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Research Article

Development and Validation of the Climate for Learning in Organizations Questionnaire

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Abstract

Organizations face interconnected challenges, including rapidly changing markets, a green transition coupled with technological advancements, difficulties in talent retention, and the ongoing need to upskill or reskill employees. Employees who engage in continuous learning are a key response to these challenges. To prioritize learning, organizations must foster a learning climate that encourages and supports employees' development. Numerous studies have been conducted to conceptualize and operationalize the learning climate, and efforts have been made to develop and validate tools to measure it. This research aims to clarify existing conceptualizations, organize and synthesize existing survey instruments, and develop and validate a questionnaire for organizations to measure the learning climate, the Climate for Learning in Organisations questionnaire (CfL-O). The study followed a three-step approach. In step 1, we conducted a qualitative meta-synthesis that resulted in the conceptualization of the learning climate across six dimensions (Study 1). Step 2 involved an inventory of existing learning climate questionnaires and a comparative analysis of items with the identified dimensions, leading to the development of the first version of the CfL-O questionnaire (Study 2). Step 3 consisted of a series of validation studies (Study 3), starting with an assessment of the face validity of the CfL-O. Based on the results, the questionnaire was revised. The final version of the six-scale questionnaire was administered to a sample of 714 employees from a private Dutch maritime contracting company, which was randomly split in half. The first half was used for exploratory factor analysis (EFA) to develop a theory about the learning climate dimensions, and the second half was used to validate the theory through confirmatory factor analysis (CFA). Finally, construct reliability, convergent, and discriminant validity tests were conducted. The CFA confirmed that the CfL-Q includes six factors that influence the learning climate: Learning Leadership, Support, Opportunities to Learn, Exchange of Knowledge, Space for Learning, and Individual Responsibility & Autonomy. Three item composition scenarios were tested to address construct validity issues, with Scenario 3 yielding the best results. This scenario represents an abbreviated version of the CfL-Q with 18 items.

Introduction

Organizations are navigating an increasingly dynamic environment. For instance, in the Fifth Industrial Revolution, human-robot collaboration is emerging as a transformative solution to innovate and streamline production processes (Laudante, Formati, and Buona, 2022). This trend is evident across industries, with Artificial Intelligence serving as one of the most prominent examples. In this rapidly evolving business landscape, where technological advancements are the primary driver, sustainability

and the green transition have moved beyond buzzwords to become central priorities on organizations' strategic agendas (Gibbs and O'Neill, 2018).

Amidst these continuous innovations, many organizations are grappling with workforce shortages coupled with high turnover rates. In response, learning has emerged as a critical focus. Prioritizing workplace learning is essential for maintaining a competitive, skilled workforce. Upskilling and reskilling employees is necessary to equip them for new roles, responsibilities, and tasks. Additionally, retaining skilled employees remains a significant challenge. Providing learning opportunities can help mitigate turnover [1] and reduce the costs associated with recruitment, hiring, and onboarding new staff [2]. However, attracting and onboarding qualified employees from the external labour market remains crucial but challenging in a market characterized by scarcity (Wallo, Lundvig, and Coetzer, 2024).

Recognizing the challenges organizations face and the need to invest in learning opportunities, research has increasingly focused on the role and characteristics of workplace learning in this evolving context (Bauer, Rehrl, and Harteis, 2007; Billett, 2023; Billett, Troth, and Yan, 2024). Research indicates that over 70% of organizational learning occurs informally during the workflow [3], highlighting the importance of leveraging the learning potential embedded in the work environment, beyond formal and easily monitored training (Crans et al., 2021). In an era where learning is a strategic element for maintaining competitiveness in an ever-changing market [4,5], organizations must find ways to foster and support employees' learning during work, outside of formal training settings [6,7]. This approach is often referred to as cultivating a "learning climate."

The significance of focusing on the learning climate has been demonstrated in numerous studies (e.g., Crans, Bude, Beausaert, and Segers, 2021; Cangialosi, Odoardi, and Battistelli, 2020). Nikolova et al. [8] reviewed existing research and showed that a positive learning climate within a company is crucial for several beneficial outcomes, including innovative behaviour [9], financial performance [10], employees' learning intentions, and positive attitudes toward learning and engaging in learning activities [11-13]. Beyond the findings in Nikolova et al. [8], additional studies highlight the positive impacts of a learning climate on outcomes such as employee retention [12], job satisfaction [14], work engagement [15], and extra-role performance behaviours [16]. Therefore, a substantial body of research underscores the importance of the learning climate and its associated positive outcomes.

Despite empirical evidence supporting its importance, the concept of Learning Climate is often used interchangeably with, yet distinct from, related concepts such as Learning Organization, Organizational Learning, Organizational Culture, and Learning Culture. This overlap poses two main issues. First, it complicates the comparison of studies that aim to identify the predictors and outcomes of a learning climate, hindering the ability to aggregate findings. Second, conceptual clarity is essential for developing a reliable instrument to measure the target construct. To measure and delineate a construct accurately, it is necessary to systematically review the existing literature and differentiate it from related constructs [17,18].

Existing measurement tools either lack a systematic literature review [8] or differ in their dimensions due to varying theoretical foundations [8,19,20]. More specifically, the development processes of most Learning Climate survey instruments are often controversial. As Clark and Watson [17] state, "A critical first step is to develop a precise and detailed conception of the target construct and its theoretical context." However, to our knowledge, no study has explained whether or how this step has been implemented. Instead, studies typically provide definitions related to Learning Climate and then acknowledge the existence of conceptual confusion. Clark and Watson [17] stress that a solid theory requires not only a precise definition but also clear demarcation from related constructs. Neither of these elements is adequately addressed in the existing literature on Learning Climate survey instruments [21].

The next step in scale development involves creating an item pool [17]. This item pool is formed by systematically sampling all relevant content for the target construct. Without a prior systematic review to define the boundaries of the target construct, this step becomes unfeasible. If the conceptualization phase is insufficient, any subsequent stages of scale development—such as test construction, initial data selection, and psychometric evaluation—become problematic [17].

The conceptual and measurement challenges outlined above form the foundation for our research. The aims of this study were to define the construct of Learning Climate, clarify its boundaries in relation to frequently used but interchangeable concepts, compile and organize existing Learning Climate scales within organizational contexts, and, through a comparative analysis, develop and validate a Learning Climate survey instrument. The distinguishing feature of the Climate for Learning in Organizations Questionnaire (CfL-O) presented here is its grounding in a conceptualization of the core construct (Learning Climate) derived from a systematic literature review and its clear demarcation from related constructs. This conceptual foundation is crucial for the creation and refinement of an item pool. By carefully following the necessary steps in scale development, the CfL-O provides future researchers in the field of Learning Climate with a clear conceptualization of the construct and a valid means of measuring it. This will facilitate the comparability of findings related to the predictors and outcomes of a Learning Climate. Additionally, with its relatively short format, the CfL-O can be a practical tool for HRM professionals to assess the learning climate in their organizations, serving as a starting point for developing improvement plans.

To achieve the objectives of this study, we employed a three-step approach. First, we conducted a systematic literature review of the Learning Climate construct to identify its core dimensions (Study 1). Second, we performed a comparative analysis of existing instruments for measuring Learning Climate and developed the Climate for Learning in Organizations Questionnaire (CfL-O) (Study

2). Finally, we examined the construct validity of the CfL-O to ensure it is a psychometrically sound and appropriate instrument [22] (Study 3).

Study 1: Systematic review of the operationalization of a learning climate

A critical first step in the development and validation of a measurement instrument is achieving conceptual clarity of the target construct. To properly conceptualize the target construct and distinguish it from closely related concepts, a systematic review of the relevant literature is essential [17,18].

Goal of this study

Our goal is to systematically and comprehensively integrate studies that present the operationalization of the construct Learning Climate, along with related constructs such as Learning Culture, Organizational Climate, Organizational Culture, Learning Organization, and Organizational Learning. This review will facilitate the conceptualization of Learning Climate and its distinction from these five related concepts. The primary aim of this review study is to define and operationalize the dimensions of the Learning Climate construct.

Method

We conducted a qualitative meta-synthesis (Paterson, 2012). The rationale for this approach is that the extensive body of studies in this area varies significantly in terms of research design and quality. Following the process logic of meta-synthesis (e.g., Jensen and Allen, 1996), we performed both a literature search and a literature selection.

First, the four databases ScienceDirect – Elsevier (499 articles), SpringerLink (220 articles), Wiley (2286 articles) and EBSCO (858 articles) were searched. Hereby, a combination of search terms and specifiers was used (see Table 1). This resulted in a total of 3863 articles.

