

Workplace learning in the green transition: competence development in the Swedish mining industry

Annika Pekkari

*Department of Human and Technology, Luleå University of Technology,
Luleå, Sweden*

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Abstract

Purpose – This study aims to examine workplace learning and competence development in the Swedish mining industry amid the green transition and ongoing technical development, the dual transition. It explores how miners' learning expectations are experienced, negotiated and enacted in everyday work.

Design/methodology/approach – Two qualitative studies were conducted at three mines operated by two companies, involving 14 interviews, six workshops and two focus group discussions with mining personnel.

Findings – Miners demonstrate a strong willingness to learn, driven by professional pride and a desire to contribute to both the collective and the green transition. Collective workplace learning enables adaptation, yet may also normalize uneven organizational conditions and mask structural limits to competence development. While collective workplace learning remains vital, emerging competence demands under the dual transition may exceed what informal, peer-based learning alone can sustain.

Practical implications – Clearer alignment between competence demands and organizational arrangements is essential to support miners' long-term learning and competence development as mining work evolves under the dual transition.

Originality/value – This study empirically shows how macro-level transformations, meso-level organizational arrangements and micro-level collective practices interact to shape workplace learning under the dual transition. Furthermore, by engaging sociocultural perspectives, this study examines how collective participation and shared norms mediate the dual transition, illustrating how continuity and transformation coexist and are negotiated in everyday work practices.

Keywords Communities of practice, Competence development, Dual transition, Green transition, Miner, Mining industry, Sociocultural theory, Technical development, Workplace learning, Worker collective

Paper type Research paper

Introduction

Once described as reluctant learners, miners today express a strong drive to acquire new competencies and a willingness to learn and adapt as the green transition and technical developments reshape mining work. This article explores how miners' workplace learning, competence development and further education are addressed in the Swedish mining industry.

Mining is increasingly framed as part of the green transition through its supply of critical raw materials for electrification, digitalization and battery production (European Commission, 2019; Dehaine *et al.*, 2020; Jensen and Sandström, 2021). These developments are closely intertwined



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with ongoing technical change. In this study, these intertwined processes of green transition and technical development are referred to as the dual transition. The dual transition transforms work and intensifies the need for learning and competence development (European Commission, 2020a, 2020b), particularly in sectors such as mining (Abrahamsson and Johansson, 2020; Herbert and Hidalgo, 2021).

As technology advances, miners are expected to shift from relying on physical, tacit knowledge to mastering more abstract, digital competencies and remote operations (Abrahamsson and Johansson, 2006). These changes intensify needs for upskilling and reskilling (Onifade *et al.*, 2023) and, as Lundmark *et al.* (2022) describe, requalification, in which competencies are replaced, combined and recombined rather than simply substituted. Together, these processes signal a shift in how competence is defined under the green transition (European Commission, 2020b; OECD, 2023).

In recent years, learning and further education have become increasingly recognized as strategic assets in the mining industry, as a skilled and engaged workforce can enhance both productivity and safety, often at a lower cost than investing in new technologies. This reinforces earlier arguments that mining companies need to develop as learning organizations (Ala-Härkönen and Rutenberg, 1993; Lööw *et al.*, 2019). Workplace learning has gained increasing prominence in mining policy and practice, as further education is framed as a cost-effective investment rather than an expense (Abenov *et al.*, 2023). Financial constraints are typically not perceived as a major obstacle to competence development (Pekkari *et al.*, 2025). Instead, time constraints often limit opportunities for both formal training and reflective learning (MacMahon *et al.*, 2024).

The pressure for rapid, continuous learning in the mining industry is expected to intensify amid technical, economic and environmental developments (Pekkari *et al.*, 2025), as mining operators are increasingly expected to acquire new skills in response to digitalization and automation (Tariq *et al.*, 2025). Yet, some actors involved in developing new technologies and work environments express limited confidence in miners' learning capacity, an attitude that may shape how technologies and competence initiatives are designed (Pekkari *et al.*, 2025). This constellation of heightened workplace learning expectations, persistent time constraints and assumptions about miners' learning capacity makes it particularly relevant to examine how workplace learning and competence development are understood, enacted and experienced by miners themselves, and how these processes are shaped in everyday work practices and by organizational conditions under the dual transition.

The aim of this article is to explore how miners' workplace learning and competence development are experienced and shaped in the Swedish mining industry under the dual transition. The first research question examines how employees perceive the relationship between workplace learning expectations and organizational support and resources. The second focuses on how miners balance individual responsibility for competence development with collective peer expectations. The third examines how miners' learning and competence development can be interpreted through the lenses of communities of practice and the worker collective.

In this study, *workplace learning* occurs in, through, or as a consequence of work and is directed toward *competence development*, defined as the ongoing development of knowledge, skills and professional judgment required to perform one's work. *Further education* refers to formal or informal activities that support the development of such competence. The *green transition* (European Commission, 2019) is understood as a multilevel process aimed at *sustainable development* (United Nations General Assembly, 2015) across ecological, social and economic dimensions (WCED, 1987). *Technical development* refers to ongoing processes of change, including the implementation and adaptation of new and existing technologies.

The intertwined processes of the green transition and technical development are referred to as the *dual transition*.

Perspectives on workplace learning in the mining industry

In general, workplace learning cannot be understood as a linear or neutral process, but is situated, negotiated and shaped by both enabling and constraining factors (Billett, 2004; Dochy, 2021; Cairns, 2022; Wiklund-Engblom *et al.*, 2023). As a result, learning is not inherently positive or problem-solving in nature, but may also reproduce discipline, conformity and established norms within work practices (Lindberg *et al.*, 2023; Vesterberg, 2023; Johansson and Ringblom, 2017). How these dynamics unfold is highly context-dependent and shaped by the specific histories, cultures and identities of workplaces.

