Volume 37 Issue 2

cjsae
the canadian journal for the study of adult education

la revue canadienne pour l'étude de l'éducation des adultes
rcééa

EXAMINING MICROCREDENTIALS AS A MITIGATOR OF WORKPLACE SKILLS GAP FOR ENTRY ROLES IN THE SUPPLY CHAIN INDUSTRY

Mike Annett, Heather McRae and Ben Smith

The Canadian Journal for the Study of Adult Education/
La revue canadienne pour l'étude de l'éducation des adultes
Editors-in-Chief: J. Adam Perry and Robin Neustaeter
French Language Editor: Jean-Pierre Mercier
Special Edition Editors: J. Adam Perry, Robin Neustaeter and Myriam Zaidi
www.cjsae-rceea.ca

37,2 December/decembre 2025, 139–165
ISSN 1925-993X (online)

EXAMINING MICROCREDENTIALS AS A MITIGATOR OF WORKPLACE SKILLS GAP FOR ENTRY ROLES IN THE SUPPLY CHAIN INDUSTRY

Mike Annett
MacEwan University

Heather McRae
MacEwan University

Ben Smith
MacEwan University

Abstract

This qualitative study examines the skills training needs and professionalization within the supply chain management (SCM) sector, focusing on the effectiveness and awareness of short-term training programs like microcredentials. Using human capital theory, the study explores the relevance of microcredentials from individual and industry perspectives. Key findings highlight employer and employee expectations, training gaps, and the role of post-secondary institutions. The study identifies a need for further training, especially for entry-level employees, with a preference for on-the-job training with industry credentials. Recommendations include increasing employer involvement in training, developing stronger collaborations between educational institutions and professional organizations, improving the visibility and credibility of microcredentials, expanding work-integrated learning opportunities, and strengthening partnerships with professional bodies to offer recognized certifications.

This study emphasizes the importance of aligning educational offerings with the evolving needs of the workforce and ensuring that workers have access to clear, valuable pathways for skill development and professional recognition.

Résumé

Cette étude qualitative examine les besoins en formation technique et en professionnalisation dans le secteur de gestion de la chaine logistique (GCL) et souligne l'efficacité des programmes de formation à court terme (ex. microcertificats). L'étude se base sur la théorie du capital humain pour explorer leur pertinence du point de vue individuel et industriel.

On souligne les attentes des employeurs et des employés, les lacunes en formation

The Canadian Journal for the Study of Adult Education/
La revue canadienne pour l'étude de l'éducation des adultes
37,2 December/decembre 2025, 139–165
ISSN 1925-993X (online)

et le rôle des établissements postsecondaires. L'étude indique le besoin de formation supplémentaire pour les employés débutants et recommande la formation en cours de travail menant à une reconnaissance industrielle.

On recommande d'augmenter la participation des employeurs dans la formation, de favoriser la collaboration entre établissements éducatifs et organismes professionnels, d'augmenter la crédibilité des microcertificats, d'élargir les possibilités d'apprentissage en cours de travail et de renforcer les partenariats avec les corps professionnels afin d'offrir des certificats reconnus.

Cette étude souligne l'importance d'aligner les formations offertes et les besoins de la main-d'œuvre afin d'assurer que les travailleurs ont accès à des parcours clairs pour le développement professionnel.

Keywords

supply chain, microcredentials, competencies, human capital

Mots clés

chaine logistique, microcertificat, compétences, capital humain

Economic woes related to product shortages and price inflation have snapped the world's attention toward the supply chain industry (Benigno et al, 2022; Gereffi & Lee, 2012). Supply chain management—the capacity for secure sourcing and assured distribution of resources and products, an inherent and long-standing component of most business operations—has become a competitive battleground (Polohua, 2016). Correspondingly, this impetus has sharpened the focus of companies optimizing the digital and physical capital they apply to improving their supply chain and value-producing operations, and reducing their vulnerabilities (Shih, 2020). This amplified scrutiny has brought a heightened awareness of the importance and contributions of skilled workers (Merkert & Hoberg, 2022). However, companies find it difficult to attract, train, and retain capable workers at all points and functions within the supply chain (McKendrick, 2023). As companies explore traditional and non-traditional sources of workers, this situation calls for a deeper understanding of workers' qualifications and training requirements. The workers who manage the company's supply chain and perform functions of procurement, warehousing/inventory, and contract/service coordination are of particular interest.

Training and professionalizing workers means to increase their capacity to deliver high-quality services and to develop skills associated with a distinctive professional group (Hoyle, 2001). Levine (2001) suggested that training and professionalization include formal and informal education that builds an understanding of certain disciplinary principles, practices, norms, and standards of conduct, such as communication and ethics. A simple internet search revealed that many universities in Canada offer programs that emphasize supply chain management. These include Carleton University, HEC Montreal, MacEwan University, University of Calgary, University of Manitoba, and Yorkville University. While post-secondary education is commonly seen as the base unit for skills enhancement and national economic regeneration and growth (Harvey, 2000), there are also common and critical gaps in the knowledge, skills, and general capacity of graduates to meet the employment requirements of modern and emerging work (Gallagher, 2018; Tomlinson, 2017). Consequently, it is appropriate to explore whether a gap exists between

workers' formal post-secondary education and employer demands in supply chain companies, and to examine remedial or beneficial educational experiences for workers managing a company's supply chain.

Increasing employability, or reducing the skills gap of workers, involves partners, which include the worker, industry, universities, and government (Oria, 2012; Tran, 2018). In addition to formal credential education programs (i.e., university degrees), multiple methods of skill and competency development have emerged over time. Examples include mentorship programs, corporate training programs, non-credit programs, and professional designation or certification programs (Black & Hertig, 2008; Blanchette et al., 2021; Evers & Rush, 1996; Harder et al., 2014, Saks & Haccoun, 2020). The relative role and success of these approaches logically depend on the landscape of interconnected contexts and constraints of country, government, industry, company, education service provider, and worker. For example, microcredentials (i.e., short-cycle training programs) are conceived and integrated differently in Canada, the United States of America, Australia, New Zealand, and Europe (Evans, 2021; Higher Education Strategy Associates [HESA] & The Strategic Council, 2023). Furthermore, the requirements for upskilling a teaching or cybersecurity professional are intuitively distinctive from the requirements for a supply chain professional. Therefore, a highly contextualized assessment can increase the understanding of worker skill development and employability.

Companies and workers are turning to microcredentials as a form of work-centric supplemental training. Additionally, higher education administrators are observing the relationship between career preparation demand and revenue opportunity (HESA & The Strategic Council, 2023; Woods & Woods, 2023). The concept of a microcredential is well-supported by the Adaptive Control of Thought–Rational (ACT-R) theory. The cognitive architecture of ACT-R allows us to map out how people process and act on information. ACT-R attends to small, practical, and pervasive gains in everyday cognitive performance, such as memory retrieval, problem-solving efficiency, and decision-making accuracy (Anderson & Lebiere, 1998; Eraut, 2002), and its domain includes employability skills (Gauthier, 2020; Varadarajan et al., 2023), such as those offered by microcredentials.

While there remains confusion and disagreement on a standardized definition of a microcredential (D'Agostino, 2023; Wheelahan & Moodie, 2021), there is some consensus that a microcredential is a shorter-duration learning experience (e.g., less than 30 hours of study) that addresses a specific competency or capability with a directly intended application (Pichette et al., 2021). For the purposes of this study, microcredentials refer to short-cycle training focused on gaining competency in a skill or series of related skills.