Table 1: Overview of number of studies found with the combination of search terms and specifiers Organi*-ational

	Learning	Innovative		Supportive learning	Innovative learning	Supportive	Total
Culture	569	90	18	0	1	8	686
Climate	328	54	14	0	0	8	404
Environment	150	492	8	3	0	14	667
Organi*ation	1865	220	9	0	1	11	2106
Total	2912	856	49	3	2	41	3863

Second, articles were excluded by the research team (see Table 3) in case the articles could not be retrieved (19 articles) or the search term combination Organi*-atonal organi*ation lead to repetitive results (1865 articles).

Next, inclusion criteria were applied to the collected articles (see Table 2).

Table 2: Inclusion Criteria for the Systematic Literature Review.

Criterion Type	Inclusion Criteria
Topic	After reading abstract literature must relate to topic of learning or organizational learning
Setting	Setting must relate directly to organizational context: remove schools or educational articles, unless it is about teacher professional education
English	Literature must be written in English
Research base	Literature must be based upon empirical research (either qualitative or quantitative)
Transparency	The methodology of the research upon which the literature is based must be made explicit (e.g., sample sizes, instruments, analysis)
Learn/develop	Literature must refer in the article to either the term 'learn' or 'develop'

Table 3: Overview of Numbers of Excluded Articles.

	Previous articles	Number of excluded articles after applied filters	Total articles
Search term	3863	-1865	1998
Article not found	1998	-26	1972
Duplicates	1972	-178	1794
Topic	1794	-1319	475

Setting	-12	463	
English	0	463	
Research article	-10	453	
Method section	-14	439	
Learn/develop on-topic	-199	240	

Third, based on the literature synthesis and a moderation session with three L&D experts, we defined the six related concepts (Learning Climate, Learning Culture, Organizational Climate, Organizational Culture, Organizational Learning, and Learning Organization) and made the boundaries between them explicit. Fourth, the literature synthesis resulted in a conceptualization of the dimensions of Learning Climate. During a moderation session with three experts, the dimensions of Learning Climate were developed by analysing all relevant articles and identifying common conceptual themes (see Table 4).

Results

First, based on the analysis of the literature, we define the target construct Learning Climate and the related five concepts. Next, we synthesize the dimensions of the Learning Climate dimension.

Learning Climate and Related Concepts

Scholars who focus on Learning Climate commonly describe it as the perceptions employees have about learning within their organization. Mikkelsen et al. [23] further explain that Learning Climate is a component of the broader organizational climate. Work environments are characterized by various climates, such as those for service, safety, or achievement. A climate that either facilitates or hinders learning is one such example. They also note that a climate exists at the organizational level and/or within its subsystems, suggesting that the Learning Climate may differ across departments or teams within an organization. Additionally, Mikkelsen et al. emphasize that a climate reflects employees' perceptions and the meanings they attach to them, a concept that aligns with the framework proposed by Cunningham et al. [24].

Several authors have further specified the focus of employees' perceptions, often vaguely described as "learning" (e.g., Baert et al., 2006). Nikolova et al. [8] and Cunningham et al. [24] specifically refer to employees' perceptions of organizational policies and practices designed to facilitate, reward, and support learning behaviours. Cunningham et al. also highlight the importance of the meaning that employees attach to these perceptions. Eldor et al. [16] describe learning as the processes of creating, acquiring, and transferring knowledge, and they define Learning Climate as employees' perceptions of the organization's activities that help them create, acquire, and transfer knowledge.

Eldor [16] expands this concept by indicating that the purpose of fostering such learning behaviours is to align with the organization's strategic goals. He defines Learning Climate as "the employee perceptions of the organization's learning activities from which employees can benefit to create, acquire, and transfer knowledge in order to meet an organization's strategic goals. These perceptions subjectively indicate the extent to which an organization maintains learning behaviours and activates them as an inherent and ongoing routine" (p. 1455).

Finally, many authors associate a positive connotation with the concept of Learning Climate. For example, Cunningham et al. [24], Nikolova et al. [8], and Eldor [16] use verbs such as helping, facilitating, rewarding, and supporting employee learning. Mikkelsen et al. [23] and Baert et al. (2006) argue that a Learning Climate can both facilitate and hinder employee learning. As Baert et al. (2006) state, "We can say that a positive learning climate exists if potential learners regard learning as something attractive or pleasurable, if they estimate that the effort they make is associated with more advantages than disadvantages, if they believe that the benefits outweigh the costs, and if they feel they can align with the prevailing norms of significant others."

Building on these conceptualizations, we define Learning Climate as the issue-specific, observable perceptions shared among organizational members, along with the meaning they attach to these perceptions of the policies, practices, and procedures within the Learning and Development environment. In other words, Learning Climate refers to how employees subjectively perceive and interpret the learning environment within their organization. This includes factors such as how learning activities are structured, the quality of existing learning procedures, and how social interactions support learning within the organization. Since Learning Climate reflects employees' perceptions, it can be measured by directly asking individuals about their experiences with the learning environment.

A Learning Climate evolves over time. Through regular interactions among employees and the development of shared values within an organization, individual perceptions gradually converge, giving rise to a Learning Climate. Moreover, it is subject to change over time and may eventually transform into a Learning Culture after a prolonged period. The interaction between the Learning Culture and Learning Climate—where each influences the other—describes a cyclical process in which both concepts shape and reinforce one another.

Finally, the Learning Climate is likely a multidimensional construct, a notion that remains a subject of ongoing debate in the literature. For example, Bartram et al. [25] propose that the Learning Climate comprises seven dimensions: management style, autonomy, team dynamics, time, opportunities for development, guidelines, and contentment. In contrast, Schneider et al. [26] identify four dimensions: relationships, hierarchy, work, and support & rewards. Nikolova et al. [8] suggest that the Learning Climate has three key dimensions: facilitation, appreciation, and

error-avoidance. Although there is no consensus on the exact dimensions of the Learning Climate, many researchers agree that it should be understood as a multidimensional construct.

In the literature, concepts such as Learning Climate, Learning Culture, Organizational Culture, Organizational Climate, Learning Organization, and Organizational Learning are often used interchangeably or seen as closely related. For example, Bauer et al. (2007) propose a framework for Learning Culture that focuses on conditions supporting informal learning in the workplace. They argue that to understand whether working conditions support learning, we must observe what employees "actually do within the formal structure of the organization and how they perceive their working conditions." In this view, the manifestation of culture is employee behaviour, which is rooted in values, beliefs, and norms (p. 16).

In contrast, Nikolova et al. [8] draw a clear distinction between climate and culture, treating them as two separate constructs. They define Learning Climate as "employees' perceptions of organizational policies and practices aimed at facilitating, rewarding, and supporting employee learning behaviour" (p. 259). Their definition centres on the employees' perceptions of the learning environment's policies and practices, which can be measured, for example, through questionnaires or interviews. The Learning Climate refers to observable and measurable attributes [8]. On the other hand, Learning Culture is viewed as a more abstract concept, which is not as easily measurable as the climate within an organization [27]. Learning Culture concerns the organization-wide values and beliefs that employees hold about learning in the workplace [26]. Since employees may not always be fully aware of these pre-existing values and beliefs, measuring Learning Culture is more intangible [26,28].

Based on a systematic literature review, we differentiate the concept of Learning Climate from the five other concepts that are often used interchangeably: Learning Culture, Organizational Climate, Organizational Culture, Organizational Learning, and Learning Organization. Our definitions, along with the authors on which these definitions are based, are presented in Table 4.

Table 4: Learning Climate and Related Concepts: Definitions and Pivotal Authors.

Term	Definition	Pivotal Authors
Learning Culture (LCU)	Learning Culture is a set of specific patterns of shared values, norms, symbols, beliefs and expectations about LEARNING & DEVELOPMENT, organization-wide. It is the less conscious psychology of the workplace.	Chen et al. (2003); Schein (1992); Van Maanen and Schein (1977); Awoniyi et al. (2002); Nonaka and Takeuchi (1995); Garwin (1993); Maton (2000);
Learning Climate (LCL)	LCL is the issue-specific observable perceptions shared among organizational members and the meaning attached to those perceptions of the policies, practices and procedures of the LEARNING & DEVELOPMENT environment provided.	Nikolova et al. (2014); Emonds et al. (2018); Bartram et al. (1993); Cunningham and Iles (2002); Genn (2001); Kyndt et al. (2009); Ahuja and Thatcher (2005);
Organizational Culture (OCU)	OCU is a set of specific patterns of values, norms, symbols, beliefs and expectations about the ORGANIZATION that are held collectively, organization-wide. It is the less conscious psychology of the workplace.	Reichers and Schneider (1990); Denison (1996); Schein (1990); Cameron and Quinn (1999); O'Reilly (1989); Hofstede et al. (1990)
Organizational Climate (OCL)	OCL is the issue-specific observable perceptions shared among organizational members and the meaning attached to those perceptions of the policies, practices and procedures of the ORGANIZATIONAL environment provided.	Schneider (1975); Ekvall (1996); James et al. (2008); Litwin and Stringer (1974); Bock et al. (2005); Forehand and Von Haller (1964); Denison (1996)
Learning Organization (LO)	LO is an organization that is able to sustain a competitive advantage by learning adaptively and continuously comparable to a living organism	Watkins and Marsick (1993); Argyris and Schön (1997); Pedler et al. (1991); Marquardt (1996); Senge (1990); Garwin (1993)
Organizational Learning (OL)	OL describes the shared learning experiences employed to gain knowledge and develop skills dispersed across an entire organization	Senge (1990); Argote and Ingram (2000); Argyris and Schön (1997); Marsick and Watkins (2003); Huber (1991); Wang et al. (2007)

Dimensions of a Learning Climate

The literature analysis identified six dimensions of Learning Climate: Learning Leadership, Support, Opportunities to Learn, Exchange of Knowledge, Space for Learning, and Individual Responsibility & Autonomy.

Learning Leadership is the cornerstone of the other five dimensions. Without strong leadership support, changing the Learning Climate is unlikely to succeed [7]. Learning Leadership refers to various leadership behaviours that foster employee learning [7]. First, leaders can enhance psychological safety, which in turn encourages risk-taking and innovative behaviour among employees [7]. For example, coaching from team leaders and positive responses to employee questions or challenges create an environment perceived as safe, increasing the likelihood that employees will engage in learning behaviours such as seeking information or discussing mistakes [29]. Research shows that team psychological safety—"a shared belief held by members of a team that the team is safe for interpersonal risk-taking" [29]—is positively associated with learning processes. In other words, if employees do not feel safe, they are less likely to experiment with new approaches that could lead to learning. Therefore, learning leaders should encourage learning by positively responding to employees' attempts to innovate and learn [7].

Second, leaders need to act as role models by demonstrating their own willingness to learn, take risks to innovate within the company, and inspire their employees to do the same [7,30].

Thus, the Learning Climate is heavily influenced by leaders who set the tone for learning within their organization [7,31,32]. According to the Theory of Trying, employees' perceptions matter significantly within organizations. Leaders must recognize that they play a core role in shaping the Learning Climate, as they are perceived by employees either as a barrier or an enabler based on their everyday actions [7]. These actions, combined with individual perceptions, collectively shape the Learning Climate and, consequently, the learning environment in organizations [7].

Support: As noted in the previous dimension of Learning Leadership, employees are more likely to innovate and learn when they feel safe [7,29]. This sense of safety can be fostered through three levels of support: support from peers, leaders, and the organization itself [7]. The perception of how learning is supported within the company is influenced by the types of stimuli and reactions employees encounter at each of these levels [7]. For example, if an employee is criticized instead of praised by a peer or leader for spending time learning something new rather than focusing on their daily tasks, they may feel unsafe to engage in learning activities in the future [29]. Employees may also feel unsafe if they fear negative consequences for their learning efforts. In contrast, several scholars emphasize the importance of creating a climate that allows for errors, enabling individuals to learn from their mistakes [6,29-31]. Additionally, organizational support, such as providing budgets for learning, is essential in signalling that the organization values and approves of employees' learning intentions [7,30].

Accordingly, this dimension evaluates whether positive stimuli, such as recognition, rewards, and approval, are present within the organization to support and reinforce employees' learning behaviours, as well as the level of error tolerance within the organization [7]. Several scholars, in line with this definition of the Learning Climate, use items, full scales, or definitions of the Learning Climate referring to support or facilitation [8,30,34], appreciation [27], and error-avoidance [28,2] when attempting to measure the learning climate.

Opportunities to Learn: This dimension assesses whether an organization provides opportunities for employees to develop and grow, access and share information, and collaborate with others [7]. The more learning opportunities employees are offered, the more likely they are to engage in informal learning activities [35]. This is particularly important considering research indicating that 70% to 90% of learning in organizations takes place informally, on the job, and continuously [3]. However, simply providing employees with learning opportunities is not always enough to ensure they will benefit from them [7]. Emonds et al. [7] draw on Carol Dweck's theory of mindset to illustrate this challenge for organizations [36]. Dweck [36] distinguishes between two types of mindsets: growth and fixed. Individuals with a growth mindset view their abilities as something they can improve through effort and learning. Conversely, those with a fixed mindset believe that abilities are innate and unchangeable, regardless of effort. As a result, employees with a fixed mindset may need encouragement to embrace change and innovation and feel safe enough to experiment with new ideas to fully benefit from available learning opportunities and develop a growth mindset [7,29,36].

Exchange of Knowledge: The fourth dimension, Exchange of Knowledge, examines the extent to which online or offline dialogues and networks between individuals, groups, or communities exist within an organization [7]. The emphasis here is on facilitating dialogue and strengthening networks across the organization to ensure an organization-wide exchange of knowledge, thereby enhancing the learning climate [7]. Similarly, Schneider et al. [27], in their literature review, concluded that higher levels of dialogue and networking between units positively impact the strength of an organizational climate. For example, an organizational climate tends to be stronger in a network of work units with higher interaction levels [37], denser communication networks [3], and greater interdependence [39].

To stimulate a climate conducive to dialogue and network-building, possibilities include job rotations, cross-functional collaborations, team discussions, virtual communities, networking events, or informal meetings [7]. This dimension also involves fostering open communication (e.g., discussing mistakes) among colleagues and teams with diverse expertise, allowing employees to learn from their work experiences [6,7]. Correspondingly, research has shown that such open communication enhances on-the-job learning by providing employees with valuable information regarding work tasks [40].

Space for Learning: The dimension Space for Learning encompasses the infrastructure, processes, and barriers to learning that exist within an organization [7]. Infrastructure includes elements such as technologies that facilitate learning (e.g., internet access, internal company platforms, and Learning Experience or Learning Management Systems) as well as a human resources department that manages courses, budgets, and the time allocated for learning [7]. The positive impact of infrastructure on learning is demonstrated in the study by Berg and Chyung [41], which found that access to computer technology is a critical factor in increasing engagement in informal learning.

This dimension also considers whether systems are in place to track the time employees spend on learning [7]. Beyond infrastructure and time-tracking systems, processes describe how easily employees can access and utilize the available resources to engage in learning activities [7]. Emonds et al. [7] emphasized that these processes can act as obstacles and should therefore be carefully monitored to ensure they support, rather than hinder, employee learning. Research in online learning environments shows that if organizations do not adjust processes that obstruct learning, employees may never begin or may discontinue their learning activities. For example, Park [42] identified time conflicts as one of the most significant factors causing individuals to drop out of online learning courses or avoid them altogether. A case study in

a U.S. landscaping company revealed that only 21% of employees who enrolled in a voluntary online learning program completed the training [43]. The study found that the sign-up process, combined with the requirement to complete the training outside working hours, prevented employees from finishing the program due to time constraints.

As a result, the authors recommended that organizations implement processes that ensure employees have sufficient time for online learning. In conclusion, organizations must identify and eliminate hindering processes—such as those that limit employees' time for learning—so that employees are encouraged, rather than discouraged, to engage in learning opportunities.

Individual Responsibility & Autonomy: The final dimension addresses two key factors—role clarity and participative decision-making—that help individuals feel responsible for their learning [7]. Role clarity involves clear expectations, where both employers and employees understand how the employee is evaluated in their current role and the expectations for the future role the employee aims for [7]. Participative decision-making empowers employees by gradually entrusting them with autonomy and decision-making power regarding their learning [7]. It is important, however, to avoid overwhelming employees with too much responsibility at once, as this may diminish their motivation to learn [7]. Instead, responsibility should be incrementally increased through continuous discussions with the employee, allowing them to make decisions about what, how, and when they engage with their learning journey [7]. Research in workplace learning indicates that employees who were given more autonomy at work exhibited increased informal learning behaviours [44]. Similarly, positive effects on informal learning, such as seeking new information or solutions to problems, were observed when employees had greater responsibility and autonomy [45].

Study 2: Design of the Climate for Learning in Organizations Questionnaire (CFLQ-O)

Goal of the study

The goal of this study is to design the Climate for Learning in Organizations Questionnaire based on the analysis of existing measurement instruments.

Analysis of Existing Instruments Based on the Six-Dimensional LCL Framework

Method

Following the approach of Böhn and Deutscher (2020), we collected surveys from the 240 articles selected in Study 1, resulting in a total of 70 different survey instruments. Of these, 58 were excluded. Exclusions were made for survey instruments used by only a single study (Böhn & Deutscher, 2020), as well as for surveys that were off-topic, not retrievable, or available only in a paid version (i.e., lacking open access). Next, in a moderation meeting, three experts conducted an inductive analysis of the survey items and categorized them according to the six dimensions identified in Study 1.

