

Developing a Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education: A PRISMA-Guided Systematic Review and CiteSpace Knowledge Mapping Analysis

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Abstract: The transformation of Technical and Vocational Education and Training (TVET) toward competency-based education has intensified the need for standardized assessment systems that accurately measure learners' occupational competence and align with evolving industry expectations. Despite the implementation of competency-based curricula within Malaysian TVET, the development of comprehensive assessment instruments for Culinary Arts education remains fragmented and lacks empirical synthesis. This study aimed to systematically map the global knowledge structure of competency-based assessment research and establish an evidence-based foundation for developing a Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education. A systematic literature review was conducted following the PRISMA 2020 guidelines, with publications retrieved from the Scopus and Web of Science databases covering the period from 2015 to 2026. Following the screening and eligibility processes, 56 peer-reviewed publications were included in the final analysis. Bibliometric knowledge mapping was performed using CiteSpace to examine publication trends, author and institutional collaborations, co-citation networks, keyword co-occurrence, thematic clusters, citation bursts, and emerging research frontiers. The findings identified eight dominant research domains: competency framework development, authentic assessment, performance assessment, assessment rubric development, industry competency standards, workplace-based assessment, assessment validity and reliability, and digital competency assessment. The knowledge mapping further revealed an increasing emphasis on technology-enhanced assessment, learning analytics, competency verification, and stronger collaboration between educational institutions and industry. The proposed framework contributes to improving assessment quality, graduate employability, and curriculum alignment while supporting the achievement of the United Nations Sustainable Development Goal 4 (Quality Education) through equitable, inclusive, and industry-responsive vocational education, and Sustainable Development Goal 8 (Decent Work and Economic Growth) by strengthening workforce competencies and employability within the hospitality and culinary sectors.



Keywords: Competency-Based Assessment; Culinary Arts Education; Technical and Vocational Education and Training (TVET); Vocational Assessment

1. Introduction

Technical and Vocational Education and Training (TVET) has become a strategic priority for many countries seeking to produce a highly skilled workforce capable of responding to industrial transformation, technological innovation, and changing labor market demands. In Malaysia, TVET plays a pivotal role in supporting the national agenda outlined in the Twelfth Malaysia Plan and the National TVET Policy 2030, which emphasize the development of competent graduates equipped with industry-relevant knowledge, technical skills, and professional attitudes. Within this landscape, Culinary Arts education represents a significant vocational discipline because it contributes directly to the hospitality, tourism, and food service industries, sectors that continue to experience substantial growth and increasing demand for skilled professionals. However, despite curriculum reforms and competency-oriented educational policies, the assessment practices employed in many Malaysian Culinary Arts vocational institutions remain largely conventional, fragmented, and inconsistent, thereby limiting the accurate evaluation of students' occupational competence (Hashim et al., 2024; UNESCO-UNEVOC, 2024). Competency-Based Education (CBE) emphasizes learners' ability to demonstrate measurable competencies rather than merely completing instructional hours or achieving academic grades. Consequently, competency-based assessment (CBA) should evaluate learners holistically by integrating technical competence, practical performance, cognitive understanding, problem-solving ability, communication skills, teamwork, and professional ethics in authentic workplace contexts (Mulder, 2023). Nevertheless, evidence from recent TVET research suggests that many vocational institutions continue to rely heavily on traditional examinations and instructor-centered assessment approaches that insufficiently capture students' practical competencies and workplace readiness (OECD, 2024). In Culinary Arts education, where learning outcomes require the integration of psychomotor, cognitive, and affective domains, assessment systems that emphasize written examinations or isolated practical tasks may fail to reflect the complexity of professional culinary performance.

Another important issue concerns the absence of a standardized competency-based assessment kit specifically designed for Malaysian Culinary Arts vocational education. Although competency standards have been established through the Malaysian Skills Certification framework and the National Occupational Skills Standards (NOSS), educators frequently develop assessment instruments independently, resulting in considerable variations in assessment criteria, scoring rubrics, evidence collection, and performance judgments across institutions. Such inconsistencies may affect assessment reliability, validity, transparency, and comparability, ultimately influencing graduates' competency certification and employability. Furthermore, instructors often encounter challenges in translating occupational competency standards into authentic assessment tasks that align with industry expectations and contemporary pedagogical practices (Department of Skills Development, 2024).