Historically, the male mining collective has at times shown reluctance toward learning and competence development, as acquiring new knowledge was considered unmanly (Somerville and Abrahamsson, 2003). This traditional mining masculinity is being challenged by technical and organizational changes (Abrahamsson and Johansson, 2020; Abrahamsson *et al.*, 2024). At the same time, new technology and work practices may create opportunities for gender equality (Somerville and Abrahamsson, 2003; Abrahamsson and Johansson, 2006) and support conditions for sustainable organizational learning (Abrahamsson and Johansson, 2008, 2020; Abrahamsson *et al.*, 2024).

For miners, workplace learning is often informal and embedded in everyday work where knowledge develops through collaboration, observation and problem-solving (MacMahon *et al.*, 2024). It is shaped by workplace cultures and embodied experiences, as learning is situated, relational and closely tied to identity, belonging and everyday practice. Therefore, learning is not merely a matter of knowledge transfer, but of workers' participation in the work community. In practice, workplace learning among miners typically occurs through hands-on tasks, peer interaction and social activities, where thinking, doing and identity evolve in parallel (Billett and Somerville, 2004). Forming a vocational identity as a miner can thus be understood as a form of learning in itself, involving shared understandings of legitimate practice and of what kinds of identities are possible, as well as recognition by others (Abrahamsson and Johansson, 2008).

Billett (1994) argues that learning amongst miners is most effective when individuals take active responsibility and integrate it into work practices, social relations and workplace culture rather than through formal training. Therefore, learning cannot be imposed; it must be appropriated through meaningful engagement with daily experiences (Billett, 1994). This perspective directs attention away from workplace learning as a formal activity and toward its embedding in miners' everyday work practices. Peer mentoring is central but also involves risks; the miners' mentors may lack adequate competence (MacMahon *et al.*, 2024) or reinforce problematic routines or attitudes (Lindberg *et al.*, 2023).

Palka (2017) notes a growing awareness among miners of the importance of continuous competence development, along with a willingness to engage when it feels relevant and meaningful. At the same time, many miners perceive current initiatives as insufficient, monotonous and poorly aligned with technical developments. Together, these observations point to the need to shift the focus from good enough performance toward mastery (MacMahon *et al.*, 2024) and to align with miners' call for stronger connections between theory and practice, greater use of contemporary pedagogical approaches and clearer communication. These conditions may enable more needs-based, well-designed learning strategies that enhance individual performance while also supporting long-term organizational development (Palka, 2017).

Understanding these tensions involves examining how expectations for workplace learning are shaped and negotiated across interconnected levels. Workplace learning is often theorized

through a focus on meso-level organizational processes, emphasizing how learning is shaped by organizational structures, cultures and practices (Gustavsson and Thunborg, 2016). This perspective has yielded valuable insights, particularly into the conditions under which employees can learn at work. However, fewer studies have examined how macro-level dynamics, such as the green transition, global competition, digitalization and sustainability agendas, reshape competence needs in terms of content, pace and scope. While they may not alter the basic logic of workplace learning, these changes are translated into organizational strategies and resources at the meso-level and ultimately encountered by miners at the micro level, where they are experienced and negotiated in work. In this article, the focus is on how employees make sense of and navigate these changes in practice, by approaching workplace learning as a social and situated process, drawing on two key theoretical concepts: communities of practice (Lave and Wenger, 1991/2008) and the worker collective (Lysgaard, 1961), which will be outlined in the following section.

The dynamics of sociocultural learning

One way to understand workplace learning is through the theory of *communities of practice*, developed by Lave and Wenger (1991). They conceptualize learning not as an individual cognitive process but as a social and situated phenomenon that emerges through participation in shared practice. In contexts such as mining, learning is closely tied to safety-critical work, embodied skills and collective coordination, making sociocultural perspectives relevant for analyzing how competence develops through participation in shared practice.

Communities of practice conceptualize learning as participation in social practice. People work together and foster learning through mutual engagement, joint enterprise and shared repertoires of routines and artifacts in these communities. Through these processes, a sense of belonging is developed, contributing to both individual and collective competence. Newcomers gradually transit from peripheral involvement to full membership in the community as they gain experience and contribute more actively to shared practices, a process known as *legitimate peripheral participation*. Hence, learning emerges through shared activities where meaning and competence are collectively negotiated and developed (Lave and Wenger, 1991/2008).

However, communities of practice are not inherently egalitarian, they may involve struggles over legitimacy and status, hinder learning and innovation and function as sites of social control that conceal internal conflicts (Contu and Willmott, 2003). This understanding aligns with Lysgaard's (1961) classic study of the *worker collective* (arbeiderkollektivet), which similarly emphasizes the formation of strong collective communities in industrial work. The worker collective provides support and identity, imposes norms, resists change and decides who belongs and who does not.

The worker collective exhibits fundamental resistance to management, fostering a broader culture of opposition to change and external control. Such resistance is established through shared norms that safeguard the group from managerial control and uphold employee dignity. Internal discipline and social control govern member behavior, maintaining the collective's cohesion and making it challenging for individuals to deviate without facing group resistance. Consequently, the worker collective functions as a social filter, interpreting external pressures through shared understandings of acceptable practice. From this viewpoint, resistance is not inherently irrational or individualistic but can embody deeply ingrained social logics (Lysgaard, 1961).