Results

Analysis of Existing Instruments Based on the Six-Dimensional LCL Framework

The moderation process resulted in eight instruments deemed relevant for measuring the six dimensions of Learning Climate (see Table 5).

Table 5: Eight Instruments and their Scales relevant for Measuring the Six Learning Climate Dimensions.

Dimensions	Scale	Instrument	Source
Learning Leadership	Provide Strategic Leadership for learning	DLOQ	Marsick and Watkins (2003)
	Learning Dialogue	OLC	Alegre and Chiva (2008)
	Good Supervision	WCQ	Kirby et al. (2003)
Support	Continuous Learning	DLOQ	Marsick and Watkins (2003)
	Clinical Learning Organizational Culture Survey	CLOCS	Henderson et al. (2010)
	Experimentation	OLC	Alegre and Chiva (2008)
Opportunities to Learn	Strategic Emphasis	OCAI	Cameron and Quinn (2006)
	Team Learning Climate	TLC – 5-item scale	Marsick and Watkins (2003)
	Interaction with The External Environment	OLC	Alegre and Chiva (2008)
	Inquiry and Dialogue	DLOQ	Marsick and Watkins (2003)
Exchange of Knowledge	Continuous Learning Inquiry and Dialogue	DLOQ	Marsick and Watkins (2003)
	Collaboration and Team Learning Dialogue	OLC	Alegre and Chiva (2008)
Space for Learning	Continuous Learning	DLOQ	Marsick and Watkins (2003)
	Systems to Capture Learning	CEV	Kaptein (2008)
	Feasibility Employee Sample	OLF	Mets and Torokoff (2007)

Individual Responsibility & Autonomy	Empower People	DLOQ	Marsick and Watkins (2003)
	Clinical Learning Organizational Culture Survey	CLOCS	Henderson et al. (2010)
	Employee Sample	OL	Mets and Torokoff (2007)
	Choice-independence	WCQ	Kirby et al. (2003)
	Learning Environment	OL	Mets and Torokoff (2007)

Composition of Scales with Items for Each of the Six LCL Dimensions

Method

The three L&D experts analysed the eight survey instruments and identified 96 relevant items. They clustered them into six scales (according to the six dimensions) and adapted the phrasing of the items so that each fitted perfectly with its respective dimension.

Results

A draft questionnaire with 96 items for the six dimensions for the learning climate emerged, with a five-point rating scale from strongly disagree to strongly agree. Table 6 shows for each of the six dimensions a description and two example items.

Table 6: The Six dimensions, their Description and Example Items.

Dimensions	Description	Example item
Learning Leadership	Leaders facilitate learning behaviour Leader's act as role models Leaders promote risk-taking and innovation	My manager … Supports me when I ask for learning. Looks for opportunities to learn new things.
Support	Three levels of support: support from peers, leaders and the organization itself that facilitate learning Presence of support in form of recognizing, rewarding and approving learning behaviour Employees are feeling safe to make	In my team… I can make mistakes without bad consequences. I feel learning is appreciated.
Opportunities to learn	Opportunities to learn accompanied by encouragement to: Develop and grow Access and share information Connect to others and collaborate	In my team… We are encouraged to look for change and innovation. We share lessons learned.
Exchange of knowledge	Dialogue and networks	In my team… We work with colleagues who have different expertise. We share knowledge freely and open
Space for learning	Infrastructure and processes Time	In my organization… There is a system to track the time and resources we spend on learning.
Individual Responsibility and Autonomy	Participative decision- making Role clarity	In my organization… There is a system to track the time and resources we spend on learning. There is a platform to support giving and seeking feedback. In my team… I have the choice to plan what, how and when I learn. It is clear to me and others what is expected of me in my role.

Study 3: Validation

Research Goal: The goal of this study is to assess the validity of the Climate for Learning in Organizations Questionnaire (CFLQ). First, we focused on evaluating the face validity, sometimes referred to as expert validation. This process involves asking experts to determine if the instrument accurately measures the intended concept based on its appearance. Experts also assess whether the items are clearly written. Ideally, individuals with expertise in the relevant field should be consulted [46] (Magee, Rickards, Byars, & Artino, 2013). Second, we aimed to measure the construct validity of the instrument.

Face Validity

Method: During this phase, the face validity of the six dimensions and the draft questionnaire was evaluated by three professional teams in five steps. In addition to evaluating the face validity, the teams also assessed whether the language used in the items was easy to understand. The goal was to ensure that employees who are not familiar with learning concepts or are not native English speakers could still comprehend the dimensions and the questionnaire.

The three professional teams each consisted of six members. The first two teams (Team 1 and Team 2) were made up of

employees from a multinational digital learning company, who are knowledgeable in the field of Learning and Development (L&D) and have regular contact with clients from various organizations. Team 3 consisted of six clients who specialize in L&D, such as Human Resources employees, Chief Learning Officers, and Learning and Development specialists.

After the review by the first two teams, the expert team received feedback indicating that employees of their clients would not be willing to complete all 96 questions. Instead, the experts requested that only five items per dimension be provided. In response, the team of experts reduced the original 96 items to 30, focusing on those that most closely aligned with the six identified dimensions.

Results

In the first step, Team 1 received the six dimensions and evaluated whether they accurately represented the concept of the learning climate (i.e., high face validity). They also assessed the clarity of the dimensions for employees. All experts agreed that both conditions were met, and no changes were necessary.

In step two, Team 2 was tasked with the same evaluations. Like Team 1, they were satisfied with both the validity and clarity of the dimensions, and no modifications were needed.

In steps three and four, the same procedure was followed with Team 1 and Team 2, but this time using the draft questionnaire. After both teams reviewed the draft and suggested adaptations to the items, step five was initiated.

In step five, Team 3 was presented with the shortened survey containing the six dimensions and adapted items, which had been revised by the three experts based on feedback from Teams 1 and 2. Team 3 received both the dimensions and the questionnaire simultaneously and was asked to assess the face validity and comprehensibility. This approach was used due to the limited availability of all six clients.

This five-step process resulted in the final version of the Climate for Learning in Organizations Questionnaire (CFLQ), which includes 30 items across six dimensions (see appendix).

Construct validity

Method of Data Collection:

For the instrument validation, a multinational Digital Learning Company distributed the CFLQ to one of their client companies. This client is a private Dutch maritime contracting firm operating globally with over 4,500 employees. After cleaning the data from 2,360 sent-out questionnaires, 936 employees from 23 departments remained in the dataset (response rate: 39.7%). Within these departments, 307 employees (43%) reported being part of a tender or project team, while the remaining 407 employees (57%) were not involved in a tender or project team. The sample included employees from 26 different nationalities, with the majority being Dutch (91.04%).

Regarding educational background, 519 participants (72.69%) reported holding a degree from a university or higher, 113 were high school graduates (15.83%), and 82 participants (11.48%) had less than a high school education. Due to data privacy concerns, neither gender nor age data was collected in the survey.

All employees who were part of the Dutch Payroll system of the company were invited to participate via an internal email link to the survey. Participants were allowed to complete the questionnaire during their working hours.

Methods of Analysis:

The first step in data analysis was data cleaning. The data were cleaned using several filters (see Table 8), including incomplete surveys, fast completion times (less than 60 seconds), long completion times (over 3600 seconds), lack of consent, late completions, straight-lining, and Christmas treeing (Qualtrics, 2019). A total of 963 employees started the questionnaire, and after the data cleaning process, 714 valid cases remained.

First, incomplete surveys were removed from the dataset, leading to the exclusion of 164 questionnaires. Next, surveys with completion times of 60 seconds or less, or longer than one hour, were excluded, resulting in the removal of 26 and 37 surveys, respectively. The next exclusion criterion was consent, with 13 employees who did not provide consent being excluded. Four participants were removed for completing the survey after the deadline (03/04/2019). Finally, after visually examining the data, five surveys were excluded due to either straight-lining or Christmas treeing. Straight-lining occurs when respondents answer a series of questions with the same response on a rating scale, while Christmas treeing refers to respondents creating a visual pattern resembling a Christmas tree or another deliberate design [47].

After these exclusions, 714 valid records remained for analysis (see Table 7).

Table 7: Results of the Data Cleaning Process.

Filter	Previous number of records	Number of deleted records after applied filters	Total number of records remaining after applying the filter
Incomplete surveys	963	-164	799
Duration 60 sec.	799	-26	773
Duration 3600 sec.	773	-37	736
I consent …	736	-13	723
End date 03/04/2019	723	-4	719

Straight-lining	719	-4	715
Christmas-trees	715	-1	714

Table 8: The Pattern Matrix Resulting from the Exploratory factor analysis of the CFLQ.