The growing complexity of the hospitality and culinary industries further amplifies the need for robust competency assessment. Rapid digitalization, automation, food safety regulations, sustainability practices, artificial intelligence applications, and evolving customer expectations require Culinary Arts graduates to possess adaptive competencies extending beyond technical cooking skills. Contemporary culinary professionals are expected to demonstrate creativity, critical thinking, digital literacy, sustainable food practices, communication, leadership, and continuous learning capabilities. Existing assessment instruments, however, frequently emphasize technical execution while overlooking these higher-order competencies that employers increasingly value (World Economic Forum, 2025). Consequently, vocational institutions require comprehensive assessment tools capable of measuring multidimensional competencies that correspond to current industry requirements. From a research perspective, scholarly investigations on competency-based assessment in TVET have expanded considerably during the past decade. However, the existing body of literature remains fragmented across multiple disciplines, including vocational education, educational assessment, hospitality education, curriculum studies, workforce development, and competency modeling. Although systematic reviews have examined competency-based education broadly, relatively few studies have synthesized global knowledge specifically concerning competency-based assessment within Culinary

Arts vocational education. Even fewer investigations have employed bibliometric knowledge mapping techniques to identify research trends, intellectual structures, collaborative networks, thematic evolution, and emerging research frontiers. Consequently, there remains limited understanding of how research on competency-based assessment has evolved internationally and how these developments can inform the design of an evidence-based assessment kit suitable for the Malaysian TVET context (Chen, 2017; Donthu et al., 2021).

Knowledge mapping using CiteSpace offers an advanced bibliometric approach capable of visualizing scientific knowledge domains through co-citation analysis, keyword co-occurrence, collaboration networks, citation bursts, and thematic evolution. Unlike conventional literature reviews, CiteSpace enables researchers to identify influential publications, emerging research themes, knowledge clusters, and future research directions objectively using large bibliographic datasets. Applying CiteSpace alongside a systematic review following the PRISMA 2020 guidelines can therefore provide a comprehensive evidence base for identifying the essential competency domains, assessment dimensions, performance indicators, and assessment strategies required for developing a competency-based assessment kit tailored to Malaysian Culinary Arts vocational education (Page et al., 2021).

Despite these methodological advances, there remains a notable gap in integrating bibliometric knowledge mapping with competency-based assessment development in Malaysian TVET. Without a comprehensive synthesis of international evidence and emerging research trends, assessment tool development risks relying primarily on expert opinion or isolated institutional practices rather than robust empirical knowledge. This limitation may reduce the effectiveness of competency assessment in preparing graduates who meet national qualification standards and evolving industry expectations. Therefore, there is a critical need to systematically map the global knowledge landscape on competency-based assessment and translate these findings into a comprehensive, evidence-informed competency-based assessment kit specifically designed for Malaysian Culinary Arts vocational education. Accordingly, the aim of this study is to systematically map and synthesize the global knowledge structure of competency-based assessment through PRISMA-guided systematic review and CiteSpace bibliometric analysis in order to develop an evidence-based Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education.

2. Literature Review

Competency-Based Assessment (CBA) has emerged as a dominant assessment paradigm in Technical and Vocational Education and Training (TVET) because it focuses on learners' demonstrated ability to perform occupational tasks according to established industry standards rather than on academic achievement alone. Unlike traditional assessment approaches that primarily measure theoretical knowledge, competency-based assessment evaluates the integration of knowledge, technical skills, attitudes, and professional behaviors in authentic workplace settings (Mulder, 2023). The Organization for Economic Cooperation and Development (OECD, 2024) emphasized that competency-based assessment improves graduates' employability by ensuring that learning outcomes are aligned with labor market requirements. Consequently, many countries have adopted competency-based assessment frameworks to strengthen workforce readiness and lifelong learning within vocational education.