However, Fältholm (1998) argues that transformations like globalization, individualized work and lean production threaten the traditional worker collective. She suggests that as work becomes less central to people's identity, collective resistance and solidarity may weaken.

Nicolini *et al.* (2022) point out communities of practice as rooted in craft and preindustrial contexts, questioning their validity in today's working life. They raise questions about whether collective forms of identity, resistance and practice-based learning remain relevant in industrial settings shaped by technical transition and organizational reforms.

This study draws on sociocultural perspectives to examine how continuity and change are negotiated in everyday mining work under the dual transition, while engaging with debates about their scope and limitations (Fältholm, 1998; Nicolini *et al.*, 2022). The mining industry offers an empirical context in which rapid structural change coexists with strong traditions of collective work practices. Precisely because sociocultural theories conceptualize learning as embedded in practice, identity, collective norms and power relations, and thus tend to highlight continuity and stability, they are useful for examining how change is negotiated, absorbed or resisted in work, as well as how responsibility for workplace learning is distributed within collective practices under conditions of technical development and green transition.

In this article, sociocultural theory is used not as a comprehensive explanatory framework but as an analytical lens to examine tensions between continuity and change in workplace learning and to illuminate the enabling and constraining dynamics of competence development as experienced by miners. In this way, sociocultural perspectives provide conceptual tools for analyzing how participation and collective norms may both enable adaptation and reproduce patterns that shape workplace learning under the dual transition.

Methods

This article is based on two qualitative studies conducted at two Swedish mining companies, referred to here as Daggerstone Ltd. and Ironfell Inc. Both studies explored how employees in the mining industry experience workplace learning, competence development and further education.

One study was conducted at two sites within Daggerstone Ltd., a privately owned mining company: an underground polymetallic mine in southern Sweden and a copper open-pit mine in the north. Six workshops were held with homogeneous groups by job function: two with production workers, two with managers, one with technicians and one with support staff (e.g. HR). Each workshop lasted about 3 h and was facilitated by my colleague, Professor Jan Johansson and me. Two company representatives also attended, a factor considered in the analysis, as their presence may have influenced the discussions, although no clear effects were observed.

The other study was conducted within two mining companies and included 14 interviews and two focus group discussions with employees. The study included the same two sites at Daggerstone Ltd. as those used in the workshop study. It also involved Ironfell Inc., a state-owned company operating multiple sites. Here, the focus was on one underground iron ore mine in northern Sweden. A semi-structured guide with open-ended questions was used in this study, addressing workplace learning, competence development and further education. Table 1 provides an overview of the data collection methods, including the number of occasions and participants.

Data were collected using methods designed to capture participants' meaning-making and provide rich, nuanced insights (Bryman, 2018) into workplace learning and competence development in mining contexts. Individual interviews revealed how participants interpret and navigate their reality and perspectives, while workshops and focus groups enabled participants to articulate and challenge their views in dialogue with others, allowing both shared patterns and differences to emerge (Flick, 2023). This methodological triangulation enriched the material and contributed to theoretical saturation. Table 2 provides an overview

Table 1. Compilation of data collection

Data collection method	No. of collection events	Total no. of participants	... of which were men	... of which were women	Mining company
Workshops	6	43	28	15	Daggerstone (two mines)
Individual interviews	7	7	4	3	Daggerstone (two mines)
Individual interviews	7	7	3	4	Ironfell (one mine)
Focus group discussions	2	7	5	2	Ironfell (one mine)
Total	22	64	40	24	Daggerstone and Ironfell (three mines)

Source(s): Author’s own work

Table 2. Overview of occupational roles and analytical groupings

Data collection method	Occupational role/ main work tasks	Referred to as
Workshops Interviews Focus group discussions	Driller, mechanic, loader, electrician, mining service, process operator	Miner
Workshops Interviews	Production manager Section manager Supervisor Planner	Manager
Workshops	HR personnel Technicians Work environment personnel	Support personnel

Source(s): Author’s own work

of occupational roles involved, the data collection methods and how participants are referred to in the analysis.

Not all data collection sessions were recorded. Two interviews, one focus group discussion and all workshops relied on detailed field notes, including summaries, quotations and contextual observations. The remaining interviews and one focus group discussion were transcribed *verbatim*. The mix of recorded and unrecorded material may be considered part of the study context rather than a limitation undermining data quality. The data were analyzed using reflexive thematic analysis (Flick, 2023).

The analysis followed an iterative, inductive process: beginning with repeated readings of the material to become familiar with the data, then generating initial codes that attended to recurring patterns and variations across occupational roles and sites. Initial coding resulted in codes related to: everyday workplace learning, formal and informal learning processes, motivations for learning, occupational pride, adaptability and willingness to engage in change. These initial codes were subsequently refined into broader categories: changes in everyday work practices, tacit knowledge, peer socialization and collective norms shaping learning practices, as well as organizational support and constraints for competence development.

These categories served as a basis for developing three analytically overarching themes: changing competence needs under conditions of the dual transition, tensions between expected competence development and available organizational support and workplace learning as a collective, practice-based process shaped by collegial relations and motivational drivers.

Sociocultural theory was introduced only after the empirical categories had been established and used reflexively to deepen the interpretation of patterns and tensions already present in the data, rather than to guide coding and categorization. As sociocultural perspectives tend to emphasize continuity, participation and the reproduction of practice, particular attention was paid to empirical accounts that indicate discontinuities or tensions exceeding established collective patterns. In this way, interpretation remained grounded in the material while analytically informed by theory. The study is based on employees' accounts and interpreted through a sociocultural analytical lens, a positioning that shapes what becomes visible in the analysis. The final analytical themes were also developed in close relation to the study's research questions.

The study adhered to Swedish ethical research principles and did not require formal approval from an ethics review board. However, some methodological considerations should be acknowledged. Participant selection differed between the companies: at Daggerstone, participants were selected by company-appointed contacts, while at Ironfell, participants were recruited through voluntary participation during on-site fieldwork. Participation in both cases was voluntary and contingent on not disrupting production. These different recruitment processes may have influenced the range of perspectives represented. In addition, data were collected using both face-to-face and digital methods.

As the study focuses on participants' accounts, it does not claim to capture workplace practices directly, but rather employees' interpretations and experiences of workplace learning. Sociocultural concepts are therefore used analytically to make sense of how participants understand, negotiate and make learning meaningful, rather than to empirically verify specific learning practices.

All data were collected in Swedish, and quotations were translated into English, with minor linguistic adjustments made to enhance readability while preserving meaning. Several managers had previously worked as production workers, and their reflections draw on experiences from across their careers; job titles in the quotations refer to participants' roles at the time of the interview.

Results

This chapter presents, analyzes and discusses the study's empirical findings in relation to its overall aim and research questions in three sections: *Learning on the Job*, *Conditions for Competence Development* and *Motivations for Competence Development*.

Learning on the job

The majority of employees perceive competence development as integral to their daily work. Informal workplace learning is particularly central among miners, who describe how learning occurs "naturally" in daily work through shadowing more experienced colleagues, observing, asking questions and solving problems together. Learning is thus intertwined with everyday work practices and social interaction, aligning with sociocultural perspectives that emphasize participation in shared practice (Lave and Wenger, 1991/2008) and workplace learning as situated and practice-based (Gustavsson, 2007; Lindberg *et al.*, 2023). One manager notes:

The exchange between colleagues is extremely important, especially with those who have been working longer. [...] Experience definitely carries the most weight, particularly in a workplace like this. (Manager, woman, interview, Ironfell Inc.)

This emphasis on experience and peer exchange resonates with earlier studies that conceptualize workplace learning in mining as socially situated and grounded in practical

engagement (Billett and Somerville, 2004; MacMahon *et al.*, 2024). Learning is described as an ongoing, collective process integrated into production work, as illustrated in the following comment:

It becomes an integrated form of learning together, all the time. There is a continuous exchange, which I think is really great. (Manager, woman, interview, Ironfell Inc.)

These accounts illustrate how workplace learning is experienced as relational, continuous and routine. At the same time, many employees express a desire for more structured support for further education, including site visits, job rotation, training centers, apprenticeships, mentorship and the exchange of experiences between different mining sites. This highlights a tension previously identified by Palka (2017), where miners value practice-based, relevant learning but often perceive existing training initiatives as insufficiently aligned with everyday work.

The findings point to a tension between peer-based learning embedded in everyday work and the need for more explicit organizational strategies for competence development, as miners continue to rely heavily on collective and experience-based forms of knowledge sharing. Under the dual transition, however, new knowledge must be introduced rather than gradually reproduced through practice. In this context, reliance on informal and collective learning alone becomes insufficient, increasing pressure on organizations to formalize competence development. This shift indicates that workplace learning under the dual transition extends beyond the stabilizing and reproductive dynamics emphasized in communities of practice and the worker collective (Lave and Wenger, 1991/2008; Lysgaard, 1961).

The majority of employees identified learning from experienced colleagues, involvement in early technical development, access to training centers, access to relevant information and space for reflection as key enablers of workplace learning. However, not all learning experiences are described as positive. Some employees point to inadequate instruction, poor onboarding or dysfunctional digital tools as barriers. Others note that mentors or instructors may leave apprentices too early or for extended periods, which can be understood as undermining legitimate peripheral participation and making integration into the workplace community of practice more difficult (Lave and Wenger, 1991/2008). These accounts illustrate how fragile learning through everyday work practices becomes when support from experienced colleagues is lacking or uneven.

This also illustrates that workplace learning is not inherently supportive, problem-solving or aligned with organizational goals (Lindberg *et al.*, 2023; Vesterberg, 2023; Johansson and Ringblom, 2017). Several employees stress that observation alone is insufficient, active participation and physically performing tasks are described as crucial for internalizing knowledge and building confidence, as shown in the following quote:

I can't learn just by standing around watching someone. I also have to participate in how to do the activity. That's usually when things go best. (Manager, woman, interview, Ironfell Inc.)

The findings indicate that workplace learning unfolds as a situated and relational process, closely tied to participation in everyday work activities rather than relying solely on formal instruction (Lave and Wenger, 1991/2008). In this sense, the results reinforce earlier arguments that mining organizations need to develop as learning organizations (Ala-Härkönen and Rutenberg, 1993; Löw *et al.*, 2019), as a way of responding to evolving competence demands.

Conditions for competence development

While workplace learning is sustained through everyday peer-based practices, the following section shifts focus to the organizational conditions that shape how competence development is supported under the dual transition. Many miners describe how new technologies and systems

are introduced without sufficient planning for competence development, leaving them to learn “on the side” while maintaining production. Under the dual transition, overlapping systems and continuous requalification (Lundmark *et al.*, 2022) become common, as employees are expected to master new technologies before fully understanding the system they replace. As one manager put it:

Have we ever received something that was actually finished, fully developed? (Manager, man, workshop, Daggerstone Ltd.)

