on a second-order factor)	1141.96***	486	2.35	1291.96	.83	.090	.133		
Model 3 (all items loading on a single factor)	1935.61***	495	3.91	2067.61	.63	.132	.096	996.18***	36

Note. AIC = Akaike information criterion; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
*** $p < .001$

Table 6

Means, Standard Deviations, Correlations and α-Reliabilities of the TCL (Sample C_1 and C_2, individual-level)

Factor	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
					Sample C_1							
1. Mutual Trust	5.40	1.04	*(.81)*									
2. Goal Alignment	5.42	1.00	.56**	*(.88)*								
3. Open Exchange	5.73	1.15	.67**	.51**	*(.85)*							
4. Support for Individual Learning	5.24	1.03	.70**	.68**	.57**	*(.78)*						
5. Regular Contact	5.34	1.17	.40**	.51**	.34**	.55**	*(.81)*					
6. Motivation and Interest	5.36	0.93	.69**	.62**	.55**	.72**	.52**	*(.71)*				
7. Team Management	5.04	1.19	.56**	.51**	.46**	.65**	.43**	.48**	*(.73)*			
8. Democracy	4.57	1.62	.39**	.29**	.40**	.32**	.14*	.25**	.30**	*(.83)*		
9. Attendance	5.81	1.46	.22**	.22**	.23**	.18**	.18**	.20**	.32**	.17*	*(.74)*	
10. TCL Global Score	5.32	0.80	.81**	.75**	.74**	.82**	.63**	.76**	.74**	.57**	.47**	*(.85)*
					Sample C_2							
1. Mutual Trust	5.12	1.23	*(.86)*									
2. Goal Alignment	5.09	1.19	.69**	*(.93)*								
3. Open Exchange	5.17	1.43	.71**	.56**	*(.90)*							
4. Support for Individual Learning	4.82	1.29	.79**	.72**	.63**	*(.85)*						
5. Regular Contact	4.96	1.39	.49**	.49**	.32**	.57**	*(.87)*					
6. Motivation and Interest	4.81	1.15	.71**	.70**	.48**	.70**	.49**	*(.79)*				
7. Team Management	4.45	1.40	.54**	.53**	.38**	.57**	.48**	.60**	*(.78)*			
8. Democracy	4.90	1.43	.31**	.24**	.33**	.33**	.22**	.26**	.34**	*(.77)*		
9. Attendance	4.67	1.75	.20**	.25**	.24**	.17*	.27**	.19*	.50**	.14	*(.77)*	
10. TCL Global Score	4.89	0.95	.83**	.79**	.72**	.84**	.67**	.78**	.78**	.50**	.51**	*(.87)*

Note. Sample C_1: $N_{individuals} = 220$; $N_{groups} = 42$. Sample C_2: $N_{individuals} = 168$; $N_{groups} = 40$. Figures in parentheses represent α-reliabilities.
* $p < .05$. ** $p < .01$ (two-tailed).

The nine subfactors of the TCL correlated moderately with each other (ranging from r = .14 to r = .72) and highly with the TCL global score (ranging from r = .57 to r = .82). The results for Sample C_2 are basically the same as the results for Sample C_1.

Measurement invariance across time. Following recommendations by Kline (2005) we used multiple-sample CFA to test for measurement invariance over time. Accordingly we set up two models, one in which the unstandardized factor loadings were constrained to be equal across time and one in which the factor loadings were unconstrained across time (i.e. from Sample C_1 in Week 3 to Sample C_2 in Week 7). If the fit of the CFA model with equality-constrained loadings is not appreciably worse than the unconstrained model, then the indicators measure the factors in comparable ways during both measurement times. To assess measurement invariance we compared the relative fits with the $\Delta\chi^2$ of the two respective models.

When comparing the structural invariance across sample C_1 (Week 3) and C_2 (Week 7) the unconstrained model had a better fit than the constrained model: $\Delta\chi^2$ (43) = 43.00, $p < .05$. While this indicates non-invariance across time, results should be treated cautiously given the N/item ratio (which was smaller than the suggested ratio of 5:1, see Kline, 2005) for the C_2 sample was too small to be conclusive (see Study 4 where we re-visit this issue).

TCL as a group level construct. Dawson's (2003) selection rate was used to exclude groups with low group level response rates from further analysis. Selection rate is a formula derived from Monte Carlo Simulations that assesses the accuracy of incomplete group data in predicting true scores as a function of number of responses per group (n) and group size (N). The cut-off point chosen was a selection rate ([N-n]/Nn) of .32, which suggests that scores measured by incomplete data are correlated with true scores to .95 or higher. No group of Sample C_1 was above this cutoff point. One group (1 individual) of Sample C_2 was above this cutoff point and

therefore excluded. This yielded to a remaining sample of 39 groups including 167 individuals (4.28 members per group on average) at Week 7 of the term.

Aggregation of data at the group level requires both a theoretical basis and empirical justification (Kozlowski & Klein, 2000). To empirically justify aggregation, within-group agreement ($r_{WG(J)}$; James, Demaree, & Wolf, 1984, 1993) and interrater reliability (ICC1 and ICC2; cf. Bliese, 2000) were calculated. The $r_{WG(J)}$ statistic measures the degree to which individual ratings within a group are interchangeable and was calculated using a rectangular null distribution. Median $r_{WG(J)}$ values of .70 or greater indicate an acceptable agreement among group members responses on a scale (George, 1990; Janz, Colquitt, & Noe, 1997). According to the recommendations of Bliese (2000) and George (1990), also the range of $r_{WG(J)}$ values and the percentage of values below .70 were calculated. One-way ANOVAs on the aggregated subscales were conducted to calculate the intraclass coefficients ICC1 and ICC2. ICC2 values above .50 suggest acceptable discriminant validity. Minimum evidence for differences across groups is indicated if an ICC1 index has *F*-ratios from an ANOVA greater than 1; however, in order to justify aggregation researchers commonly use a significant *F*-ratio (Klein & Kozlowski, 2000).

Table 7 provides ICC1 and ICC2 values, $r_{WG(J)}$ values, and the results of *F*-tests for each of the nine subfactors of the TCL as well as for the TCL global score for Sample C_1. The average $r_{WG(J)}$ of the nine sub-factors of the TCL ranged from .58 (Democracy) to .92 (Goal Alignment). The average $r_{WG(J)}$ for the TCL global score is .94. Except for the factors Team Management ($r_{WG(J)}$ = .69), Democracy ($r_{WG(J)}$ = .69), and Attendance ($r_{WG(J)}$ = .61), average $r_{WG(J)}$ values for the TCL subscales and the average $r_{WG(J)}$ for the TCL global score were above .70, indicating that six subscales and the TCL global score had sufficient consensual validity. Additionally, only the factor Democracy had a median $r_{WG(J)}$ below .70. Four of the nine subfactors reached the

recommended ICC2 values of .50 or above. However, except of the factor Open Exchange the *F*-values of the ICC1 are above unity for all subscales, and are significant for seven of the subscales as well as for the TCL global score, indicating that eight of the nine subscales and the TCL global score had acceptable discriminant validity.

Table 7 provides the same statistics for Sample C_2. Five subscales and the TCL global score had sufficient consensual validity (mean $r_{WG(J)}$) and only the factor Attendance had a median $r_{WG(J)}$ below .70. All of the nine subfactors as well as the TCL global score reached the recommended ICC2 values of .50 or above. All *F*-values of the ICC1 are above unity for all subscales, and are significant for all subscales as well as for the TCL global score, indicating that all nine subscales and the TCL global score had acceptable discriminant validity. A comparison of the results from Sample C_1 (Week 3) and C_2 (Week 7) suggests that the TCL measures' consensual validity (agreement within teams) basically remains stable over time whereas their discriminant validity (differentiation between teams) improves over time.

Test-retest reliability. Group-level data from 39 groups could be matched for both data collection points (t_1: Week 3 and t_2: Week 7). Thus, test-retest reliability was calculated based on samples C_1 and C_2 by correlating the respective t_1 and t_2 scores of all nine TCL factors and the TCL global score (see Table 8). Except for the factor Support for Individual Learning all scales exceeded Robinson, Shaver, and Wrightsman's (1991) extensive criterion (second highest standard) of a correlation of greater than .40 for a minimum of a 3-month period between data collection.

Table 7

Intraclass Correlations, F-Test and Within-Group Agreement $r_{WG(J)}$ (Sample C_1 and C_2)

Factor	ICC1	ICC2	*F*	*p*	η^2	$r_{WG(J)}$ (mean)	$r_{WG(J)}$ (median)	$r_{WG(J)} < .70$ (% of groups)
			Sample C_1					
Mutual Trust	.18	.54	2.15***	.000	.33	0.84	0.89	11.9
Goal Alignment	.08	.31	1.45	.054	.25	0.87	0.92	7.1
Open Exchange	.00	.00	1.00	.487	.19	0.75	0.82	28.6
Support for Ind. Learning	.09	.35	1.54*	.029	.26	0.81	0.89	11.9
Regular Contact	.16	.51	2.03**	.001	.32	0.75	0.86	28.6
Motivation and Interest	.15	.49	1.95**	.002	.31	0.85	0.88	7.1
Team Management	.12	.42	1.72**	.008	.28	0.69	0.79	33.3
Democracy	.29	.68	3.10***	.000	.42	0.58	0.62	59.5
Attendance	.26	.65	2.89***	.000	.40	0.61	0.77	47.6
TCL Global Score	.18	.54	2.16***	.000	.33	0.94	0.96	2.4
			Sample C_2					
Mutual Trust	.38	.72	3.63***	.000	.52	0.83	0.89	15.4
Goal Alignment	.20	.51	2.04**	.002	.38	0.83	0.91	15.4
Open Exchange	.25	.58	2.39***	.000	.42	0.69	0.79	33.3
Support for Ind. Learning	.34	.69	3.24***	.000	.49	0.78	0.87	25.6
Regular Contact	.29	.64	2.75***	.000	.45	0.72	0.82	33.3
Motivation and Interest	.31	.66	2.95***	.000	.47	0.80	0.87	20.5
Team Management	.37	.71	3.47***	.000	.51	0.62	0.76	38.5
Democracy	.28	.63	2.69***	.000	.44	0.64	0.74	43.6
Attendance	.43	.76	4.20***	.000	.56	0.53	0.62	59.0
TCL Global Score	.43	.77	4.26***	.000	.56	0.95	0.96	0.0

Note. Sample C_1: $N_{individuals} = 220$, $N_{groups} = 42$. Sample C_2: $N_{individuals} = 167$, $N_{groups} = 39$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 8

Test-Retest Reliability for the TCL (C_1–C_2)

Factor	r_{tt}
Mutual Trust	.61**
Goal Alignment	.48**
Open Exchange	.42**
Support for Ind. Learning	.32*
Regular Contact	.44**
Motivation and Interest	.53**
Team Management	.43**
Democracy	.49**
Attendance	.69**
TCL Global Score	.46**

Note. $N_{groups} = 39$.
* $p < .05$. ** $p < .01$.

Given these findings and that the data structure could be replicated over time this qualifies the TCL as a reliable measurement instrument. However the medium to large effect sizes also indicate that the measure is still sensible enough to track changes in a group's climate for learning over time.

Multi-level criterion validation of the TCL. In order to validate the TCL we used objective and a subjective criterion measure. The objective measure was based on students' marks obtained in the organizational behavior module on an individual case study assignment. We used this particular outcome measure because students had to solve similar cases collectively in their work groups as part of this course. Accordingly, if it is true that a positive '*group-to-individual learning transfer*' (Laughlin & Jaccard, 1975) takes place in work groups with a favorable team climate for individual learning, TCL scores should correlate positively with the students' grades for their individual case study assignment. This objective measure was obtained

in Week 10 from university records for students who gave their informed consent. The subjective measure was a one-item measure that asked students on a 10-point Likert-type response scale ranging from 1 (*very low*) to 10 (*very high*) to what extent students thought they profited for their individual learning from their learning groups. This was measured in Week 7 at the end of the TCL questionnaire. The objective and the subjective criterion variables are unrelated (r = -.02; *n.s.*).

Because team climate is a group level variable and individual learning outcomes are individual-level variables, multi-level regression analyses were employed to assess the criterion validity of the TCL. The two individual-level outcome variables were regressed on each of the nine factors of the TCL entered as group level variables. To account for the nested data structure we allowed the intercept of the regression equation to vary at random (cf. Snijders & Bosker, 1999). All analyses were carried out using the MIXED procedure in PASW 18®.

First, the objective criterion measure was regressed on the nine factors and the TCL global score measured in Week 3. Second, the regression was repeated for the same predictors in Week 7, once without and once with controlling for the respective predictors in Week 3. As can be seen in Table 9 none of the Week 3 predictors explained a significant amount of criterion variance. In contrast, the Week 7 predictors (except Democracy) had a positive effect on the students' marks assessed in Week 10. The amount of explained variance ranged between 2% for Team Management and Motivation and Interest respectively to 6% for Goal Alignment. Basically the same results were obtained when the respective Week 3 TCL factors and the TCL global score were controlled for.

When the subjective measure, taken in Week 7, was regressed individually on the nine factors and the TCL global score taken in Week 3, a somewhat different pattern emerged. This

time, most predictors except for Regular Contact, Team Management, Democracy, and Attendance predicted students' perceptions of the amount of their individual learning profit from participating in group work. The amount of variance explained ranges between 4% for Goal Alignment and 9% for Open Exchange. When the subjective criterion variable was regressed on the Week 7 predictors, all factors and scores except for Regular Contact and Attendance were significant. The amount of variance explained ranged between 7% for Democracy and 26% for Support for Individual Learning. When controlled for the respective Week 3 predictors, Democracy, Regular Contact and Attendance did not predict perceived learning profits significantly. The amount of explained variance for all predictors dropped somewhat (range from 8% to 23%).

Taken together these findings suggest that the team climate for individual learning measured during the second half of the term not only predicts students' perceptions about how much they profit for their individual learning from group work, but also, and more importantly, the students' actual performance on an individual assignment for which they have been practicing during their learning groups. Although the two outcome variables are empirically unrelated to each other, both are positively affected by a more favorable team climate for learning. The purpose of Study 4 was to replicate the tests and findings from Study 3.

Table 9

Predictive Validity of the TCL (Based on Combined Samples C1 and C2)

	Individual mark on case study				Perceived profit for individual learning			
	Coefficient	*SE*	*t*	ΔR^2	Coefficient	*SE*	*t*	ΔR^2
				t_1 (Week 3)				
TCL Global Score	0.07	1.33	0.05	0.00	1.12	0.50	2.26*	0.06
Mutual Trust	0.31	1.07	0.29	0.00	1.08	0.39	2.76**	0.08
Goal Alignment	0.17	1.28	0.13	0.00	0.88	0.46	1.90^{+}	0.04
Open Exchange	-0.66	1.22	-0.54	0.00	1.29	0.45	2.89**	0.09
Support for Ind. Learning	-0.46	1.15	-0.40	0.00	1.22	0.43	2.86**	0.09
Regular Contact	0.04	0.96	0.04	0.00	-0.18	0.37	-0.49	0.00
Motivation and Interest	-0.75	1.17	-0.64	0.00	1.28	0.43	2.94**	0.09
Team Management	0.68	0.98	0.70	0.00	0.53	0.38	1.39	0.02
Democracy	0.15	0.59	0.26	0.00	0.48	0.23	2.80	0.05
Attendance	0.05	0.66	0.07	0.00	-0.04	0.27	0.87	0.00
	$N_{individuals} = 167$, $N_{groups} = 32$				$N_{individuals} = 141$, $N_{groups} = 39$			
				t_2 (Week 7)				
TCL Global Score	3.51	1.06	3.28**	0.05	1.34	0.24	5.67***	0.20
Mutual Trust	2.25	0.80	2.81**	0.05	1.15	0.18	6.30***	0.23
Goal Alignment	3.10	1.00	3.10**	0.06	1.08	0.25	4.31***	0.14
Open Exchange	2.20	0.74	2.97**	0.05	0.98	0.20	4.98***	0.17
Support for Ind. Learning	2.10	0.78	2.69**	0.04	1.21	0.17	7.29***	0.26
Regular Contact	2.63	0.86	3.06**	0.05	0.31	0.24	1.35	0.01
Motivation and Interest	1.84	0.91	2.02*	0.02	1.40	0.18	7.77***	0.28
Team Management	1.48	0.71	2.08*	0.02	0.76	0.19	4.01***	0.13
Democracy	0.88	0.81	1.09	0.00	0.62	0.22	2.85**	0.07

Attendance	1.46	0.53	2.78**	0.04	0.15	0.17	0.87	0.00
	$N_{individuals} = 136$, $N_{groups} = 32$				$N_{individuals} = 162$, $N_{groups} = 40$			
	t_1 and t_2 (Week 7) [a]							
TCL Global Score	3.69	1.11	3.31**	0.08	1.14	0.30	3.75**	0.14
Mutual Trust	2.58	0.93	2.77**	0.05	1.01	0.25	3.97***	0.15
Goal Alignment	3.65	1.13	3.22**	0.07	0.87	0.33	2.63*	0.08
Open Exchange	2.60	0.80	3.24**	0.07	0.72	0.24	3.05**	0.09
Support for Ind. Learning	2.25	0.84	2.69**	0.05	1.06	1.90	5.71***	0.23
Regular Contact	2.91	0.95	3.04**	0.06	0.31	0.29	1.08	0.01
Motivation and Interest	2.41	1.05	2.29*	0.03	1.26	0.24	5.27***	0.21
Team Management	1.36	0.81	1.68^{+}	0.03	0.71	0.24	2.99**	0.10
Democracy	1.19	1.02	1.18	0.00	0.31	0.28	1.07	0.00
Attendance	2.30	0.76	3.03**	0.06	0.29	0.25	1.14	0.01
	$N_{individuals} = 122$, $N_{groups} = 32$				$N_{individuals} = 147$, $N_{groups} = 39$			

Note. Estimates are based on a random intercept model.
[a] Controlled for t_1 (Week 3).
$^{+}$ $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Study 4: Replication Validation of the TCL's Nine Factor Structure (Samples D1 and D2)

Methods

Sample and procedures. The same 33-item version of the TCL was administered to all MBA/MSc students registered one year later in the organizational behavior module of the same British business school as in the previous study, again during Week 3 and Week 7 of the first term, with all other conditions remaining the same (voluntary participation, no extra credit given, work group size of 4 to 8 students, group formation, group longevity, group and individual task assignments). During Week 3 338 students from 71 groups participated and 289 participants (85.5%) from 71 groups (1–7 members per group, $M = 4.07$, $SD = 1.30$) provided complete data for Sample D_1 ($M_{age} = 25.13$ years, $SD = 4.71$, age range = 20–50 years; 50.5% female, diverse ethnical backgrounds, with 33.7% born in the UK). During Week 7 249 students from 70 groups participated and 224 participants (90.0%) from 70 groups (1–6 members per group, $M = 3.20$, $SD = 1.31$) provided complete data for Sample D_2 ($M_{age} = 25.95$ years, $SD = 5.31$, age range = 20–50 years; 50.4% female, and 33.8% born in the UK). The nine-factor model of the TCL investigated in Study 3, again assuming correlations between the different factors, was cross-validated with samples D_1 and D_2, using the same statistical methods as before in Study 3.

Results and Discussion

Table 10 provides the results of the confirmatory factor analyses. The nine-factor model assuming correlations between the sub-factors showed a good model fit in both samples (Sample D_1, χ^2 (459, $N = 289$) = 955.47, $p < .001$, AIC = 1159.47, CFI = .91, RMSEA = .061, SRMR = .055; Sample D_2, χ^2 (459, $N = 224$) = 944.35, $p < .001$, AIC = 1148.35, CFI = .91, RMSEA = .069, SRMR = .052) and, as in Study 3, outperformed the alternative models, one including a second-order factor (Sample D_1: AIC = 1367.68; Sample D_2: AIC = 1398.40) and one assuming

all items to directly load on one single factor (Sample D_1: AIC = 2398.15, $\Delta\chi^2 = 1310.68$, $p < .001$; Sample D_2: AIC = 2263.78, $\Delta\chi^2 = 1187.43$, $p < .001$). In both samples, the item loadings were significant ($p < .05$) and, for the exception of the same item as in Study 3 ("There is lack of time keeping in group meetings"), were all above .40 on their respective factors. Again, the χ^2-value of the nine-factor model as well as of all alternative models reached significance, but univariate values of skewness and kurtosis of the single items were within the limits postulated by West, Finch, and Curran (1995; i.e. skewness < 2 and kurtosis < 7).

As is shown in Table 11, for Sample D_1 Cronbach's alpha of the nine subscales ranged from .72 to .90 (TCL global score: $\alpha = .86$), indicating sufficient to high levels of internal consistency of all scales. The nine sub-factors of the TCL correlated moderately with each other (ranging from $r = .49$ to $r = .77$) and highly with the TCL global score (ranging from $r = .51$ to $r = .84$). The respective indices for Sample D_2, all of similar magnitude and range as in Sample D_1, are also presented in Table 11.

TCL as a group level construct. Selection of groups for group-level analyses and justification for data aggregation to group level were established in the same ways as in Study 3. Seven groups (15 individuals) from Sample D_1 and 19 groups (29 individuals) from Sample D_2 were above Dawson's (2003) cutoff point and therefore excluded from further analysis, yielding a sample of 64 groups including 274 individuals (4.28 members per group on average) at Week 3 and a sample of 51 groups including 195 individuals (3.82 members per group on average) at Week 7 of the term.

Table 12 provides ICC1 and ICC2 values, $r_{WG(J)}$ values, and the results of *F*-tests for each of the nine sub-factors of the TCL as well as for the TCL global score for Samples D_1 and D_2. The average $r_{WG(J)}$ of the nine subfactors of the TCL ranged from .67 (Regular Contact) to .92

(Goal Alignment) and .97 for the TCL global score in Sample D_1 and from .66 (Democracy) to .91 (Goal Alignment) and .96 for the TCL global score in Sample D_2. These results and the respective ICC1, ICC2 and *F*-values indicate that in Sample D_1 eight subscales and the TCL global score and in Sample D_2 seven and all nine subscales respectively and the TCL global score had sufficient consensual and discriminant validity.

As was found in Study 3, comparison of Sample D_1 (Week 3) and D_2 (Week 7) reveals, that the TCL measures' consensual validity (agreement within teams) basically remains stable over time whereas their discriminant validity (differentiation between teams) improves over time.

Measurement invariance across time. For establishing factor invariance across time (cf. Kline, 2005), again two models, one in which the unstandardized factor loadings were constrained to be equal across Week 3 and Week 7 samples D_1 and D_2 respectively, and one in which the factor loadings were unconstrained, were tested. No significant differences between the unconstrained and the constrained model were found, $\Delta\chi^2\,(43) = 27.84$, *n.s.*, indicating that the factor structure is invariant across time.

Test-retest reliability. Group-level data from 48 groups could be matched for both data collection points. Test-retest reliability (see Table 13) ranged from $r_{tt} = .25$ to $r_{tt} = .54$ (mean $r_{tt} = .37$). Three of the nine factors (Interest and Enthusiasm, Regular Contact, Democracy) as well as the TCL global score exceeded Robinson, Shaver, and Wrightsman's (1991) criterion of .40 (for 3-months period). Given these findings and that the data structure could be replicated over time this replication of findings from Study 3 qualifies the TCL as a reliable measurement instrument which is also sensible enough to track changes in a group's climate for learning over a period of about one month.

Multi-level criterion validation of the TCL. Criterion validity of the TCL with an objective measure (individual marks in Week 10 from university files) and a subjective measure of learning profit (Week 7) were established with the same procedures as in Study 3. There was again no significant correlation between the objective and the subjective measure ($r = .07$; n.s.).

As can be seen in Table 14 none of the Week 3 predictors explained a significant amount of the objective criterion variance. In contrast, the Week 7 predictors (except Democracy, Open Exchange, Regular Contact) had a positive effect on the students' marks assessed in Week 10. The amount of explained variance ranged between 3% and 4%. Even stronger results, with explained criterion variance ranging between 2% and 6% for each TCL factor (except for Democracy) and the TCL global score were obtained when the respective Week 3 TCL factors and the TCL global score were controlled for.

For the subjective measure, taken in Week 7, a somewhat different pattern emerged, as was also found in Study 3. Most predictors, except for Goal Alignment, Open Exchange and Regular Contact, predicted students' perceptions of the amount of their individual learning profit from participating in group work. The amount of variance explained ranges between 4% for Attendance and 11% for Motivation and Interest. When the subjective criterion variable was regressed on the Week 7 predictors, all factors and scores were significant, ranging in variance explained from 4% for Democracy to 35% for Support for Individual Learning and Motivation and Interest respectively. When controlled for the respective Week 3 predictors, Democracy wasn't any longer predicting perceived learning profits (as in Study 3), and the amount of explained variance for all predictors stayed about the same, ranging from 5% for Attendance to 33% for Support for Individual Learning.

Table 10

Confirmatory Factor Analysis: Fit Indices for the Alternative Models (Sample D_1 and Sample D_2)

Sample and Model	χ^2	*df*	χ^2/df	AIC	CFI	RMSEA	SRMR	$\Delta\chi^2$	Δdf
Sample D_1 ($N = 289$)									
Model 1 (nine factors correlated)	955.47***	459	2.08	1159.47	.91	.061	.055		
Model 2 (nine factors loading on a second-order factor)	1217.68***	486	2.51	1367.68	.86	.072	.111		
Model 3 (all items loading on a single factor)	2266.15***	495	4.58	2398.15	.66	.111	.089	1310.68***	36
Sample D_2 ($N = 224$)									
Model 1 (nine factors correlated)	944.35***	459	2.06	1148.35	.91	.069	.052		
Model 2 (nine factors loading on a second-order factor)	1248.40***	486	2.57	1398.40	.86	.084	.137		
Model 3 (all items loading on a single factor)	2131.78***	495	4.31	2263.78	.70	.122	.081	1187.43***	36

Note. AIC = Akaike information criterion; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
*** $p < .001$.

Table 11

Means, Standard Deviations, Correlations and α-Reliabilities of the TCL (Sample D_1 and D_2, individual-level)

Factor	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
						Sample D_1						
1. Mutual Trust	5.21	0.91	*(.81)*									
2. Goal Alignment	5.65	1.04	.62**	*(.90)*								
3. Open Exchange	5.01	0.93	.69**	.45**	*(.86)*							
4. Support for Ind. Learning	4.43	1.35	.76**	.71**	.51**	*(.80)*						
5. Regular Contact	5.08	0.87	.39**	.45**	.25**	.51**	*(.88)*					
6. Motivation and Interest	4.83	1.04	.70**	.61**	.49**	.71**	.53**	*(.72)*				
7. Team Management	4.72	1.25	.61**	.50**	.47**	.62**	.44**	.51**	*(.73)*			
8. Democracy	5.61	1.29	.41**	.30**	.32**	.36**	.10	.33**	.39**	*(.74)*		
9. Attendance	5.08	0.74	.33**	.26**	.14*	.30**	.28**	.29**	.46**	.25**	*(.77)*	
10. TCL Global Score	5.21	0.91	.84**	.74**	.66**	.84**	.64**	.79**	.78**	.56**	.51**	*(.86)*
						Sample D_2						
1. Mutual Trust	5.32	1.07	*(.84)*									
2. Goal Alignment	5.32	1.02	.68**	*(.93)*								
3. Open Exchange	5.52	1.24	.71**	.60**	*(.91)*							
4. Support Ind. Learning	5.06	1.14	.74**	.77**	.57**	*(.84)*						
5. Regular Contact	5.03	1.36	.64**	.62**	.41**	.64**	*(.88)*					
6. Motivation and Interest	4.99	1.13	.73**	.68**	.50**	.75**	.68**	*(.84)*				
7. Team Management	4.59	1.29	.62**	.58**	.47**	.64**	.54**	.65**	*(.75)*			
8. Democracy	5.08	1.43	.44**	.42**	.47**	.46**	.31**	.35**	.42**	*(.82)*		
9. Attendance	5.06	1.70	.34**	.29**	.12	.28**	.33**	.36**	.47**	.05	*(.72)*	
10. TCL Global Score	5.11	0.93	.86**	.82**	.71**	.85**	.77**	.83**	.81**	.58**	.51**	*(.87)*

Note. Sample D_1: $N_{individuals} = 289$; $N_{groups} = 71$. Sample D_2: $N_{individuals} = 224$; $N_{groups} = 70$. Figures in parentheses represent α-reliabilities.
* $p < .05$; ** $p < .01$ (two-tailed).

Table 12

Intraclass Correlations, F-Test and Within-Group Agreement $r_{WG(J)}$ (Sample D_1 and D_2)

Factor	ICC1	ICC2	*F*	*p*	η^2	$r_{WG(J)}$ (mean)	$r_{WG(J)}$ (median)	$r_{WG(J)} < .70$ (% of groups)
			Sample D_1					
Mutual Trust	.09	.30	1.42*	.034	.30	0.88	0.93	3.1
Goal Alignment	.17	.46	1.86**	.001	.36	0.92	0.95	4.7
Open Exchange	.13	.39	1.63**	.006	.33	0.84	0.92	15.6
Support for Ind. Learning	.08	.26	1.35	.060	.29	0.88	0.91	6.3
Regular Contact	.31	.66	2.92***	.000	.47	0.76	0.84	26.6
Motivation and Interest	.17	.47	1.88***	.000	.36	0.89	0.92	4.7
Team Management	.16	.45	1.81**	.001	.35	0.82	0.86	10.9
Democracy	.08	.27	1.38*	.049	.29	0.67	0.71	43.8
Attendance	.33	.68	3.13***	.000	.48	0.73	0.81	32.8
TCL Global Score	.20	.51	2.04***	.000	.38	0.97	0.97	0.0
			Sample D_2					
Mutual Trust	.33	.66	2.92***	.000	.50	0.88	0.92	7.8
Goal Alignment	.33	.65	2.89***	.000	.50	0.91	0.95	5.9
Open Exchange	.24	.55	2.21***	.000	.43	0.79	0.90	23.5
Support Ind. Learning	.31	.64	2.75***	.000	.49	0.83	0.92	19.6
Regular Contact	.47	.77	4.36***	.000	.60	0.80	0.89	25.5
Motivation and Interest	.46	.76	4.23***	.000	.59	0.89	0.91	3.9
Team Management	.41	.72	3.62***	.000	.56	0.71	0.80	33.3
Democracy	.31	.63	2.72***	.000	.49	0.66	0.75	39.2
Attendance	.47	.78	4.45***	.000	.61	0.67	0.80	41.2
TCL Global Score	.52	.80	5.09***	.000	.64	0.96	0.96	0.0

Note. Sample D_1: $N_{individuals} = 274$, $N_{groups} = 64$. Sample D_2: $N_{individuals} = 195$, $N_{groups} = 51$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 13

Test-Retest Reliability for the TCL (D_1–D_2)

Factor	r_{tt}
Mutual Trust	.34*
Goal Alignment	.33*
Open Exchange	.25*
Support for Ind. Learning	.28*
Regular Contact	.46**
Motivation and Interest	.54***
Team Management	.31*
Democracy	.42**
Attendance	.35*
TCL Global Score	.42**

Note. $N_{groups} = 48$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 14

Predictive Validity of the TCL (Based on Combined Samples D1 and D2)

	Individual mark on case study				Perceived profit for individual learning			
	Coefficient	*SE*	*t*	ΔR^2	Coefficient	*SE*	*t*	ΔR^2
				t_1 (Week 3)				
TCL Global Score	0.53	1.74	0.30	0.00	1.39	0.40	3.46**	0.11
Mutual Trust	1.14	1.25	0.91	0.00	0.88	0.37	2.37*	0.05
Goal Alignment	-0.94	1.23	-0.77	0.00	0.54	0.35	1.54	0.02
Open Exchange	0.31	1.06	0.29	0.00	0.82	0.32	1.94^{+}	0.03
Support for Ind. Learning	-0.32	1.45	-0.22	0.00	0.94	0.40	2.34*	0.05
Regular Contact	-1.30	0.69	-1.89^{+}	0.02	0.42	0.22	1.88^{+}	0.03
Motivation and Interest	1.38	1.45	0.95	0.00	1.23	0.35	3.54*	0.11
Team Management	0.21	1.18	0.17	0.00	1.03	0.33	3.13*	0.09
Democracy	0.60	0.86	0.70	0.00	0.71	0.28	2.54*	0.06
Attendance	1.32	0.74	1.78^{+}	0.02	0.52	0.23	2.28*	0.04
	$N_{\text{individuals}} = 143$, $N_{\text{groups}} = 35$				$N_{\text{individuals}} = 146$, $N_{\text{groups}} = 48$			
				t_2 (Week 7)				
TCL Global Score	2.01	0.89	2.26*	0.04	1.53	0.17	9.00***	0.32
Mutual Trust	1.75	0.85	2.06*	0.03	1.48	0.17	8.53***	0.30
Goal Alignment	1.75	0.93	1.88^{+}	0.03	1.33	0.19	7.06***	0.25
Open Exchange	1.10	0.73	1.51	0.01	0.80	0.23	3.44**	0.10
Support for Ind. Learning	2.00	0.85	2.36*	0.04	1.52	0.16	9.78***	0.35
Regular Contact	1.00	0.78	1.27	0.01	0.99	0.14	7.30***	0.27
Motivation and Interest	1.82	0.80	2.28*	0.04	1.40	0.14	9.78***	0.35
Team Management	1.37	0.68	2.02^{+}	0.03	1.12	0.14	8.04***	0.29
Democracy	0.45	0.65	0.70	0.00	0.41	0.20	2.08*	0.04

Attendance	0.97	0.47	2.06^{+}	0.03	0.45	0.14	3.27**	0.08
	$N_{individuals} = 126$, $N_{groups} = 35$				$N_{individuals} = 173$, $N_{groups} = 48$			
	t_1 and t_2 (Week 7) [a]							
TCL Global Score	2.47	0.97	2.54*	0.06	1.42	0.22	6.55***	0.25
Mutual Trust	1.81	0.95	1.92^{+}	0.03	1.42	0.21	6.66***	0.26
Goal Alignment	2.27	0.98	2.31*	0.05	1.34	0.23	5.83***	0.23
Open Exchange	1.42	0.83	1.71^{+}	0.02	0.73	0.25	2.95**	0.09
Support for Ind. Learning	2.22	0.89	2.48*	0.06	1.48	0.18	8.36***	0.33
Regular Contact	1.46	0.81	1.80^{+}	0.02	1.04	0.18	5.89***	0.23
Motivation and Interest	2.07	0.97	2.13*	0.04	1.40	0.19	7.29***	0.28
Team Management	1.56	0.73	2.15*	0.04	1.09	0.15	7.07***	0.08
Democracy	0.83	0.81	1.03	0.00	0.32	0.23	1.36	0.02
Attendance	1.02	0.52	1.95*	0.03	0.36	0.16	2.33*	0.05
	$N_{individuals} = 106$, $N_{groups} = 35$				$N_{individuals} = 146$, $N_{groups} = 48$			

Note. Estimates are based on a random intercept model.
[a] Controlled for t_1 (Week 3).
$^{+}$ $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

General Discussion

The present research was conducted to develop a new construct – team climate for *individual* learning, and to develop and validate an instrument that measures it within the context of student group work in higher education. Results from a series of studies suggest that the proposed nine-factor structure of the construct and the individual and group level scores of the respective measurement instrument are reliable and valid.

One exploratory and four confirmatory factor analyses attest to the replicability of the underlying nine-factor structure, which was induced on the basis of a qualitative study and deduced from the literatures on cooperative learning, team learning, and team innovation. One out of two comparative confirmatory factor analyses, each conducted across two measurement periods in time (with about 1 month interim period) attests to the factor structure's stability over time. All four confirmatory factor analyses demonstrated that the nine-factor structure model was superior to two alternative models (a nine-factors-one-second-order-factor model, and an all-items-one-factor model). Reliability analyses provided evidence for the internal consistency and relative stability of the instrument's scores. Cronbach's Alphas across all five samples, each time assessed for nine factors and the TCL global score, ranged from .71 to .93, exceeding the .70 standard. The test-retest correlations across Studies 3 and 4 ranged from .25 to .69 across all nine factors and were .42 and .46 respectively for the TCL global score. Given these acceptable but still moderate levels of test-retest reliabilities, and the fact that the data structure could be replicated over time, this qualifies the TCL as an overall reliable measurement instrument, which appears still sensible enough to track changes in a group's climate for learning over time.

Moreover, the team climate for individual learning was found to be a group level construct. Consensual validity in the form of within team consensus (mean $r_{WG(J)} > .70$) could be established for six to eight out of the nine sub-scales and for the TCL global score.

Discriminant validity in the form of between team differentiation (ICC1, ICC2, significant *F*-test results) could be established for seven to all nine sub-scales and for the TCL global score. No individual sub-scale remained below the cut-off point set for discriminant validity across all samples. Whereas the TCL measures' consensual validities remained stable over time, their discriminant validities improved over a month time (Week 3 to Week 7) in both longitudinal studies. The more the teams progressed over time the clearer one can distinguish their team climates for individual learning.

Furthermore, the team climate for individual learning construct showed good criterion validity. While none of the Week 3 TCL predictors explained a significant amount of variance in the objective individual learning outcome, the Week 7 predictors (except Democracy in both studies) had a positive effect on the students' marks assessed in Week 10 (ranging from 2% to 6% in Study 3 and from 3% to 4% in Study 4). The predicted variances were somewhat stronger when the respective Week 3 TCL factors and the TCL global score were controlled for (ranging from 3% to 8 % in Study 3 and from 4% to 6% in Study 4).

In the same way, criterion validity was established using a subjective criterion variable (the extent students thought they profited for their individual learning, taken in Week 7). The variance predicted by the TCL factors and the TCL global score was higher when using the subjective than the objective criterion, which might be due to equivalent measurement time, common method bias and common source bias likely having inflated these results (Podsakoff, MacKenzie, Lee, & Podsakoff 2003).

While some of the Week 3 TCL predictors (four in Study 3 and six in Study 4) explained a significant amount of subjective learning profit estimates (ranging from 8% to 9% in Study 3 and from 4% to 11% in Study 4), the Week 7 predictors (except for Democracy in both studies) had a positive effect on the students' ratings (ranging from 7% to 28% in Study 3 and from 4% to 35% in Study 4), which remained the same or were slightly

weaker when the respective Week 3 TCL factors and the TCL global score were controlled for (ranging from 8% to 23% in Study 3 and from 5% to 33% in Study 4). Note that the factor Support for Individual Learning was among the strongest predictors of subjectively perceived profit from the learning group. This might be due to the strong content overlap of the respective TCL scale with the content of the item used as subjective criterion measure.

In summary, the 9-factor, 33-item version of the TCL demonstrates robust psychometric properties, with acceptable levels of reliability, stability over time, within-team consensus, between team discrimination (which is strongest after about 2 months of group development), and most importantly criterion or predictive validity for objective and subjective measures of learning profit. These results provide initial support for the utility of the construct and for the respective self-report measure of a facet- specific team climate for individual learning within work groups in higher education.

Theoretical Implications

The concept of a facet-specific team climate for individual learning was theoretically derived from the organizational and group climate literatures and the cooperative and team learning literatures. It extends the social interactive (cooperative) learning approach which focuses on short term group arrangements and their effects on individual learning (e.g., Slavin, 1996) and the educational climate approach, which focuses on the social environment in the classroom and its effects on the individual learner (e.g., Fraser, 1998) by making the study of team level processes in semi-permanent and semi-autonomous student groups possible in relation to individual learning outcomes. In doing so, it also complements organizational work group research, which focuses team level processes and outcomes, like group learning (e.g., Edmondson, 2003) and team innovation (Anderson & West, 1998), without considering individual learning outcomes, from which groups and organizations as a whole can profit indirectly.

Furthermore, our study contributes to the extensive literature on interdependent learning in groups (Slavin, 1992, Johnson & Johnson, 2000) by suggesting that there are perceptions of group functioning, in addition to objective characteristics such as task, goal or reward interdependencies per se, that relate to individual learning benefits. In particular, our results show that controlling for such objective characteristics (all groups in our samples were working on common group tasks, rewarded as a group and individually, and were set the same objectives) the perceived team climate for individual learning explains incremental variance in objectively measured individual learning outcomes and subjective accounts of individual learning profits.

Our results respond to Lizzio and Wilson' s (2005) call for more systematic and inductively driven empirical work on what facilitates (and impedes) group functioning within self-managed student learning groups. While the authors highlighted the importance of generic perceptions of the overall learning environment, including factors outside and inside student teams, our work emphasizes the importance of a facet-specific team climate for individual learning and suggests that there are nine different sub-facets of such a team climate that facilitate (or undermine) individual learning (i.e. mutual exchange, trust, motivation and interest, team management, cooperation, regular contact, goal alignment, support for individual learning, and democracy).

Overall, the team climate for learning construct provides a new and potentially fruitful avenue of research that can help educational scholars to better understand the team processes that promote (or inhibit) individual learning in semi-autonomous and semi-permanent student work groups. For an example, it can help to identify facilitating (or impeding) context factors for individual learning in groups, such as the quality of staff-support and leadership provided, group, task, and goal structures, reward systems, or group compositional aspects (e.g., diversity in team member personalities, competencies or ethnic backgrounds), and the

mechanisms by which this translates into relevant outcomes, such as individual learning and satisfaction.

Practical Implications

Our findings suggest that practitioners need not only rely on design aspects of cooperative learning (c.f. external and structural aspects for effective cooperative learning, Lizzio & Wilson, 2005) but should also use opportunities for fostering the development of a favorable team climate for learning and respective perceptions. The newly developed TCL measure can be used to assess the favorability of a team's climate for individual learning, which, as we have shown, predicts individual learning success and the group members' satisfaction with the learning support they receive from their peers. On the basis of this assessment survey feedback can be delivered, including a discussion of the respective climate facets, providing resources for team coaching and team development in higher education. Furthermore, the TCL measure appears sensitive enough to changes in team climate for learning over time, so that it can also be used in intervention studies where team climate for learning serves as a control, mediator or dependent variable. Of practical importance is also the finding that the longer learning teams worked together (from three to seven weeks), the better the TCL discriminates between teams while maintaining high levels of intra group consensus over time.

Limitations and Future Research

All studies were consecutively conducted within the same international British business school, which might impose some restrictions to the generalizabilty of the findings. In terms of participant characteristics, generalizability appears to be rather high, because the samples of the validation studies 2, 3 and 4 are highly diverse in cultural background (46% to 66% were not born in the UK, representing more than 60 nationalities from all continents), highly balanced in gender (49% to 52% female students) and assembled from an array of

programs of study which is typically offered within Business Schools (e.g., Marketing, MBA, International Business, Accounting, HRM, Work and Organizational Psychology). In terms of level of student programs, generalizability to undergraduate and graduate students seems warranted, because the qualitative Study 1 (Sample A), which was used to generate the construct categories and items, comprises undergraduate students (mean age about 20 years), while the remaining Samples B to D2, which were used for construct validation, comprise graduate students (mean age ranging from 25 to 27). Particular generalizability limitations might apply to the kind of student groups used, in terms of group longevity (semi-permanent groups ranging from three to 10 weeks), group task (semi-autonomous group work with a mix of collaborative and individual tasks assignments within the domain of organizational behavior), and group size (four to eight students). The transferability to other programs of study in non-business related university schools, like engineering, language studies or arts and humanities, and to other studying contexts, like adult education or distance studying programs, needs to be established in future studies. For the purpose of transferring the TCL to business contexts, for example, work groups in organizations, we recommend to adjust item wording and item content to the respective organizational and task context and to validate and complement the categories found here by using a qualitative and quantitative study mix similar to the one reported here.

Across studies, the Democracy factor positioned among the least consensual scales of the TCL, with 39% to 60% of the work groups in the respective samples which did not exceed the $r_{WG(J)}$ criterion of.70. This factor also failed several times to relate significantly to the objective and subjective criterion variables. Democracy was assessed with two items ("One team member dominates the group", "The leader in my group dominates other group members."). For this factor's shortcoming in consensual validity, one should bear in mind that measures of within group consensus rely on the degree of alignment among individual

perceptions, which in the particular case, where one person may dominate a group, are likely to be naturally distorted toward lower consensus levels. It is plausible to assume that there is at least one group member (the dominating one) who attests to a lower degree of dominance within the team as all others do (who feel dominated by him or her).

What is not known yet is whether asymmetries in the perceptions of democracy – dominance (or any other TCL factor) within groups impact on individual or group performance and satisfaction. In the area of conflict, Jehn, Rispens, and Thatcher (2010) recently demonstrated that asymmetric perceptions about conflict within groups can have consequences for objective group and individual performance as well as for self-reported performance and satisfaction. Social processes and group climate mediate these effects. Thus, future research should address the question of whether asymmetric perceptions of democracy–dominance, or any other TCL factor, impact group functioning and individual learning in similar ways.

Another reason for the Democracy factor's shortcoming in criterion validity might be the issue of which type of leadership behavior inhibits or facilitates individual learning profit in teams. The studies from Edmondson (2003) with work teams in organizations suggest that, with respect to team and individual learning, leadership might be a double edged sword. While directive forms of leadership have been shown to promote team level learning and performance, they are also likely to inhibit individual learning progress to occur. The role of leadership with respect to a work group's climate for learning and individual and group level learning outcomes appears to be a relevant question for future research, not only from a higher education perspective (e.g., to inform staff development) but also from the perspective of organizational learning and innovation (e.g., to inform leadership development initiatives).

References

Akaike, H. (1987). Factor analysis and AIC. *Psychometrika, 52*, 317–332. doi: 10.1007/BF02294359

Ambrose, M. L., & Kulik, C. T. (1999). Old friends, new faces: Motivation research in the 1990s. *Journal of Management, 25*, 231–292. doi:10.1177/014920639902500302

Anderson, N. R., & West, M. A. (1998). Measuring climate for work group innovation: Development and validation of the team climate inventory. *Journal of Organizational Behavior, 19*, 235–258. doi: 10.1002/(SICI)1099-1379(199805)19:3<235::AID-JOB837>3.0.CO;2-C

Arbuckle, J. L. (1999). *AMOS 4.0 for Windows.* Chicago, IL: Small Waters.

Argote, L. (1993). Group and organizational learning curves: Individual, system and environmental components. *British Journal of Social Psychology, 32*, 31–51.

Baldwin, T. T., Bedell, M. D., & Johnson, J. L. (1997). The social fabric of a team-based M.B.A. program: Network effects on student satisfaction and performance. *Academy of Management Journal, 40*(6), 1369–1397. doi: 10.2307/257037

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–249. doi: 10.1037//0033-2909.107.2.238

Bliese, P. D. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In K. J. Klein & S. W. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 349–381). San Francisco, CA: Jossey-Bass.

Brodbeck, F. C., & Greitemeyer, T. (2000a). A dynamic model of group performance: Considering the group members' capacity to learn. *Group Processes & Intergroup Relations, 3*(2), 159–182. doi: 10.1177/1368430200003002004

Brodbeck, F. C., & Greitemeyer, T. (2000b). Effects of individual versus mixed individual and group experience in rule induction on group member learning and group performance. *Journal of Experimental Social Psychology, 36*(6), 621–648. doi: 10.1006/jesp.2000.1423

Brodbeck, F. C., Guillaume, Y. R. F., & Lee, N. (2010). Ethnic diversity as a multilevel construct: The combined effects of dissimilarity, group diversity, and societal status on learning performance in work groups. *Journal of Cross-Cultural Psychology*. Advance online publication. doi:10.1177/0022022110383314

Brodbeck, F. C., Kerschreiter, R., Mojzisch, A., & Schulz-Hardt, S. (2007). Improving group-decision making under conditions of distributed knowledge: The information asymmetries model. *Academy of Management Review, 32*, 459–479.

Brodbeck, F. C., & Maier, G. W. (2001). Das Teamklima-Inventar (TKI) für Innovation in Gruppen: Psychometrische Überprüfung an einer deutschen Stichprobe [The Team Climate Inventory (TCI) for Innovation: A psychometric test on a German sample of work groups]. *Zeitschrift für Arbeits- und Organisationspsychologie, 45*(2), 59–73. doi: 10.1026//0932-4089.45.2.59

Byrne, J. A. (1995). *Business Week's guide to the best business schools*. New York, NY: McGraw-Hill.

Costigan, R. D., Ilter, S. S., & Berman, J. J. (1998). A multi-dimensional study of trust in organizations. *Journal of Managerial Issues, 10*, 303–317.

Cruz, M. G., Henningsen, D. D., & Smith, B. A. (1999). The impact of directive leadership on group information sampling, decisions, and perceptions of the leader. *Communication Research, 26*, 349–369. doi: 10.1177/009365099026003004

Dawson, J. F. (2003). *Do we have enough? The accuracy of incomplete data from small groups*. Best paper proceedings of the Academy of Management, Seattle, USA.

Durham, C. C., Knight, D., & Locke, E. A. (1997). Effects of leader role, team-set goal difficulty, efficacy, and tactics on team effectiveness. *Organizational Behavior and Human Decision Process, 72*, 203–231. doi: 10.1006/obhd.1997.2739

Edmondson, A. C. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*, 350–383. doi: 10.2307/2666999

Edmondson, A. C. (2002). The local and variegated nature of learning in organizations: A group-level perspective. *Organization Science, 13*, 128–146. doi: 10.1287/orsc.13.2.128.530

Edmondson, A. C. (2003). Managing the risk of learning: Psychological safety in work teams. In M. A. West, D. Tjosvold, & K. G. Smith (Eds.), *International handbook of organizational teamwork and cooperative working* (pp. 255–275). London, England: Blackwell.

Edmondson, A. C., Bohmer, R. M., & Pisano, G. P. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly, 46*, 685–716. doi: 10.2307/3094828

Edmondson, A. C., Dillon, J. R., & Roloff, K. S. (2007). Three perspectives on team learning: Outcome improvement, task mastery, and group process. *The Academy of Management Annals, 1*, 269–314. doi: 10.1080/078559811

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*, 117–140. doi: 10.1177/001872675400700202

Fraser, B. J. (1998). Classroom environment instruments: Development, validity and applications. *Learning Environments Research, 1,* 7–33. doi: 10.1023/A:1009932514731

George, J. M. (1990). Personality, affect, and behavior in groups. *Journal of Applied Psychology, 75,* 107–116. doi: 10.1037/0021-9010.75.2.107

Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology, 47*, 307–338. doi: 10.1146/annurev.psych.47.1.307

Hackman, J. R. (1987). The design of work teams. In J. W. Lorsch (Ed.), *Handbook of organizational behavior* (pp. 315–348). Englewood Cliffs, NJ: Prentice-Hall.

Henderson, R., & Clark, K. (1990). Architectural innovation: The reconfiguration of existing product technology and the failure of existing firms. *Administrative Science Quarterly, 35*, 9–30. doi: 10.2307/2393549

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin, 121*, 43–64. doi: 10.1037/0033-2909.121.1.43

Holsti, O. R. (1969). *Content analysis for the social sciences and the humanities*. Reading, MA: Addison-Wesley.

Hosking, D. M., & Anderson, N. R. (Eds.). (1992). *Organizational change and innovation: Psychological perspectives and practices in Europe*. London, England: Routledge.

Hu, L., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 76–99). Thousand Oaks, CA: Sage.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3*, 424–453. doi: 10.1037/1082-989X.3.4.424

James, L. R., Demaree, R. G., & Wolf, G. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology, 69*, 85–98. doi: 10.1037/0021-9010.69.1.85

James, L. R., Demaree, R. G., & Wolf, G. (1993). r_{wg}: An assessment of within-group interrater agreement. *Journal of Applied Psychology, 78*, 306–309. doi: 10.1037//0021-9010.78.2.306

Janz, B. D., Colquitt, J. A., & Noe, R. A. (1997). Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables. *Personnel Psychology, 50*, 877–904. doi: 10.1111/j.1744-6570.1997.tb01486.x

Jehn, K. A., Rispens, S., & Thatcher, S. M. B. (2010). The effects of conflict asymmetry on work group and individual outcomes. *Academy of Management Journal*, *53*, 596–616. Retrieved from http://aom.metapress.com/link.asp?id=g1868r5m25n75007

Johnson, D. W., & Johnson, R. T. (2000). *Joining together: Group theory and group skills (7th ed.)*. Boston, MA: Allyn & Bacon.

Johnson, D. W., Johnson, R., & Smith, K.A. (1998). *Active learning: Cooperation in the college classroom* (2nd ed.). Edina, MN: Interaction Book Company.

Katz-Navon, T., Naveh, E., & Stern, Z. (2009). Active learning: when is more better? The case of resident physicians' medical errors. *Journal of Applied Psychology, 94,* 1200–1209. doi: 10.1037/a0015979

Kerr, N. L. (1983). Motivation losses in small groups: A social dilemma analysis. *Journal of Personality and Social Psychology, 45,*819-828. doi:10.1037/0022-3514.45.4.819

Klein, K. J., & Kozlowski, S. W. (2000). *Multilevel theory, research, and methods in organizations.* San Francisco, CA: Jossey-Bass.

Kline, R. B. (2005). Principles and practice of structural equation modeling. New York, NY: Guilford Press.

Kozlowski, S. W., & Klein, K. J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein & S. W.

Koslowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 3–90). San Francisco, CA: Jossey-Bass.

Kramer, R. M. (1999). Trust and distrust in organizations: Emerging perspectives, enduring questions. *Annual Review of Psychology, 50*, 569–598. doi: 10.1146/annurev.psych.50.1.569

Larson, J. R. Jr., Foster-Fishman, P. G., & Franz, T. M. (1998). Leadership style and the discussion of shared and unshared information in decision-making groups. *Personality and Social Psychology Bulletin, 24*, 482–492. doi: 10.1177/0146167298245004

Laughlin, P. R., & Barth, J. M. (1981). Group-to-individual and individual-to-group problem-solving transfer. *Journal of Personality and Social Psychology, 41*, 1087–1093. doi: 10.1037//0022-3514.41.6.1087

Laughlin, P. R., & Jaccard, J. J. (1975). Social facilitation and observational learning of individuals and cooperative pairs. *Journal of Personality and Social Psychology, 32*, 873–879. doi: 10.1037/0022-3514.32.5.873

Lawler, E. E., III (1998). *Strategies for high performance organizations*. San Francisco, CA: Jossey Bass.

Lizzio, A., & Wilson, K. (2005). Self-managed learning groups in higher education: Students' perceptions of process and outcomes. *British Journal of Educational Psychology, 75*, 373–390. doi: 10.1348/000709905X25355

Matsui, T., Kukayama, T., & Onglatco, M. L. (1987). Effects of goals and feedback on performance in groups. *Journal of Applied Psychology, 72*, 407–415. doi: 10.1037/0021-9010.72.3.407

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integration model of organizational trust. *Academy of Management Review, 20*, 709–734. doi: 10.2307/258792

McDonald, R. P., & Ho, M.-H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7*, 64–82. doi: 10.1037//1082-989X.7.1.64

Morgeson, F. P., DeRue, D. S., & Karam E. P. (2010). Leadership in teams: A functional approach to understanding leadership structures and processes. *Journal of Management, 36*, 3–39. doi: 10.1177/0149206309347376

Nunnally, J. C. (1978). *Psychometric theory*. New York, NY: McGraw-Hill.

Parker, C. P., Baltes, B. B., Young, S. A., Huff, J. W., Altmann, R. A., Lacost, H. A., & Roberts, J. E. (2003). Relationships between psychological climate perceptions and work outcomes: A meta-analytic review. *Journal of Organizational Behavior, 24*, 389–416. doi: 10.1002/job.198

Pearce, C. L. (2004). The future of leadership: Combining vertical and shared leadership to transform knowledge work. *Academy of Management Executive, 18*, 47–57. doi: 10.1109/EMR.2006.1679080

Pearce, C. L., & Conger, J. A. (2003). *Shared leadership: Reframing the hows and whys of leadership*. Thousand Oaks, CA: Sage.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*, 879–903. doi: 10.1037/0021-9010.88.5.879

Reichers, A. E., & Schneider, B. (1990). Climate and culture: An evolution of constructs. In B. Schneider (Ed.), *Organizational climate and culture* (pp. 5–39). San Francisco, CA: Jossey Bass.

Robinson, J. P., Shaver, P. R., & Wrightsman, L. S. (1991). *Measures of personality and social psychological attitudes*. San Diego, CA: Academic Press.

Rousseau, D. M. (1988). The construction of climate in organization research. In C. L. Cooper & and I. T. Robertson (Eds.), *International review of industrial and organizational psychology* (pp. 139–159). Chichester, England: Wiley.

Schneider, B. (1975). Organizational climates: An essay. *Personnel Psychology, 28*, 447–479. doi: 10.1111/j.1744-6570.1975.tb01386.x

Schneider, B., & Reichers, A. E. (1983). On the etiology of climates. *Personnel Psychology, 36*, 19–39. doi: 10.1111/j.1744-6570.1983.tb00500.x

Schneider, B., White, S. S., & Paul, M. C. (1998). Linking service climate and customer perceptions of service quality: Test of causal a model. *Journal of Applied Psychology, 83*, 150–163. doi: 10.1037/0021-9010.83.2.150

Shepperd, J. A. (1993). Productivity loss in performance groups: A motivation analysis. *Psychological Bulletin, 113*, 67–81. doi: 10.1037/0033-2909.113.1.67

Slavin, R. E. (1992). When and why does cooperative learning increase achievement? Theoretical and empirical perspectives. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups: The theoretical anatomy of group learning* (pp. 145–173). New York, NY: Cambridge University Press.

Slavin, R. E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology, 21*, 43–69. doi: 10.1006/ceps.1996.0004

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling.* London, England: Sage.

Springer, L., Stanne, M. E., & Donovan, S. S. (1999). Effects of small-group learning on undergraduates in science: Mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research, 69*, 21–51. doi: 10.3102/00346543069001021

Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research, 25*, 173–180. doi: 10.1207/s15327906mbr2502_4

Tracey, J. B., Tannenbaum, S. I., & Kavanagh, M. J. (1995). Applying trained skills on the job: The importance of the work environment. *Journal of Applied Psychology, 80*, 239–252. doi: 10.1037/0021-9010.80.2.239

Wageman, R., Hackman, J. R., & Lehman, E. V. (2005). The Team Diagnostic Survey: Development of an instrument. *Journal of Applied Behavioral Science, 41*, 373–398. doi:10.1177/0021886305281984

Walberg, H. J. & Anderson, G. J. (1968). Classroom climate and individual learning. *Journal of Educational Psychology*, *59*, 414–419. doi: 10.1037/h0026490

Watson, W. E., Johnson, L., & Zgourides, G. D. (2002). The influence of ethnic diversity on leadership, group process, and performance: An examination of learning teams. *International Journal of Intercultural Relations, 26*, 1–16. doi: 10.1016/S0147-1767(01)00032-3

Weber, R. (1990). *Basic content analysis*. Newbry Park, CA: Sage.

Weldon, E., & Weingart, L. R. (1993). Group goals and group performance. *British Journal of Social Psychology, 32*, 307–334.

West, M. A. (1990). The social psychology of innovation in groups. In M. A. West & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 309-333). Chichester, England: Wiley.

West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with non-normal variables. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 56–75). Thousand Oaks, CA: Sage.

Wilson, J. M., Goodman, P. S., & Cronin, M. A. (2007). Group learning. *Academy of Management Review, 32*, 1041–1059.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology, 65*, 96–102. doi: 10.1037/0021-9010.65.1.96

Zohar, D., & Luria, G. (2005). A multilevel model of safety climate: Cross-level relationships between organization and group-level climates. *Journal of Applied Psychology, 90*, 616–628. doi: 10.1037/0021-9010.90.4.616