Previous studies have consistently demonstrated the positive effects of competency-based assessment on students' practical performance and professional competence. Mulder (2023) argued that competency assessment should be evidence-based, criterion-referenced, and performance-oriented to ensure that learners demonstrate mastery of occupational standards before certification. Similarly, Gessler and Peters (2020) reported that authentic assessment activities, including workplace simulations, performance tasks, portfolios, and direct observation, provide more valid measures of vocational competence than conventional written examinations. These findings are particularly relevant to Culinary Arts education, where practical demonstrations, food preparation, hygiene compliance, teamwork, creativity, and customer service collectively determine occupational competence (Kharuddin et al., 2026). However, despite the widespread adoption of competency-based curricula, many vocational institutions continue to experience difficulties in developing valid, reliable, and standardized competency assessment instruments that accurately reflect workplace expectations (UNESCO-UNEVOC, 2024).

Within the Malaysian TVET system, competency-based assessment has been progressively implemented through the Malaysian Skills Certification framework and the National Occupational Skills Standards (NOSS). Nevertheless, empirical studies indicate that implementation remains inconsistent across institutions because instructors often possess varying levels of assessment literacy and interpret competency standards differently (Department of Skills Development [DSD], 2024). Recent investigations have shown that assessment practices continue to rely heavily on summative practical tests and instructor judgment, with limited use of structured rubrics, competency evidence matrices, reflective assessment, and workplace-based evaluation (Hashim et al., 2024). Such inconsistencies may reduce assessment reliability, fairness, and comparability among graduates. Consequently, researchers increasingly advocate the development of standardized competency-based assessment tools capable of improving assessment quality while maintaining alignment with industry competency standards. The development of assessment kits has become an important research area in educational measurement because standardized assessment resources promote consistency, transparency, and validity in evaluating learner performance. An assessment kit generally consists of competency standards, assessment specifications, performance indicators, scoring rubrics, observation checklists, evidence collection guidelines, assessor manuals, moderation procedures, and documentation templates that collectively support systematic competency evaluation (Brown & Knight, 2021). According to Boud and Soler (2016), well-designed assessment systems should not only measure student achievement but also facilitate learning by providing meaningful feedback that promotes continuous improvement. Consequently, contemporary assessment kits increasingly incorporate formative assessment strategies, authentic learning activities, self-assessment, peer assessment, and reflective practice alongside traditional summative evaluation.

Several recent studies have emphasized that competency-based assessment kits should be developed collaboratively with industry experts to ensure alignment with occupational standards and workplace expectations. In vocational education, industry participation improves the authenticity of assessment tasks while enhancing graduates' employability by ensuring that competencies reflect current professional practice (CEDEFOP, 2024). Furthermore, digital transformation has encouraged the integration of electronic portfolios, digital rubrics, learning analytics, and artificial intelligence-assisted assessment into competency-based assessment systems. Such innovations enable more comprehensive documentation of learner performance while facilitating real-time feedback and continuous competency monitoring (Ifenthaler & Schumacher, 2023). Despite these advances, relatively few studies have focused specifically on developing competency-based assessment kits for Culinary Arts education, particularly within the Malaysian vocational education context. Existing assessment instruments often concentrate on technical cooking skills while giving comparatively less attention to communication, leadership, sustainability practices, creativity, food innovation, and problem-solving competencies required by the contemporary hospitality industry.

Another significant development in educational research involves the application of bibliometric knowledge mapping to synthesize large bodies of scientific literature objectively. Knowledge mapping provides researchers with systematic approaches for identifying influential publications, collaboration networks, research clusters, thematic evolution, citation relationships, and emerging research trends across academic disciplines. Unlike traditional narrative reviews, bibliometric analysis minimizes subjective bias by employing quantitative visualization techniques that reveal the intellectual structure of a research field (Donthu et al., 2021). Consequently, bibliometric methods have become increasingly valuable for informing evidence-based policy development, curriculum reform, and educational innovation. Among the available bibliometric software packages, CiteSpace has gained considerable recognition because of its advanced capabilities for visualizing scientific knowledge domains. Developed by Chen (2017), CiteSpace supports co-citation analysis, co-authorship networks, keyword co-occurrence, burst detection, cluster analysis, timeline visualization, and identification of emerging research frontiers. Recent systematic reviews have demonstrated that CiteSpace provides a comprehensive understanding of knowledge development by revealing influential authors, institutions, countries, journals, and research themes across diverse academic disciplines (Zhu & Liu, 2024). Educational researchers increasingly employ CiteSpace to investigate trends in competency-based education, digital learning, educational technology, artificial intelligence, and vocational education because the software enables objective synthesis of extensive bibliographic datasets that would be difficult to analyze manually.