Considering the increased attention to optimization of the supply chain industry, the probable gap between post-secondary education and job requirements, and the contextual realities of different approaches to enhancing the qualifications of workers, this study serves to provide insight into the knowledge, skills, and abilities requirements for entry-level, supply chain management–focused positions in Alberta-based organizations. Through participant interviews, this study examines the perceptions of students, workers, and company representatives regarding pre-hire qualifications, post-hire upskilling, and how to attain this training. In particular, the utility of microcredentials is examined. As a result of this study, we have gained a greater understanding of and insight into the specific interests, expectations, and motivations of both workers and companies regarding employment, as well as the necessary training and development for new entrants into

the field. The results of this study may be useful to individuals pursuing education and employment in this field, company supervisors, and education service providers.

Review of the Literature

Research on microcredential effectiveness and other short-term training initiatives in Canada is nascent. Recent articles in academic journals provide a range of critiques about stakeholder engagement, frameworks, approaches, and curriculum and assessment issues. Most papers identifying the need for and design of credentials for skill development are in the form of reports or studies completed by governmental organizations and private educational providers. These articles support market-aligned training that increases individual workplace competency and supports economic growth. Others disagree with the notion of specific skill training, suggesting that it is too narrow due to its focus on specific tasks rather than addressing the larger context or theoretical perspectives (Lester & Costley, 2010). Furthermore, the lack of a coherent dialogue about the purpose of and approaches to delivering and recognizing microcredentials and other short-term training has resulted in confusion for both employers and employees (HESA & The Strategic Council, 2023; Martinez-Marroquin & Male, 2021). Additionally, uptake by academic educators is confounded by a lack of systemic funding within the institutions (Desmarchelier & Cary, 2022; Olcott, 2022) and limited understanding by senior leaders and faculty (Pickard et al., 2018).

This review examines the challenges and opportunities relating to four issues identified in the literature:

- theoretical grounding in human capital theory
- the need for skills training to address labour market needs
- current gaps in the design and delivery of the credential
- the absence of a system-wide structured approach

While this review focuses on the microcredential landscape in North America, references from Great Britain, Europe, Australia, and New Zealand are included to provide additional context.

Theoretical Grounding

Human capital theory guides this study's perspectives. Human capital theory is based on the premise that increasing the knowledge and skill levels of individuals is a driver of economic growth and prosperity (Schultz, 1961). Schultz (1961) posited that individuals will seek training opportunities that lead to increased salary and promotions, and that businesses will seek training opportunities for workers that lead to improved productivity and innovation. Investment in training can be quantified by measuring increased wages and productivity. According to Schultz (1971), post-school investment, along with workplace training, plays "a large role in increasing the stock of human capital" (p. 2).

The belief that education and skill development increases productivity and earnings in a linear fashion dominated the economic policy discourse in the 1960s (Walters, 2004). Concerns about human capital theory include the lack of access to skills-based training, particularly for untrained workers, and a narrow understanding of the relationships between education and work (Marginson, 2017). Many of the studies supporting human capital theory examine the relationship between higher education and increased earnings,

rather than taking into consideration the effect of family income, and social and cultural factors (Marginson, 2017). Evidence that work-related education results in increased productivity and employment opportunities is not substantiated in the literature; however, it has become a popular narrative (Marginson, 2017; Walters, 2004). Much of the support for human capital theory relates to perceptions that it is a desirable policy goal and a way to "fix" problems with education to address the specific concerns of the marketplace (Wheelahan et al., 2022, p. 484). In Canada, there is interest in the development of skills and of training policies and programs to ensure economic growth and prosperity through a highly skilled and educated workforce (Munro, 2019).

Despite its limitations, human capital theory, with its focus on economic growth, provides a lens for viewing the motivations and interests of employers, employees, and prospective employees relating to participation in workplace skills training. According to Walters (2004), support for human capital theory continues, given beliefs that investment in education will result in increases in earnings and productivity. The recent re-emergence of a skills agenda in Canada, evidenced by federal and provincial funding for skills research and training, is driven by technological change and the desire for increased productivity and competitiveness.

Microcredentials and other short-cycle training focus on gaining competencies relating to specific work requirements. Furthermore, these training programs are short, allowing benefits to be realized with limited opportunity costs. According to Schultz (1961), human capital contributes to economic growth; hence, policies and practices that support skill development as a deliberate investment are an important part of the economy.

Need for Skills Training

Most papers in the field are prospective, focusing on the need for an increasingly skilled labour force and suggesting that short-cycle training programs, such as microcredentials, can address these shortages (Gauthier, 2020; Healy, 2021; Oliver, 2019; Varadarajan et al., 2023). The interest in microcredentials from a policy perspective increased during and following the COVID-19 pandemic as the demand for a skilled workforce intensified (Wheelahan & Moodie, 2022). Additionally, the loss of skilled workers due to retirement or disruptive technology is also influencing the labour market (Mahboubi, 2019). According to employers, skills shortages can result in reduced productivity, lower quality, reduced profits, loss of new opportunities, less innovation, and increased costs (Mahboubi, 2019).

While employers want to ensure their employees have the required workplace skills, it is unclear if employers view microcredentials as a solution. Microcredentials' value and purpose are ambiguous for employers and prospective employees. In a recent pan-Canadian study of employers, 59% of respondents were unfamiliar with the term microcredentials; only 10% of employers indicated awareness of this credential (Pichette, et al., 2021). Potential learners also had limited knowledge—approximately 25% of respondents had heard of microcredentials, and only 19% could provide a general definition. Despite the need for more awareness of these credentials, the study findings identified that employers and prospective employees are interested in microcredentials to learn specific skills quickly and advance their careers. Similar findings were reported in a study of students and employers in Ontario (Ashcroft et al., 2021). Both students and employers had some knowledge of microcredentials; however, the overall understanding of the credentials was low. Other

concerns about short-cycle credentials include the notion that these types of credentials contribute to the privatization of higher education, devaluation of the undergraduate degree, and unbundling of the curriculum into smaller, marketable components (Ralston, 2021; Wheelahan & Moodie, 2022).

Microcredentials and other short-cycle training courses might benefit from alternative approaches, such as work-based learning involving a partnership between universities, employers, and employees. Additionally, Lester & Costley (2010) suggested that a formal agreement that involves accreditation of employer courses, individualized learning, and assessment of professional competencies like workplace-integrated learning practices would improve the learning experience.

Gaps in Design and Delivery

Several gaps exist in the literature regarding the design and delivery of microcredentials. These include the types of skills required by employers, skill mismatches in the workplace, stakeholder communication and participation, and concerns about equitable access to learning.

Articles increasingly focus on gaps between employees' job readiness and employers' skill requirements, suggesting ways to improve outcomes (Asantha, 2023; Gauthier, 2020; Martinez-Marroquin & Male, 2021; Wheelahan & Moodie, 2021). According to a paper by the World Economic Forum (2017), "shifting business models and the nature of work are significantly altering the skills demanded by the labour market" (n.p.). An Alberta study about future employment identified that employers were preparing to transition to a more highly skilled workforce in three to five years (Conference Board of Canada, 2019). The study findings indicated most employers would primarily seek soft skills, including problem-solving, critical thinking, teamwork and communication, and some specific technical and occupational skills.

The primary stakeholders in microcredential development and delivery include "learners, educational institutions, employers, professional bodies, quality assurance and regulatory bodies," along with trade unions and government (Brown et al., 2021, p. 238). Post-secondary institutions are perceived as having a growing role in assisting businesses and industries to address change and prepare workers (Diversity Institute et al., 2022). Turnbull (2019) suggested that Canada needs to develop a national platform to improve information exchange, build partnerships between employers and educational institutions to identify labour market needs and align training, provide income support and incentive structures, and use evidence-based approaches to achieve skill security rather than employment security. These approaches echo a recent Public Policy Forum report (Munro, 2019), which stated that "Canada's systems of training, reskilling, and lifelong learning have substantial gaps and need improvement if they are to meet the needs of workers and firms" (p. 32). Other studies addressed the disconnect between post-secondary education and employers, suggesting that better discourse between the groups would help ensure alignment between learning and job requirements (Martinez-Marroquin & Male, 2021).

A C.D. Howe Institute study indicated that for approximately 13% of Canadian workers, their skills do not match their jobs (Mahboubi, 2019). The author submitted that skill mismatches lead to employee frustration and lack of productivity, suggesting that policy development and increased participation in lifelong learning programs and specific

training opportunities are essential steps to support over- and under-skilled workers. According to Munro (2019), many training programs are targeted to those who have already attained a high level of credentials and skill. The equitable supply and demand of adult learning opportunities, the short shelf life of skills training, and access and affordability for marginalized and low-income learners are identified as critical issues requiring further discourse (Ositelu et al., 2021; World Economic Forum, 2017).

Some solutions to address these gaps include understanding the demand for skills, improving communication between employers and educational providers, developing funding supports, recognizing and promoting workplace-integrated learning and customized training, and developing standardized frameworks and assessment practices. The following section addresses these approaches.

Missing System-Wide Approach

An emerging theme in the literature focuses on the disconnect between employers and post-secondary institutions recommending system-wide changes. Implementing mutually beneficial changes would ensure that short-term training is integrated with academic preparation, employer recognition, stakeholder engagement, beneficial learning outcomes, and international transferability.

Without a national framework for microcredentials, post-secondary institutions in North America have been tasked with establishing institutional governance and guidelines. According to Jackson (2003): "The development of a university strategy for micro-credentials requires finding a balance between the vision of an academic plan, building a framework that provides a clear structure for product development and a staged approach for implementation" (n.p.). Not everyone within the academy supports microcredentials, believing that the vocational and profit-centric motives undermine the institution's mission (Ralston, 2021; Wheelahan & Moodie, 2022).

In Canada, microcredentials are shaped by government funding requests, post-secondary continuing education units, and employer interests. Employers and institutions are unclear about the value of microcredentials, which is reflected by the limited adoption of this type of credential (HESA & The Strategic Council, 2023). Assessment practices are not standardized in North America; however, there are suggestions relating to assessment and reporting outcomes. While many public providers use project or practicum approaches to measure competencies, others use multiple-choice questions or self-assessments. Inconsistent assessment practices and the lack of clearly defined metadata make laddering or stacking microcredentials challenging.

Ideally, microcredentials are short, easy to access, supported by employers and professional associations, affordable, and stackable to other programs or degrees. In Canada, some provinces have a general definition for microcredentials but do not address issues such as metadata requirements or credit transfer. Most microcredentials are developed by continuing education units that have experience responding to labour market demands. These units may or may not have institutional frameworks, quality assurance requirements, or formal relationships with employers and professional associations. As a result, the structure and fees of microcredentials resemble other kinds of continuing education offerings. The value proposition for learners is unclear, resulting in confusion within the marketplace.

Oliver (2021) submitted that a clear definition and a value proposition for stakeholders are required before microcredentials are fully supported. They proposed a framework that identifies the learner's focus based on eight different benefits and two types of costs: money and effort/time. The value proposition for business and microcredential providers needs further examination. According to a Canadian report: "The combination of rapid development, lacking frameworks, large funding pool, and an unfamiliar term seems to have created a disconnect between industry and institution on the value of micro-credentials" (HESA & The Strategic Council, 2023, p. 12).

Marginalized, unemployed, or underemployed individuals might have less access to the programs unless the government or employers fund them. To support broad participation, New Zealand has a cap on the cost of microcredentials; countries within the European Union provide subsidies or grants for individual learners.

Comparing microcredentials in North America, Europe, New Zealand, and Australia identifies how different countries have supported the development of microcredentials (Table 1). Canada and the United States have not taken a directive approach; funding has been available for specific projects and initiatives in various organizations and contexts. Other countries have established national frameworks and criteria and funding support for development and participation.

Table 1
Comparison of approaches (Canada and United States, New Zealand, Australia, European Union)

	Canada and United States	**New Zealand**	**Australia**	**European Union (EU)**
System-wide definition	No—some agreement on principles	Yes	Yes	Recommended definition (adopted June 2022)
Alignment with job skills/codes	No—in Canada, National Occupation Classifications are out of date	Yes	Skills pathway aligned to job skills	Has a 12-point skills agenda to be achieved in 2025
Qualifications framework	No	Yes—aligns with steps/ levels	Yes—industry recognition and/or credit (Accreditation and Quality Assurance)	Yes—aligns with the European Quality Assurance in Vocational Education and Training framework

	Canada and United States	**New Zealand**	**Australia**	**European Union (EU)**
Standardized use of metadata	No	Yes	Yes	Yes—has mandatory elements
Stacking or laddering	Varies	Yes	Yes—for pathways to degrees	Yes—identifies flexible learning pathways (receiving organization must accept)
National regulation	No	Varies	Marketplace for public sector offerings only; private orgs must meet required elements	Comparable across EU (projects are in progress)
Assessment requirements	Not specified/ determined by individual post-secondary institutions	Required	Required	Included in Bologna process for Quality Assurance
Fees	Market-based	Capped at $64 (NZD) per credit (2024)	Costs must be stated. Funding available.	Funding support through gov't and agencies

Adapted from:

Higher Education Strategy Associates & The Strategic Council. (2023). *Revisiting micro-credentials in the Canadian marketplace* [White Paper]. Toronto.

New Zealand Qualifications Authority. (2023). *Micro-credentials*. https://www2.nzqa.govt.nz/tertiary/approval-accreditation-and-registration/micro-credentials/.

Australian Government. Department of Education, Skills and Employment. (2021). *National microcredentials framework*. https://www.education.gov.au/higher-education-publications/resources/national-microcredentials-framework.

Australian Government. Department of Education, Skills and Employment (2023). *National higher education initiatives*. https://www.education.gov.au/higher-education/national-higher-education-initiatives.

European Union. (2022). *A European approach to microcredentials*. https://education.ec.europa.eu/education-levels/higher-education/micro-credentials.

The lack of a national framework or approach in North America has resulted in increasing concerns that microcredentials might be a craze or that the landscape will be dominated by a few public and private players (Ralston, 2021). Others suggest it will take time for microcredentials to evolve (Brown et al., 2021; Martinez-Marroquin & Male, 2021). The current variability in approaches limits credential recognition when learners move within or outside the country (Martinez-Marroquin & Male, 2021). Laddering, stacking, and transferability of credentials are anticipated to be the responsibility of Canadian post-secondary institutions, given that developing a regulated national framework is unlikely due to the time and resources required (HESA & The Strategic Council, 2023). HESA & The Strategic Council (2023) further predict that policy language will develop to support institutional requirements and labour market rationale.

Despite the challenges, the promise of microcredentials provides a compelling case for continued support. Microcredentials have the potential to provide short-cycle training that addresses specific skill requirements in the marketplace. Furthermore, they are designed to be cost-effective and offered in flexible formats. While microcredentials may lack clarity and consistency, there is hope that issues such as national and international recognition, access, assessment, value proposition, and the roles of the stakeholders will improve. Further research is needed on the labour market value of microcredentials for employers and employees. Microcredentials could be integral to the higher education learning ecosystem if combined with other workplace and formal learning opportunities.

Methods

Qualitative case study research allows for an in-depth examination of instances of a certain phenomenon, resulting in rich, contextualized insights (Baxter & Jack, 2008). In this exploratory study, we adopted the constructivist approach recommended by Merriam (1998) to form particularistic insights from employers, early-career professionals, and students about their experiences with, beliefs about, and perspectives of microcredentials. This approach includes conducting a literature review, adopting a theoretical framework, and developing an appropriate research protocol. In this section, we outline the methods undertaken, including the composition and roles of the research team, participant sourcing, interview design, and data collection and coding.

Research Team

Our research team consisted of individuals with diverse expertise and backgrounds to enhance the rigour and depth of the qualitative research process. The core team was comprised of 1) One principal investigator with a background in human resources management, responsible for the overall design, execution, and supervision of the study; 2) Two co-investigators, one with a background in continuing education and the other in health systems management, who both contributed to the development of research questions, interview protocol, and data analysis; and 3) Five student research assistants with backgrounds in professional communications and business. Students assisted in participant recruitment, data collection, transcription, and preliminary analysis.

Participant Sourcing

Selecting the right participants is a critical aspect of qualitative research. As recommended by Patton (2014), we employed purposive sampling to identify individuals who possessed relevant knowledge and experiences pertinent to the research topic: entry-level roles in supply chain management. This approach allowed us to ensure that participants could provide in-depth insights into the phenomena under investigation (Creswell & Poth, 2018). We sought the perspectives of four groups: a) students in a related bachelor's degree program, b) students in a related continuing education program, c) early-career professionals performing related work, and d) company representatives who hire workers for related early-career positions. These groups afforded responses that provided a multi-angle view of the skills and training relevant to an early-career supply chain management role.

To recruit the participants, we employed several tactics, including: a) using membership lists of professional and student organizations, b) soliciting students enrolled in relevant academic programs, c) identifying individuals with pertinent LinkedIn profiles, and d) engaging individuals personally known to the research team. Participants were incentivized with $10 Amazon gift cards for their involvement in the study. Before soliciting participants, we secured approval from MacEwan University's Research Ethics Board.

The research team communicated with 29 people, generating interest from 24. From this group, we conducted 15 successful interviews.

Data Collection

Interviews

Interviews targeted three principal considerations about knowledge, skills, and abilities (KSA) pertinent to entry-level positions in the supply chain industry. These are: a) Which KSAs are relevant to the role? b) In what manner and from where should these KSAs be obtained? c) What is the perceived significance of microcredentials relative to these KSAs?

To facilitate the interviews, we crafted a semi-structured interview protocol, a widely adopted approach in qualitative research (Rubin & Rubin, 2012). This protocol comprised open-ended questions and probes designed to extract comprehensive insights from participants. The research team convened to identify the core areas of inquiry, formulate questions, and arrange them in a manner conducive to a conversational interview style. These questions were constructed to prevent any leading or biasing of responses and underwent a pilot testing phase to enhance clarity and effectiveness. The interview form was tested by two individuals. Subsequently, the form underwent slight modifications to ensure it generated the requisite information.

Interview Questions

Questions on role-related professional KSAs were grounded in industry literature to enhance the relevance and contemporariness of the skills prompted and explored. The literature included a competency pyramid produced by Supply Chain Canada (2022) and a World Economic Forum (2020) resource on hard and soft skills for the modern post-pandemic industry.

Participant responses were targeted to a participant-defined, specific, entry-level job appropriate for recent graduates and early-career professionals in supply chain management.

Company representatives were asked the following questions.

- What technical skills should an employee have before they get this position at your company? Where or how could prospective employees train for these skills?
- Which personal attributes would you like to see in an applicant?
- What skills are you expecting employees to develop after they join your company? Where or how could current employees train for these skills?
- I have a list of skills/competencies that are highlighted by Supply Chain Canada. Please review this list. What are the most important competencies in this list?
- What has your experience been with microcredentials and certifications? Which microcredentials are valuable for employees in the supply chain industry?

Other groups were asked similar questions with appropriate tailoring. For example, students were asked to describe a job they would like to hold within five years of graduation.

As a prompt, company representatives were asked to consider a job that required less than five years of experience that they had hired for in the last six months or that they would be hiring for soon. They were asked to give the job title and to describe its general role, functions, and accountabilities. Participants were then asked to describe the qualifications for this position and the requirements and upskilling opportunities of the position.

In addition to these direct KSA explorations, we also enquired about the perceived value of testing or validation of learning, and problematic gaps between formal education preparation and real-world work performance requirements. For example:

- Some professional skills can be developed through open access courses. How important is it to you to have proof of competency in addition to course attendance?
- Do you have any suggestions on how post-secondary institutions can help bridge the skills gaps?
- Please share any comments or views about the role or relevance of university-based continuing education for microcredential training.

A research assistant conducted interviews that took place between May and August 2023. They were conducted through a video conference in a comfortable and private setting. Our aim was to foster an environment conducive to open and honest communication (Fontana & Frey, 2000). Each interview session was video- and audio-recorded with the participant's consent to ensure accurate data capture. The researchers took notes to record non-verbal cues and contextual information (Miles et al., 2019). Interviews were transcribed verbatim, allowing for subsequent analysis. The transcription was generated by the video conference software. A separate research assistant viewed the recording and addressed transcription errors or unclear audio segments to produce a final transcript copy that the principal investigator validated.

Data Coding

Data coding in academic qualitative studies involves several systematic steps to organize and interpret the data. Following guidance of Miles et al. (2019), our framework construction was based on the research objectives and questions, informed by relevant literature, and responsive to the information provided by participants. Initially, we familiarized ourselves with the data supplied in two interviews and assessed the focus and content of participants' answers. Then we developed initial codes that captured the essence of what was being said and broke down complex responses to ensure that each code accurately represented the responses. The final codebook included definitions, examples, and guidelines for applying each code to ensure consistency and transparency in the coding process.

The codebook allowed for the simple categorization of responses with commonality or consistency (e.g., where should workers take needed training?), as well as capturing the free text of more open-ended questions (e.g., suggestions for universities in bridging the skills gap). A research assistant produced the initial interview codes. These codes were validated by the principal investigator. The principal investigator also categorized and summarized the open-ended questions, including the descriptions of pre- and post-hire skills.

Findings

The interviews provided rich information on participants' views regarding the knowledge, skills, and abilities required for an entry-level role in the supply chain industry. This section presents an account of the emerging themes and patterns.

Participant Profiles

Participants represented various businesses and industries, including large retail, aviation, energy and primary resources, construction and construction equipment, manufacturing and materials supply, and transportation and logistics.

In total, 15 people participated in the study and were categorized as four students in a 12-month continuing education certificate program for supply chain management, two students in a bachelor's business degree program and completing a major in supply chain, two early-career professionals, and seven company representatives working as managers or leaders who hired and/or supervised workers in early-career supply chain positions. Certificate students and company representatives were mutually exclusive categories. Degree students and early-career professional categories required delineation as some students had also completed co-operative education terms and, thus, had practical early-career job experience. These students were asked to respond only from their student platform and encouraged not to draw on their work experience during the interview.

When asked to describe and focus on an early-career position, participants provided responses that were quite varied. It was possible, however, to organize the responses into broad categories of warehousing, procurement, and coordinator. Warehousing was the most basic role, with procurement being more complex. The coordinator role was identified as the most complex. Examples of these roles are presented in Table 2.

Table 2
Roles and Responsibilities

Role	Description
Warehousing (3 roles)	Warehousing (unloading/stocking/picking/packing), coordinating and forwarding shipments, completing reports
Procurement (8 roles)	Sourcing materials, quoting, comparing prices, selecting and communicating with vendors, contracting, order managing and tracking
Coordinator (4 roles)	Building contracts, tracking quotes and orders, auditing suppliers, managing vendor and internal relationships, resolving logistic or fulfillment issues

Table 3 presents a matrix of participant and target roles.

Table 3
Roles and Participants

Roles	Student	Early career	Company rep	Totals
Warehousing	3	0	0	3
Procurement	3	1	4	8
Coordinator	0	1	3	4
Totals	**6**	**2**	**7**	**15**

Knowledge, Skills, and Abilities (KSAs)

Pre-Hire

Participants answered several questions about KSAs expected of workers before gaining entry to the target role. The objectives of the questions were to understand what these KSAs were and how the participant should acquire them. Participants provided considerably diverse responses, with the most common KSAs summarized as:

- **Office software:** Ability to use word processing and spreadsheet applications
- **Industry software:** Ability to use SAP, IBM Cognos, and other similar applications
- **Industry terminology and core concepts:** Having a working knowledge of supply chain processes and ability to communicate with peers using industry language
- **Critical thinking and problem-solving:** Ability to work through challenging situations and find non-obvious solutions
- **Communication:** Ability to share information clearly and effectively in verbal and written form with managers, clients, and partners
- **Collaboration:** Working effectively with others to achieve a shared objective
- **Curiosity and self-initiated learning:** Ability to initiate and engage in self-identified learning processes (opposite of "being told" what to learn)

Participant responses were varied when asked where and how these KSAs should be developed or acquired. Common answers included general life experience, general work experience, post-secondary institution non-credit programs, and post-secondary institution credit programs. Notably, the general internet and open education platforms (e.g., Coursera, LinkedIn Learning) were minimally commented on.

Post-Hire

Questions about the KSAs required to grow and perform in the role were asked next. The objectives were to understand what these were, whether they differed from the pre-hire KSAs, and how they should be acquired. Participants again provided diverse responses; however, some themes emerged. Table 4 summarizes the nature of KSAs required, including the number of times they were mentioned.

Table 4

Role and Knowledge, Skills, and Abilities (KSAs)

Role	KSAs
Warehousing (3 roles)	Company internal operations (1); trust building (1); self-motivation (1)
Procurement (8 roles)	Communication (7); management of others (5); management of own work (4); materials and processes (4); working with others (3); critical thinking (3); software (1); account development (1); confidence (1)
Coordinator (4 roles)	Communication (5); working with others (3); software (2); strategic thinking (1); common sense (1); customer centricity (1); following protocols (1); data analysis (1)

The three leading KSAs across the role categories are noted below with a generalized description derived from the participants' comments:

- **Communication** (12): Providing clear and effective information sharing in verbal and written form with managers, clients, and partners
- **Working with others** (6): Engaging in collaborative work and having a willingness to work with other people and demonstrate team-supportive behaviours
- **Management of others** (5): Providing direction to people for completing work, including people leadership, intercultural management, and project management

The most frequently mentioned KSAs pertain to interpersonal interaction, and participants infrequently commented on technical KSAs such as data analysis, following protocols, and software.

A comparison of the pre-hire and post-hire KSAs shows that communication and working with others (collaboration) are the two most frequently mentioned skills.

When asked about developing post-hire skills, participant comments centred on four principal providers: the company, open-access learning providers, post-secondary institution non-credit programs, and post-secondary institution credit programs. When the question was phrased as where *could* the worker develop the skills, the most frequent answers were "the company" and "open-access learning providers." Participant responses

also generally indicated that they expected the employees to learn on the job. Drawing on related participant explanations, this is attributed to several factors: a) low awareness of formal external training options, b) uniqueness of the company operations, and c) expectation that experience, not knowledge, is most needed. In short, "the company" seemed to be a convenient, encompassing, and default answer.

When the question was phrased as where *should* the worker develop the skills, "post-secondary institution credit programs" and "the company" (with a reduced count) were the most frequent answers. Participant responses do not provide a clear explanation for the shift toward post-secondary institution credit programs or the shift away from open-access learning providers and post-secondary institution non-credit programs.

Supply Chain Competencies

In contrast to the open-ended queries about KSAs, the Supply Chain Canada competency triangle provided parameters and focus for discussing specific supply chain KSAs. The triangle is comprised of three layers of progressive competence: foundational (14 competencies), integrative (7 competencies), and functional (4 competencies). Participants were allowed to review the triangle and seek clarification on terminology and descriptions before responding to questions. A minority of participants had seen the competency triangle before. However, the majority agreed that it was sufficient despite some having minor critiques and suggestions for improvement.

To indicate competency priorities or importance, participants were asked to select the top five foundational competencies and the top three integrative competencies. The functional competencies were not queried, as the research team identified them as being less applicable to an entry-level position.

Regarding the top foundational competencies, four were most frequently commented (Table 5): adaptability, professional and ethical behaviour, communications, and creative thinking and innovation.

Table 5
Foundational Competency Prioritization or Emphasis

Most frequently commented	Least frequently commented
Adaptability (14)	Collaboration and synergy (5)
Professional and ethical behaviour (10)	Growth mindset (5)
Communications (9)	Leadership (5)
Creative thinking and innovation (8)	Systems thinking (5)
	Business acumen (3)
	Customer centricity (3)
	Decisiveness (3)
	Digital dexterity (2)
	Diversity mindset (2)
	Outcome driven (0)

Per Supply Chain Canada (2022), these competencies mean:

- **Adaptability:** Supply chain management professionals demonstrate the openness and ability to apply routine knowledge rapidly and flexibly to novel circumstances. Supply chain management professionals are able to work effectively with new information and technologies, evolving business models and fluctuating economic and geo-political environments.
- **Professional and Ethical Behaviour:** Supply chain management professionals draw on their ability to act with honesty, integrity, credibility, self-confidence, and independence, while coping with ambiguity, conflicts of interest and the need to protect the public interest. SCM professionals do more than adhere to the rules of professional conduct; they demonstrate ethical behaviour that exemplifies and enhances the reputation of the profession.
- **Communications:** Supply chain management professionals communicate effectively through listening, speaking, writing with clarity, and effectively applying the art of guidance and negotiation. SCM professionals must be able to clearly communicate complex matters to internal and external audiences, at any employee level in any organization, and to the public.
- **Creative Thinking and Innovation:** Supply chain management professionals discover new opportunities and problem-solving solutions by looking beyond current practices and using innovative thinking; they seek opportunities to "futureproof" the supply chain. Creative thinking applications include knowing when a new approach is required; importing and adapting a solution from outside the current work environment; or creating a new solution. SCM professionals have a solutions-focused mindset.

Excepting professional and ethical behaviour, the most frequently identified functional competencies align well with the frequently commented KSAs in the open-ended questions.

Regarding the top integrative competencies, four were most frequently commented (Table 6): supply chain strategy, supply chain sustainability, supply chain analytics, and supply chain resilience.

Table 6
Integrative Competency Prioritization or Emphasis

Most frequently commented	Least frequently commented
Supply chain strategy (11)	Systems technology (5)
Supply chain sustainability (9)	Supply chain dynamics (2)
Supply chain analytics (8)	Supply chain design (2)
Supply chain resilience (7)	

Per Supply Chain Canada (2022), these competencies mean:

- **Supply Chain Strategy:** Supply chain management professionals demonstrate the ability to define the current marketplace environment, conduct a gap analysis and roadmap and create an end state vision that involves the integration of different elements of the supply chain to form an integrated coherent supply chain that can deliver the required business results. SCM professionals examine the economic environment and, where appropriate, introduce new business models. In today's changing marketplace, they focus on customer centricity and growth and profitability, instead of efficiency and cost only.
- **Supply Chain Sustainability:** Supply chain management professionals with this competency collaborate with relevant stakeholders (e.g., shareholders, employees, suppliers, customers, government and policymakers, and society) to proactively craft policies to support evolving Environment Social Governance (ESG) priorities (e.g., decarbonization, circular economy, social responsibility), set clear targets and metrics indicative of progress covering ESG concerns, effectively implement processes to overcome evolving ESG concerns, and hold organizations accountable for meeting evolving ESG metrics. They can identify the costs and benefits of reducing harmful and wasteful practices and any associated synergies and trade-offs with other supply chain KPIs [key performance indicators] such as cost, quality, and delivery.
- **Supply Chain Analytics:** Supply chain management professionals use a variety of techniques (statistics, predictive modelling, and machine learning) to find meaningful patterns and knowledge in order, shipment, and transactional and sensor data. An important goal of supply chain analytics is to improve forecasting and efficiency and be more responsive to customer needs as well as optimize cost and capital aligned to the strategy.
- **Supply Chain Resilience:** Supply chain management professionals with this competency work effectively across internal functions and network partners to craft and implement policies and practices that ensure supply chains are designed to be robust. Their organizations experience minimal negative effects and recover quickly from manifested supply chain risks on productive assets, the flow of physical goods and information and non-physical assets (e.g., cash, intellectual property, employees, etc.).

These integrative competencies were minimally noted in the open-ended KSA queries.

Microcredentials

Participants replied to several questions pertaining to microcredentials. These questions were meant to illustrate awareness and prevalence of such training in the industry and to identify which topics garnered the most interest and investment in learning. When

participants asked for a definition of microcredential, the interviewer advised that they should be considered as "short-cycle training" that might be completed in less than 30 hours. Few respondents declared strong knowledge of microcredentials, and most were uncertain why a person would enroll in a microcredential. Instead, respondents tended to jump to professional designations, such as Certified Supply Chain Professional (CSCP), as the mechanism for the industry's short- and long-term development. That is, the package of additional education, experience, and tests required to achieve the designation was commonly cited as the best way to achieve competency and demonstrate professional capacity in the field. While the individual courses that make up the education requirements of the professional designation might be considered synonymous with a microcredential, they are dissimilar in that they are not meant to be taken a) as stand-alone non-packaged learning experiences, or b) by people not purposefully pursuing the full professional designation.

When participants made remarks about microcredentials, particularly with reference to which courses or credentials were known to them, they frequently repeated the example list of microcredentials given in the interview protocol: "Intelligent supply chain" and "Using block chain in the supply chain." When asked about course topics that seem most useful as a microcredential, responses trended toward topical and technology knowledge or general competencies. For example:

- **Topical and technology knowledge:** Supply chain fundamentals; intelligent supply chain; gaining knowledge from suppliers; sustainability; artificial intelligence; block chain integration; robotics and warehousing
- **General competencies:** Adaptability; data analysis; sales; business communication; interpersonal communication

Challenges experienced during the interview to secure clear and specific responses from all categories of participants about microcredentials indicate that microcredentials are not a common or expected source of supply chain management–related knowledge, skills, and abilities.

Interview questions about whether microcredentials should require proof of learning yielded positive responses from all participants. One participant, referencing a negative experience with supposedly certified workers, questioned whether the test would be sufficiently valid. Overwhelmingly, participants indicated that an "attendance record" was not sufficient. Students and company representatives wanted verification of the knowledge students acquired. For students, this was to have proof of their competency to increase their attractiveness to the company. For company representatives, this was so the reps could have confidence in the person's ability when the person was assigned work tasks, and help ensure the reps were not being deceived about the person's capability to perform the work.

Role of Post-Secondary Institutions

Several of the questions asked about the existence of a knowledge, skills, and abilities gap between post-secondary education (credit and non-credit programs) and entry-level roles. Many participants indicated a problematic gap, meaning that substantial further development was required before students could perform the entry-level role effectively. However, the identified resolutions trended to forms of job-related work experience. Consequently,

there were no calls for changes to the course-based education. Rather, participants saw the need for more opportunities for co-operative education programs and field placements, and recognized that employers should continue to plan to develop the work-readiness of new hires and provide industry- or company-specific preparation once a person is hired.

Specific questions regarding the role and relevance of post-secondary institution non-credit programs (i.e., continuing education units) produced answers that were unclear. Most frequently, participants responded the same way they did to the general question about gaps that follow formal education. That is, they suggested providing more support for work-experience building, such as facilitating a co-op or apprenticeship.

Analysis and Recommendations

Current skills policies assume that employers are clear about the skill requirements in their workplace and that employees will successfully achieve these skills for the economic good of both groups (Wheelahan et al., 2022). However, the findings suggest a limited knowledge about skills training stemming from a lack of clarity about the options and opportunities. This is an important limitation in the research as it is unclear why participants had limited knowledge of microcredentials.

A review of the interviews suggests several findings for training and professionalization of workers. First, life experience and formal education in supply chain management are essential foundations for entry roles, but they are insufficient. Students and employers both recognize that additional training and development is necessary for new hires. This is consistent with the expectations and provisions of Adaptive Control of Thought–Rational (Anderson & Lebiere, 1998; Eraut, 2002) and comments by Gauthier (2020) and Varadarajan et al. (2023), which suggest that additional training and development are beneficial but not exclusive to enhancing the employability of workers. The importance of training for entry-level workers is supported by human capital theory, based on the premise that early investment in training will improve earnings over time (Schultz, 1971).

Second, the focus of that training is predominantly general competencies—communication, strategic thinking, organization skills, collaboration, etc. This is not unexpected and is similar to expectations in other industries and roles (Bierema & Eraut, 2004; Eraut, 2002). Supply chain management's specific training needs are difficult to generalize beyond topical and technical knowledge, such as block chain integration, borders and customs, and industry products. Each participant had a relatively narrow view of training requirements, likely bounded by the targeting of responses to an entry-level role. Considering the variety of learner demands, the foundational competencies of the Supply Chain Canada (2022) triangle could serve as appropriate general guides for necessary training for entry roles.

Third, the principal expected source of required training is the company, which includes internal training programs and general work experience. Private training providers were minimally mentioned as sources of microcredentials or specific skills training. We had expected that the rise of on-demand training (e.g., through LinkedIn Learning) and massive open online courses (e.g., Rutgers through Coursera) would have been suggested more frequently. However, the reliance on employer-provided training may reflect the belief that educational credentials, such as undergraduate degrees, will assist employees with getting the job; ensuring employees learn the specific skills then becomes the responsibility of the company (Walters, 2004).

Regarding opportunities for post-secondary institution (PSI) credit and non-credit programs to contribute to the training of SCM professionals, three avenues appear most suitable. First, PSIs should increase the assignment or proportion of work-integrated learning experiences for students. Students and company representatives consistently noted that the gap was not about "gaining more knowledge or skills" but "practising the application of existing knowledge and skills." Second, PSIs should increase or continue the provision of training for general competencies. The most frequently mentioned knowledge and skill requirements pertained to broadly applicable abilities to communicate and collaborate and to be flexible, creative, and professional. Third, PSIs should increase or continue partnerships with professional designation accreditation bodies. Students and company representatives clearly understand the knowledge and experience provisions of professional designation and, aside from "on-the-job experience," view these designations as the logical next step in worker training and professionalization.

Study participants' interest in workplace practice is not consistent with human capital theory, where investment in education and skill development leads to increased wages and positions in a linear fashion. However, the desire to attain a professional designation supported by the employer that could lead to economic gain for both the employer and the employee is consistent with growing human capital. A clear mechanism for identifying the skills required and supporting participation through funding or other means of acknowledgment is important. Industry certification can provide the framework for skills, providing clarity for employers and employees.

Last, the strong desire for validation of knowledge and skills was an unexpected result. Participants saw the verification of learning as a meaningful signal to others. Clearly, the validity of the educational provider is important. PSIs and private organizations offer a range of microcredentials and short-term training, flooding the marketplace with options. Based on participants' comments, improved communication between providers and employers is critical to ensure the value and purpose of the training is clear. A qualifications framework and standardized use of metadata, similar to approaches used in New Zealand and Australia (Table 1), would assist with clarity and consistency.

The following recommendations may assist educational providers with the development of future skills training.

- Increase employer involvement in training and professional development to ensure the skills taught are directly relevant to industry needs.
- Develop stronger collaborations between educational institutions and professional organizations to enhance training pathways for SCM professionals.
- Improve the visibility and credibility of microcredentials by aligning them with industry competencies and demonstrating their impact on career advancement.
- Expand work-integrated learning opportunities to bridge the gap between theory and practice.
- Continue to focus on general competencies that are universally applicable across industries.
- Strengthen partnerships with professional bodies to offer recognized certifications that enhance employability and professional growth.