This quote suggests that managers are aware of the lack of readiness that often accompanies the introduction of new systems. Under the dual transition, new competence demands are introduced that are not fully accommodated within existing organizational structures, leaving adaptation to be absorbed within everyday work practices. Rather than openly resisting these conditions, miners tend to collaborate and improvise. When meso-level structures provide limited scaffolding, micro-level collective practices compensate by sustaining learning informally within production. From the perspective of the worker collective (Lysgaard, 1961), such collective adaptation reflects a shared responsibility to uphold production. While the worker collective enables resilience, it may also compensate and normalize adaptation in ways that obscure the need for structural change. Communication about upcoming changes is perceived as insufficient, and as Palka (2017) notes, effective communication is essential. In these cases, earlier involvement of miners could support both the implementation and the learning of new technology (Löw, 2020; Tariq *et al.*, 2025).

In practice, competence development frequently relies on miners’ initiative and mutual support, often unfolding through problem-solving in everyday work, as Billett and Somerville (2004) also describe. Several participants emphasize that workplace learning would be strengthened if competence development were treated more explicitly as a long-term investment (Abenov *et al.*, 2023) and integrated into everyday operations in the same spirit as earlier safety initiatives. Interestingly, few participants explicitly describe financial resources as a limiting factor. Instead, they point to time, coordination and personal engagement as primary challenges, which aligns with findings from Pekkari *et al.* (2025). One participant puts it like this:

It’s usually not about money, but about time, willingness, and engagement. (Support personnel, man, workshop, Daggerstone Ltd.)

The quote also illustrates that personal motivation alone is not enough. However, economic considerations may play a significant yet often overlooked role, as workplace learning requires organizational space and support, which can be facilitated by financial support. This highlights a tension between employees’ expressed willingness to engage in competence development and the organizational conditions that enable such efforts. Although financial resources are rarely framed as the primary constraint, they remain a structural condition that enables time allocation and more systematic learning initiatives (European Commission, 2020b; OECD, 2023).

Like MacMahon *et al.* (2024) highlight, workplace learning often occurs under tight time constraints. Structural aspects of the work, including lean staffing and shift schedules, limit opportunities for learning and formal training. One of the most frequently mentioned barriers to further education is the perception of the organization as lean, or as one manager at Daggerstone Ltd. put it: “an anorexic organization.” With no staffing buffer, even short-term absences due to illness, childcare or vacation can become obstacles to competence development. One support personnel summarized the situation succinctly:

We are not dimensioned for this kind of learning, but for producing ore. (Support personnel, woman, workshop, Daggerstone Ltd.)

Despite several constraints on competence development, both companies have implemented supportive measures, such as structured onboarding, mentoring by experienced workers and individualized development plans, with follow-up discussions with their managers. There are also examples of training centers, job shadowing, scheduled handover sessions for knowledge and learning exchange between teams, and opportunities for role rotation and specialization. The participants describe a workplace culture in which knowledge sharing is encouraged, and professional development is met with positive attitudes from both peers and management.

Competence development within one's current role is generally welcomed and valued by colleagues, as it strengthens the collective. However, there are subtle indications that when such development leads to upward mobility, such as transitions into managerial positions, it may be met with a degree of ambivalence. From the perspective of the worker collective (Lysgaard, 1961), this reflects the normative boundaries of the group: competence-building that reinforces the collective is embraced, while movement away from it can be perceived as distancing oneself from shared experiences and identity. Although rarely openly expressed, this tension highlights how workplace learning is socially situated and interpreted within the workplace's cultural logic (Somerville and Abrahamsson, 2003; Billett and Somerville, 2004). This also suggests that competence development is shaped not only by organizational conditions but also by the social norms and identities that structure participation within the workplace.

These findings highlight the role of the organization as an intermediary level between structural transformation and everyday practice. While macro-level processes associated with the dual transition introduce new competence needs, it is at the meso-level that these needs are translated into concrete arrangements, priorities and resource allocations. The recurrent emphasis on time constraints, lean staffing and production demands indicates that organizational structures filter macro-level ambitions through existing operational logics. Organizational arrangements thus shape not only how these ambitions are implemented, but also the extent to which they can be realized in practice.

Motivations for competence development

The findings show that miners are generally open to technical change, although attitudes are not uniform across the companies. In some cases, resistance appears to stem less from technophobia and more from uncertainty about the direction of change, as one manager explains:

Some of those who are against development are just trying to protect their jobs. They don't understand the end goal. (Manager, man, workshop, Daggerstone Ltd.)

The reference to *the end goal* can be understood as reflecting how the dual transition is translated into organizational strategies and enacted in everyday work practices. At the same time, if this direction is not made explicit, employees may struggle to see the relevance of ongoing change efforts. This may also reflect a gap in how the industry's evolving identity is communicated and understood, as mining is repositioned from a source of environmental strain to a key contributor to the green transition and sustainable development (Dehaine *et al.*, 2020; Jensen and Sandström, 2021).

Differences in attitudes toward change create tension in the workplace. While resistance is often expressed at the individual level, it can influence the broader team climate, at times prompting more reluctant employees to leave the team or the company. Although colleagues

generally show understanding for those who need time to adapt, there is less tolerance for persistent resistance to learning and development, as shown in this quote:

If you're interested in your work and curious, then you're probably curious to learn. Then you probably want to as well. If you don't want to, then maybe you've lost the spark. Then maybe you're in the wrong place. (Miner, man, interview, Daggerstone Ltd.)

Conversely, resistance can also be socially constructed within a team, leading individuals to express resistance even when they are positively disposed. However, resistance may also be perceived as holding back collective progress, and there is a matter-of-fact recognition of the broader trajectory of change, a sense that adaptation is ultimately inevitable. One miner bluntly put it like this:

Everyone will have to accept and keep up with technical development sooner or later. (Miner, man, workshop, Daggerstone Ltd.)

Another miner instead sums up the situation like this:

If it doesn't suit you, then you should find another job. We're here voluntarily, after all. (Miner, male, workshop, Daggerstone Ltd.)

These statements reflect a broader acceptance of change as inevitable and workplace learning as a necessary response. This marks a shift from earlier accounts of resistance to learning in mining workplaces (Abrahamsson and Johansson, 2008, 2020; Abrahamsson *et al.*, 2024). These responses also reflect a moral logic within the worker collective (Lysgaard, 1961) and communities of practice (Lave and Wenger, 1991/2008), where motivation to learn is tied to being a reliable and contributing member. While these collective norms support adaptation under the dual transition, they may also marginalize those who struggle to keep pace. Learning thus becomes a socially recognized obligation rather than merely an individual choice.

Many miners show a strong personal drive to deepen and expand their competencies, not only to meet job requirements but out of a genuine desire to understand how things work and fit together. Competence is described as something that provides control, confidence and a sense of meaning. Another recurring motive for competence development is the ambition to excel, to be skilled, independent and reliable in their own eyes and the eyes of others. This was expressed in different ways. One miner with many years of experience in the mining industry said:

I still want to be the best. When I do something, I want to be damn good at it! (Miner, man, interview, Ironfell Inc.)

While another miner instead justified the desire to learn and develop like this:

You want to be as independent as possible. You want to be the one people turn to with questions. You know, to become a specialist in your work. That is what I aim for now: to become that specialist. (Miner, woman, interview, Daggerstone Ltd.)

These aspirations contrast with assumptions that miners are unwilling to engage in competence development (Pekkari *et al.*, 2025) and align with calls to move beyond basic proficiency toward broader mastery (MacMahon *et al.*, 2024).

The need for competence development is not only emphasized at the macro level (see e.g. European Commission, 2019; OECD, 2023). Several miners emphasize the importance of developing specialized skills as a key factor in motivation and professional pride. However, some roles are characterized by fixed routines and limited variation, leading miners to describe a "learning ceiling." Once work tasks are mastered, there is simply no room for

further growth unless one changes positions or occupations, which in turn requires reskilling (Onifade *et al.*, 2023). Some miners say that you cannot be better than best. This view may reflect the limited opportunities for advancement or recognition in their work. It can also be interpreted as a subtle form of resistance to dominant discourses of continuous improvement, in line with the protective functions of the worker collective (Lysgaard, 1961).

Many point out that there are no clear links between job roles and the required competences, making it difficult to know which competences are expected. Although salary is rarely discussed explicitly, frustration emerges when competence development does not translate into higher pay. Overall, miners consider their wages reasonable but comparatively low in relation to other industries requiring similar qualifications. Fixed pay scales and limited flexibility restrict formal recognition of competence and contribute to job mobility. As one manager observed:

It's insanely irritating that people switch jobs all the time just to get a raise – because salary can't be adjusted in any other way. (Manager, man, workshop, Daggerstone Ltd.)

While frustrations over pay reflect structural barriers, it also points to deeper questions of recognition and motivation. In contrast, the next quote captures the broader significance of workplace learning, not only as a personal or professional ambition, but as something that benefits the collective:

Everyone wins if we learn more. (Support personnel, woman, workshop, Daggerstone Ltd.)

These contrasting perspectives reflect different logics of participation, one shaped by organizational constraints, the other by shared values and collective responsibility. The accounts illustrate how motivation for competence development is situated within overlapping structural demands and collective expectations. In line with Communities of Practice (Lave and Wenger, 1991/2008) and the worker collective (Lysgaard, 1961), workplace learning emerges not primarily as individual advancement, but as participation in shared norms of belonging, mutual support and contribution to a common purpose.

Conclusions

The study demonstrates that workplace learning under the dual transition, understood here as the combined green transition and technical development of the mining industry, is structured through the dynamic interaction of macro-level transformation, meso-level organizational translation and micro-level collective regulation. Macro-level processes related to the dual transition generate new competence needs; meso-level organizational arrangements filter and condition how these needs are supported; and micro-level collective practices absorb and negotiate their implications in everyday work.

An analytical contribution of this study lies in showing how sociocultural perspectives such as communities of practice (Lave and Wenger, 1991) and the worker collective (Lysgaard, 1961) illuminate how the dual transition is mediated in everyday work. While these perspectives offer limited leverage for theorizing structural transformation or changing competence demands, they provide important insight into how such transformation is enacted into practice. Their focus on participation, belonging and collective norm formation makes visible how new competence demands are translated into everyday routines, morally regulated within peer groups and stabilized through collective adaptation. Sociocultural theory is not primarily designed to theorize rupture; rather, it clarifies how structural change is mediated, negotiated and integrated into everyday work practices.

A central empirical contribution of this study is the demonstration that miners are not reluctant learners, but highly motivated participants in competence development. Their motivation is rooted

in professional pride, aspirations for mastery and a desire to contribute to both their collective and the broader ambitions of the green transition. However, organizational arrangements do not always support this motivation. When structured learning opportunities are limited, responsibility for competence development shifts toward individuals and peer groups. In this context, competence development becomes not only a personal obligation but a collectively regulated expectation within peer cultures. Collective adaptation helps sustain production and integrate new demands into everyday routines, but it may also normalize uneven learning conditions and obscure structural constraints on workplace learning.

Taken together, the findings suggest that while workplace learning often occurs “through work,” emerging competence demands under the dual transition may exceed what informal practice-based learning alone can sustain. As the dual transition unfolds through everyday mining work, it reshapes not only work practices but also the conditions for how miners develop, share and sustain competence in practice.

References

- Abenov, T., Franklin-Hensler, M., Grabbert, T. and Larrat, T. (2023), “Has mining lost its luster? Why talent is moving elsewhere? Why talent is moving elsewhere and how to bring them back?” *McKinsey’s Metals and Mining and People and Organizational Performance Practices*.
- Abrahamsson, L. and Johansson, J. (2006), “From grounded skills to sky qualifications: a study of workers creating and recreating qualifications, identity and gender at an underground iron ore mine in Sweden”, *Journal of Industrial Relations*, Vol. 48 No. 5, pp. 657-676.
- Abrahamsson, L. and Johansson, J. (2008), “Future mining – workers’ skills, identity and gender when meeting changing technology”, First International Future Mining Conference. 19 - 21 November: International Future Mining Conference. Sydney, NSW, pp. 213-220.
- Abrahamsson, L. and Johansson, J. (2020), “Can new technology challenge macho-masculinities? The case of the mining industry”, *Mineral Economics*, Vol. 34 No. 2, pp. 263-275, doi: [10.1007/s13563-020-00221-8](https://doi.org/10.1007/s13563-020-00221-8).
- Abrahamsson, L., Johansson, K., Heimann, S. and Tosser Franklin, W. (2024), “Maskuliniteter i förändring på mansdominerade arbetsplatser. Exemplet gruvindustrin”, *Tidskrift För Genusvetenskap*, Vol. 44 Nos 1-2, pp. 34-57, doi: [10.55870/tgv.v44i1-2.13957](https://doi.org/10.55870/tgv.v44i1-2.13957).
- Ala-Härkönen, M. and Rutenberg, D. (1993), “The dawn of organizational learning in the mining industry”, *Resources Policy*, Vol. 19, No. 3, pp. 205-216.
- Billett, S. (1994), “Situated learning: a workplace experience”, *Australian Journal of Adult and Community Education*, Vol. 34 No. 2, pp. 112-130.
- Billett, S. (2004), “Workplace participatory practices: conceptualising workplaces as learning environments.” *The Journal of Workplace Learning*, Vol. 16 No. 6, pp. 312-324.
- Billett, S. and Somerville, M. (2004), “Transformations at work: identity and learning”, *Studies in Continuing Education*, Vol. 26 No. 2, pp. 309-326, doi: [10.1080/158037042000225272](https://doi.org/10.1080/158037042000225272).
- Bryman, A. (2018), *Samhällsvetenskapliga Metoder*, Liber, Stockholm.
- Cairns, L. (2022), “Learning and work: theories and developments”, in Malloch, I.M., Cairns, L., Evans, K. and O’Connor, B.N., *The SAGE Handbook of Learning and Work*, SAGE Publications, London, pp. 4-33.
- Contu, A. and Willmott, H.C. (2003), “Re-embedding situatedness: the importance of power relations in learning theory”, *Organization Science*, Vol. 14 No. 3, pp. 283-296.
- Dehaine, Q., Michaux, S.P., Pokki, J., Kivinen, M. and Butcher, A.R. (2020), “Battery minerals from Finland: improving the supply chain for the EU battery industry using a geometallurgical approach”, *European Geologist*, Vol. 49, pp. 5-11.

- Dochy, F. (2021), "Building training and development programmes on recent theories of learning in the digital era", in Dochy, I.F., Gijbels, D., Segers, M. and Van den Bossche, P. *Theories of Workplace Learning in Changing Times*, Routledge, London.
- European Commission (2019), "The European Green Deal", Hämtat från eur-lex.europa.eu, available at: <https://eur-lex.europa.eu/legal-content/SV/TXT/?uri=celex:52019DC0640>
- European Commission (2020a), "A new industrial strategy for Europe. Brussels, 10.3.2020, COM (2020) 102 final: European Commission", Hämtat från eur-lex.europa.eu, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0102&den 07 02 2023>
- European Commission (2020b), *European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience*, European Commission.
- Fältholm, Y. (1998), *Work, Cooperation and Professionalization – A Multiple Case Study*, Luleå tekniska universitet, Luleå.
- Flick, U. (2023), *An Introduction to Qualitative Research*, SAGE, Los Angeles, (7 Suppl).
- Gustavsson, M. (2007), "The potential for learning in industrial work", *Journal of Workplace Learning*, Vol. 19 No. 7, pp. 453-463.
- Gustavsson, M. and Thunborg, C. (2016), "Pedagogik i arbetslivet – forskningsområdets utveckling under 2005-2015", *Pedagogisk Forskning i Sverige*, Vol. 21, pp. 3-4.
- Herbert, J. and Hidalgo, A. (2021), "Improving the engineering education in the raw materials sector in an advanced, decarbonised, and digital European society", *21st International Multidisciplinary Scientific Geo Conference SGEM 2021, 16-22 Augusti 2021*.
- Jensen, T., and Sandström, J. (2021), *Gruvans Makt*, Black Island Books, Luleå.
- Johansson, M. and Ringblom, L. (2017), "The business case of gender equality in Swedish forestry and mining - restricting or enabling organizational change", *Gender, Work and Organization*, Vol. 24 No. 6, doi: [10.1111/gwao.12187](https://doi.org/10.1111/gwao.12187).
- Lave, J., and Wenger, E. (1991), *Situated Learning: legitimate Peripheral Participation*, Cambridge University Press, Cambridge, (18 Suppl).
- Lindberg, O., Rantatalo, O. and Haake, U. (2023), "Workplace learning, power, and practice: modes of participation for civilian criminal investigators", *Vocations and Learning*, Vol. 17 No. 1, pp. 43-65, doi: [10.1007/s12186-023-09335-w](https://doi.org/10.1007/s12186-023-09335-w).
- Lööv, J. (2020), "Soft" Questions in a "Hard" Industry? *Sociotechnical Problems of the Mining Industry*, Luleå University of Technology, Luleå.
- Lööv, J., Abrahamsson, L. and Johansson, J. (2019), "Mining 4.0—the impact of new technology from a work place perspective", *Sustainable Intelligent Mining Systems Mining, Metallurgy and Exploration*, Vol. 36 No. 4, pp. 701-707, doi: [10.1007/s42461-019-00104-9](https://doi.org/10.1007/s42461-019-00104-9).
- Lundmark, F., Abrahamsson, L. and Johansson, J. (2022), "Industri 4.0 – vargen kommer eller guds gåva till mänskligheten", I K. Palm, and L. Ivarsson (Red.), *Framtidens Arbetsliv: Arbetsvillkor Och Arbetsmiljö*, Studentlitteratur AB, Lund, pp. 291-313.
- Lysgaard, S. (1961), *Arbeiderkollektivet. En Studie i de Underordnedes Sosiologi*, Universitetsforlaget, Oslo.
- MacMahon, S.J., Corbett, B., Hassall, M., Carroll, A. and De Boer, R. (2024), "What good looks like": building a shared understanding of quality training and learning in the mining industry", *Vocations and Learning*, Vol. 17 No. 3, pp. 509-536, doi: [10.1007/s12186-024-09353-2](https://doi.org/10.1007/s12186-024-09353-2).
- Nicolini, D., Pyrko, I., Omidvar, O. and Spanellis, A. (2022), "Understanding communities of practice: taking stock and moving forward", *Academy of Management Annals*, Vol. 16 No. 2, doi: [10.5465/annals.2020.0330](https://doi.org/10.5465/annals.2020.0330).
- OECD (2023), *OECD Skills Outlook 2023: Skills for a Resilient Green and Digital Transition*, OECD Publishing, Paris: doi: [10.1787/27452f29-en](https://doi.org/10.1787/27452f29-en).

- Onifade, M., Adebisi, J.A., Shivute, A.P. and Genc, B. (2023), "Challenges and applications of digital technology in the mineral industry", *Resources Policy*, Vol. 85, No. B, doi: [10.1016/j.resourpol.2023.103978](https://doi.org/10.1016/j.resourpol.2023.103978).
- Palka, D. (2017), "The role and importance of training for improving the safety and awareness of the technical staff in the mining plant", *CBU International Conference Proceedings on innovations in science and education, Prague, Czech Republic: journals.cz*, doi: [10.12955/cbup.v5.1095](https://doi.org/10.12955/cbup.v5.1095).
- Pekkari, A., Lööw, J., Johansson, J., Gustafson, A. and Abrahamsson, L. (2025), "Den gröna omställningen och teknikutvecklingens effekter på framtida gruvarbete", *Arbetsmarknad and Arbetsliv*, Vol. 31 No. 2, pp. 29-53, doi: [10.58236/aa.26007](https://doi.org/10.58236/aa.26007).
- Somerville, M. and Abrahamsson, L. (2003), "Trainers and learners constructing a community of practice: masculine work cultures and learning safety in the mining industry", *Studies in the Education of Adults*, Vol. 35, No. 1, pp. p19-16p, doi: [10.1080/02660830.2003.11661472](https://doi.org/10.1080/02660830.2003.11661472).
- Tariq, M., Pekkari, A., Gustafson, A., Schunnesson, H. and Johansson, J. (2025), "End-users' perspectives on digitalisation and automation—insights from the Swedish mining industry", *Mining, Metallurgy and Exploration*, Vol. 42 No. 2, doi: [10.1007/s42461-025-01203-6](https://doi.org/10.1007/s42461-025-01203-6).
- United Nations General Assembly (2015), "Transforming our world: the 2030 agenda for sustainable development", Hämtat från unfpa.org, available at: www.unfpa.org/resources/transforming-our-world-2030-agenda-sustainable-development den 07 02 2023
- Vesterberg, V. (2023), "Citizenship, learning and social inclusion. An interrogation of EU-funded welfare projects in Sweden", *European Journal for Research on the Education and Learning of Adults*, Vol. 14 No. 3, pp. 343-357, doi: [10.3384/rela.2000-7426.4328](https://doi.org/10.3384/rela.2000-7426.4328).
- WCED (1987), *Our Common Future*, Oxford Univ. Press, Oxford.
- Wiklund-Engblom, A., Polo, F., Kullbäck, C. and Asplund, S. (2023), "Defining and implementing a smart working environment for employee sustainability: action research for organisational development and learning", *Journal of Workplace Learning*, Vol. 35, No. 8, pp. 693-712, doi: [10.1108/JWL-01-2023-0006](https://doi.org/10.1108/JWL-01-2023-0006).

Corresponding author

Annika Pekkari can be contacted at: annika.pekkari@ltu.se