Although bibliometric research within TVET has expanded substantially, studies integrating CiteSpace with competency-based assessment remain relatively limited. Existing reviews primarily examine competency-based education, curriculum development, employability skills, or vocational teacher education rather than assessment development. Moreover, very few investigations focus specifically on Culinary Arts vocational education despite its increasing importance to the hospitality and tourism industries (Chan et al., 2026). Consequently, there remains insufficient understanding of the global knowledge structure, intellectual evolution, emerging research hotspots, and collaborative patterns concerning competency-based assessment within culinary education. This knowledge gap limits researchers' ability to develop evidence-informed assessment frameworks grounded in international best practices. Collectively, the reviewed literature demonstrates that competency-based assessment enhances vocational learning outcomes, standardized assessment kits improve assessment validity and consistency, and CiteSpace provides a rigorous methodology for synthesizing evolving scientific knowledge. Nevertheless, the integration of these three domains remains underexplored, particularly within Malaysian Culinary Arts vocational education. Most existing studies investigate the variables independently rather than examining how bibliometric knowledge mapping can inform the systematic development of competency-based assessment instruments. Therefore, the present study addresses this gap by employing PRISMA-guided systematic review and CiteSpace knowledge mapping to synthesize global evidence and establish the empirical foundation for developing a comprehensive Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education.

3. Research Methodology

This study employed a systematic literature review (SLR) guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework to systematically identify, screen, evaluate, and synthesize scholarly literature on competency-based assessment within Technical and Vocational Education and Training (TVET), with particular emphasis on Culinary Arts education. PRISMA 2020 is internationally recognized for enhancing the transparency, rigor, and reproducibility of systematic reviews through its four sequential phases: identification, screening, eligibility, and inclusion (Page et al., 2021). Consistent with the recommendations of Liberati et al. (2009), the PRISMA protocol provides a structured reporting framework that minimizes selection bias and ensures methodological consistency throughout the review process. However, PRISMA itself is a reporting guideline rather than an instrument for evaluating the methodological quality of individual studies.

In addition to the PRISMA protocol, this study incorporated CiteSpace (Version 6.4.R1) to conduct bibliometric knowledge mapping. CiteSpace facilitates the visualization of scientific knowledge through co-citation analysis, keyword co-occurrence, collaboration networks, citation burst detection, and thematic evolution, thereby enabling the identification of influential authors, institutions, journals, research clusters, and emerging research frontiers (Chen, 2017). The integration of PRISMA and CiteSpace provides both qualitative synthesis and quantitative visualization, offering a comprehensive understanding of the development of competency-based assessment research and generating empirical evidence for the development of a Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education (Rahman et al., 2026). The review focused exclusively on peer-reviewed publications indexed in Scopus and Web of Science (WoS), as these databases are recognized for their extensive coverage of high-quality scholarly publications and compatibility with bibliometric analysis. The review period covered publications from 2015 to 2026 to capture recent developments in competency-based assessment, competency-based education, vocational assessment, culinary education, and educational assessment in TVET. Only publications written in English were included to ensure consistency in data extraction and bibliometric analysis (Kharuddin et al., 2026).

Process 1: Identification

The identification stage involved a comprehensive and systematic search strategy designed to retrieve all relevant publications associated with competency-based assessment and assessment kit development within vocational education. Keywords were identified through previous systematic reviews, controlled vocabularies, database thesauri, and frequently occurring author keywords in leading journals related to TVET, educational assessment, competency-based education, and hospitality education. Search strategies were finalized in July 2026 using Boolean operators

(AND, OR), phrase searching, wildcard symbols where appropriate, and database-specific search fields including TITLE, ABSTRACT, and KEYWORDS.

The Boolean operator OR was employed to include synonymous concepts and alternative terminology, whereas AND combined major research constructs to improve search precision. The search strategy was refined iteratively through pilot searches to maximize retrieval sensitivity while minimizing irrelevant records.