	1	2	3	4	5	6
ll3 My manager looks for opportunities to learn new things	,826					
ll2 My manager coaches the employees s/he leads	,816					
ll5 My manager advices me about the best way to learn something new	,782					
ll4 My manager stimulates us to have discussions	,769					
ll1 My manager supports me when I ask for learning	,715					
s2In my team, I am rewarded for learning	,530					
otl5 In my team, we seek and give honest feedback		-,613				
otl3 In my team, we share lessons learned		-,600				
otl4 In my team, we share information from outside the company		-,600				
eok1 In my team, we openly discuss mistakes in order to learn from them		-,537				
eok2 In my team, critical, constructive thinking is encouraged and we encourage each other to speak up s1 In my team, I can get budget to support my learning		-,503				
sfl2 In my organization, there is a system to track the time and resources we spend on learning			,867			
sfl3 In my organization, there is a platform to support giving and seeking feedback			,752			
sfl4 In my organization, the procedures for learning are simple			,630			
sfl1 In my organization, there are processes, resources and time to learn			,614			
s4 In my team, I can make mistakes without bad consequences				,728		
otl2 In my team, we can experiment and take risks with new ideas				,661		
otl1 In my team, we are encouraged to look for change and innovation				,416		
s3 In my team, I help others to learn and I share learning experiences				,408		
s5 In my team, I feel learning is appreciated						
ira4 In my team, I can take up tasks associated with another role to learn new things						
ira1 In my team, I have the choice to plan what, how and when I learn						
ira3 In my team, I know how I perform in my role					,905	
ira2 In my team, it is clear to me and others what is expected of me in my role					,753	
ira5 In my team, I can ask how I perform in my role anytime					,485	
eok4 In my team, we work with colleagues who have different expertise's.						,794
eok3 In my team, we share information with other teams						,503
eok5 In my team, we share knowledge freely and open						,481

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.a

a. Rotation converged in 19 iterations.

Note. Factor loadings less than .40 suppressed

In the second step, after assessing the adequacy of the data for factor analysis, we conducted both an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA). To ensure meaningful execution of both analyses, the sample of 714 employees was randomly divided into two subsamples using a filter variable created in SPSS. This approach was based on Henson and Roberts' (2006) recommendation that it is not informative to perform both methods on the same sample. To divide the dataset, we utilized SPSS's random sampling function to select approximately 50% of the cases for each subsample. This resulted in two random datasets: one consisting of 358 individuals for the EFA and the other with 356 individuals for the CFA.

In the EFA, we used both a scree plot test and parallel analysis as techniques to guide the factor extraction procedure of the principal component analysis [48] (Henson & Roberts, 2006). The principal component procedure was chosen because it achieves a data reduction by producing "[...] a smaller number of linear combinations of the original variables in a way that captures (or accounts for) most of the variability in the pattern of correlations" [4] and is considered a psychometrically sound procedure [50]. Next, after the number of factors have been identified, an oblimin rotation was chosen to support the interpretation. Oblimin rotation was chosen because it is expected that subscales are intercorrelated and this rotation method allows for such a correlation [49]. At the end, Cronbach's alpha was calculated with .6 as the minimum criterion to assess the internal consistency and reliability of the CFLQ [51].

The CFA was based on the factor structure that resulted from the EFA. We used Amos 24.0 to conduct a CFA on the second subsample. A CFA is a suitable method to validate the hypothesized measurement because of three reasons: (1) The CFLQ has been developed based on a systematic literature review [7]; (2) the CFA examines the item-to-factor associations (i.e., factor loadings) [52]; and (3) it is able to verify the construct validity of the proposed theory [52] resulting from the prior EFA. Four conventional goodness-of-fit measures for a CFA are used to examine the extent the proposed model fits the data: chi-square (X2)/degrees of freedom (df) ratio < 5.0 [53]; Root Mean Square Error of Approximation (RMSEA) < .05 indicates good fit, between .05 and .08 sufficient fit, between .08 and .10 average fit and > .10 indicates bad fit [54]; a cut-off value for Standardized Root Mean Squared Residual (SRMR) close to .08 (Hu & Bentler, 1999) and a Comparative Fit Index (CFI) value > .9 [55]. Next, the modification indices will be considered for potential model improvement.

Finally, reliability, convergent and discriminant validity tests are conducted to assess the construct validity. The overall aim of a CFA is to determine if the measured variables are able to represent the construct [56]. Taber [57] raised the issue that research commonly uses Cronbach's alpha when developing and reporting research instruments to claim that they are ready to use despite various known limitations of this reliability statistic [57-59]. In contrast, this study goes beyond this limited approach by using an alternative reliability statistic and combining the CFA additionally with convergent and construct validity tests. Doing so leads to a more comprehensive understanding how well the variables represent the construct [56]. As an alternative to Cronbach's alpha, the construct reliability (CR) is used which also estimates internal consistency, indicating the extent to which all measures represent the same latent construct [56]. Convergent validity describes the proportion of variance that items from the same factor share and indicates if this common variance is sufficient [56]. Discriminant validity on the item level, another construct validity test, reports the degree to which measured items of a construct clearly represent their construct and no other constructs in the same model [56].

Hair et al. [56] lists four rules to assess construct validity for a CFA: (1) standardized loading estimates should be .5 or ideally .7 or higher (convergent validity); (2) the average variance extracted (AVE), which depicts the average percentage of variation explained between the items of a construct, should be at least .5 (convergent validity); (3) the square root of AVE should be greater than the inter-factor correlations (discriminant validity); (4) a construct reliability between .6 and .7 is acceptable if other indicators of a model's construct validity are good and .7 or higher suggests good reliability (internal consistency & convergent validity). The Amos plugin Master Validity developed by Associate Professor James Gaskin from the BYU Marriott School of Business was used to evaluate the compliance of the current CFA to these four rules [60].

Results

Exploratory Factor Analysis

The Kaiser-Meyer-Olkin value was .911, exceeding the recommended value of .6 [61,62] Bartlett's sphericity test [63] yielded a X2 value of 4650,054 and reached statistical significance. Since all measures supported the suitability for a factor analysis, the 30 items of the CFLQ were subjected to a principal component analysis (PCA) using SPSS version 26.

The principal component analysis revealed six components with eigenvalues exceeding 1, explaining 32,5 %, 8,6%, 5,5%, 4,5%, 4,4% and 3,9% of the variance correspondingly. Cattell's [64] scree plot test revealed a break after the first and another slightly break after the third component. Due to the inconclusive results from utilizing aforementioned measures Parallel Analysis was used. This analysis found three eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (30 variables x 358 participants). The component matrix in the PCA showed that item five sfl5 from the factor Support for Learning (In my organization, Information is available on possibilities to learn) had cross-loadings on factor one, two, three and six and was therefore removed from the data set. Consequently, the PCA was rerun without item sfl5. Still, six components with eigenvalues exceeding 1 were found that explained the same percentages as indicated above. Four additional items (s1: In my team, I can get budget to support my learning; s5: In my team, I feel learning is appreciated; ira4: In my team, I can take up tasks associated with another role to learn new things; and ira1: In my team, I have the choice to plan what, how and when I learn) were taken out from the questionnaire because their factor loadings were below .40 [65]. The results for both the scree plot test and the Parallel Analysis yielded the same results as the original analysis. Both of these tests recommended a different factor structure. Nevertheless, oblimin rotation revealed the presence of a six-factor structure with strong item loadings for each factor (see Table 8). The results of this analysis support the use of the CFLQ with 25 items loading on 6 factors.

The first factor contains all five items of the original learning leadership scale and one initial support item (In my team, I am rewarded for learning). The factor was, therefore named Learning Leadership. The second factor is comprised of three items from the opportunities to learn scale and two items of the exchange of knowledge scale. Item eok1 (In my team, we openly discuss mistakes

in order to learn from them) and item eok2 (In my team, critical, constructive thinking is encouraged and we encourage each other to speak up) both cover ways of communicating to enable learning opportunities within a team. For this reason, the scale is labelled Opportunities to Learn. All of the item loadings for this factor were found to be negative. The third factor consists of four items from the initial space for learning scale. Consequently, it is labelled Space for Learning. The fourth factor has four items that are loading on it. Two items stem from the support scale and the other two from the opportunities to learn scale. The two latter items also relate to support because they both describe supportive environment provided by the team (otl2: In my team, we can experiment and take risks with new ideas; otl1: In my team, we are encouraged to look for change and innovation). So, the scale received the name Support. The fifth factor consists of three items from the original individual responsibility & autonomy scale and is therefore of the same name. The sixth factor has three items loading on it, all pertaining to the initial exchange of knowledge scale. As a result, it received the name Exchange of Knowledge.

Concluding the reliability analysis, Cronbach's alpha ranges for the six scales from .625 to .877 (see Table 13). Three scales of the instrument do not equal or exceed the alpha value of .70 that is commonly used as a rule of thumb indicating a threshold for a scale's internal consistency [57,58]. Taber [57], however, demonstrates that there exists no consensus in research about acceptable alpha values indicating internal consistency. Instead, the author lists a wide range of common interpretations for alpha values. This study will rely on these ranges for labelling the internal consistency for each scale. Accordingly, the alpha values for the scales Learning Leadership and Opportunities to Learn fall within the range reliable (.84-.90). The internal consistency of Space for Learning is considered fairly high (.76-.95). The alpha value of Individual responsibility & Autonomy indicates an adequate (.64-.85) internal consistency and the values for the scales Exchange of Knowledge and Support both are seen as moderate (.61-.65). For these reasons, a questionnaire of 25 items emerged that is comprised of six internally consistent scales.

Confirmatory Factor Analysis

Based on the second subsample (N= 356), the SEM software AMOS was used to execute the CFA on the 25 CFLQ items (Figure 1). The analysis confirmed that the hypothesized model with six correlated factors, obtained from the prior EFA, has a good model fit to the observed data (X2/df= 2.06; RMSEA: .055; CFI= .918; SRMR: .058). Therefore, no further model improvements needed to be applied during this step (see Figure 1).

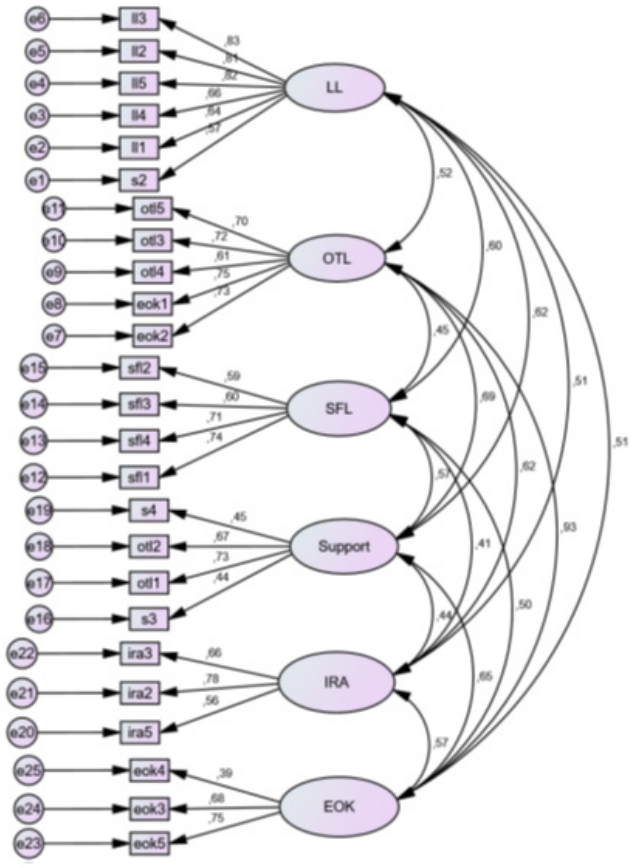

Figure 1: Results of the CFA with standardized estimates for the 25 item CFLQ (N= 356).

To assess the construct validity, the CFA was scrutinized according to the four rules provided by Hair et al. [56]. First, the standardized loading estimates of item s4, s3 and eok4 were observed to be below the recommended .5 value (see Figure 1), indicating an issue with convergent validity. To assess the compliance to the remaining rules the Amos Master Validity plugin was run with the 25 items of the CFLQ (Scenario 1), yielding six discriminant validity, five convergent validity and two reliability issues (see Table 9).

Table 9: Scenario 1. Construct Validity Analysis of all 25 items of the CFLQ (no items deleted).

	CR	AVE	LL	OTL	SFL	Support	IRA	EOK
LL	0,869	0,531	0,729					
OTL	0,829	0,494	0,517***	0,703				
SFL	0,758	0,442	0,601***	0,450***	0,665			
Support	0,667	0,345	0,620***	0,694***	0,566***	0,588		
IRA	0,712	0,456	0,509***	0,617***	0,406***	0,442***	0,676	
EOK	0,642	0,389	0,505***	0,928***	0,501***	0,651***	0,575***	0,624

Note. Numbers in red indicate unmet rule for reaching full construct validity; diagonal contains the square root of AVE.

[a]Discriminant Validity: the square root of the AVE for OTL is less than its correlation with EOK.

[b]Convergent Validity: the AVE for OTL is less than 0.50. Try removing otl4 to improve AVE.

[c]Convergent Validity: the AVE for SFL is less than 0.50. Try removing sfl2 to improve AVE.

[d]Reliability: the CR for Support is less than 0.70. Try removing s3 to improve CR.

[e]Convergent Validity: the AVE for Support is less than 0.50. Try removing s3 to improve AVE.

[f]Discriminant Validity: the square root of the AVE for Support is less than its correlation with LL.

[g]Discriminant Validity: the square root of the AVE for Support is less than its correlation with OTL.

[h]Discriminant Validity: the square root of the AVE for Support is less than its correlation with EOK.

[i]Convergent Validity: the AVE for IRA is less than 0.50. Try removing ira5 to improve AVE.

[j]Reliability: the CR for EOK is less than 0.70. Try removing eok4 to improve CR.

[k]Discriminant Validity: the square root of the AVE for EOK is less than its correlation with OTL.

[l]Convergent Validity: the AVE for EOK is less than 0.50. Try removing eok4 to improve AVE.

[m]Discriminant Validity: the square root of the AVE for EOK is less than its correlation with Support.

*** p < .001

To reduce these issues, a second run of the plugin took place with incorporating its recommendations for deleting the five items otl4, sfl2, s3, ira5, eok4 to improve the construct validity issues. Accordingly, the analysis was rerun with 20 items (see Table 10), resulting in reducing the discriminant to two and the convergent to three issues (scenario 2).

Table 10: Scenario 2. Construct Validity Analysis of 20 items of the CFLQ (five items deleted: otl4, sfl2, s3, ira5, eok4).

	CR	AVE	LL	OTL	SFL	Support	IRA	EOK
LL	0,870	0,531	0,729					
OTL	0,816	0,526	0,510***	0,726				
SFL	0,716	0,459	0,636***	0,473***	0,678			
Support	0,670	0,416	0,604***	0,631***	0,594***	0,645		
IRA	0,750	0,607	0,414***	0,508***	0,409***	0,360***	0,779	
EOK	0,662	0,495	0,504***	0,950***	0,515***	0,598***	0,501***	0,704

Note. Numbers in red indicate unmet rule for reaching full construct validity; diagonal contains the square root of AVE.

[a]Discriminant Validity: the square root of the AVE for OTL is less than its correlation with EOK.

[b]Convergent Validity: the AVE for SFL is less than 0.50. Try removing sfl3 to improve AVE.

[c]Reliability: the CR for Support is less than 0.70. Try removing s4 to improve CR.

[d]Convergent Validity: the AVE for Support is less than 0.50. Try removing s4 to improve AVE.

[e]Reliability: the CR for EOK is less than 0.70. Try removing eok3 to improve CR.

[f]Discriminant Validity: the square root of the AVE for EOK is less than its correlation with OTL.

[g]Convergent Validity: the AVE for EOK is less than 0.50. Try removing eok3 to improve AVE.

*** p < .001

The two reliability issues from the prior analysis remained. After this analysis, the Amos plugin suggested deleting sfl3, s4 and eok3. Therefore, in the last scenario (scenario 3) sfl3 and s4 were deleted so that the analysis was run with 18 items of the CFLQ (see Table 11). Since this kind of analysis needs at least two item per factor item eok3 could not be deleted because it would leave the factor EOK only with the item eok5. Additionally, having only one item for a factor renders this factor unrepresentative of the latent construct [56]. After the analysis was run with the remaining 18 items, only four construct validity issues remained all associated with factor EOK. Two discriminant validity issues of EOK with OTL, one convergent validity issue of EOK continued to exist, and one reliability issue of EOK remained.

Table 11: Scenario 3. Construct Validity Analysis of 18 items of the CFLQ (seven items deleted: otl4, sfl2, s3, ira5, eok4, sfl3, s4).

	CR	AVE	LL	OTL	SFL	Support	IRA	EOK
LL	0,870	0,531	0,729					
OTL	0,816	0,526	0,510***	0,726				
SFL	0,703	0,542	0,635***	0,424***	0,737			
Support	0,700	0,540	0,604***	0,614***	0,553***	0,735		
IRA	0,747	0,602	0,419***	0,513***	0,360***	0,352***	0,776	
EOK	0,662	0,496	0,504***	0,949***	0,463***	0,590***	0,506***	0,704

Note. Numbers in red indicate unmet rule for reaching full construct validity; diagonal contains the square root of AVE.

[a]Discriminant Validity: the square root of the AVE for OTL is less than its correlation with EOK.

[b]Reliability: the CR for EOK is less than 0.70. Try removing eok3 to improve CR.

[c]Discriminant Validity: the square root of the AVE for EOK is less than its correlation with OTL.

[d]Convergent Validity: the AVE for EOK is less than 0.50. Try removing eok3 to improve AVE.

*** p < .001

Scenario 2 had the outcome that factor IRA and EOK have less than three items. Scenario 3 had the outcome that factor IRA, EOK, SFL and Support have less than three items. Overall, the first scenario yields the same number of items as the outcome of the EFA. The second scenario yields 6 items for the factor LL, 4 for OTL, 3 for SFL, 3 for support, 2 for IRA and 2 for EOK. The third scenario yields 6 items for factor LL, 4 for OTL and 2 items for SFL, Support, IRA as well as EOK.

This analysis yields correlation coefficients for the three scenarios showing that the six factors are significantly and positively related to each other. The coefficients range from .406 to .928. After taking all possible recommendations of the Amos validity master plugin into account, scenario 3 reaches the best construct validity based on the construct reliability, convergent and discriminant validity tests that were conducted.

Conclusions

This study aimed to develop a questionnaire to measure the learning climate within an organization and to evaluate its construct validity. The questionnaire, designed to assess the Climate for Learning in Organisations questionnaire (CfL-O), was developed in collaboration with external researchers who based its creation on a systematic literature review. This review distinguishes between a climate for learning and a culture for learning, identifying the key dimensions that comprise a climate for learning. The steps of this literature review were as follows: (1) database search; (2) application of inclusion criteria; (3) synthesis of findings; and (4) conclusion. For more details, please refer to the results section and Emonds et al. [7]. This process led to the development of the initial Cf-O questionnaire, consisting of six scales and 30 items: Learning Leadership, Opportunities to Learn, Space for Learning, Exchange of Knowledge, Support, and Individual Responsibility & Autonomy.

To achieve the second objective—evaluating the construct validity—the factorial structure, convergent validity, and discriminant validity of the questionnaire were examined. The first step in examining the factorial structure was conducting an Exploratory Factor Analysis (EFA) to develop a theory of the learning climate. The EFA resulted in a 25-item questionnaire loading on six factors: Learning Leadership (6 items), Opportunities to Learn (5 items), Space for Learning (4 items), Support (4 items), Individual Responsibility & Autonomy (3 items), and Exchange of Knowledge (3 items). The item "sfl5" was deleted due to cross-loadings across four factors. Four additional items were removed from the questionnaire because their factor loadings were below the .40 threshold (s1, s5, ira4, and ira1). All six scales demonstrated internal consistency.

It is important to note that all five items for the second factor, Opportunities to Learn, had negative factor loadings. There is no consensus in the research community regarding this issue. However, one frequently mentioned interpretation suggests that negative factor loadings may indicate the opposite pole of the intended construct [66]. In this case, the items could be measuring Threats to Learn rather than Opportunities to Learn. After re-examining the wording of the relevant items with an expert in the field, this possibility was deemed unlikely. Another potential explanation is that employees in this sample may interpret the items differently than the researchers intended. For example, the item "In my team, we share information from outside the company" might be seen as a threat to learning in their company culture, thus influencing their perception. If the company culture holds the (unconscious) belief that sharing information outside the company threatens learning, employees may interpret the item in that context. This suggests that the learning climate may influence the learning culture, and vice versa [7]. Given the ambiguity of this interpretation, it is recommended to interview employees from this sample to understand why they may have perceived these items as threats to learning. Alternatively, if such interviews are not feasible or do not yield useful insights, the validation procedure should be replicated in a different sample from a different sector to determine if the negative factor loadings were caused by measurement or sampling errors. This would help clarify whether the sample's characteristics bias the results or whether the factor and its items need to be revised.

Next, a Confirmatory Factor Analysis (CFA) was conducted to confirm the proposed theoretical factor structure from the EFA. The CFA yielded a good model fit, indicating that no further model improvements were necessary. While it is common to report only Cronbach's alpha during a CFA and claim that acceptable construct validity is established, relying solely on Cronbach's alpha to claim construct validity is controversial [57-59]. To provide a more robust validation approach, this study goes beyond Cronbach's alpha by using more sophisticated measures of reliability and validity. Construct validity was assessed through construct reliability, discriminant validity, and convergent validity, with support from the Amos plugin Master Validity. Based on this analysis, three scenarios are proposed to improve construct validity (see Tables 14–16). These scenarios vary in terms of the number of items deleted to address systematic construct validity issues

Scenario 1 serves as the baseline model, where no items were deleted to evaluate the initial construct validity (see Table 9). Scenarios 2 and 3 were designed to enhance construct validity, with the caveat that additional items might need to be generated to ensure that each dimension includes at least three items. As anticipated, both scenarios resulted in factors with fewer than three items, which falls below the recommended minimum for a factor to reliably measure its underlying construct [56,67].

Given the identification of 13 issues affecting construct reliability, all recommendations for item deletions provided by the Amos plugin were followed. As a result, Scenario 2 involved deleting five items, resulting in a 20-item instrument (see Table 10). This modification reduced the construct validity issues from 13 to 7. Scenario 3 represents the most stringent approach, where all proposed deletions were followed except one, to avoid leaving the Exchange of Knowledge (EOK) factor with only a single item (see Table 11). This scenario reduced the identified construct issues from 7 to 4. Following the strictest Scenario 3, the resulting instrument had 20 items distributed across the original six factors of the CFLQ: 6 items for Learning Leadership, 4 for Opportunities to Learn, and 2 items each for Space for Learning, Support, Individual Responsibility & Autonomy, and Exchange of Knowledge. Both Scenarios 2 and 3 resulted in factors with fewer than three items, which may limit their ability to measure their underlying constructs [67,68]. For this reason, caution is advised when using these scenarios. However, since Scenario 3 represents the shortest version of the CFLQ while achieving the best overall construct validity, this study recommends favouring Scenario 3 over the others.

Therefore, Scenario 3, the abbreviated version of the CfL-O with 18 items, should be preferred when aiming for the best construct validity while maintaining a concise instrument. However, in Scenario 3, the Exchange of Knowledge (EOK) factor still exhibits a strong correlation with the Opportunities to Learn (OTL) factor (correlation coefficient: .928), leading to potential discriminant validity issues. These issues arise because the items for both factors correlate with items from other factors, which could blur the distinction between the two factors. Furthermore, the Average Variance Extracted (AVE) for EOK is nearly at the recommended threshold of .5, indicating borderline convergent validity (.495). Additionally, the Construct Reliability (CR) for EOK does not reach the recommended value of .7 for good internal consistency (construct reliability). However, as noted by Hair et al. [56], CR values between .6 and .7 are considered acceptable if other indicators of construct validity are strong. Currently, this is only problematic for the EOK factor, suggesting that this factor does not yet exhibit sufficient construct reliability. These validity issues could be further improved by generating additional items for the factors that have insufficient item counts.

In conclusion, the analysis indicates that Scenario 3, despite some remaining construct validity issues between EOK and OTL,

provides the best overall construct validity of the three scenarios. Therefore, the abbreviated 18-item, six-factor version of the CfL-O is recommended for future use when the goal is to maintain the shortest instrument with the highest construct validity.

Through the development (Study 1 and Study 2) and validation (Study 3) of the CfL-O, this research contributes to the field in several ways. First, it creates, to the author's knowledge, the first questionnaire specifically designed to measure the learning climate in organizations, based on a systematic literature review. Second, it clarifies the conceptual confusion in the literature by distinguishing between the adjacent concepts of organizational culture and climate, as well as learning culture and climate. Third, with the help of three experts in the field, it synthesizes the most common conceptual elements from 240 studies, resulting in the identification of six dimensions of the learning climate.

Fourth, the study explicitly outlines each step of the systematic literature review process and employs three expert groups to verify the face validity and comprehensibility of the six dimensions and their associated items. Given that the items in the CfL-O are phrased in simple, clear language, the questionnaire is suitable for employees with diverse educational backgrounds and professional experiences. Fifth, the resulting 30-item version of the CfL-O represents a synthesis of over 70 analysed questionnaires, selecting the most relevant items for each of the six dimensions. The 30-item CfL-O is the outcome of paraphrasing and/or combining items from the eight most relevant, validated questionnaires. Sixth, this synergized 30-item CfL-O underwent advanced validation through a CFA. Seventh, the validation process produced three different scenarios, with the third scenario representing the shortest version of the CfL-O while also yielding the best overall construct validity. These seven contributions make this study a unique and valuable addition to the literature on learning climates.