Summary

This qualitative study seeks to understand the views and expectations of employees and employers in the supply chain industry relating to short-term training programs such as microcredentials. This study uses perspectives provided by human capital theory to explore levels of awareness about alternative credentials, as well as preferences regarding the type and nature of training.

Perspectives from human capital theory were used to examine the interests in skills development for economic growth. This theory assumes a linear relationship between education and the economy. It is a useful lens for examining the long-term relationship between post-secondary education and economic growth, such as in traditional undergraduate programming. A weakness of this theory relating to short-term training is that it does not take into consideration the complexity of today's workplace, with rapidly changing technology, competition and sector-specific demands, or the confusion in the marketplace relating to the plethora of short-term skills training programs and the lack of information regarding employer requirements. In time, human capital theory may be more relevant, particularly if there is evidence of a clear relationship between skills training, advancement, and economic growth.

In this study, researchers explored student and company perceptions of training needs for entry-level roles in the supply chain industry. The study engaged informed and relevant participants to uncover common and diverging views on the knowledge, skills, and abilities of workers and how they should be acquired. Key findings include:

- Participants most frequently indicate the need for general competency training over specific skills training.
- Real-world experience is the most anticipated form of worker upskilling.
- Professional designation pathways are the most understood form of external provider training and development.
- Correspondingly, microcredentials are not highly understood.

The findings of this study are consistent with the review of the literature. Employers and employees currently have limited knowledge of and support for microcredentials. Until microcredentials are clearly aligned with workplace competencies, and have value as a credential that supports businesses and career growth, they will likely remain marginal, one of many short-cycle training options in the marketplace.

The study included several inherent limitations. First, as an exploratory study, it presents open-ended questions designed to gain understanding of participants' interests in skills training within the context of supply chain management and the current gaps or issues associated with gaining specific skill competencies. Second, the study population is small and builds on a convenience sample. Response themes are identified, and extrapolations are made, but care should be taken not to over-generalize the findings. Third, the professional and academic literature is sparse. Additional grounding in theory and tested models would be beneficial.

The study also offers opportunities for additional research. To build on this study, other investigators may wish to consider:

- Definitions and delineations of training programs, including short-cycle training, microcredentials, and professional designation courses

- The consistent interest in general competency development, and whether that gap is due to error or oversight in university (formal) education, is a persistent and continuous improvement area regardless of prior preparation, or is a default answer when a person does not know what to say
- Why on-demand and open-source courses are not a top-of-mind response to training needs, including whether it is an awareness issue or a non-proof-of-learning issue
- Underlying reasons for why microcredentials are not well known or well regarded in the supply chain industry

Addressing these issues will advance the critical and impactful employment preparation and performance dialogue pertaining to microcredentials.

References

Anderson, J. R., & Lebiere, C. (1998). *The atomic components of thought*. Lawrence Erlbaum Associates.

Asantha, M. (2023). *Enabling learning for life: New realities for work and education* (Canadian version) [White Paper]. D2L Corporation. https://www.d2l.com/resources/assets/new-realities-for-work-and-education-ca-version/

Ashcroft, K., Etmanski, B., Fannon, A., & Pretti, T. (2021). Microcredentials and work-integrated learning [Special issue]. *International Journal of Work-Integrated Learning*, *22*(3), 423–432.

Australian Government, Department of Education, Skills and Employment. (2021). *National microcredentials framework*. https://www.education.gov.au/higher-education-publications/resources/national-microcredentials-framework

Australian Government, Department of Education, Skills and Employment. (2023). *National higher education initiatives*. https://www.education.gov.au/higher-education/national-higher-education-initiatives

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. In *The Qualitative Report*, *13*(4), 544–559. Nova Southeastern University, Inc.

Benigno, G., Di Giovanni, J., Groen, J. J., and Noble, A. I. (2022). The GSCPI: A new barometer of global supply chain pressures. *Federal Reserve Bank of New York Staff Reports*, *1017*.

Bierema, L., & Eraut, M. (2004). Workplace-focussed learning: Perspectives on continuing professional education and human resource development. *Advances in Developing Human Resources*, *6*(1), 52–68.

Black, I. S., & Hertig, C. A. (2008). Professional certifications: Milestones of professionalism. In S. J. Davies & C. A. Hertig (Eds.), *Security supervision and management: The theory and practice of asset protection* (3rd ed.). Elsevier.

Blanchette, L. M., Holler, J., Steffenhagen, A., Vakil, N., Ghaffari, M., Powell, M., and Terenyi, J. (2021). A call to action: Maximizing the pharmacy technician role through certifications. *Journal of the American Pharmacists Association*, *61*(6), 10–13.

Brown, M., Mhichil, M., Beirne, E., & MacLochlainn, C. (2021). The global micro-credential landscape: Charting a new credential ecology for lifelong learning. *Journal of Learning for Development*, *8*(2), 228–254.

Conference Board of Canada. (2019). *Building skills connection series: Perspectives of Alberta employers* [White Paper]. https://www.conferenceboard.ca/docs/default-source/public-pdfs/bscs-3_perspectives-of-alberta-employers.pdf

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage.

D'Agostino, S. (2023, March 2). Microcredentials confuse employers, colleges and learners. *Inside Higher Ed*. https://www.insidehighered.com/news/2023/03/03/microcredentials-confuse-employers-colleges-and-learners

Desmarchelier, R., & Cary, L. J. (2022). Toward just and equitable micro-credentials: An Australian perspective: Revista de Universidad y Sociedad del Conocimiento. *International Journal of Educational Technology in Higher Education*, *19*(1), 25–37.

Diversity Institute, The Future Skills Centre, and SK Futures Inc. (2022). *Planning when you can't predict: Strategic foresight and the future of work* [White Paper]. https://fsc-ccf.ca/wp-content/uploads/2022/07/Planning-When-You-Cant-Predict_Strategic-Foresight-and-the-Future-of-Work_compressed.pdf

Eraut, M. (2002). *Developing professional knowledge and competence*. The Falmer Press.

European Union. (2022). *A European approach to microcredentials*. https://education.ec.europa.eu/education-levels/higher-education/micro-credentials

Evans, P. (2021). *Exploring the potential of micro-credentials and digital badging: The rise of the micro-credentials—What's in it for students?* Quality Assurance Agency for Higher Education. https://www.enhancementthemes.ac.uk/docs/ethemes/resilient-learning-communities/exploring-the-potential-of-micro-credentials-and-digital-badging-the-rise-of-the-micro-credential---what's-in-it-for-students.pdf?sfvrsn=31ccd881_12

Evers, F. T., & Rush, J. C. (1996). The bases of competence: Skill development during the transition from university to work. *Management Learning*, *27*(3), 275–299.

Fontana, A., & Frey, J. H. (2000). The interview: From structured questions to negotiated text. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 645–672). Sage.

Gallagher, S. R. (2018). *Educational credentials come of age: A survey on the use and value of educational credentials in hiring.* Northeastern University: Centre for the Future of Higher Education and Talent Strategy. https://cps.northeastern.edu/wp-content/uploads/2021/03/Educational_Credentials_Come_of_Age_2018.pdf

Gauthier, T. (2020). The value of micro-credentials: The employer's perspective. *Journal of Competency-Based Education*, *5*(2), https://doi.org/10.1002/cbe2.1209

Gereffi, G., & Lee, J. (2012) Why the world suddenly cares about global supply chains. *Journal of Supply Chain Management*, *48*(3): 24–32.

Harder, C., Jackson, G., & Lane, J. (2014). *Talent is not enough: Closing the skills gap* [Research Report]. Centre for Human Capital Policy. https://cwf.ca/wp-content/uploads/2015/10/CWF_HCP_TalentNotEnough_Report_SEP2014.pdf

Harvey, L. (2000). New realities: The relationship between higher education and employment. *Tertiary Education and Management*, *6*(1), 3–17.

Healy, M. (2021). Microcredential learners need quality careers and employability support. *Journal of Teaching and Learning for Graduate Employability*, *12*(1), 21–23.

Higher Education Strategy Associates and The Strategic Council. (2023). *Revisiting micro-credentials in the Canadian marketplace* [White Paper].

Hoyle, E. (2001). Teaching as a profession. *International Encyclopedia of the Social & Behavioral Sciences*, 15472–15476. https://doi.org/10.1016/B0-08-043076-7/02450-5

Jackson, M. (2023, July 27). Strategic and operational roadblocks to broad acceptance of microcredentials. *Evolllution*. https://evolllution.com/programming/credentials/strategic-and-operational-roadblocks-to-broad-acceptance-of-microcredentials

Lester, S., & Costley, C. (2010). Work-based learning at higher education level: Value, practice and critique. *Studies in Higher Education*, *35*(5), 561–575.

Levine, F. J. (2001). Professionalization of social and behavioral scientists. *International Encyclopedia of the Social & Behavioral Sciences*, 12146–12154. https://doi.org/10.1016/B0-08-043076-7/00050-4

Mahboubi, P. (2019, September). *Bad fits: The causes, extent and costs of job skills mismatch in Canada* (Commentary 552). C. D. Howe Institute. https://cdhowe.org/publication/bad-fits-causes-extent-and-costs-job-skills-mismatch-canada/

Marginson, S. (2017). Limitations of human capital theory. *Studies in Higher Education*, *44*(2), 1–19.

Martinez-Marroquin, E., & Male, S. (2021). Micro-credentials for recognition of workplace learning. *Journal of Teaching and Learning for Graduate Employability*, *12*(1), 52–57.

McKendrick, J. (2023, September 18). How to address the supply-chain staffing crisis. *Harvard Business Review*. https://hbr.org/2023/09/how-to-address-the-supply-chain-staffing-crisis

Merkert, R., & Hoberg, K. (2022). The future of logistics and supply chain management: Changing skill sets and smart career choices. In R. Merkert & K. Hoberg (Eds.), *Global logistics and supply chain strategies for the 2020s*. Springer, Cham. https://doi.org/10.1007/978-3-030-95764-3_1

Merriam, S. B. (1998). *Qualitative research and case study applications in education* (2nd ed.). Jossey-Bass.

Miles, M. B., Huberman, A. M., & Saldana, J. (2019). *Qualitative data analysis: A methods sourcebook* (4th ed.). Sage.

Munro, D. (2019). *Brave new work: Skills, training and lifelong learning* [White Paper]. Public Policy Forum. https://ppforum.ca/wp-content/uploads/2019/03/SkillsTrainingAndLifelongLearning-PPF-MARCH2019-EN.pdf

New Zealand Qualifications Authority. (2023). *Micro-credentials*. https://www2.nzqa.govt.nz/tertiary/approval-accreditation-and-registration/micro-credentials/

Olcott, D. (2022). Micro-credentials: A catalyst for strategic reset and change in U.S. higher education. *American Journal of Distance Education*, *36*(1), 19–35.

Oliver, B. (2019). *Making micro-credentials work for learners, employers and providers*. Deakin University. https://dteach.deakin.edu.au/wp-content/uploads/sites/103/2019/08/Making-micro-credentials-work-Oliver-Deakin-2019-full-report.pdf

Oliver, B. (2021). Micro-credentials: A learner value framework. *Journal of Teaching and Learning for Graduate Employability*, *12*(1), 48–51.

Oria, B. (2012). Enhancing higher education students' employability: A Spanish case study. *International Journal of Technology Management & Sustainable Development*, *11*(3), 217–230.

Ositelu, M., McCann, C., & Laitinen, A. (2021). *The short-term credentials landscape: What we see and what remains unseen* [White Paper]. New America. www.newamerica.org/education-policy/reports/the-short-term-credentials-landscape/

Patton, M. Q. (2014). *Qualitative research and evaluation methods: Integrating theory and practice* (4th ed.). Sage.

Pichette, J., Brumwell, S., Rizk, J., & Han, S. (2021). *Making sense of microcredentials*. Higher Education Quality Council of Ontario. https://heqco.ca/pub/making-sense-of-microcredentials/

Pickard, L., Shah, D., & De Simone, J. J. (2018). Mapping microcredentials across MOOC platforms. *2018 Learning with MOOCS (LWMOOCS)*, 17–21.

Poluha, R. G. (2016). Introduction: The real competition will be between supply chains in the future. In *The Quintessence of Supply Chain Management* (Quintessence Series). Springer. https://doi.org/10.1007/978-3-662-48515-6_1

Ralston, S. (2021). Higher education's microcredentialing craze: A post-digital-Deweyan critique. *Postdigital Science and Education*, *3*, 83–101.

Rubin, H. J., & Rubin, I. S. (2012). *Qualitative interviewing: The art of hearing data* (2nd ed.). Sage.

Saks, A. M., & Haccoun, R. R. (2020). *Managing performance through training and development* (8th ed.). Nelson.

Schultz, T. (1971). *Education and productivity*. National Commission on Productivity.

Schultz, T. (1961). Investment in human capital. *American Economic Review*, *51*(1), 1–17.

Shih, W. C. (2020, September-October). Global supply chains in a post-pandemic world. *Harvard Business Review*. https://hbr.org/2020/09/global-supply-chains-in-a-post-pandemic-world

Supply Chain Canada. (2022). *The competencies of Canadian supply chain professionals*. https://www.supplychaincanada.com/media/reports/Supply-Chain-Canada-Competencies-Framework.pdf

Tomlinson, M. (2017). Forms of graduate capital and their relationship to graduate employability. *Education + Training*, *59*(4), 338–352. https://doi.org/10.1108/ET-05-2016-0090

Tran, L. H. N. (2018). Game of blames: Higher education stakeholders' perceptions of causes of Vietnamese graduates' skills gaps. *International Journal of Educational Development*, *62*, 302–312.

Turnbull, L. (2019). *Let's get "skills secure": Closing the gaps in Canada's lifelong education system* [White Paper]. Public Policy Forum. https://ppforum.ca/publications/lets-get-skills-secure-gap-in-canadas-education-system/

Varadarajan, S., Hwee Ling Koh, J., & Daniel, B. (2023). A systematic review of the opportunities and challenges of micro-credentials for multiple stakeholders: Learners, employers, higher education institutions and government. *International Journal of Educational Technology in Higher Education*, *20*(13). https://doi.org/10.1186/s41239-023-00381-x

Walters, D. (2004). The relationship between postsecondary education and skill: Comparing credentialism with human capital theory. *Canadian Journal of Higher Education*, *34*(2), 97–24.

Wheelahan, G., and Moodie, G. (2021). Analyzing micro-credentials in higher education: A Bernsteinian analysis. *Journal of Curriculum Studies*, *53*(2), 212–228.

Wheelahan, G., and Moodie, G. (2022). Gig qualifications for the gig economy: Micro-credentials and the "hungry mile." *Higher Education*, *83*, 1279–1295.

Wheelahan, G., Moodie, G., and Doughney, J. (2022). Challenging the skills fetish. *British Journal of Sociology of Education*, *43*(3), 475–494.

Woods, K., & Woods, J. A. (2023). Less is more: Exploring the value of micro-credentials within a graduate program. *Journal of Continuing Higher Education*, *71*(2): 215–223.

World Economic Forum. (2017). *Accelerating workforce reskilling for the fourth industrial revolution* [White Paper]. https://www3.weforum.org/docs/WEF_EGW_White_Paper_Reskilling.pdf

World Economic Forum. (2020). *The future of jobs report* [White Paper]. https://www.weforum.org/publications/the-future-of-jobs-report-2020/