Table 1: Search Strings Used in This Study

Database	Search Strategy
Scopus	TITLE-ABS-KEY ("Competency-Based Assessment" OR "Competency Assessment" OR "Performance Assessment" OR "Authentic Assessment") AND ("Technical and Vocational Education" OR TVET OR "Vocational Education" OR "Skills Training") AND ("Culinary Arts" OR Hospitality OR Gastronomy OR "Food Service Education") AND ("Assessment Kit" OR Rubric OR Competency OR Evaluation)
Web of Science	TS=("Competency-Based Assessment" OR "Competency Evaluation") AND ("TVET" OR "Vocational Education") AND ("Culinary Arts" OR Hospitality Education) AND ("Assessment Framework" OR Rubric OR Competency Standards)

The initial search identified publications from both databases, which were subsequently exported in BibTeX format for duplicate removal and bibliometric processing in CiteSpace.

Process 2: Screening (Inclusion and Exclusion Criteria)

Following the identification stage, retrieved records underwent a systematic screening process. Duplicate publications were first removed using reference management software and manual verification. Subsequently, document types that did not meet the study objectives, including editorials, book reviews, dissertations, conference abstracts without full papers, notes, and non-peer-reviewed publications, were excluded. The remaining studies were evaluated according to predetermined inclusion and exclusion criteria to ensure methodological consistency.

Table 2: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Type	Peer-reviewed journal articles	Editorials, books, theses, conference abstracts, reports, book chapters
Language	English	Non-English publications
Publication Year	2015–2026	Before 2015
Subject Area	TVET, competency-based education, educational assessment, Culinary Arts, hospitality education	Studies unrelated to education or vocational assessment
Research Focus	Competency-based assessment, assessment development, competency frameworks, assessment tools	Studies focusing solely on curriculum or teaching without assessment components
Database	Scopus and Web of Science	Publications outside selected databases

Application of these criteria ensured that only studies directly relevant to competency-based assessment development within vocational education were retained for further analysis.

Process 3: Eligibility

The eligibility phase involved an extensive manual examination of article titles, abstracts, keywords, and, where necessary, full-text publications to determine their relevance to the research objectives. Studies were assessed based on their contribution to competency-based assessment, assessment instrument development, competency frameworks, vocational education, and Culinary Arts education. Articles were excluded if they lacked empirical evidence, focused exclusively on curriculum development without assessment components, or addressed competency issues outside vocational education. During this phase, additional duplicate records not detected during the initial screening were removed. Only studies demonstrating clear methodological rigor and direct relevance to competency-based assessment were retained for bibliometric analysis. The final dataset was exported into CiteSpace for network visualization, co-citation analysis, keyword co-occurrence analysis, cluster detection, timeline mapping, and citation burst analysis. These analyses enabled the identification of influential publications, research hotspots, emerging themes, and intellectual structures within competency-based assessment research.

Process 4: Included

Following the eligibility assessment, the final collection of eligible studies constituted the dataset for systematic review and knowledge mapping analysis. These publications represented the most relevant scholarly evidence concerning competency-based assessment, competency framework development, vocational assessment practices, assessment instrument design, and Culinary Arts education. The selected studies were subsequently analyzed using both qualitative synthesis and CiteSpace bibliometric techniques. The systematic review synthesized conceptual developments, assessment models, competency domains, and implementation strategies reported across the literature, while the bibliometric analysis visualized research trends, collaboration networks, keyword evolution, and emerging research frontiers. The integration of these findings provided a robust empirical foundation for proposing a comprehensive Competency-Based Assessment Kit tailored to the Malaysian Culinary Arts Vocational Education context.

4. Data Analysis and Abstractions

In this section, the publications included in the final dataset were systematically analyzed, critically evaluated, and synthesized in accordance with the objectives of the study. The selected publications focused on competency-based assessment, competency framework development, assessment instrument design, vocational assessment, competency-based education, and Technical and Vocational Education and Training (TVET), with particular relevance to Culinary Arts and hospitality education. The review synthesized both empirical and conceptual studies published between 2015 and 2026, reflecting contemporary developments in competency-based assessment and vocational education. These publications constituted the evidence base for identifying research trends, intellectual structures, emerging themes, and assessment dimensions that informed the development of a Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education. The final dataset comprised publications retrieved from Scopus and Web of Science (WoS), the two most widely recognized multidisciplinary databases for high-quality scholarly research. These databases were selected because they provide comprehensive coverage of peer-reviewed literature, standardized bibliographic metadata, and compatibility with bibliometric software such as CiteSpace. The final collection of studies represented the most relevant literature concerning competency-based assessment, competency standards, vocational education, educational assessment, authentic assessment, performance-based assessment, and assessment framework development.

The integration of PRISMA-guided systematic review, CiteSpace bibliometric knowledge mapping, and qualitative content synthesis provided a robust methodological framework for identifying the current state of competency-based assessment research. More importantly, it established an empirical foundation for developing an evidence-informed Competency-Based Assessment Kit specifically designed to support competency assessment

practices in Malaysian Culinary Arts Vocational Education. By combining quantitative visualization with qualitative interpretation, this study offers a comprehensive understanding of global research developments while generating practical implications for assessment standardization, curriculum enhancement, and competency evaluation within the Malaysian TVET system.

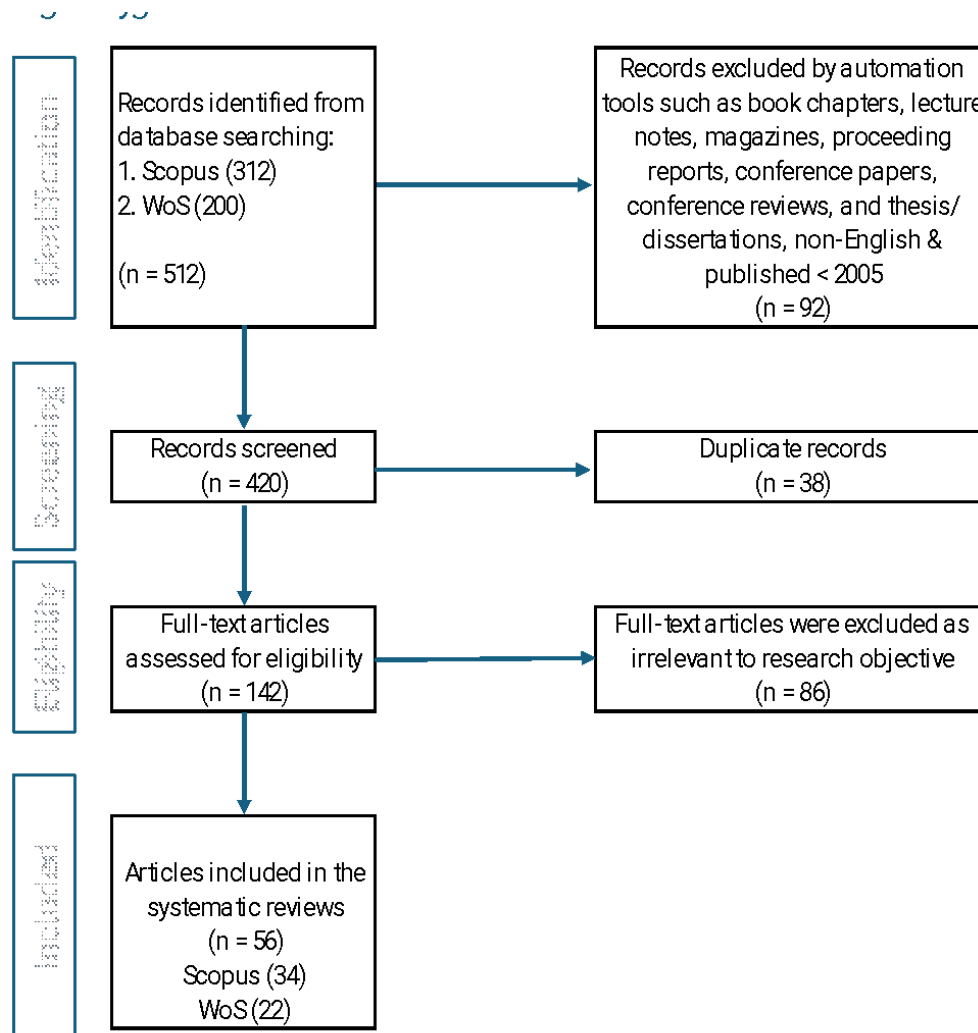


Figure 1: PRISMA 2020 Flow Summary of Literature Selection Process

The PRISMA 2020 selection process resulted in a final dataset of 56 publications for systematic review and bibliometric knowledge mapping analysis. Initially, 512 records were retrieved from two internationally recognized academic databases, comprising 312 publications from Scopus and 200 publications from Web of Science (WoS). These databases were selected because of their comprehensive coverage of high-quality, peer-reviewed research in Technical and Vocational Education and Training (TVET), competency-based education, educational assessment, hospitality education, and Culinary Arts. Furthermore, both databases provide standardized bibliographic metadata that are fully compatible with CiteSpace, thereby facilitating reliable bibliometric analysis and knowledge visualization.

During the identification stage, 92 records were excluded through automated and manual filtering based on the predetermined inclusion and exclusion criteria. Publications removed at this stage included book chapters, books, editorials, conference abstracts, conference reviews, dissertations, reports, notes, and other non-peer-reviewed documents. In addition, publications written in languages other than English and studies published before 2015 were

excluded to ensure consistency with the review scope and to capture contemporary developments in competency-based assessment research. These screening procedures enhanced the methodological rigor of the review by ensuring that only high-quality scholarly publications relevant to the research objectives were retained.

Following the identification process, 420 records remained for title and abstract screening. During this stage, studies that were unrelated to competency-based assessment, competency-based education, vocational education, Culinary Arts education, or educational assessment were excluded. The screening process focused on identifying publications that explicitly examined competency frameworks, assessment models, authentic assessment, performance assessment, workplace-based assessment, assessment instrument development, or competency evaluation within TVET or closely related educational contexts.

Subsequently, 142 full-text articles were assessed for eligibility. The full-text evaluation examined the methodological quality, relevance, and conceptual alignment of each publication with the objectives of the present study. A total of 86 publications were excluded because they did not directly address competency-based assessment, focused primarily on curriculum development without assessment components, examined educational contexts outside vocational or technical education, or lacked sufficient empirical or conceptual evidence to contribute meaningfully to the development of a competency-based assessment framework. Studies emphasizing general teaching strategies, educational technology without assessment applications, or hospitality management unrelated to competency evaluation were also excluded during this stage.

Following the eligibility assessment, a final dataset of 56 publications was retained for systematic review and bibliometric knowledge mapping. Of these, 34 articles were indexed in Scopus, while 22 articles were indexed in Web of Science (WoS). These publications constituted the primary evidence base for subsequent analyses using CiteSpace, including publication trend analysis, author and institutional collaboration networks, document and journal co-citation analysis, keyword co-occurrence analysis, thematic clustering, citation burst detection, and timeline visualization. Together, these analyses facilitated the identification of influential publications, emerging research themes, intellectual structures, and evolving trends in competency-based assessment research.

5. Data Analysis, Results, and Findings

Research Question: What are the major research themes and competency domains identified in the global literature on competency-based assessment in Technical and Vocational Education and Training (TVET), particularly in Culinary Arts education?

The systematic review and bibliometric knowledge mapping identified eight dominant research themes that characterize the global development of competency-based assessment research within Technical and Vocational Education and Training (TVET). These themes emerged from the analysis of keyword co-occurrence networks, document co-citation clusters, and qualitative content synthesis of the selected publications. Collectively, they represent the principal knowledge domains that underpin competency-based assessment and provide the conceptual foundation for developing a Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education. The identified themes include competency framework development, authentic assessment, performance assessment, assessment rubric development, industry competency standards, workplace-based assessment, assessment validity and reliability, and digital competency assessment.

Table 3: Categorization of Major Research Themes Identified in Competency-Based Assessment Literature

Authors	Competency framework development	Authentic assessment	Performance assessment	Assessment rubric development	Industry competency standards	Workplace-based assessment	Assessment validity & reliability	Digital competency assessment

Mulder (2023)	✓	✓	✓	✓	✓	✓	✓	
Gessler & