



Design and Implementation of a Micro-Credential Framework at King Mongkut's University of Technology Thonburi (KMUTT), Thailand

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Abstract

Micro-credentials are increasingly recognized as a flexible and targeted mechanism for bridging the divide between traditional higher education and evolving workforce demands. This study details the development and implementation of a micro-credential framework at King Mongkut's University of Technology Thonburi (KMUTT), Thailand, adapted from the Digital Promise model to align with Thailand's Outcome-Based Education (OBE) principles. Unlike conventional models that emphasize content mastery alone, this framework prioritizes competency-based assessment, real-world skill validation, and collaboration with industry stakeholders. The framework was constructed through a structured, three-phase methodology: (1) *Planning*, involving a review of global practices to identify transferable components; (2) *Development*, aligning competencies, assessments, and digital credentialing with KMUTT's academic infrastructure; and (3) *Application*, through pilot implementation in four domains—business, technology, education, and science and engineering. Evaluation was conducted using user participation data, and internal quality review processes to assess usability and learner engagement. During the first year of implementation, 24 micro-credentials were developed and launched across the four categories. Platform usage data indicated increasing learner interest alongside challenges in assessment completion, highlighting the need for learner support and clearer communication of credential value. This paper offers a practical and scalable model for integrating micro-credentials into higher education systems, particularly where OBE is present but lacks mechanisms for verifying applied competencies. It further identifies implementation challenges and outlines directions for future research in credentialing and workforce-aligned educational design.

Introduction

In today's rapidly evolving job market, traditional education systems often struggle to meet the changing demands of employers. Micro-credentials have emerged

as a strategic tool to bridge this gap. These short, targeted certifications enable learners to acquire and demonstrate specific, career-relevant skills. Unlike full degree programs, micro-credentials are flexible, modular, and

can be earned more quickly, making them particularly suitable for upskilling and reskilling (Organisation for Economic Co-operation and Development [OECD], 2023; Ruddy & Ponte, 2019).

Globally, there is increasing interest in leveraging micro-credentials to connect education with employment. Numerous institutions have developed structured frameworks to validate both formal and informal learning. For instance, Malaysian universities have integrated micro-credentials into academic and professional development systems (Lim, Nair, Keppell, Hassan, & Ayub, 2018), while European models, such as those proposed by O’Leary, Dooley, and McCarthy (2022) offer robust standards for quality assurance and assessment. These international efforts highlight the potential of micro-credentials to address industry needs, expand flexible learning opportunities, and enhance the relevance of higher education.

These challenges are particularly pressing in Thailand, where a substantial portion of the workforce remains misaligned with labor market demands. Recent studies indicate that 34% of Thai workers are overqualified for their current roles, and nearly 38% are employed in fields unrelated to their academic background (Vandeweyer, Espinoza, Reznikova, Lee, & Herabat, 2020). This mismatch reflects deeper structural issues, including outdated university curricula and limited pathways for adult learning and career transitions. Concurrently, Thailand is facing one of the fastest aging populations in ASEAN. By 2050, individuals aged 65 or older are projected to comprise over 51% of the working-age population, surpassing the Organisation for Economic Co-operation and Development (OECD) average of 48.8% (Teerawichitchainan, Pothisiri, Knodel, & Prachuabmoh, 2019). These trends underscore the urgent need for flexible, accessible learning models that enable mid-career and older adults to remain competitive in a dynamic economy.

Despite this urgency, research and implementation of micro-credentials in Thailand remain limited. When King Mongkut’s University of Technology Thonburi (KMUTT) began exploring micro-credentials in 2019, awareness of the concept was minimal. Observations and informal reviews revealed that many students, educators, and employers misunderstood micro-credentials, often equating them with online courses or basic participation certificates. The foundational principle—that micro-credentials are grounded in competency-based assessment—was not widely recognized. Moreover, there

was no established national framework or ecosystem to support their development or recognition within Thai higher education.

A further gap lies in the integration of micro-credentials with Outcome-Based Education (OBE). Although OBE has been promoted in Thailand for several years, its implementation has largely focused on curriculum alignment and classroom-based learning outcomes. What remains lacking is a mechanism to verify whether learners can apply their knowledge and skills in authentic, real-world contexts. At KMUTT, which has long embraced OBE principles, micro-credentials were identified as a promising means to extend OBE beyond content mastery and toward validated, job-relevant competencies.

Recognizing this potential, KMUTT began developing a comprehensive micro-credentialing system prior to the release of the United Nations Educational, Scientific and Cultural Organization (UNESCO)’s global definition in 2022. The university launched the *4LifelongLearning* platform, designed both curriculum-integrated and standalone micro-credentials, and established quality assurance mechanisms to support assessment and recognition. The overarching goal was to create a bridge between higher education and workforce needs—empowering learners to demonstrate verified competencies and enabling employers to recognize them.

This paper presents KMUTT’s micro-credential framework, adapted from the Digital Promise model and implemented across four key domains: education, business, technology, and science and engineering. It outlines the design, development and approval processes, and examines the challenges and opportunities encountered during implementation. A key contribution of this study is its demonstration of how micro-credential products can operationalize Outcome-Based Education (OBE), strengthening the connection between university learning and external skill development—rather than simply repackaging existing courses for external audiences.

Objectives

The objective of this paper is to present and analyze the design and implementation of King Mongkut’s University of Technology Thonburi (KMUTT)’s micro-credential framework, adapted from the Digital Promise model and aligned with Outcome-Based Education (OBE) principles in Thailand. Specifically,

the paper seeks to:

1. Describe the institutional motivations and contextual challenges that led to the adoption of micro-credentials at KMUTT.

2. Detail the processes of framework planning, development, and pilot application across four domains—education, business, technology, and science and engineering.

3. Explore how competency-based assessment and digital badging were conceptualized and piloted to support skill validation within KMUTT's micro-credential framework.

4. Identify the challenges and opportunities encountered during implementation, highlighting implications for higher education institutions in similar contexts.

Methodology

This study employed a structured, evidence-informed approach to develop KMUTT's micro-credential framework, integrating international models with local institutional experience. The process followed three main stages—planning, development, and application—and was guided by the goal of creating a scalable framework aligned with Thailand's Outcome-Based Education (OBE) practices.

Planning the Framework

The planning stage began with a review of international micro-credential models. The Digital Promise framework served as the primary guide due to its emphasis on clearly defined competencies, evidence-based assessment, and digital badging. Additional references included models from the OECD, Malaysia, and New Zealand, which provided insights into system design and implementation (Digital Promise, 2016; Lim et al., 2018; Otago Polytechnic, 2018). Key elements identified through this review included job-relevant skills, transparent assessment criteria, collaboration with industry stakeholders, and flexible, modular learning structures.

Developing the Framework

In the development phase, KMUTT's framework was tailored to fit the university's academic system and support OBE principles. This involved selecting appropriate competencies, designing learning and assessment processes, and establishing quality assurance standards. Collaboration with faculty members and industry partners ensured that the micro-credentials reflected actual workforce needs. The framework also

incorporated guidelines for issuing digital badges that clearly communicate learners' verified capabilities.

Applying the Framework

Following finalization, the application phase involved implementing the framework to create micro-credentials across four domains: education, business, technology, and science and engineering. Each micro-credential underwent a formal review and was approved by KMUTT's academic committee before being published on the 4LifelongLearning platform. During the pilot phase, data were collected on learner engagement, assessment submission rates, and badge attainment. These insights informed iterative improvements to the framework and supported its reparation for broader institutional adoption.

Results and Discussion

Micro-Credentials at KMUTT: Definitions and Framework Design

At KMUTT, efforts to promote awareness and understanding of micro-credentials have been ongoing for the past five years. These initiatives have included outreach through social media, blog posts, workshops, and onboarding sessions targeting both internal and external stakeholders. Despite these efforts, widespread understanding remains limited, with many stakeholders unclear about the structure, purpose, and distinctions between micro-credentials and traditional certifications.

In response, KMUTT conducted a review of global literature and practices revealing a wide range of definitions shaped by contextual factors. This diversity has informed KMUTT's approach to defining, designing, and implementing micro-credentials in a manner that not only aligns with international standards but also reinforces Thailand's OBE practices—particularly by emphasizing verified, job-relevant competencies.

To establish a clear foundation for KMUTT's micro-credential initiative, the following sections present: 1) global and institutional definitions of micro-credentials; 2) the design principles and components of KMUTT's micro-credential development framework; and 3) the structure and role of the *4LifelongLearning* platform.

1. Understanding Micro-Credentials: Global and Institutional Definitions

Globally, definitions of micro-credentials vary across academic institutions and policy-making bodies. However, several consistent themes emerge across these frameworks:

The European Union (EU) defines a micro-credential as a record of learning outcomes achieved through a small volume of learning. These outcomes are assessed against clearly defined criteria. Learning experiences leading to micro-credentials are designed to deliver specific knowledge, skills, and competencies that respond to societal, personal, cultural, or labor market needs. Micro-credentials are portable, learner-owned, and may be used independently or stacked into larger qualifications. Quality assurance is maintained through agreed standards in the relevant sector (Camilleri, Poličnik, Kamšek, & Darmanin, 2022).

UNESCO describes a micro-credential as a record of focused learning achievement that verifies what a learner knows or can do. It includes an assessment based on defined standards, is awarded by a trusted provider, and may stand alone or be combined with other micro- or macro-credentials. It must meet established quality assurance criteria (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2022).

The Malaysian Qualifications Agency (MQA) defines a micro-credential as a digital certificate confirming knowledge, skills, and competencies in a specific area or field. These credentials may form part of an accredited program or be offered as standalone short courses for professional, academic, or personal development (Malaysian Qualification Agency, 2020).

The Organization for Economic Co-operation and Development OECD views micro-credentials as organized learning activities that culminate in a credential. This credential recognizes a skill or competency acquired through learning and validated through an assessment (Organisation for Economic Co-operation and Development [OECD], 2021).

The New Zealand Qualifications Authority (NZQA, 2024) defines micro-credentials as short units of learning that recognize specific skills required by learners, employers, industries, or communities.

Digital Promise describes a micro-credential as a competency-based recognition that demonstrates mastery in a particular skill or domain, verified through submitted evidence.

Although these definitions differ in scope and emphasis, they share a common focus on skills acquisition, assessment rigor, flexibility, and relevance to real-world needs. Scholars such as Oliver (2019); O’Leary, Dooley, and McCarthy (2022) underscore the importance of clearly defining micro-credentials to

ensure their value and recognition across sectors. Without shared definitions and standards, learners face challenges in transferring credentials, and employers may hesitate to trust their validity.

At KMUTT, the *Digital Promise* model was selected as the foundation for the institutional framework due to its emphasis on practical, evidence-based learning. This model was adapted to suit Thailand’s educational context. According to Sithitavorn, Khlaisang, Thammetar, Theeraroungchaisri, and Duangchinda (2024), micro-credentials at KMUTT are targeted, stackable qualifications focused on specific skills and competencies. They are designed to be flexible and support individual career trajectories. These credentials aim to bridge the gap between traditional academic learning and workforce demands, promoting lifelong learning and enhancing employability.

2. Framework Design for Micro-Credential Development

The micro-credential framework provides learners with a clear and structured pathway for acquiring, demonstrating, and validating job-specific skills and competencies. By adhering to well-defined principles and processes, the framework ensures that the credentials are practical, transparent, and aligned with both learner needs and industry expectations. KMUTT’s framework is built upon three core principles, beginning with the foundational characteristics of its micro-credential design.

Characteristics of KMUTT Micro-Credentials

Micro-credentials at KMUTT are designed according to the following characteristics:

1. **Job-Related Competencies:** Micro-credentials emphasize job-specific skills, incorporating feedback based on authentic work examples and expert recommendations. This approach enables learners to enhance their capabilities at their own pace and aligns with models that prioritize industry-informed curricula and employer-recognized competencies (Vasilev, 2024).

2. **Practical Application:** KMUTT’s micro-credentials focus on learners’ ability to apply skills in real-world contexts, rather than solely demonstrating theoretical understanding. Each credential requires submission of practical evidence—such as project work, case studies, or professional tasks—that illustrates skill application. Assessment is guided by Miller’s (1990) Pyramid, particularly the “Shows How” and “Does” levels, which emphasize performance-based demonstration over conceptual explanation (see Figure 1).

3. **Research-Based:** Micro-credentials are grounded in research and utilize evidence-based methods to validate skills and enhance professional outcomes. This ensures both academic rigor and relevance to evolving workforce demands.

4. **Transparency:** Learners are provided with clear information regarding expectations, assessment methods, and evaluation criteria. This transparency is consistent with standard elements proposed by the European Council and European Higher Education Area (EHEA) (TPG-LRC CoRe Working Group, 2024).

5. **Self-Paced Learning:** Micro-credentials are designed to be completed on flexible timelines, supporting lifelong learning goals and reducing barriers to access. This approach accommodates diverse learner needs and promotes inclusive participation (Ministry of Advanced Education and Skills Training, 2021).

6. **Recognizable Credentials:** Upon successful completion, learners receive digital badges that showcase verified competencies. These badges securely store metadata—including issuer information, evaluation criteria, assessor comments and recommendations, and submitted evidence—and are shareable with employers and professional networks.

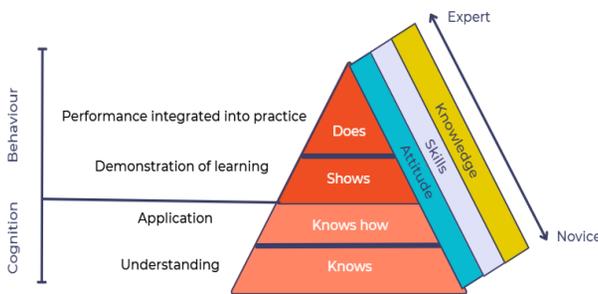


Figure 1 Competency levels in KMUTT's micro-credential assessment framework, adapted from Miller's (1990) Pyramid.

Micro-Credential Information

Designers must prepare comprehensive micro-credential information that is accessible to learners prior to registration. This information should include the following components:

Description of the Micro-Credential: A concise overview outlining the purpose, learning objectives, and potential applications of the micro-credential in academic or workforce contexts.

Competency to be Demonstrated: A clear articulation of the specific skills, knowledge, or abilities

that learners are expected to demonstrate in order to earn the micro-credential.

Methods of Demonstrating Competency: An explanation of the approaches used to assess competency, which may include hands-on projects, case studies, simulations, formal assessments, or real-world applications.

Submission Requirement: A detailed outline of the evidence or deliverables required for successful completion. Examples include portfolios, project reports, performance-based tasks, video demonstrations, or standardized assessments.

Digital Badge or Certificate: Upon completion, learners receive a verifiable digital badge or certificate containing metadata that documents the achievement, competency level, and issuing institution, assessor feedback, and submitted evidence. These credentials are designed to be shareable with employers and professional networks.

Target Learner Description: A specification of the intended audience, which may include professionals, students, or defined learner groups such as developers, educators, scientists, or startup teams.

Assessment Process

KMUTT's micro-credential assessment process is grounded in the established framework and guidelines of *Digital Promise*. The assessment principles specify the types of evidence learners must submit to earn a micro-credential. Designers are responsible for developing the assessment criteria and guidelines to ensure validity, transparency, and alignment with competency-based standards.

To ensure the sufficiency and relevance of submitted evidence, the assessment process is divided into three components (Digital Promise, 2016; Lim et al., 2018):

1. Part 1: Overview Questions (Provides Context)

This component allows learners to provide contextual information for the evidence they submit. Designers develop guiding questions or prompts that help learners articulate the background, purpose, and relevance of their submissions. Each overview question is accompanied by clearly defined passing criteria which assist both assessors and learners in understanding the expectations and evaluation standards.

2. Part 2: Work Examples / Artifacts

Learners must submit artifacts that demonstrate their competency in the targeted skill area. These artifacts are assessed using a rubric developed by the micro-credential designer. Acceptable forms of evidence may

include video recordings, photographs, written documents, or any other media appropriate to the skill being assessed. The focus is on authentic, performance-based evidence that reflects real-world application.

3. Part 3: Reflection

Learners are asked to reflect on their learning experience, including how the acquired competency has influenced their current practice and how it may impact future professional development. Reflection prompts may address lessons learned, challenges encountered, and anticipated applications of the skill in evolving contexts.

This assessment framework ensures that learners develop competencies through a structured evaluation process that integrates contextual understanding, evidence-based submission, and reflective practice. Assessors provide feedback aligned with assessment guidelines for each component, applying clearly defined passing criteria and a standardized scoring rubric to validate learner performance.

Although definitions of micro-credentials vary slightly across countries and institutions, they consistently emphasize core features such as skill development, flexible learning pathways, and assessment grounded in real-world application. Scholars such as Vasilev (2024) and Altuna et al. (2023) highlight that well-designed micro-credentials can support the acquisition of job-relevant skills and foster ongoing professional development. However, in the absence of a common structure or clearly articulated standards, learners may encounter difficulties in transferring micro-credentials across institutions or gaining recognition from employers.

Reports from the MICROBOL Project (2022) and the TPG-LRC CoRe Working Group (2024) recommend the inclusion of essential elements—such as defined learning outcomes, workload specifications, assessment types, and quality assurance mechanisms—to enhance transparency and trust. These shared standards contribute to the broader acceptance and utility of micro-credentials across diverse educational systems and industry sectors. Similarly, the Ministry of Advanced Education and Skills Training (2021) emphasizes the importance of clear information, industry collaboration, and robust quality assurance processes in ensuring that micro-credentials are meaningful and valuable to both learners and employers.

3. KMUTT's Micro-Credential Platform

To operationalize its micro-credential framework, KMUTT developed the *4LifelongLearning* platform as

a centralized hub for the design, delivery, and recognition of micro-credentials (see Figure 2). The platform features a user-friendly interface that includes learner dashboards, metadata-rich digital badges, and searchable credential listings. It facilitates transparent communication among multiple stakeholders—including students, faculty, and industry partners—by clearly outlining the structure, competencies, and assessment criteria associated with each micro-credential.

Micro-credentials offered through the platform are organized into four key categories: Science & Engineering, Business, Education, and Technology. As shown in Table 1, a total of 84 micro-credentials were launched between 2021 and 2024. Among these, Business and Science & Engineering categories accounted for the highest numbers, with 29 micro-credentials each. This diversity reflects KMUTT's strategic intent to align micro-credential offerings with institutional strengths and evolving labor market demands.

The Design, Development, and Approval Process

As previously noted, KMUTT's micro-credential framework is adapted from the *Digital Promise* model. As illustrated in Figure 3, the process begins with the submission of pre-design concepts (*Identify needs*), which include the proposed competency, target learner profile, and evidence or artifact based on the initial idea. This phase parallels the credential initiation used at institutions like the Royal Melbourne Institute of Technology University (RMIT), where proposals outline learning outcomes, target audiences, and industry alignment prior to governance approval (Ponte & Saray, 2019).

This initial concept is reviewed by the designer support team to confirm its readiness for development. Once approved, the designer collaborates with a support team consisting of a designer support member and a coach from the *4LifelongLearning* Committee. The coach provides ongoing guidance throughout the design phase, supporting micro-credential development (Design & Coach) and ensuring that assessments are aligned with the specified competencies.

The designer is responsible for key tasks, including drafting content, curating resources, structuring the credential (including core information and assessment components) and incorporating references. Weekly meetings are held to review progress, discuss the framework alignment, and assign tasks. These meetings follow an iterative model similar to the sprint cycles used at RMIT, allowing for flexibility and timely adjustments to ensure successful completion.

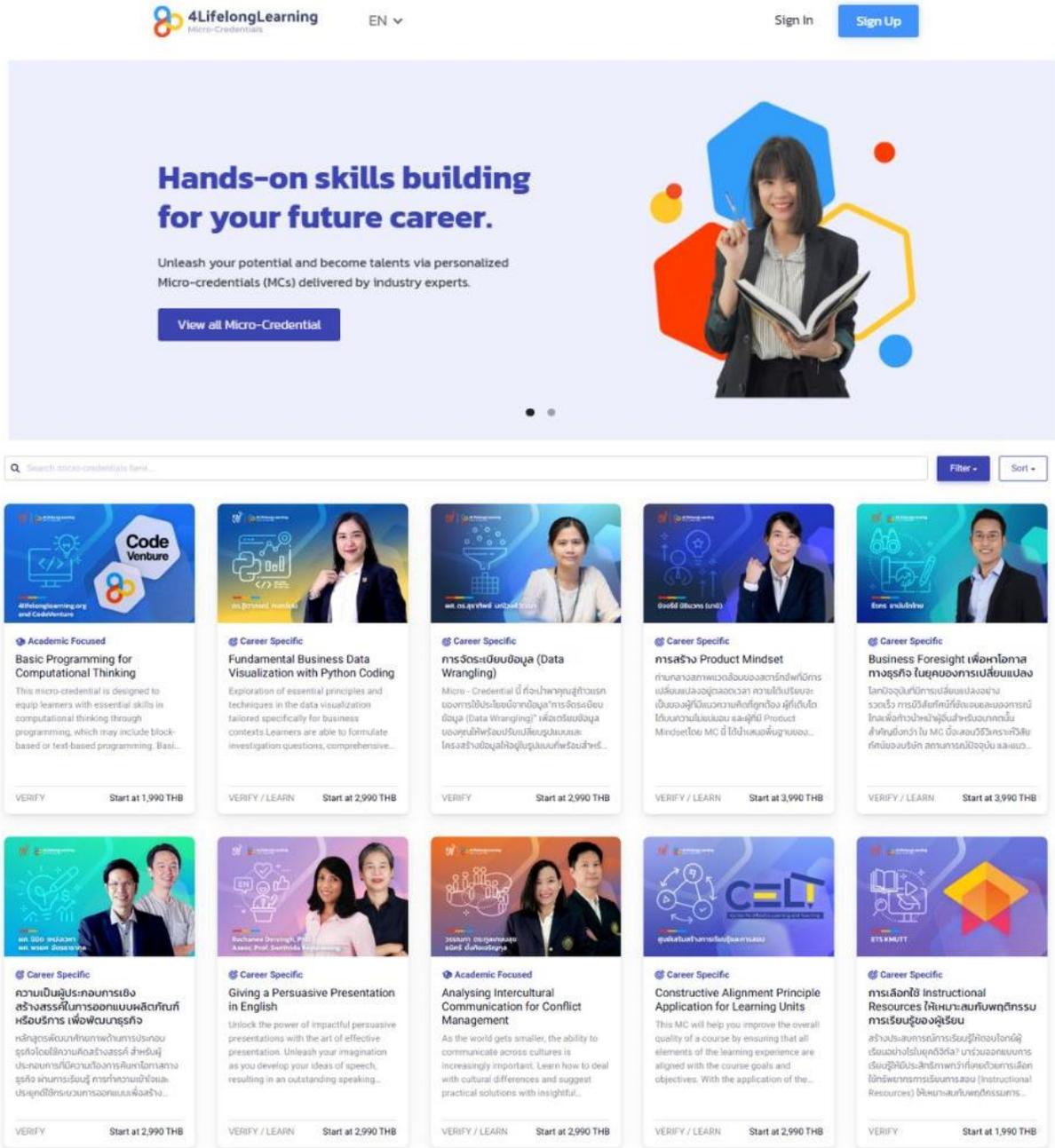


Figure 2 4LifelongLearning platform interface at KMUTT, displaying learner navigation, credential search, and badge metadata features.
Source: <https://www.4lifelonglearning.org/>

Table 1 Number of micro-credentials developed at KMUTT (2021–2024), categorized by academic field

Category / Year	2021	2022	2023	2024	Total
Science & Engineering	3	11	12	3	29
Business	16	2	3	8	29
Education	4	2	0	14	20
Technology	1	1	2	2	6
Total	24	16	17	27	84

Following the completion of the design and coaching phase, each micro-credential undergoes a formal approval process to ensure quality and validity. Initially, the content is reviewed by an internal or external expert to assess its accuracy, relevance, and reliability. Subsequently, the micro-credential is submitted to the academic committee for final evaluation, during which the assessment criteria and rubrics are carefully examined to confirm alignment with the specified competencies.

Upon approval, a digital badge is created to serve as a verifiable credential, and the micro-credential is officially published on the *4LifelongLearning* platform. Once published, the micro-credential enters the evaluation and feedback stage, where learners engage with the content, complete assessments and receive expert feedback.

Assessment data and user feedback are systematically collected and analyzed to support continuous improvement. This iterative process ensures that each micro-credential remains relevant, effective, and responsive to the evolving needs of learners and industry stakeholders.

Micro-Credential Ecosystem and Learner Journey

The successful implementation of micro-credentials depends on a well-functioning ecosystem involving three key stakeholder groups: issuers, learners, and recognizers (see Figure 4). These actors must interact in a coordinated and collaborative manner to ensure that micro-credentials are designed, delivered, and recognized in ways that align with labor market demands and lifelong learning objectives (Oliver, 2019; UNESCO, 2022).

1) Issuers: Issuers, including universities, vocational institutions, and training providers play a central role in

developing micro-credentials by identifying essential skills, establishing assessment criteria and ensuring quality assurance. According to the OECD (2023), effective issuers modular and stackable micro-credentials that are closely aligned with current labor market and technological trends. Collaboration with industry partners is critical to ensure that the credentials reflect authentic job requirements. This co-development approach, commonly employed in technical and vocational education and training (TVET) systems, helps ensure that micro-credentials meet workforce needs and are valued by employers (Digital Promise, 2016; Resei, Friedl, Staubitz, & Rohloff, 2019; Vasilev, 2024). Within the issuer’s operation, two essential sub-roles are identified (Digital Promise, 2018):

(1) Designers: Responsible for creating the micro-credential components by clearly specifying the required evidence and the methods for its evaluation. Evaluation criteria are typically articulated through rubrics. In addition, designers may provide supporting resources and design relevant learning experiences, particularly when the micro-credential involves learner development.

(2) Assessors: Responsible for evaluating the evidence submitted by learners to determine whether micro-credential should be awarded based on the established criteria. Beyond making evaluative judgments, assessors also provide constructive feedback to guide learners in improving their submissions. To ensure quality and fairness, assessors should be trained in both general micro-credential assessment principles and the specific criteria associated with each micro-credential.

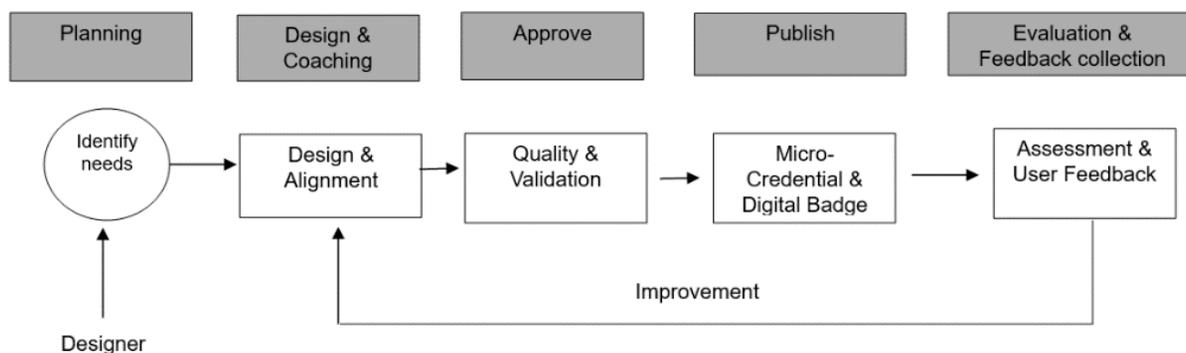


Figure 3 Structured process for the design, development, and approval of micro-credentials at KMUTT. The figure outlines key stages including needs identification, collaborative design and coaching, internal and external reviews, committee approval, digital badge issuance, and ongoing evaluation based on learner engagement and feedback.

2) Learners: Learners, including students, educators, and working professionals are the primary beneficiaries of micro-credentials. They seek accessible, self-paced, and career-relevant learning opportunities. Ruddy and Ponte (2019) and Baxley (2024) emphasize that micro-credentials empower learners by allowing them to focus on targeted competencies rather than broad academic content. This makes micro-credentials particularly attractive to non-traditional learners and working adults seeking flexible options for upskilling or reskilling without committing to full-degree programs. However, research also indicates that without strong institutional support and employer recognition, learners may not fully perceive the value of micro-credentials (Calonge & Shah, 2016).

3) Recognizers: Recognizers, including employers, industry groups, and government agencies play a pivotal role in validating micro-credentials within the labor market. Their recognition influences the adoption and utility of micro-credentials in hiring and promotion decisions. According to Jayraman and Banerjee (2021), meaningful engagement from employers in the development and assessment of micro-credentials enhances trust in the credentialing system and improves the employability of credential holders. As noted by the Shapiro Futures, Andersen, and Larsen (2020), recognition mechanisms such as digital badges with standardized metadata help make competencies transparent and verifiable, thereby strengthening employer confidence. In addition to these three stakeholder groups, governments increasingly view micro-credentials as policy instruments for expanding access to higher education and lifelong learning. The OECD (2021)

highlights their potential to reach underserved populations—including part-time students and adult learners—through flexible and modular formats. This aligns with broader international goals of democratizing education and addressing skill mismatches in rapidly evolving economies (UNESCO, 2022; Vandeweyer, et al., 2020).

Within this ecosystem, the process of obtaining a micro-credential and earning a digital badge on the *4LifelongLearning* platform is illustrated in Figure 5. The learner's journey begins with registration on the platform, followed by exploration of available micro-credentials to identify one that aligns with their interests or career goals. This approach mirrors practices adopted at institutions such as RMIT University, where learners first select digital credentials based on career relevance, then proceed to learn, earn, and share their achievement within professional networks (Ponte & Saray, 2024).

Once a suitable micro-credential is identified, the learner applies for enrolment. At this stage, they assess their readiness: if unprepared, they are guided to develop the necessary competencies before proceeding; if ready, they advance to the submission phase. The learner then submits evidence demonstrating their competency, which is then reviewed and evaluated by the assessor and issuing institution—typically a university. If the submission does not meet the established criteria, the learner receives feedback and is encouraged to revise and resubmit. Upon meeting the competency requirements, the learner is awarded the micro-credential.

Following successful completion, the learner receives a digital badge—a verifiable credential that recognizes their achievement. This badge can be shared on professional platforms, résumés, and social media to enhance career visibility. As with RMIT's Creds ecosystem, badges may be distributed via LinkedIn, digital portfolios, and other channels to support employment opportunities (Ponte & Saray, 2024). Recognizers, including employers and industry partners, play a critical role by acknowledging these credentials and incorporating them into hiring and workforce development strategies. This structured approach ensures that micro-credentials function as an effective tool for lifelong learning, career advancement, and industry upskilling.

To establish a robust micro-credential ecosystem, its structure must be clearly defined, enabling both learners and recognizers to fully understand the credentials offered by various issuers. According to the

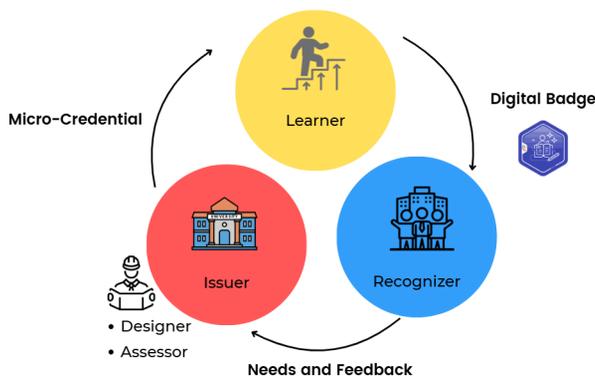


Figure 4 The micro-credential ecosystem at KMUTT, illustrating the interaction between issuers, learners, and recognizers. Issuers design credentials, learners build skills, and recognizers (such as employers) validate and apply the credentials.

OECD (2023), building a strong ecosystem requires a two-fold strategy. First, it involves the formulation of public policies that support issuers and learners while integrating micro-credentials into broader education, training, and labor market frameworks. Second, it necessitates active collaboration among key stakeholders—including educational and training institutions, public authorities, employers, and industry leaders. Through coordinated efforts and policy alignment, micro-credentials can become a fully integrated and widely recognized component of the modern education and workforce development landscape.

Challenges in Micro-Credential Development, Implementation, and Recognition

Although micro-credentials are increasingly recognized as flexible and responsive tools for upskilling and reskilling, their implementation continues to face several substantive challenges. Drawing on both

KMUTT’s institutional experience and insights from international research, these challenges can be categorized into three primary areas: policy and regulation, stakeholder engagement, and public perception (see Figure 6).

1) Policy and Regulatory Challenges

A primary barrier to the widespread adoption of micro-credentials is the absence of clear national policies and regulatory standards that support their formal recognition. In the absence of consistent frameworks, micro-credentials struggle to gain acceptance across educational institutions and industry sectors (OECD, 2021). For instance, the potential to stack micro-credentials toward full qualifications remains ambiguous in many countries, thereby limiting their long-term value and integration into formal education pathways (European Commission, 2022).

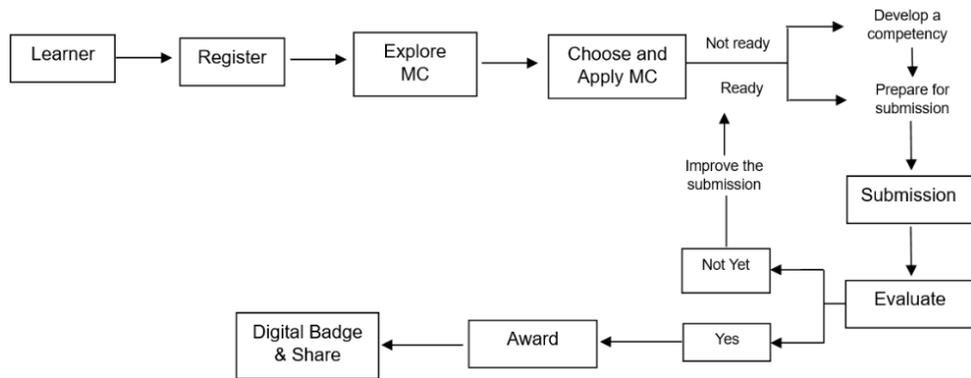


Figure 5 The process of earning a micro-credential on the *4LifelongLearning* Platform at KMUTT, illustrating steps from registration and learning to evidence submission, feedback, and digital badge issuance. The badge can be shared on social media, résumés, and professional networks to enhance career visibility.

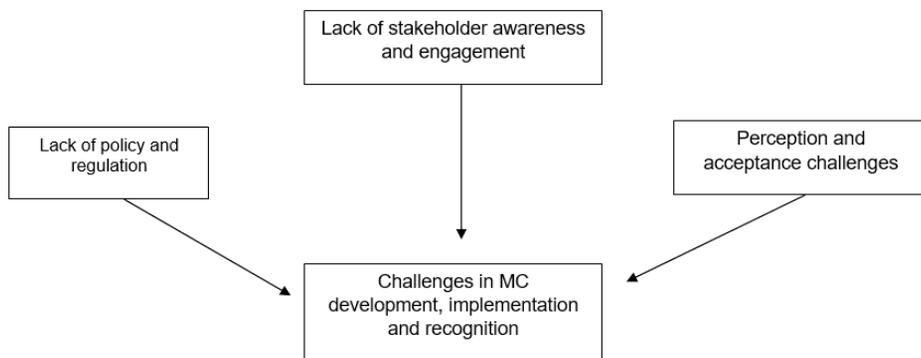


Figure 6 Key challenges in the development, implementation, and recognition of micro-credentials at KMUTT, categorized into policy and regulatory barriers, limited stakeholder engagement, and varying levels of acceptance among learners and employers.

Incorporating micro-credentials into national qualification frameworks requires coordinated efforts among universities, industry stakeholders, and government agencies. Such integration is essential for establishing credibility, ensuring quality assurance, and promoting transferability across systems (MICROBOL Project, 2022; OECD, 2023).

2) Stakeholder Awareness and Engagement

The effectiveness of micro-credential systems relies heavily on robust collaboration among learners, issuers, and employers. However, widespread unfamiliarity with micro-credentials continues to hinder their adoption. Many learners and companies remain uncertain about what micro-credentials entail and how they differ from conventional certifications. Research indicates that employers often perceive them as informal or non-essential, while learners may conflate them with online certificates that lack rigorous assessment components (Che Ahmat, Bashir, Razali, & Kasolang, 2021; Galindo, Fennelly-Atkinson, Franklin, & Luna, 2024).

Designing relevant and impactful micro-credentials requires close industry involvement. Yet, collaboration with industry partners is frequently time-consuming and difficult to maintain—particularly when skill demands vary significantly across sectors (Resei et al., 2019). Additionally, some educators express resistance to adopting micro-credentials, viewing them as a potential challenge to the traditional degree model and its perceived academic integrity (Jayraman & Banerjee, 2021).

3) Perception and Acceptance Challenges

A persistent challenge in micro-credential implementation is the widespread misunderstanding of their nature and purpose. Learners often expect micro-credentials to resemble online courses that simply award certificates upon completion. In contrast, most micro-credentials are competency-based, requiring learners to submit evidence of skill mastery for review by qualified assessors (Galindo et al., 2024; OECD, 2021). This misalignment in expectations can negatively impact learner motivation and completion rates.

KMUTT's internal data provides valuable insights into learner engagement with micro-credentials over a three-year period. As shown in Table 2, user registrations on the *4LifelongLearning* platform remained steady at approximately 301 users per year. In 2024, this number rose significantly to 398 users—a 32% increase—largely driven by pilot initiatives involving both students and staff. However, despite the growth in

registrations, the number of users who submitted assessment evidence declined sharply, from 170 in 2023 to only 76 in 2024. This gap suggests that while interest in micro-credentials is increasing, fewer learners are completing the full credentialing process.

Several factors may explain this trend. First, some learners may find the assessment requirements too difficult without adequate preparation or guidance. Second, a lack confidence in submitting evidence—particularly among those unfamiliar with digital badges or unclear about the evaluation criteria—may deter participation. Third, the optional nature of learning resources may not sufficiently support learners who require structured guidance to build the necessary competencies. One contributing factor is that the early design of KMUTT's *4LifelongLearning* platform prioritized assessment and verification, positioning learning resources as supplementary rather than integral to the credentialing process. However, many learners benefit from a more guided learning experience that prepares them for assessment.

This pattern is further reflected in the number of digital badges awarded. In 2022, 40 learners earned badges; the number rose to 98 in 2023, then declined to 41 in 2024, mirroring the drop in assessment submissions. These findings indicate that strong initial interest is insufficient on its own—learners require clear instructions, consistent support, and encouragement to complete their micro-credentials. To improve completion rates and learner outcomes, future iterations of micro-credential programs should focus on enhancing assessment clarity, integrating supportive learning resources, and raising awareness about the career benefits of micro-credentials.

Table 2 Number of users in KMUTT's micro-credential initiative (2022–2024), with annual data on platform registrations, assessment submissions, and digital badges awarded.

User Status	Year		
	2022	2023	2024
Applied (number of users)	301	301	398
Submission (number of users)	149	170	76
Awarded (received digital badge)	40	98	41

Note: *Applied* refers to the number of users who registered for micro-credentials. *Submission* indicates the number of users who completed and submitted the required assessments. *Awarded* represents the number of users who successfully met the criteria and received a digital badge.

Moreover, micro-credentials are interpreted differently across stakeholder groups. Educators often view them as a bridge between formal and informal learning, while employers tend to equate them with

certificates from short professional development programs designed to support lifelong learning (Che Ahmat et al., 2021). In the absence of a shared understanding, it becomes difficult to establish widespread trust, recognition, and integration into existing education and employment systems.

To address these challenges, a coordinated strategy is essential—one that clarifies the nature, value, and intended purpose of micro-credentials. This involves improving communication, aligning stakeholder expectations, and strengthening institutional support mechanisms. Raising awareness among learners, educators, and employers is critical to positioning micro-credentials as credible, competency-based qualifications rather than mere certificates of participation. Enhancing recognition and understanding across all stakeholder groups will ultimately support broader acceptance and facilitate the integration of micro-credentials into national education frameworks and workforce development strategies.

Conclusion

This study presents a practical framework for designing and implementing micro-credentials at King Mongkut's University of Technology Thonburi (KMUTT), adapted from the *Digital Promise* model to suit the Thai higher education context. The framework has been applied across four domains: Education, Business, Technology, and Science & Engineering—and is grounded in principles of competency-based assessment, flexibility, and industry collaboration. Notably, it addresses a critical gap in Thailand's implementation of Outcome-Based Education (OBE). While OBE emphasizes intended learning outcomes, it often lacks concrete mechanisms for verifying whether learners can demonstrate those outcomes in authentic, real-world contexts. Micro-credentials help close this gap by offering a structured means to validate applied competencies.

A major strength of this study lies in its demonstration of how an international framework can be effectively localized within a Thai university setting. KMUTT began developing micro-credentials as early as 2019—prior to UNESCO's formal definition in 2022—positioning the university as one of the first institutions in Thailand to establish a comprehensive ecosystem. This includes the *4LifelongLearning* platform, internal quality assurance standards, and both curriculum-integrated and standalone micro-credential structures.

The KMUTT case offers valuable guidance for institutions seeking to align educational offerings with workforce demands.

The study further illustrates how micro-credentials can enhance OBE by shifting from classroom-based learning to demonstrable skill application in professional contexts. Drawing on platform data, the study highlights both the growing interest in micro-credentials and the challenges learners face—particularly in completing assessments and understanding the value of digital badges. These findings underscore the need for clearer assessment guidelines, more supportive learning resources, and improved communication regarding the benefits of micro-credentials.

However, the study has limitations. It primarily examines the design and early implementation phases at KMUTT and does not yet explore long-term impacts, such as how micro-credentials influence career trajectories or employer recognition. As the data is drawn from a single institution, the findings may not be generalizable to other contexts within Thailand or internationally. Additionally, while the study emphasizes industry collaboration, it does not deeply investigate how employers evaluate or apply micro-credentials in hiring decisions.

Despite these limitations, the study offers practical insights into the conditions necessary for successful micro-credential implementation. It emphasizes the importance of clear assessment criteria, robust learner support, and effective stakeholder communication. These elements are essential to help learners complete the credentialing process and understand how their skills are recognized. Importantly, the framework demonstrates how micro-credentials can bridge the gap between university learning and workforce needs, making education more flexible, relevant, and skill focused.

Future research should examine how micro-credentials influence employment outcomes, support career advancement, and are perceived across different industries. It is also important to explore how this framework can be adapted to other institutions and regions, and how universities can more effectively collaborate with employers in co-designing micro-credentials. Further investigation is needed into structured learning approaches that enable individuals to reliably demonstrate their ability to perform specific tasks or roles to defined standards. This continues to represent a significant gap in educational practice, as there are few scalable approaches that effectively support learners from

diverse backgrounds in acquiring consistent, job-ready competencies. Addressing this issue could significantly enhance both educational quality and workforce development.

In conclusion, this study offers a practical and adaptable model for implementing micro-credentials in higher education. It contributes to the growing discourse on how micro-credentials can connect education with real-world demands and support flexible, skill-based learning. Most importantly, it points toward the next phase of educational transformation: building systems that not only teach but also *prove* what learners can do.

Key Definitions

To support a shared understanding of terminology used throughout this paper, the following definitions are provided

Learner: An individual seeking to earn credentials or develop competencies. Learners must submit evidence of specific skills and demonstrate competency to meet the requirements of a micro-credential.

Designer: The entity responsible for creating a micro-credential by identifying a valued competency, compiling relevant learning resources to learn, specifying the required evidence for competency demonstration, and establishing assessment criteria.

Assessor: An individual who evaluates submitted evidence using a rubric to determine whether the learner has met the competency standards. The assessor also provides feedback on strengths and areas for improvement.

Issuer: An organization or institution that verifies competencies and oversees the overall quality of the credentialing process. In this study, KMUTT serves as the issuing institution.

Recognizer (or Partner): An organization or institution that acknowledges, values, and recognizes the verified competencies. Recognizers may use micro-credentials for purposes such as hiring and promotion, or professional development. They collaborate with issuers or designers to ensure that competencies align with organizational needs.

Digital Badge: A verifiable, online representation of a learner's skills and achievements. Digital badges contain metadata detailing the issuing institutions, assessment criteria, evidence submitted, and feedback received, and can be shared across professional platforms.

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