Journal of Education and Educational Research
ISSN: 2957-9465 | Vol. 17, No. 2, 2026

Dynamic Life Cycle-integrated Logistics Competency Map: A Multi-Stakeholder, Demand-Driven Pathway for Vocational Education in a Learning Society

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Abstract: A well-built competency map is the linchpin that embeds logistics vocational education into a lifelong-learning society. Moving beyond static skill lists, we propose a life cycle-based framework co-designed by government, industry, schools and learners. The model dissects the map's evolving priorities--goals, competencies, skill progression and cost-benefit—across four lifecycle phases: emergence, growth, maturity and renewal. Anchored in Yunnan's modern logistics sector, the map translates regional talent needs and technology trends into a three-tier architecture that stacks basic skills, professional expertise and strategic literacy. Differential learning modules are then carved out for entrants, mid-career staff and leaders, while real-time weighting of knowledge nodes keeps the map in lockstep with new technologies and shifting job profiles. The result is a sustainable, self-updating competency backbone that fuses vocational education with regional industrial development.

Keywords: Logistics Competency Map; Life Cycle Framework; Demand-driven Co-creation; Dynamic Alignment with Industry.

1. Introduction

Global supply chains now refresh their technologies every few quarters, yet the syllabuses of Chinese logistics vocational colleges are normally locked for three to five years. The lag is keenly felt in Yunnan, where the province is being re-positioned as the south-western land-bridge of the Belt and Road Initiative. Employers complain that graduates are "knowledge-rich but capability-poor"; teachers reply that no shared language links classroom content to fast-moving job requirements. A competency map that can update itself in real time is therefore urgently needed.

1.1. Life Cycle Theory

The life cycle theory concentrates on the various stages individuals or organizations experience throughout their entire development process, as well as the unique characteristics that each stage presents. The application of the life cycle theory in vocational education is primarily seen in the process of training skilled talents. Shi Weiping posits that the integrated training model of vocational education focuses on the law of skill formation, streamlining the teaching chain to enhance the adaptability of vocational education [1]. Tang Zhibin and Yang Ruyaanalyzed the full life cycle of vocational education, examining the characteristics and needs at various stages to achieve the systematization and scientification of vocational education [2].

1.2. Talent Demand Characteristics

Field interviews and vacancy-text mining conducted in 2024 show that recruiters no longer ask for "logistics generalists" — a term denoting operators who possess only broad, non-specialised logistics knowledge and are unable to handle digital or niche tasks. Instead, they search for profiles that combine six tightly-specified attributes.

1)Strong technical adaptability

With intelligent warehousing, AI routing and IoT sensors spreading along the China–Laos railway corridor, graduates are expected to master new hardware or software within weeks, not semesters. Employers rate "ability to self-train on an unknown WMS module" as the top criterion in 68 % of job postings[3].

2)Knowledge and skills compound

Vacancy texts simultaneously mention Python scripting, cold-chain chemistry and RCEP (Regional Comprehensive Economic Partnership) trade terms; this mirrors the interdisciplinary structure found in knowledge-graph-based curricula[4]. A single node (e.g., "temperature-controlled last-mile") now links three formerly separate domains: transport management, food safety and carbon accounting

3) Comprehensive management capability

As Yunnan builds seven national logistics hubs, project-style coordination—across warehousing, customs and multi-modal yards—becomes routine. Job descriptions increasingly bundle PMP (Project Management Professional) scheduling with lean-logistics tools, confirming the managerial layer predicted by the life-cycle model [5].

4) Innovation ability and practical ability

Companies such as JD-Asia No. 1 and Cainiao expect operators to propose process tweaks that cut kWh or shorten cycle time; this echoes the "gold specialist" framework in which innovation credits are embedded inside technical modules[6].

5) International vision

Cross-border e-commerce volumes through Ruili and Mohan ports rose 18 % in 2024; postings therefore demand bilingual declarants who understand the RCEP (Regional Comprehensive Economic Partnership) Single Window. Competency maps that include "regional flag" attributes for border prefectures outperform generic national standards[4].

6) High professional ethics and stress tolerance

Night-shift e-commerce peaks and vaccine cold-chain contingencies require resilience and compliance consciousness; these soft skills are now explicitly coded as weighted edges in the graph architecture[7].

2. Multi-level Architecture of the Vocational Education Capability Map

In the context of a learning society, the construction of a vocational education ability map should be designed from three levels: individual, organizational, and societal, to meet the learning needs of different levels [8].

2.1. Individual-level Occupational Ability Life-Cycle Model

1) Objective

To provide a clear path for personal career development and support their promotion from entry-level positions to senior ones.

2) Ability level

The basic ability level primarily encompasses foundational knowledge of logistics, operational skills, and the application of information technology. Professional capability levels primarily include data analysis, supply chain management, intelligent storage, and transportation technology. Comprehensive management ability levels primarily include project management, strategic planning, and team leadership skills. Innovation and transformation capabilities primarily include green logistics, technological innovation, and international vision.

3) Post corresponding

Basic positions include logistics operator, warehouse administrator, and transportation dispatcher. Professional positions include logistics data analyst, supply chain assistant, and intelligent warehouse technician. Management positions include logistics manager, supply chain manager, and project supervisor. Expert positions include logistics technology expert, green logistics manager, and international logistics project manager.

4)Input and output

A basic ability level typically equates to lower investment, such as lower costs for vocational education courses or internships. Consequently, the corresponding output includes primary post-employment opportunities and lower income. Professional competence level signifies an investment in secondary education and skill enhancement training. The corresponding output is the opportunity for promotion to intermediate positions and a middle income bracket. Comprehensive management ability level indicates a significant investment in advanced management training and industry seminars. The corresponding output is a position in senior management and a high income. Levels of innovation and transformation capability denote the highest investment in cutting-edge technology training and international exchanges. The corresponding output includes expert positions or transformation opportunities, and the highest income.

2.2. Organizational-level Occupational Ability Life-cycle Model

1) Objective

To provide a talent development framework for the organization, optimize the allocation of human resources, and enhance its competitiveness.

2) Ability level

Team cooperation skills primarily include cross-departmental cooperation and communication skills. Training and development capabilities primarily encompass an internal training system and the improvement of staff skills. Strategic planning ability primarily involves developing organizational development strategies in accordance with industry trends.

3) Post corresponding

The grassroots team includes the operation team and the storage team. Middle management includes department heads and project managers. Senior management includes the logistics director and the supply chain director.

4)Input and output

Team cooperation ability refers to the low input required for internal training and team - building activities. The corresponding output aims to enhance team efficiency and collaboration. Training and development capabilities require inputs such as external training and online learning platforms. The corresponding output is aimed at promoting employee skills and job advancement. Strategic planning capabilities necessitate significant investment, including senior management training and industry consulting. The output is geared towards optimizing organizational strategy and enhancing competitiveness.

2.3. Social-level Policy and Resources Collaborative Network

1) Objective

To establish a unified professional competency standard for society, to foster the standardized development of the industry, and to promote the construction of a learning society.

2) Ability level

olicy understanding ability refers to the capacity to comprehend national and local logistics policies. Industry leading ability entails promoting industry innovation and sustainable development. Awareness of social responsibility involves fostering green logistics and sustainable development.

3) Post corresponding

Policy analysts are responsible for researching policies and providing policy interpretations. Industry experts are responsible for promoting the formulation of industry standards and technological advancement. Sustainable development experts are responsible for promoting green logistics and low-carbon development.

4) Input and output

Policy understanding ability needs low input such as policy training and industry seminars. The output is for policy interpretation and compliance improvement. Industry-leading capabilities require moderate investment, such as industry exchange and technology promotion, to produce industry standard formulation and technological innovation. A strong sense of social responsibility necessitates significant investment, including green logistics training and international certification, to foster the sustainable development of the industry and enhance the social image.

3. Dynamic Integration of Life Cycle Theory with the Capability Map

To clarify the path and logic of ability development, the construction of an ability map should create a dynamic,

hierarchical lifelong learning system that is based on the stage characteristics of career ability development and incorporates the life cycle theory.

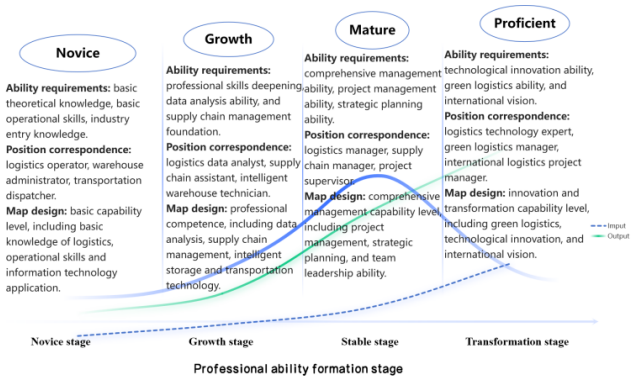

Figure 1. Schematic diagram of the capability map fusion combined with the life cycle theory

This system should cater to the learning needs of individuals at various levels. The capability map must encompass the hierarchical structure ranging from basic skills to senior management capabilities, align with job levels and income within the logistics industry, and delineate the capacity input and output data for each stage. This will provide a foundation for the continuous optimization of vocational education, as illustrated in Figure 1.

The career life cycle has experienced four stages: the novice, growth, maturity, and expert phases. In contrast, the product life cycle differs in its fourth stage, as most products and markets enter a stable period before eventually declining. In the workplace, the maturity phase corresponds to the expert period, where continuous learning and the input-output effect are more pronounced than in earlier stages. Opportunities for transformation and development are also evident, as illustrated in Table 1.

Table 1. Relationship between the life cycle of occupational ability and the logistics position

Career stage	Typical post	Ability module	Input (time / cost)	Output (income / promotion)
Novice	Junior operator	Equipment operation, basic data processing	3 months (RMB 5,000)	Annual income RMB50-60 thousand
Growth	Intermediate technician	Data analysis, smart device maintenance	6 months (RMB 10,000)	Annual income RMB50-60 thousand
Stable	Senior manager	Supply chain optimization, project management	1 year (RMB 20,000)	Annual income RMB150-200 thousand
Proficient	Industry consultant / Director	Green logistics design, international strategic planning	Continuous (RMB 30,000)	Annual income RMB300 thousand

3.1. Dynamic Adaptation and Ability Connection

With the rapid technical advancements in the logistics industry, including intelligent storage and AI prediction, the learning phase of the growth period is shortened. There is an increased emphasis on digital skills training, cross - stage ability certification is achieved through micro - certificates, and flexible promotion is supported.

3.2. The Enterprise Establishes a "Post - Ability - Training" Linkage Mechanism and Designs an Internal Capability Map Tailored to Industry Demands.

Integration of distribution path planning, equipment operation, and other technical expertise, supply chain risk response, digital supply chain operation management module, refining the core ability pool and job demand matching, and developing the corresponding abilities to improve internal courses, universities building training bases, the ability improvement and salary, through the ability map mutual recognition channel.

3.3. Government and Industry Association Support

The government aims to promote the standardization of ability certification and to unify the industry salary system. Led by the industry association known as the "Logistics Ability Development Alliance," in collaboration with enterprises and universities, it has released a map detailing the annual demand for logistics industry abilities. This initiative is designed to guide the development of courses, integrate educational resources from schools, enterprises, and industry associations, and construct a provincial smart logistics education platform that includes virtual simulation experiments, thereby reaching out to remote areas.

3.4. Capacity Decline and Reinvestment Mechanisms

Establish the validity period of the capacity based on the technology's penetration rate within the industry, and set up a recession warning system to offer seasoned professionals transformation solutions akin to a "skill renewal plan," thereby extending the career lifecycle value of the industry.

3.5. Input-output Visual Model

Big data technology is utilized to construct an input-output ratio model for capacity enhancement, based on the data of logistics practitioners. This model visually represents the time cost, capital cost, opportunity cost, and salary growth range, as well as the promotion probability and career stability throughout the career life cycle.

4. The Integration of the Life Cycle Theory

4.1. Personalized Learning Recommendation System

1) Utilize big data to analyze personal ability gaps and push customized courses.

2) Dynamically adjust recommended content based on user learning progress and feedback to ensure that the learning path aligns with personal development goals.

3) Introduce artificial intelligence technology to facilitate intelligent tutoring and Q&A, thereby enhancing learning efficiency.

4) Establish a learning community to encourage users to share their learning experiences and insights, promoting knowledge sharing and exchange.

4.2. School-enterprise Joint Training Mode

1) Universities and logistics enterprises have jointly established an "intelligent storage training center," integrating real enterprise projects into the curriculum.

2) Through the "work-study alternation" model, students can seamlessly transition between theoretical study and practical operations. For instance, they can be scheduled for practice at an enterprise each semester, with the curriculum adjusted to meet the actual needs of the enterprise.

3) The "double-teacher system" is implemented in teaching, meaning that school teachers and enterprise mentors collaboratively guide students to ensure that the teaching content is closely aligned with industry requirements.

4) Joint scientific research projects are carried out to encourage students to engage in solving real-world problems faced by enterprises, thereby enhancing their research capabilities and practical innovation skills.

5) A scholarship and internship incentive mechanism has been established to motivate students to actively participate in school-enterprise joint training programs, thereby improving the quality of the training.

4.3. Feedback Mechanism

Establish a feedback mechanism among enterprises, educational institutions, and practitioners. Enterprises should propose suggestions for enhancing the vocational education ability map based on the performance and ability requirements of their employees in real work scenarios. In turn, educational institutions should provide feedback on students' reception of the ability map and the effectiveness of the map's teaching methods, in light of the actual teaching process. Practitioners may propose suggestions for enhancing the map based on their work experience and career development requirements, and refine the ability map in accordance with the practical application scenarios. The feedback mechanism fosters communication and collaboration among enterprises, educational institutions, and practitioners, jointly advancing the enhancement of vocational education quality. Specific feedback methods encompass regular surveys, questionnaire surveys, symposiums, etc., ensuring that the perspectives of all parties are fully expressed and gathered.

4.4. Dynamic Update Mechanism of the Capability Map

Conduct regular industry research to grasp the latest technological advancements and shifts in job market demands. Annually, revise the capability modules to align with industry trends, ensuring the map remains current. Stay informed about national and local policies, and update the policy-related modules within the capability map accordingly. Integrate emerging technology modules, such as those focusing on artificial intelligence, the Internet of Things, and blockchain, to ensure the capability map reflects the industry's cutting-edge requirements.

5. Conclusion

Embedding life-cycle tags and stakeholder voting in a knowledge graph let the Yunnan logistics map retire obsolete skills and endorse emerging ones within one academic year. The pilot shows that governance rights, penetration-rate alerts and input-output transparency are the minimum toolkit for keeping vocational curricula synchronised with intelligent supply chains across the RCEP region.

Acknowledgments

This work was supported by key project of Yunnan Provincial Education Science Planning Program for 2025: Construction and application of a capability Map for Modern Logistics Vocational Education Based on the Perspective of Demand in the Context of a Learning Society under grant no. BB25008.

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