



Using a non-recursive model with feedback loops to identify barriers to learning as a dynamic construct in workplace learning

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Abstract

Barriers to learning in the workplace form a holistic set of missing individual, team, and organizational aspects that hinder the initiation of successful learning, interrupt learning possibilities, delay proceedings, or end learning activities much earlier than intended. These barriers ultimately determine the way individuals seek learning opportunities in the workplace. Based on an explorative interview study and the development and validation of a measurement instrument for barriers to learning at the workplace, this cross-sectional questionnaire study ($N=230$) was conducted to investigate barriers to learning as a dynamic construct in workplace learning. Factor analysis, analysis of Cronbach's alpha, descriptive analyses, and structural equation modeling (SEM) of a non-recursive model with feedback loops were conducted to identify the dynamic aspects and interplay of barriers to learning with the factors job satisfaction and turnover intention. The non-recursive model with feedback loops ($CFI=.98$ and $RMSR=.073$) indicated that the relationship between barriers to learning with sub-categories such as individual components and organizational limitations are negatively related to job satisfaction and have an indirect effect on turnover intention. With this interdisciplinary contribution, trainings and work-based learning scenarios can be initiated to unlock the potential of learners that has been blocked due to previously under-researched barriers to learning.

Keywords Barriers to learning · Workplace learning · Non-recursive model · Feedback loops

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Introduction

Throughout the last few decades, the fostering of factors that promote learning activities has taken a prominent role in research on learning and professional development (e.g., Brandi & Iannone, 2021; Ellinger, 2005; Kyndt et al., 2018; Parenrengi et al., 2025). The more about the fostering of factors for learning has been revealed, the better learning environments have been designed. Especially in concepts of workplace learning (Goller & Paloniemi, 2022) and informal learning (Decius et al., 2024), research has made multiple steps. Learning itself and learning activities (Slattery, 2024) represent key aspects of lifelong learning approaches and 21st-century skills. Here, these concepts are widely used to refer to all the factors that encourage learners to actively create better learning and, consequently, working conditions.

Upon taking a closer look at the complexity of learning and its underlying theories, however, the pure focus on learning factors negates another prominent factor: the role of antecedents to learning (Boeren, 2016). Despite the importance of lifelong learning and the development of various programs to promote learning for professional development, its necessity does not always lead to successful learning activities (Anselmann, 2022a). Even so, previous research approaches to workplace learning mainly focus on concepts that foster learning activities (Billett, 2022; Kyndt & Baert, 2013; Pylväs et al., 2022). Learning obstacles or barriers receive less attention.

Barriers to learning at the workplace are factors that hinder the initiation of successful learning, interrupt learning possibilities, delay proceedings, or end learning activities much earlier than intended (Anselmann, 2022a; Belling et al., 2004; Shuk & Herd, 2012). These barriers can be internal, external, or a result of organizational correlation issues and can occur at the individual, team, or organizational level (Anselmann, 2022a). Following Barrett (2021), the topic of learning barriers is diverse, complex, and underrepresented in research on professional learning processes like workplace learning or vocational education and training. Barriers to workplace learning specifically represent a significant research gap because the failure to learn can lead to an inability to perform tasks, achieve personal growth, or meet corporate or personal goals. They are a significant reason why new learning activities are not initiated or inadequately started. Additionally, the literature suggests that the complex and varied nature of learning barriers makes it challenging to understand the specific obstacles encountered in the workplace, how they affect knowledge acquisition, and the key aspects of managing them (Keck Frei et al., 2021; Schilling & Kluge, 2009).

With this research, we aim to clarify the complex relationship between learning barriers and educational endeavors in the workplace. It can be inferred that barriers to learning at various stages have different effects, creating a mix of educational challenges. This makes it crucial to examine these connections closely since individuals prefer diverse learning methods in the workplace. This, in turn, suggests that barriers to learning form a spectrum based on specific learning circumstances, conditions, and capacities. Thus, understanding educational endeavors requires considering both barriers and facilitators of learning. Our applied approach can be utilized for more holistic examinations of workplace barriers at the individual, team, and organizational levels, thereby closing an existing research gap with this innovative research method.

The majority of research models can determine a relation from point A to point B. However, a non-recursive model with feedback loops can describe a dynamic real-life workplace scenario. Such models are highly beneficial to holistic assessments of barriers to learning, as there are two other crucial concepts that should be taken into account when researching this topic at the workplace: job satisfaction (Spector, 1985) and intention to leave (Kenny et al., 2016). Both reveal the immense influence on learning processes at the workplace. The second aim of this contribution is therefore to capture the entire dynamic context of workplace learning by shifting the focus from purely promoting learning to identifying learning barriers in relation to job satisfaction and turnover intention.

Since the integrated structure of barriers to learning at the workplace has not previously been modeled and because cross-sectional SEM cannot establish temporal or causal directionality, we employ research questions rather than hypotheses. This approach is consistent with methodological recommendations for exploratory SEM (Kline, 2023; Marsh et al., 2014) and avoids overstating theoretical precision where the literature remains fragmented (Wang & Wang, 2019). Using research questions also prevents post-hoc hypothesis construction and maintains transparency in line with contemporary methodological standards (Aguinis et al., 2021; Wang & Wang, 2019).

Based on an explorative interview study and the development and validation of a measurement instrument of barriers to learning at the workplace, we conducted a cross-sectional questionnaire study ($N=230$) to investigate barriers to learning as a dynamic construct in workplace learning.

Theoretical framework

This section details the main concepts crucial to this research. It sums up the concept of barriers to learning, characteristics of workplace learning, informal learning at work, job satisfaction, and turnover intention.

Barriers to learning at the workplace

Contemporary models conceptualize workplace learning as the interaction of affordances and constraints within organizational, relational, and task environments (Billett, 2022; Tynjälä, 2022). Many barriers to learning can therefore be understood as inverse indicators of well-established learning facilitators. For example, insufficient managerial support represents the absence of a widely documented driver of workplace learning (Blume et al., 2024), while resource scarcity mirrors the inverse of resource-rich learning environments known to enable knowledge acquisition and engagement (Noe et al., 2014). Similarly, the perception of unfitting or low-quality tasks reflects the inverse of task designs that positively shape sense-making and competence development (Gore et al., 2018). Framing barriers as the counterpart of learning conditions positions them within, rather than outside of, the workplace learning literature and provides a theoretically grounded rationale for their empirical examination.

Extensive research highlights the necessity of lifelong learning (Eriksson, 2025; González-Pérez & Ramírez-Montoya, 2022). However, engagement in learning activities does not occur automatically; it depends on cognitive, emotional, and behavioral evaluations of participation within the learning process itself (Ehlers, 2022; Kauffeld et al., 2025; Shuck & Herd, 2012). These assessments are shaped by internal and external constraints, as well as organizational alignment factors. A lack of engagement in learning activities may result in difficulties performing routine work tasks and hinder the achievement of long-term career objectives (Shuck, 2019). Building on existing research (Schilling & Kluge, 2009; Shuck & Herd, 2012), this study introduces a comprehensive model of learning barriers. This framework integrates workplace affordances with barriers at the individual, team, and organizational levels, classifying them into three main categories internal, external, and organizational fit, while considering different learning environments, including formal, non-formal, and informal settings, to provide a holistic understanding of workplace learning challenges.

Barriers can be categorized as internal, external, or related to organizational fit, each affecting individuals, teams, or entire organizations. External barriers include hierarchical constraints (Ababneh & Ababneh, 2025) and limited resource availability (Beier et al., 2025). Other identified barriers include motivational challenges (Nouwen et al., 2021), social dynamics (Hwang & Yoon, 2025), workplace infrastructure (Barrett, 2021; Schilling & Kluge, 2009), and career advancement limitations (Daniels et al., 2024). Addressing external barriers may involve improving resource allocation, fostering a supportive work culture, or expanding learning opportunities. Internal barriers often stem from personal learning preferences that influence the approach, location, and motivation behind participation in learning activities. Fit-related barriers encompass physical, psychological, or emotional misalignments between job requirements and learning processes (Papacharalampous & Papadimitriou, 2021; Sepehrom, 2025). Employees may resist organizational expectations if they perceive them as ineffective or inconsistent with their work styles. A lack of learning engagement may constrain daily professional responsibilities and hinder the realization of long-term career aspirations (Bristol-Alagbariya et al., 2024).

Viewing barriers and facilitators as structural inverses aligns with contemporary models of workplace learning, which conceptualize learning environments as systems of affordances and constraints (Billett, 2022). Recent studies show that managerial support, task autonomy, and resource availability operate in direct opposition to the barriers commonly reported by employees (Decius et al., 2023). Accordingly, the present study does not conceptualize barriers as a separate domain but as negative manifestations of the established conditions that enable employee learning. This framing situates our study firmly within the workplace learning literature and emphasizes its contribution to understanding the structural configuration of learning environments.

Barriers to workplace learning arise from a combination of individual, team, and organizational factors. These impediments can delay, interrupt, or halt learning activities, thereby impeding professional growth (Crouse et al., 2011). Current assessment tools predominantly focus on barriers at the organizational level (e.g., Allen & Heredia, 2021; Kezar & Holcombe, 2020). To address these barriers effectively and facili-

tate improved learning outcomes, it is necessary to examine the factors that influence learning conditions and instructional settings as well (Cerasoli et al., 2018; Jeong et al., 2018; Kyndt et al., 2018). Decius et al. (2023) emphasize the significance of analyzing both individual attributes and the organizational learning environment to gain deeper insight into learning dynamics.

Barriers to effective team learning operate at both contextual and individual levels and inhibit collective information exchange, knowledge integration, and adaptive problem-solving. At the contextual level, low interpersonal trust and an absence of psychological safety reduce members' willingness to voice concerns, admit errors, or propose novel solutions, behaviors that are central to team learning (Edmondson, 1999; Edmondson & Bransby, 2023; Frazier et al., 2017). Structural and processual barriers, such as ambiguous or poorly aligned goals, ineffective communication practices, constrained time or workload pressures, and weak lines of accountability or leadership support, further limit opportunities for reflection, feedback, and coordinated sense-making within teams (Anselmann, 2022a; Rebelo et al., 2022).

Individual-level barriers also play a critical role. Concerns about failure, maladaptive perfectionism, and related affective responses (e.g., anxiety, self-criticism) can produce defensive behaviors, avoidance of risk, or information withholding that undermine collective inquiry and error-based learning (Mohr et al., 2022). Social dynamics such as low cohesion or a fragmented community of practice, and broader resistance to change or new ideas, compound these effects by reducing psychological safety and the exchange of diverse perspectives (Anselmann, 2022b; Rebelo et al., 2022).

The relationship between facilitators and barriers to learning is dynamic, where new stimuli may act as enhancers, whereas pre-existing elements may serve as obstacles (Cerasoli et al., 2018; Keck Frei et al., 2021; Louws et al., 2017). As a result, the classification of facilitators and barriers is context-dependent, varying based on individual or group perspectives. Elements such as time constraints or access to particular resources may present obstacles for some learners, yet facilitate learning for others. Identifying learning barriers helps pinpoint areas for improvement, including ineffective communication, unfavorable work conditions, and limited employee autonomy (Brion, 2021; Crouse et al., 2011; Decius et al., 2024). Given the complexity of workplace learning barriers, a thorough and methodical investigation is necessary to address the diverse challenges encountered in knowledge-intensive professional environments (Dymock & Tyler, 2018).

Contemporary research demonstrates that the key antecedents of informal learning, such as supportive leadership, task autonomy, developmental feedback, and access to adequate resources, have structurally mirrored negative counterparts that emerge when these enabling conditions are absent (Tynjälä, 2022). In workplace learning conditions models, these positive learning affordances form the basis for employee engagement and knowledge construction (Noe et al., 2014), whereas their absence manifests as restrictive structures, resource scarcity, or poorly designed tasks that limit opportunities for participation and sense-making. Consistent with psychosocial and structural constraint research, such negative conditions also encompass relational tensions, low psychological safety, and heightened interpersonal conflict, all of which undermine employees' motivation and capacity to learn (Shuck, 2019). Together, this

evidence underscores that barriers to workplace learning are not independent phenomena but reflect the inverse expression of well-established antecedents and learning conditions. Synthesizing these strands provides a theoretically coherent rationale for examining how different types of barriers cluster and interact within workplace learning environments.

Characteristics of workplace learning

When referring to workplace learning, it often comes back to generic terms. Workplace learning may, in a broader context, be seen as improving the skills of employees and enhancing their knowledge (Olsen & Tikkanen, 2018). This directly leads to different forms of learning at the workplace, such as formal, non-formal, and informal learning. Starting with Marsick and Watkins (1990), learning in the workplace is first and foremost individual learning that is intentional and reflects the experiences of the individual. In contrast, Matthews and Gilliland (1999) highlight that workplace learning should be complementary and thought of as a well-founded learning process for the achievement of the desired individual and company goals. The results should promote the development of both the individual and the company, taking into account the existing and planned goals of the company and the individual's career development. Considering these concepts, Billett (1995, 2022) and Lohmann (2009) argue that it is structured and unstructured work-based activities that create new capabilities to effectively perform direct job-related responsibilities.

Therefore, workplace learning is a dynamic and multifaceted process that occurs at individual, team, and organizational levels to facilitate the acquisition, retention, and application of knowledge, skills, and competencies within professional environments. The phenomenon is influenced by cognitive, social, and structural factors, necessitating a holistic approach to its optimization (Decius et al., 2024a; Eraut & Hirsch, 2007; Tynjälä, 2022). It integrates formal, non-formal, and informal learning experiences, each contributing uniquely to an individual's professional growth and organizational effectiveness (Bandura, 1977; Lotfi et al., 2025).

Taking the multifaceted process of workplace learning into account, four key characteristics may be identified to characterize workplace learning. First is contextual embeddedness. Here, learning is deeply integrated into the work environment, leveraging real-life situations and tasks to develop practical competencies. This immersion facilitates the acquisition of tacit knowledge and situation-specific skills (Goller & Paloniemi, 2022). Second is social participation, whereby engagement with colleagues and participation in professional networks are central to workplace learning. These social interactions enable knowledge sharing and collective problem-solving, fostering a collaborative learning culture (Ahsan, 2025; Segers et al., 2021). Third is the continuum of formality, which posits that workplace learning spans a spectrum from formal training programs to informal incidental learning experiences. This continuum reflects the dynamic nature of learning opportunities within professional settings. Fourth, the integration of work and learning represents how learning is often inseparable from work activities, with employees acquiring new skills and knowledge through the execution of their job responsibilities. This integration emphasizes the practical application of learning outcomes (Billett, 2022; Cseh et al., 1999).

Workplace learning is arguably situated within a sociocultural context and is conceptualized in terms of three distinct phases: the pre-stage, the process, and the product. The pre-stage encompasses factors related to the learner(s) (Hilkenmeier et al., 2021), such as motivational drives and prior knowledge, as well as contextual elements like organizational structure and managerial support. The process of workplace learning is influenced by underlying assumptions and self-concepts, wherein learning unfolds through a combination of informal, formal, and non-formal activities (Segers et al., 2021). These activities occur through engagement in the work itself, reflective practices, and the addressing of novel challenges and tasks (Tynjälä, 2013, 2022). The product of this process is manifested in the learning outcomes, which may include enhanced task performance or improvements in workflow efficiency. Within this approach, work-related learning is mainly an explicit process driven by set learning objectives. It is viewed as a cognitive and rational activity occurring within a structured environment (Smet et al., 2022), where access to knowledge is directed and managed by authorities. The outcome of this process is primarily an individual enhancement of knowledge and skills (Harteis, 2022).

Informal learning at work

Informal workplace learning is an essential aspect of professional development that occurs outside the formal educational and training programs within an organization. Especially in workplace learning, informal learning is regarded as a key element (Crans et al., 2023). It encompasses a broad range of activities through which employees acquire skills, knowledge, and competencies in the workplace setting (Eraut & Hirsch, 2007; Lotfi et al., 2025). Unlike structured training programs, informal learning is typically unplanned, experiential, and driven by the learner's initiative and curiosity (Rosemann, 2022). Informal workplace learning is characterized by its spontaneity and integration into daily work activities. It is often opportunistic, arising from specific tasks, problem-solving situations, and social interactions among colleagues (Crans et al., 2021). Informal learning is facilitated through various mechanisms that enhance employee development and organizational effectiveness. These mechanisms include on-the-job experiences, mentoring and coaching, peer collaboration, observational learning, and informal networks, with each contributing uniquely to the learning process within organizational settings.

According to Eraut (2004), employees acquire knowledge and skills by engaging directly in their work tasks, confronting challenges, and devising solutions. This hands-on approach is invaluable to practical learning and professional growth. Studies indicate that learning occurs continuously in diverse settings, with a significant portion happening informally during daily work activities. In addition, experienced colleagues provide guidance, feedback, and support, assisting less experienced employees in navigating their roles and developing competencies. Mentorship in particular fosters a culture of continuous learning and skill development within organizations (Lukosch & De Vries, 2009). Collaborative work among colleagues promotes knowledge sharing and collective problem-solving, enhancing learning outcomes. Working alongside others allows individuals to observe, listen, and participate in activities, thereby acquiring new knowledge and skills (Eraut, 2004; Lotfi

et al., 2025). Chian et al. (2018) state that employees learn by observing others perform tasks, identifying effective strategies, and emulating successful behaviors. This form of learning enables individuals to acquire skills and knowledge without direct instruction, contributing to skill development. Finally, interactions within informal networks, such as social gatherings and online communities, offer opportunities for knowledge exchange and professional development. These networks facilitate the sharing of insights and experiences, enriching the learning environment (Livingstone, 2001).

Recent studies further elucidate the mechanisms and benefits of informal learning within workplace settings. For instance, Taheri et al. (2022) examine how workplace fun influences informal learning through factors like motivation to learn, learning opportunities, and management support. Their findings suggest that a fun workplace positively impacts informal learning by enhancing these mediating variables. Similarly, Crans et al. (2021) developed a model highlighting the social dimensions of informal learning among consultants. This model emphasizes the roles of organizational context, team relationships, and individual learner characteristics in facilitating informal learning processes.

These contemporary studies underscore the multifaceted nature of informal learning, highlighting the importance of social interactions, organizational culture, and individual motivations in fostering effective learning environments within the workplace. Therefore, informal learning offers several advantages to both employees and organizations, including relevance and timeliness, flexibility, cost-effectiveness, enhanced engagement, and continuous improvement. Learning occurs in real time and within the context of actual work, making it directly applicable to tasks at hand (Eraut, 2004). Employees can learn at their own pace, tailoring their learning experiences to their needs, which enhances motivation and engagement (Livingstone & Scholtz, 2006). Moreover, informal learning reduces the need for structured training programs, saving organizations time and financial resources while still enhancing employee skills (Froehlich et al., 2019). This approach fosters a culture of continuous improvement and adaptability, which are essential for navigating the rapidly changing workplace environment (Marsick & Watkins, 2001).

Informal workplace learning is a vital component of professional development that complements formal training programs. By understanding its mechanisms and fostering a supportive environment, organizations can enhance the continuous learning and adaptability of their workforce. Emphasizing the importance of informal learning can lead to a more engaged, skilled, and resilient workforce that is better equipped to meet the challenges of the modern workplace.

Job satisfaction

Job satisfaction is a critical construct in organizational behavior and human resource management, denoting the extent to which employees feel content and fulfilled by their work. It encompasses a multifaceted evaluation of various job elements, such as tasks, relationships, compensation, and organizational environment, reflecting an individual's overall assessment of their job experience (Busque-Carrier et al., 2021).

Following Kammeyer-Mueller et al. (2024), there are three basic theoretical frameworks that provide fundamental insights into the determinants and implications of job satisfaction. Starting with Maslow's hierarchy of needs, this theory posits that job satisfaction is achieved when basic physiological and safety needs are met, followed by higher-order needs such as belonging, esteem, and self-actualization (Maslow, 1943). Recent research suggests that while this model provides a useful heuristic, its hierarchical structure may not always hold in modern workplaces (Gutierrez et al., 2025). Building on this groundbreaking work, Herzberg's two-factor theory identifies hygiene factors (e.g., salary, work conditions) and motivators (e.g., recognition, responsibility) as key components of job satisfaction (Herzberg et al., 1959). Contemporary studies confirm that while hygiene factors mitigate dissatisfaction, intrinsic motivators play a more substantial role in enhancing engagement and performance (Bakker & Demerouti, 2017). Taking a more workplace-orientated approach, the Job Characteristics Model, developed by Hackman and Oldham (1976), suggests that job satisfaction is influenced by core job characteristics like skill variety, task identity, task significance, autonomy, and feedback. A meta-analysis by Humphrey et al. (2007) confirms the strong predictive power of this model, particularly in knowledge-intensive jobs.

Job satisfaction can also be dissected into several dimensions, each contributing to the overall satisfaction of an employee. These dimensions typically include the work itself (Deci et al., 2017), compensation and benefits (Colquitt et al., 2001), work conditions (Danna & Griffin, 1999), coworker and supervisor relationships (Cropanzano & Mitchell, 2005), career development opportunities (Özkan, 2023), as well as organizational policies and culture (Chatman & O'Reilly, 2016).

High job satisfaction is associated with numerous positive organizational outcomes. It correlates with increased employee engagement, higher productivity, and improved performance (Kammeyer-Mueller et al., 2024). Satisfied employees are more likely to exhibit organizational citizenship behaviors, going beyond their formal job responsibilities to benefit the organization (Podsakoff et al., 2018). Moreover, high job satisfaction reduces turnover intention and absenteeism, leading to greater organizational stability and reduced costs associated with employee replacement and lost productivity (Berber et al., 2022). Conversely, low job satisfaction can result in negative outcomes such as decreased motivation, lower performance, and higher turnover rates. Dissatisfied employees may engage in counterproductive work behaviors, such as tardiness, absenteeism, and even sabotage (Spector & Fox, 2005).

These patterns closely parallel findings from vocational education and training (VET) research on persistence and dropout intentions. Studies in this domain highlight that factors such as perceived autonomy, satisfaction with training conditions, social integration, and supportive relationships are critical for engagement and retention (Arianta & Goller, 2024; Holtmann & Solga, 2023). When trainees or team members experience low satisfaction, inadequate feedback, or poor supervisory support, both learning motivation and commitment to collective goals tend to decline. In such contexts, insufficient psychological safety and limited perceived autonomy can foster disengagement and eventual withdrawal dynamics analogous to dropout processes observed in the early phases of vocational training (Arianta & Goller, 2024). Job satisfaction is therefore a vital element in achieving organizational success. By

understanding its dimensions, theoretical underpinnings, and measurement methods, organizations can implement strategies to enhance job satisfaction, thereby fostering a more engaged, productive, and stable workforce.

Turnover intention

As stated previously, job satisfaction and turnover intention are closely linked. Turnover intention is defined as an employee's conscious and deliberate willingness to leave their current job, serving as a critical precursor to actual turnover, which can have substantial ramifications for organizational performance, morale, and overall stability (Hom et al., 2017).

Antecedents play an important part when taking a closer look at turnover intentions in research. The antecedents of turnover intention are multifaceted, encompassing individual, organizational, and environmental factors. At the individual level, demographic variables such as age, tenure, education, and personality traits (e.g., neuroticism, conscientiousness) have been examined. Younger employees and those with shorter tenure are generally found to exhibit higher turnover intention, likely due to a stronger desire for career advancement and lower organizational commitment (Özkan, 2023). Personality traits, specifically high neuroticism and low conscientiousness, have also been associated with greater turnover intention (Zimmerman, 2008). At the organizational level, job satisfaction and organizational commitment are among the most potent predictors of turnover intention. Employees with high job satisfaction and commitment are less likely to leave (Ramalho Luz et al., 2018). Leadership and managerial practices also play a pivotal role. Transformational leadership, characterized by inspiring and motivating employees, is often linked to reduced turnover intention, while abusive supervision and lack of managerial support can significantly elevate turnover intention (Ilyas et al., 2025). Turnover intention can lead to actual turnover, imposing direct costs related to recruitment and training, as well as indirect costs such as loss of organizational knowledge, decreased productivity, and diminished morale (Hancock et al., 2013). Additionally, turnover intention can create a ripple effect, where the departure of one employee triggers additional turnover (Park & Shaw, 2013).

Khanam and Tarab (2024) state that the complex and multifactorial construct of turnover intention significantly impacts organizational stability and performance. By understanding its antecedents, consequences, and underlying theoretical frameworks, organizations can develop effective strategies to mitigate turnover intention, thereby enhancing employee retention and organizational effectiveness. Continuous research and tailored interventions are essential to addressing the dynamic nature of turnover intention in an ever-evolving workplace environment (Lopes et al., 2025).

Method

A cross-sectional questionnaire study featuring an online-based questionnaire was conducted. The questionnaire consisted of the following scales: barriers to learning (Anselmann, 2022b), the informal workplace component scale (Decius et al., 2019),

a job satisfaction scale (Spector, 1985), and turnover intention (Kenny et al., 2016). In addition, participant demographic data were collected. Since all constructs were assessed through self-report at a single measurement occasion, several procedural steps were implemented to minimize potential method-related inflation. Items from different scales were presented in randomized order, and response formats differed across instruments to reduce response patterns driven by scale familiarity or consistency motives. The survey was also administered anonymously, which is known to lessen social desirability influences and reduce participants' tendencies to provide overly positive or uniform responses (Podsakoff et al., 2023). These procedural safeguards were incorporated to limit the likelihood that shared response tendencies, rather than substantive perceptions, would artificially increase the correlations among the measured constructs.

Sample

A total of 230 participants from the fields of human resource (HR) development and organizational consulting participated in the study (59.7% female, 38.4% male, 1.9% declined to answer; age: $M=41.30$ years, $Min=25$, $Max=66$, $SD=11.54$). The participants were employed or freelancing in German-speaking companies across four countries (Germany, Austria, Switzerland, and Liechtenstein). They had an average of 14.27 years of work experience ($Min=1$, $Max=39$, $SD=16.79$). More than 96% held at least a bachelor's degree, while 78% held either a master's degree or graduated with an older but equal degree, like a diploma. Their degrees covered a wide range of topics, including economics (48.7%), psychology (21.5%), educational science (14.4%), engineering (7.2%), and other fields (8.2%). The participants' main work activities varied from company and contract work but covered the following aspects typically related to the work environment: organization of employee recruitment; employer branding and personnel marketing; promotion of the corporate culture and establishment of remuneration systems and guidelines; market development analysis; support for digitalization processes; support for mergers and company take-overs; support with start-ups; and controlling.

Procedure

The data collection started in January 2022 and ended in July 2022. Throughout the entire research process, we adhered to the General Data Protection Regulation (GDPR) of the European Union, as well as to the ethical guidelines of the American Psychological Association, ensuring transparency, informed consent, and secure data handling. Before distributing the survey, we provided participants with clear information regarding data usage, anonymity, and their right to withdraw. Additionally, we established a procedure index, which was approved by our universities' data protection officers to ensure GDPR compliance.

We distributed the survey using EFS Survey Software by UNIPARK, a digital platform with secure data encryption and controlled access. In accordance with institutional guidelines, we ensured proper data storage and applied pseudonymization techniques where necessary. The entire research process, including question-

naire development, was reviewed and approved by the university's ethics committee, receiving a positive vote without constraints. Upon completion, we conducted statistical analyses using IBM SPSS Statistics 27 and Mplus Version 8.7 to derive meaningful conclusions, ensuring transparency and reproducibility in our results.

Recruitment occurred across four channels: LinkedIn (targeted professional networks; estimated reach ≈ 1.000), Facebook (open professional groups; estimated reach ≈ 400), two domain specific blogs (estimated reach ≈ 500), and targeted email invitations to consultants ($N=375$). Based on platform analytics, approximately 2.300–2.400 individuals viewed the invitation. With 230 completed surveys, the approximate response rate was 9 to 10 percent. To target consultants, keyword searches were utilized with terms like “HR consultancy,” “outplacement consultancy,” “recruitment,” “human resource development,” “professional training,” and “professional coaching.” In the next phase, consultants were sent an email invitation to participate in the study, along with a brief introduction and key study details. A follow-up reminder was sent two weeks after the initial email to encourage participation and maximize response rates. The participants required approximately 25 min to complete the online questionnaire. We acknowledge that recruiting through HR- and consultancy-related channels may overrepresent employees with strong occupational identity or heightened sensitivity to workplace learning conditions (Aguinis et al., 2021). We therefore treat our sample as convenience-based rather than representative of the general workforce.

Several procedural measures were implemented to reduce the risk of common method bias associated with single-source, single-wave data collection. Items from different constructs were presented in randomized order, response formats varied across scales, and the survey was administered anonymously to discourage socially desirable responding and reduce consistency-based answering patterns (Podsakoff et al., 2023). These steps were incorporated to help limit the extent to which shared measurement context might artificially increase correlations among variables.

Instruments

Within this section, the scales used are briefly described, and item examples are given.

Table 1 gives a first overview of scales, items and Cronbach's alpha values of the scale items used in the questionnaire.

Barriers to learning

The barriers to learning instrument contains 53 items and 6 factors that identify obstacles that hinder employees' ability to learn and apply new learning at work (Anselmann, 2022b). It assesses individual components (19 items), technical limitations (3 items), structural components (11 items), resource constraints (10 items), team constraints (4 items), and organizational limitations (6 items) such as limited time, lack of managerial support, and resistance to change. The instrument uses a 5-point Likert-scale, with 1 expressing total disagree, 3 undecided and 5 total agree. Understanding these barriers allows organizations to implement targeted interventions to improve learning conditions. By identifying common challenges, companies

Table 1 Overview of scales, items and Cronbach's alpha values of the scale items used in the questionnaire

Scale (number of items)	Item example	α	M	SD
Barriers to formal learning				
Individual components (19)	Learning means additional work for me	.81	1.74	.57
Technical limitations (3)	I experience technical limitations while using devices	.82	1.79	.94
Structural components (11)	I have no access to appropriate information at work	.86	1.68	.55
Resource constraints (10)	Due to my location, I do not have easily access to further training opportunities	.82	1.70	.61
Team constraints (4)	The exchange with team members is difficult	.85	1.96	.73
Organizational limitations (6)	I have difficulties getting time off from work to participate in further training	.86	2.05	.70
Informal workplace learning component				
Trying and applying own ideas (3)	I try out my own ideas for new tasks	.82	1.84	.65
Model learning (3)	I look at how my colleagues work so I do not make the same mistakes as they do	.79	1.77	.73
Direct feedback (3)	I ask my foreman or head when I am not sure how well I worked	.88	3.38	.58
Vicarious feedback (3)	I ask my colleagues about the methods and tricks they use at work	.85	3.26	.61
Anticipatory reflection (3)	Before work, I think about how I prepare my workplace	.87	2.67	.74
Subsequent reflection (3)	When I have finished a new task, I think about what I still could do better next time	.80	2.84	.85
Extrinsic intent to learn (3)	I want to learn something new for myself because then I am better at work than my colleagues	.91	1.99	.59
Intrinsic intent to learn (3)	I want to learn something new for myself because then I can solve problems at work faster	.86	2.03	.64
Job Satisfaction				
Intrinsic cluster (18)	I like doing the things I do at work	.82	3.08	.83
Extrinsic cluster (18)	I feel I am being paid a fair amount for the work I do	.86	2.51	.91
Turnover Intention				
Work environment satisfaction (5)	Are you satisfied with the physical work environment and equipment?	.87	1.79	.78
Work hours & wages satisfaction (5)	Are you satisfied with your current hours of work in this job?	.85	2.30	.73

can create strategies to enhance workplace training and knowledge-sharing culture. This instrument is particularly useful for organizations looking to improve learning efficiency. Structural components refer to formalized processes, workflow design, and role clarity, capturing the procedural architecture through which work is coordinated (Decius et al., 2023). Organizational limitations, in contrast, capture strategic and cultural features of the organization, including the presence of learning policies, leadership orientation, and overarching support structures (Barrett, 2021). Interpersonal constraints represent relational dynamics within teams, such as communication quality, psychological safety, and conflict patterns.

Informal workplace component

The informal workplace component instrument by Decius et al. (2019) contains 24 items and assesses how employees engage in self-directed and experiential learning within their work environment. The instrument uses a 4-point Likert-scale, with 1 expressing total disagree and 4 total agree. Informal learning plays a crucial role in skill development and adaptation to changing work demands. This scale captures aspects such as knowledge acquisition through trial and error, collaboration with colleagues, and feedback-seeking behavior. It examines the extent to which employees proactively explore new ideas and integrate learning into their daily tasks. By measuring informal learning behaviors, organizations can identify ways to foster continuous development.

Job satisfaction

The job satisfaction instrument contains 36 items and evaluates employees' contentment with their work environment, responsibilities, and career progression (Spector, 1985). High job satisfaction is linked to increased motivation, performance, and retention. The instrument uses a 6-point Likert-scale, with 1 expressing disagree very much and 6 agree very much. The scale assesses key factors such as job role clarity, work-life balance, autonomy, and recognition. By measuring these elements, organizations can identify areas for improvement in employee well-being and engagement. The results can also help HR departments implement policies that enhance job satisfaction and productivity.

Turnover intention

The turnover intention instrument by Kenny et al. (2016) uses 10 items to assess employees' likelihood of leaving their current organization. The instrument uses a 5-point Likert-scale, with 1 expressing least satisfied and 5 most satisfied. Factors that influence turnover intention include job dissatisfaction, limited career growth, and workplace climate. By measuring employees' intent to leave, organizations can proactively address retention challenges and improve employee engagement. The results provide valuable insights into workplace dynamics and help HR teams implement retention strategies.

Demographic data

At 15 items, the demographic data section collected essential background information about the respondents. This data helped contextualize the survey findings by analyzing trends based on age, education, experience, and other personal attributes. While demographic details do not directly measure workplace factors, they are crucial for segmenting responses and identifying patterns across different groups. Accordingly, the data collected allowed for more nuanced and meaningful interpretations of the survey results.

Analyses

We employed a range of statistical analyses to ensure the validity, reliability, and robustness of our findings. All analyses were conducted using SPSS 27, MPLUS 8, and AMOS 27 following best practices in quantitative research.

We first performed factor analyses (exploratory and confirmatory) to examine the underlying structure of our survey instruments. Factor analysis helps determine construct validity by identifying latent variables that explain item correlations (Fabrigar & Wegener, 2012). Reliability was assessed using Cronbach's alpha, a widely used measure of internal consistency, where values above 0.70 indicate acceptable reliability (Taber, 2018).

Using descriptive statistics, we analyzed central tendencies (mean, median) and dispersion (standard deviation) to summarize key characteristics of the data (Field, 2022). Pearson correlations were calculated to assess the relationships between study variables, allowing us to explore bivariate associations and multicollinearity concerns (Schober et al., 2018). Additionally, we applied structural equation modeling (SEM) to examine complex relationships and consider multiple dependent variables simultaneously. Specifically, we used non-recursive models with feedback loops in AMOS 27 to capture bidirectional influences between constructs. Non-recursive models with feedback loops are an advanced subset of SEM used to analyze complex systems in which variables influence each other reciprocally over time. Unlike recursive models, which assume unidirectional causality, non-recursive models recognize that causality can be bidirectional, allowing for the incorporation of feedback mechanisms that more accurately reflect real-world dynamics (Kline, 2023; Pearl, 2009). These models are characterized by feedback loops, where at least one dependent variable influences another dependent variable, which in turn affects the original dependent variable. This interdependency is particularly relevant in systems where actions and reactions are interconnected and ongoing. Non-recursive models account for reciprocal causality, enhancing theoretical precision and reducing model specification errors (Byrne, 2016). Our analytical approach ensured methodological rigor, contributing to the robustness of our findings.

In specifying the structural model, we included several bidirectional paths between barrier categories to represent theoretical propositions that these constructs may be mutually associated within workplace learning environments. Because our data are cross-sectional, we emphasize that these non-recursive paths do not provide evidence of reciprocal causation. Our intention was not to test dynamic causal feedback loops but rather to examine whether theoretically suggested interdependencies are reflected in the observed pattern of associations. As Bollen (1989) and Kline (2016) note, structural equation modelling serves both theory-testing and theory-building purposes and can be appropriately used to evaluate theoretically motivated model structures even when causal directionality cannot be established.

In line with methodological guidance, reciprocal paths in cross-sectional SEM should therefore be interpreted as equilibrium associations rather than temporal or causal influences. MacCallum and Austin (2000) emphasize that cross-sectional SEM cannot determine temporal order, and Bollen and Pearl (2013) similarly caution that reciprocal paths in such models should not be understood as evidence of

dynamic causal processes. Guided by this literature, we interpret the bidirectional paths as reflecting interdependence among barrier categories rather than directional influence. To avoid overstating the implications of our findings, we now clearly note that the non-recursive structure is theory-driven and exploratory, and that longitudinal or experimental designs are required to assess whether the observed associations correspond to actual temporal or causal feedback mechanisms.

Results

This section presents the results of the empirical analysis aimed at uncovering the dynamic interrelations among barriers to workplace learning, job satisfaction, and turnover intention. The analyses proceeded in two phases. First, we conducted a Pearson correlation analysis to explore bivariate relationships among individual, structural, technical, and team components of learning barriers, as well as their associations with dimensions of individual learning behavior. Second, we implemented a SEM framework incorporating non-recursive paths and feedback loops to examine potential reciprocal relationships among key latent constructs, particularly focusing on organizational limitations, job satisfaction, and turnover intention.

Correlational analysis

A Pearson correlation matrix (see Table 2) provided a comprehensive view of the linear relationships among various components of learning barriers and learning-related behaviors. The variables examined included five primary dimensions of learning constraints: individual components, technical limitations, structural components, team constraints, and organizational limitations. Also included were multiple indicators of informal workplace learning (IWL): Feedback reception, containing direct feedback (IWL_dir_Feedback) and vicarious feedback (IWL_var_Feedback), as well as reflection (IWL_Reflection), and intent to learn (IWL_Intent). Referring to the original scales by Decious et al. (2019) the subscales anticipatory reflection and subsequent reflection are grouped to one subscale. The same goes for the subscales extrinsic

Table 2 Pearson correlation matrix of learning barriers and IL dimensions

	1	2	3	4	5	6	7	8	9	10
1. Individual components	-									
2. Technical limitations	.48**	-								
3. Structural components	.54**	.50**	-							
4. Resource constraints	.52**	.38**	.65**	-						
5. Team constraints	.40**	.35**	.61	.59**	-					
6. Organizational limitations	.46**	.41**	.64**	.70**	.63**	-				
7. IWL_Experience/Action	-.16*	-.02	-.06	-.01	-.02	-.65*	-			
8. IWL_dir_Feedback	.19**	.11	.18*	.18*	.21**	.19**	.17**	-		
9. IWL_var_Feedback	.04	-.17*	-.11	-.04	-.02	-.60	.25**	.34**	-	
10. IWL_Reflection	-.17*	-.12	-.15*	-.12	-.13	-.13	.25**	.03	.20**	-
11. IWL_Intent	-.20**	-.16*	-.08	-.03	-.20	-.11	.28**	.11	.33**	.35**

* $p < .05$, ** $p < .01$

intent to learn and intrinsic intent to learn. The subscale model learning has been excluded from the analyses. As well as for the subscales trying and applying own ideas and model learning (IWL_Experience/Action).

Interrelations among barriers to learning

The correlational findings demonstrated substantial interdependence among different forms of learning barriers. Individual components showed strong positive associations with technical limitations ($r=.48, p<.01$), structural components ($r=.54, p<.01$), organizational limitations ($r=.52, p<.01$), and team constraints ($r=.40, p<.01$), indicating that individual preconditions or limitations (e.g., competencies, cognitive load, or motivational states) are closely aligned with external and organizational barriers.

Similarly, technical limitations were significantly correlated with structural components ($r=.50, p<.01$) and team constraints ($r=.35, p<.01$), suggesting that deficiencies in resources or technologies tend to co-occur with more systemic or social structural deficits. Notably, structural components (e.g., role clarity, rules, or reporting hierarchies) were highly associated with organizational limitations ($r=.65, p<.01$) and team constraints ($r=.61, p<.01$), indicating that formal and informal structures jointly create a contextual web that can inhibit learning.

Taken together, these findings provide empirical support for the conceptualization of learning barriers as a multifaceted and interlocking system rather than isolated factors.

Relationships between learning barriers and informal workplace components

Significant inverse relationships were observed between several barrier components and dimensions of individual learning. Individual components were negatively correlated with IL_Try ($r=-.16, p<.05$), IL_Reflection ($r=-.17, p<.05$), and IL_Intent ($r=-.20, p<.01$), suggesting that individuals experiencing greater internal or dispositional limitations may be less inclined to engage in reflective or initiative-based learning.

Technical limitations were also negatively related to IL_var_Feedback ($r=-.17, p<.05$) and IL_Intent ($r=-.16, p<.05$), pointing toward the demotivating effect of inadequate technological infrastructure or digital competence gaps on learning engagement.

Conversely, team constraints and team dynamics were found to exhibit positive associations with feedback-seeking behavior. For instance, IL_dir_Feedback was positively associated with individual components ($r=.19, p<.01$), structural components ($r=.18, p<.01$), organizational limitations ($r=.18, p<.01$), and team constraints ($r=.21, p<.01$), suggesting that in challenging contexts, individuals may proactively seek direct feedback as a compensatory strategy. Interestingly, team dynamics were negatively correlated with IL_Try ($r=-.65, p<.05$), implying that stronger or more rigid team norms may discourage experimentation or risk-taking in individual learning processes.

Collectively, these findings point to a systemic entanglement of constraints, where individual, technical, and organizational barriers interact and mutually reinforce each

other while also influencing how individuals engage with their learning environment. Therefore, this correlation matrix provides insights into how different factors related to barriers to learning and organizational components are interrelated. It highlights the importance of individual components, technical limitations, structural and team constraints, and their relation to team dynamics and individual learning behaviors. Understanding these relationships can help in designing interventions to improve learning outcomes and job satisfaction while reducing turnover intentions.

SEM and feedback loops

To investigate the systemic and dynamic relationships among barriers to learning, job satisfaction, and turnover intention, we designed a non-recursive structural equation model with feedback loops. The model fit indices indicated an excellent fit to the data (CFI=.98; RMSR=.073; RMSEA=.04), providing confidence in the robustness of the model estimates (Fig. 1).

In specifying the structural model, we included several bidirectional paths between barrier categories to represent theoretical propositions that these constructs may be mutually associated within workplace learning environments. Because our data are cross-sectional, we emphasize that these non-recursive paths do not provide evidence of reciprocal causation. Our intention was not to test dynamic causal feedback loops but rather to examine whether theoretically suggested interdependencies are reflected in the observed pattern of associations. As Bollen (1989) and Kline (2016) note, structural equation modelling serves both theory-testing and theory-building purposes and can be appropriately used to evaluate theoretically motivated model structures even when causal directionality cannot be established.

In line with methodological guidance, reciprocal paths in cross-sectional SEM should therefore be interpreted as equilibrium associations rather than temporal or causal influences. MacCallum and Austin (2000) emphasize that cross-sectional SEM cannot determine temporal order, and Bollen and Pearl (2013) similarly caution that reciprocal paths in such models should not be understood as evidence of dynamic causal processes. Guided by this literature, we interpret the bidirectional paths as reflecting interdependence among barrier categories rather than directional influence. To avoid overstating the implications of our findings, we now clearly note that the non-recursive structure is theory-driven and exploratory, and that longitudinal or experimental designs are required to assess whether the observed associations correspond to actual temporal or causal feedback mechanisms.

Direct structural pathways

The structural model confirmed that individual components had substantial direct relations on technical limitations ($\beta=.70$, $p<.01$), structural components ($\beta=.74$, $p<.01$), and resource constraints ($\beta=.27$, $p<.01$). These pathways affirm the foundational role of individual predispositions in shaping perceived and experienced learning barriers.

Structural components in turn significantly relate to team constraints ($\beta=.716$, $p<.01$) and organizational limitations ($\beta=.47$, $p<.01$), indicating that more formal-

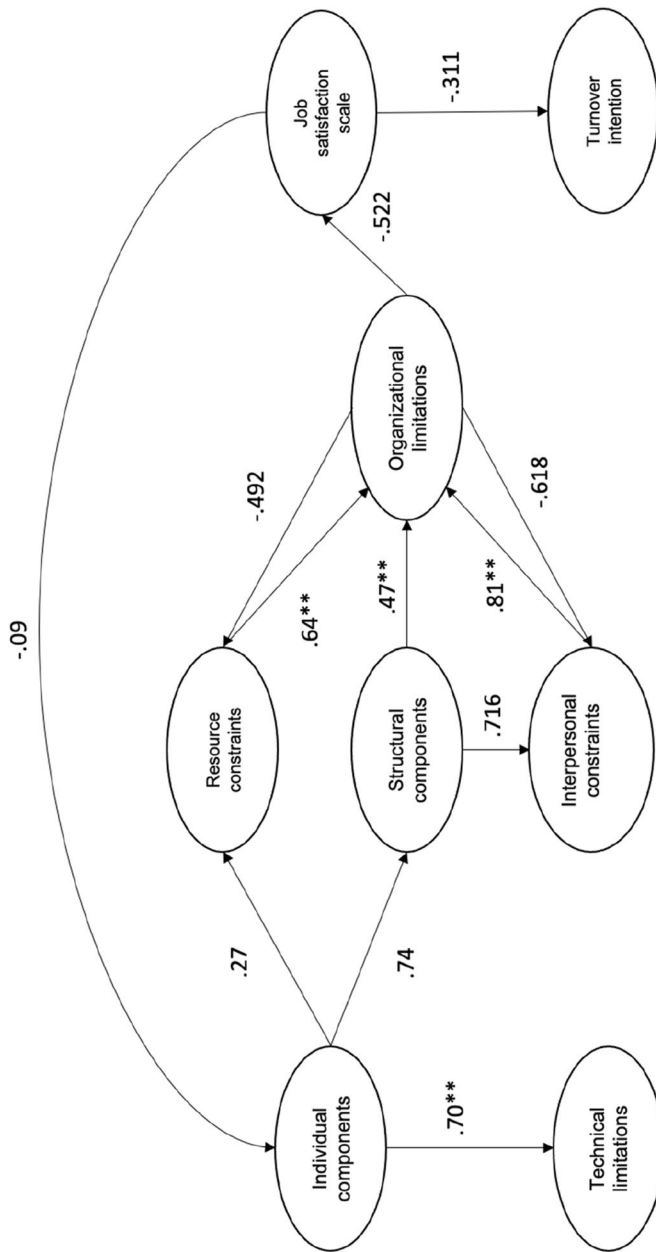


Fig. 1 Non-recursive model with feedback loops of learning barriers, job satisfaction, and turnover intention. Note. ** $p < .01$

ized or rigid organizational designs contribute to strained team relations and broader systemic issues within the organization.

Further, team constraints emerged as the strongest predictor of organizational limitations ($\beta = .81, p < .01$), highlighting how social tensions within teams or departments can escalate into more pervasive organizational challenges.

Relations on job satisfaction and turnover intention

The core finding from the SEM concerned the mediating role of organizational limitations in linking learning barriers with job satisfaction and turnover intention. Specifically, organizational limitations significantly reduced job satisfaction ($\beta = -.522, p < .01$), which in turn negatively predicted turnover intention ($\beta = -.311, p < .01$). Organizational limitations also had a direct relation on interpersonal constraints ($\beta = -.618, p < .01$), suggesting both mediated and unmediated pathways. Thus, the model delineates a dual-path mechanism through which systemic barriers in the learning environment lead to reduced job satisfaction and heightened turnover intention, both directly, through increased interpersonal constraints, and indirectly, through the detrimental relation of organizational limitations on employees' affective evaluations of their work.

Feedback loops and dynamic relationships

A distinct contribution of this study lies in our modeling of non-recursive feedback loops, which enabled an exploration of bidirectional relation among key variables, thereby addressing the research question concerning dynamic interdependencies. Three central feedback loops were identified:

Resource constraints $\leftrightarrow$ Organizational limitations.

While resource constraints reflected a lack of time, materials, or access to support, they also contributed to higher organizational limitations ($\beta = .64, p < .01$), indicating that insufficient resources are closely tied to broader systemic barriers within the learning environment.

Structural components $\leftrightarrow$ Organizational limitations.

Structural barriers had a substantial positive relation on organizational limitations ($\beta = .47, p < .01$), and given their association with team constraints and association with organizational limitations, which feed back into structural dynamics (organizational limitations), a multi-variable indirect loop was formed. This loop suggests a self-reinforcing mechanism in which systemic rigidity and hierarchy perpetuate broader organizational dysfunction.

Team constraints $\leftrightarrow$ Organizational limitations.

The strongest feedback dynamic was observed between team and organizational limitations ($\beta = .81, p < .01$). This direct feedback loop indicates that relational breakdowns within teams are not merely consequences of structural dysfunctions but may actively perpetuate or intensify organizational inefficiencies and authority-related conflicts, leading to a downward spiral in employee satisfaction and retention.

To enhance conceptual clarity and strengthen the practical relevance of the findings, we expanded the description of the learning barrier instrument to more explic-

itly reflect its underlying subdimensions. Although the higher-order barrier categories used in the analyses (e.g., individual, interpersonal, structural, and organizational barriers) provide a theoretically meaningful overview, each construct is composed of distinct, empirically validated subcomponents that describe more specific obstacles encountered in everyday work. These subdimensions include, for example, limited managerial support, insufficient time and resources for learning, rigid or inefficient work processes, resistance to change, and communication and coordination challenges within teams.

The factor structure of these subdimensions has been validated in earlier applications of the instrument (Anselmann, 2022a; Anselmann, 2022b), supporting the appropriateness of grouping them into higher-order constructs. In the present manuscript, we now summarize these key subdimensions and their representative item content to provide a clearer understanding of what each aggregate barrier category captures. This clarification helps to illustrate both the theoretical value of modelling barriers at a broader structural level and the practical implications of the specific obstacles reported by employees, thereby making the results more interpretable and actionable for organizational stakeholders.

The associations observed between interpersonal constraints and organizational limitations should be interpreted as co-occurring perceptions captured at a single measurement point, not as evidence of temporal or causal feedback processes. In the earlier version of the manuscript, terms such as “perpetuate” and “downward spiral” inadvertently implied longitudinal dynamics. These expressions have now been removed. Instead, we clarify that employees who report strained interpersonal relations within their teams also tend to perceive structural or strategic shortcomings at the organizational level.

Although organizational theory suggests that interpersonal dynamics and organizational structures may influence one another over time, our cross-sectional SEM does not allow such temporal conclusions. Methodological guidance emphasizes that reciprocal paths in cross-sectional models represent associational patterns, not causal or recursive mechanisms (Bollen, 1989; Kline, 2016). Accordingly, any notion that these constraints might form a reinforcing cycle should be understood as a theoretical proposition rather than an empirical finding.

At the same time, situating these associations within broader conceptual models remains useful. Cross-sectional SEM is often employed as a hypothesis-generating approach, highlighting relationships that merit closer investigation in longitudinal or multi-wave designs (Bollen & Pearl, 2013; MacCallum & Austin, 2000). The present findings therefore offer an initial empirical indication of potential interdependence among workplace constraints, while clearly acknowledging that future longitudinal research is required to test whether such relationships unfold over time.

These results demonstrate that learning barriers operate as a complex, interactive network with significant implications for employee outcomes. The use of a non-recursive SEM approach provided unique insights into the mutually reinforcing nature of workplace constraints, confirming that job satisfaction and turnover intention are deeply embedded in the organizational learning environment.

Discussion

Reviewing the findings

The findings of this study provide empirical support for the conceptualization of barriers to learning at the workplace as a complex and dynamic construct associated with interrelated individual, team, and organizational levels. The use of a non-recursive structural equation model with feedback loops extends current approaches to studying workplace learning by emphasizing reciprocal associations rather than unidirectional causality, offering a more holistic understanding of how learning barriers interact with job satisfaction and turnover intention.

While the associations observed between resource constraints, interpersonal tensions, and organizational limitations align with theoretical perspectives that conceptualize workplace learning environments as complex and interdependent systems, it is important to emphasize that our cross-sectional design cannot confirm dynamic or causal feedback processes. The patterns identified in the structural model represent relationships measured at a single point in time and should therefore be interpreted as concurrent associations rather than evidence of recursive or self-reinforcing mechanisms.

Any discussion of potential feedback loops is intended as a theoretical interpretation, informed by existing models of organizational functioning and constraint interdependence, rather than as an empirical demonstration of temporal dynamics. In line with this, we now explicitly note that these interpretations should be viewed as conceptual propositions that require verification in longitudinal or multi-wave studies capable of assessing whether such relationships unfold and reinforce one another over time.

By situating the findings within this appropriately cautious framework, the study contributes to a growing body of research suggesting that workplace constraints may be interconnected in ways that merit further investigation while avoiding overstated claims about processes that the present design cannot empirically establish.

Contribution to the understanding of barriers to learning

This study's results reinforce existing literature that highlights the multifactorial nature of learning barriers at work (Barrett, 2021; Crouse et al., 2011; Schilling & Kluge, 2009). Specifically, the organizational, technical, and team dimensions of learning barriers were shown to be significantly correlated, suggesting that organizational learning impediments do not occur in isolation, but as co-occurring patterns that may mutually reinforce one another. The strong correlations observed between organizational barriers and both team and individual barriers mirror earlier observations by Kezar and Holcombe (2020), who argue that rigid institutional structures can contribute to poor collaboration, power imbalances, and exclusion from learning opportunities.

The present study contributes to workplace learning research by mapping how negative learning conditions cluster within an integrated structural framework. Although the associations observed are consistent with theoretical accounts of inter-

connected workplace constraints, our cross-sectional design does not allow causal or dynamic inference. These findings complement existing models of learning climate and affordance-based learning by illustrating how constraints co-occur in employee perceptions. Future longitudinal research is needed to evaluate whether these associations reflect stable patterns or evolving dynamics within learning environments.

A novel contribution of this study lies in the identification of feedback loops between resource constraints, team tensions, and organizational dysfunction. These findings align with emerging work in organizational behavior that challenges linear models of workplace dynamics (Byrne, 2016; Kline, 2023), instead proposing that workplace systems are recursive and self-reinforcing. In particular, the observed loop between team constraints and organizational limitations suggests that poor team dynamics not only result from but also exacerbate dysfunctional learning environments. This expands on previous studies that recognize social relations to influence informal learning by demonstrating how these relations form bidirectional processes that impact organizational structures (Crans et al., 2021; Mishra, 2020).

Informal learning components and the impact of barriers to learning

Another central finding of this study is the differential relationship between learning barriers and informal learning dimensions such as trial-based learning, feedback-seeking behavior, and reflection. As the results show, higher levels of individual and technical barriers were consistently associated with reduced self-directed learning and motivation. This complements research by Eraut and Hirsh (2007) and Decius et al. (2024), who note that learners experiencing greater autonomy and access to resources are more likely to engage in informal and experiential learning.

Interestingly, the positive associations between feedback-seeking and several barrier components may indicate a compensatory behavior, wherein employees seek team validation or guidance in the face of systemic constraints. This may reflect a kind of adaptive learning behavior under unfavorable conditions, as also discussed in Bandura's (2001) theory of social cognitive learning, where learners mitigate challenges by increasing their engagement with social learning networks.

This study's findings raise a critical consideration for practice: While feedback-seeking may be an adaptive response, it is not a sufficient solution for systemic issues. The reciprocal model indicates that unless team and organizational limitations are addressed at their root, individual strategies to overcome learning constraints may only provide temporary relief, not sustainable learning engagement.

Job satisfaction, turnover intention, and organizational fit

This study makes a significant contribution to the understanding of how learning barriers are associated with job satisfaction and turnover intention. The structural model demonstrated both direct and mediated effects, with organizational limitations acting as a central variable. This reinforces earlier work by Spector and Fox (2005) and Judge et al. (2017), who identify job satisfaction as a primary determinant of workplace outcomes. The current model builds on this by demonstrating how learning-

related barriers, often overlooked in job satisfaction research, form part of a feedback system that decreases workplace morale and increases the likelihood of attrition.

Furthermore, the direct negative relation of organizational limitations on turnover intention, beyond the indirect pathway through job satisfaction suggests that systemic learning conditions alone may be sufficient to influence an employee's decision to leave. This is consistent with findings by Podsakoff et al. (2018) and Özkan (2023), who highlight the impact of environmental and structural factors on retention outcomes. By incorporating these dynamics into a reciprocal model, this study contributes to the growing call for integrating learning-related constructs into broader models of employee retention and workplace well-being.

Methodological considerations and limitations

One of the major strengths of this research lies in the application of non-recursive SEM. This advanced analytical approach provides deeper insight into the dynamic and reciprocal relationships among constructs, addressing a common limitation in earlier workplace learning studies, which have typically relied on linear models (Hoyle, 2012; Pearl, 2009). However, despite the theoretical and methodological advancements, several limitations warrant consideration.

First, the use of a cross-sectional design constrains the ability to make causal inferences or evaluate the evolution of feedback loops over time. Longitudinal studies are necessary to observe the actual temporal dynamics suggested by the model.

Second, while the sample size of 230 participants provided a solid base for structural modeling, the study population consisting of consultants in HR development and organizational development from German-speaking countries, may limit the results' generalizability. Different sectors or cultural contexts may exhibit unique organizational constraints or learning norms (Tynjälä, 2022). Future research might consider expanding the model cross-culturally or across industries with different learning ecosystems.

Third, is grounded in the reliance on self-reported data, which may be influenced by social desirability or recall bias. Triangulating data through observational or performance-based measures of informal learning engagement and organizational behavior would help validate and enrich these findings (Field, 2022).

A final limitation of the present study is its reliance on self-report data collected at one point in time. Although procedural measures such as randomized item ordering, varying response formats, and anonymous administration were used to reduce potential consistency motives and social desirability artifacts, we recognize that common method bias cannot be ruled out entirely. Respondents' general affective states or evaluative orientations may have contributed to shared variance across the constructs assessed. We therefore interpret the magnitude of the associations with appropriate caution and recommend that future research incorporate multi-source data, objective indicators of learning activities, or temporal separation of measures to strengthen methodological rigor and reduce the risk of shared-source inflation (Aguinis et al., 2021; Podsakoff et al., 2023).

Since all constructs were assessed through self-report at a single time point, the findings may in part reflect shared evaluative tendencies among respondents. Individ-

uals experiencing dissatisfaction or strain may provide consistently negative ratings across both barrier and outcome measures, introducing potential common method variance that cannot be completely eliminated despite procedural safeguards (Podsakoff et al., 2023). As a result, the magnitude of the associations reported in this study should be interpreted with caution. Future research should incorporate multi-source data and objective indicators such as supervisor evaluations or HR records to reduce the influence of shared method effects and improve the robustness of conclusions (Aguinis et al., 2021).

Practical implications and future research

The findings have several implications for both research and practice. From a practical standpoint, organizations seeking to improve learning outcomes and employee retention must address learning barriers not as isolated challenges but as dynamic and systemic issues. Targeted interventions should focus on structural flexibility, team trust-building, and resource accessibility, with recognition of how these factors interact recursively. For instance, leadership development programs should not only teach managers to support learning but also to recognize when team constraints may be reinforcing deeper organizational issues. Similarly, efforts to enhance informal learning, such as mentorship programs or collaborative platforms, should be embedded within organizational structures to enable autonomy and psychological safety (Bakker & Demerouti, 2017; Edmondson, 1999).

In terms of theory, this study highlights the value of integrating learning theory, organizational psychology, and systems thinking. Further research can explore whether similar feedback loops exist between other variables in workplace learning environments, such as innovation, psychological safety, or team cohesion. Additionally, machine learning techniques and dynamic modeling can be employed to simulate and predict the evolution of organizational learning climates based on shifts in barrier dynamics (Hoyle, 2012).

Conclusion

In this study, we examined barriers to workplace learning as a dynamic, multidimensional construct and their implications for job satisfaction and turnover intention. By applying a non-recursive structural equation model with feedback loops, we identified how individual, team, and organizational barriers are interrelated with informal learning engagement and employee outcomes.

The central contribution of this research lies in demonstrating that barriers to learning are part of a mutually reinforcing system, where structural and organizational limitations influence not only learning behavior but also broader workforce dynamics. Organizational limitations were especially shown to significantly reduce job satisfaction and increase turnover intention, both directly and indirectly. These findings suggest that improving workplace learning conditions may be a powerful lever not only for skill development but also for organizational retention and employee well-being.

By shedding light on these systemic relationships, this research provides a theoretical and empirical foundation for more integrated workplace learning models and invites further inquiry into the dynamic feedback mechanisms that shape modern organizational learning.

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Authors' contributions All authors whose names appear on the submission made substantial contributions to the conception and design of the work, and the analysis of the data. S.A. drafted the work and V.A. revised it critically for important intellectual content and approved the version to be published. Both agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. S.A.: Conceptualization, Investigation, Design, Resources, Writing V.A.: Methodology.

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Data availability The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Declarations

Ethics approval and consent to participate The study has been reviewed and approved by the ethics committee of the University of Education Schwäbisch Gmünd, receiving a positive vote without constraints.

Consent for publication Throughout the entire research process, we adhered to the General Data Protection Regulation (GDPR) of the European Union, as well as to the ethical guidelines of the American Psychological Association, ensuring transparency, informed consent, and secure data handling. Before distributing the survey, we provided participants with clear information regarding data usage, anonymity, and their right to withdraw. Additionally, we established a procedure index, which was approved by our universities' data protection officers to ensure GDPR compliance.

We distributed the survey using EFS Survey Software by UNIPARK, a digital platform with secure data encryption and controlled access.

Competing interests The authors declare no competing interests.

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