Future Research

"Validation is a matter of degree, not an all-or-nothing matter" [69]. In other words, a valid instrument is not created by a single validation study but is part of an ongoing process. This study represents the first step in that process, beginning with an EFA and CFA, resulting in three scenarios based on a sample from a private Dutch maritime contracting company. Scenario 3 provided the best overall construct validity. However, this strict scenario, which led to the deletion of several items, resulted in factors with fewer than three items. Ideally, a factor should have at least three items to effectively measure its underlying construct [67]. Future research should carefully select or create additional items to complement the factors with fewer than three items and revalidate the scale. This could be done in collaboration with the authors of the systematic literature review [7], who possess a comprehensive understanding of available instruments and items in the literature.

Initially, the plan was to conduct the EFA and CFA on two distinct samples from different companies. Using different samples is the typical approach to test whether the factor structure identified in the EFA holds in a new sample [70]. However, due to the Covid-19 pandemic, the second sample could not be collected on time due to constraints imposed by the second company. As a result, this study used a random split of the original sample, with one half used for the EFA and the other half used to validate the EFA theory through a CFA [71]. Future research should continue this validation process by conducting a CFA with a sample from a different source than the original EFA.

Regarding sample size, no limitations were encountered, as both randomly divided subsamples exceed the recommended 300 cases for factor analysis [68]. However, to enhance the generalizability of the findings, it is recommended that future studies collect samples from a broader range of sectors, organizations, and countries, including both Western and non-Western societies. While Western, industrialized, rich, and democratic (WEIRD) societies are not representative of the global population, they are commonly used in research [72]. This is especially problematic in the context of learning climate, which is based on "issue-specific observable perceptions shared among organizational members and the meaning attached to those perceptions" [7]. These shared perceptions and meanings can vary significantly depending on cultural backgrounds [73]. Therefore, future research should aim to collect samples from a diverse range of organizations across both Western and non-Western countries to ensure a more comprehensive understanding of the learning climate.

Due to sample constraints, this study did not assess factorial measurement invariance across different educational levels and departments. Measurement invariance evaluates whether the obtained scores for the latent construct are sufficiently equivalent across groups [74]. For measurement invariance to be meaningful, the groups being compared should have comparable sizes [75], with each group ideally having at least 200 responses [76,77]. In this study, the educational groups did not meet these criteria: 519 participants (72.69%) had a university degree or higher, while only 113 (15.83%) were high school graduates, and 82 (11.48%) had less than a high school education. Similarly, the department groups within the organization were unbalanced (i.e., unequal in size), with none of the 23 departments reaching the recommended 200 responses. Only four departments had more than 40 participants.

If the sample size permits, factorial measurement invariance can be tested in AMOS through three consecutive stages: configural invariance (testing if both groups have the same factor loading patterns when no cross-group path constraints are applied), metric invariance (testing if factor loadings for similar items are invariant), and scalar invariance (testing intercepts and structural covariances instead of measurement weights) [78]. Future studies should aim to collect larger, more balanced samples from multinational companies across different sectors, with more than 200 participants per group. This would enable the testing of these three measurement invariance stages in the CFA, allowing for conclusions about whether the CfL-O factor structure differs across subgroups.

Other factors could also be considered when compiling a sample for future validation studies. Research indicates that

organizations often have multiple climates [27], which suggests that it might be useful to explore whether differences exist among departments within the same organization. Furthermore, Schneider et al. [27] noted that subcultures, such as those defined by function, occupation, or gender, can lead to different perceptions and experiences among individuals. Since research suggests that learning climate and learning culture influence each other [7], it is possible that group memberships could play a role in shaping perceptions of the learning climate. Future research should aim to compile a sample with enough responses from these different groups, enabling meaningful factorial measurement invariance testing to determine whether these groups perceive the learning climate differently.

This study conducted convergent and discriminant validity tests at the item level. Future research should extend these tests to the instrument level and assess predictive validity. Convergent validity measures the degree to which two measures of the same concept are correlated [79]. In their study, Nikolova et al. [8] used the Opportunities to Develop Scale [23] to establish convergent validity. This scale had been used in prior research as a proxy for the learning climate. Similarly, future research could use the Opportunities to Develop Scale to establish the convergent validity of the CfL-O. High correlations between the two measures would indicate that the CfL-O is effectively measuring its intended construct [79].

In contrast, discriminant validity assesses how distinct concepts are from one another [79]. A similar concept to the learning climate is the learning organization, which is typically measured by the DLOQ. To demonstrate high discriminant validity, future research could compare the Cf-O to the DLOQ to confirm that the two constructs are sufficiently distinct.

Lastly, future studies should evaluate the predictive validity of the CfL-O. Predictive validity examines whether the scores from a questionnaire can predict a criterion measured after the test is administered [80]. Previous research has shown that the learning climate is linked to turnover intentions [1]. Therefore, future studies could explore the correlation between the CfL-O and turnover intentions to assess its predictive validity.

Practical implications

This study introduces a questionnaire designed to measure the learning climate in organizations, based on a systematic literature review. As such, the CfL-O represents a valuable tool for both researchers and practitioners. HR professionals can use the CfL-O to gain an overview of the current state of the learning climate within their organizations, enabling them to make informed strategic decisions in collaboration with management to address areas for improvement identified by the questionnaire.

For now, it is recommended to use the full 30-item version of the CfL-O, as the 18-item version proposed in Scenario 3 still does not have at least three items per dimension. Once further research leads to the generation of new items and the cross-validation of the shorter version, HR practitioners will be able to adopt an even more streamlined version of the CfL-O. A shorter version will facilitate regular assessments of the learning climate within organizations, offering a quick and efficient tool for decision-making.

Furthermore, the CfL-O can be applied to compare the learning climate across various business units, departments, or locations. Such comparisons will help identify performance differences tied to learning strengths and weaknesses, making it easier to scale the successes associated with a strong learning climate [81-124].

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Conflict of Interest

No conflict of interest.

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APPENDIX

A Climate for Learning Questionnaire

Welcome!

We are conducting a study to explore the learning climate at XXX in collaboration with Maastricht University. As part of this study, we will be asking you a few questions on this topic. Please rest assured that your responses will remain completely confidential. All responses will be anonymized, and no personal or contact information will be stored.

The survey will take approximately 10 minutes to complete. Participation in this study is entirely voluntary. You are free to withdraw at any point, for any reason, without any consequences. If you have any questions or would like to discuss the study, please contact the Principal Investigator at XXX via email.

By clicking the button below, you confirm that you understand your participation is voluntary, you are at least 18 years old, and you are aware that you may withdraw from the study at any time, for any reason.

Please note: This survey is best viewed on a laptop or desktop computer. Some features may not display properly on mobile devices.

I consent, begin the study	I do not consent, I do not wish to participate

General information

1. What is your nationality?

- … (OPEN TEXT BOX)

2. What is country of residence?

- … (OPEN TEXT BOX)

3. What is the highest degree or level of education you have completed?

- … (OPEN TEXT BOX)

4. Are you currently part of a Tender or Project team?

- Yes
- No

5. Which department do you work for?

(Due to data protection the possible departments were removed)

6. Which function do you currently have?

- … (OPEN TEXT BOX)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning leadership *My manager…*					
Supports me when I ask for learning					
Coaches the employees s/he leads					
Looks for opportunities to learn new things					
Stimulates us to have discussions					
Advices me about the best way to learn something new					

Support *In my team, …*					
I can get budget to support my learning					
I am rewarded for learning					
I help others to learn and I share learning experiences					
I can make mistakes without bad consequences					
I feel learning is appreciated					

Opportunities *In my team, …*					
We are encouraged to look for change and innovation					
We can experiment and take risks with new ideas					
We share lessons learned					
We share information from outside the company					
We seek and give honest feedback					

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Exchange of knowledge *In my team, …*					
We openly discuss mistakes in order to learn from them					
Critical, constructive thinking is encouraged and we encourage each other to speak up					
We share information with other teams					
We work with colleagues who have different expertise's.					
We share knowledge freely and open					

Space for learning *In my organization, …*					
There are processes, resources and time to learn					
There is a system to track the time and resources we spend on learning					
There is a platform to support giving and seeking feedback					
The procedures for learning are simple					
Information is available on possibilities to learn					

Individual responsibility & Autonomy **In my team, …**					
I have the choice to plan what, how and when I learn					
It is clear to me and others what is expected of me in my role					
I know how I perform in my role					
I can take up tasks associated with another role to learn new things					
I can ask how I perform in my role anytime					

Thank you for taking the time to fill in this questionnaire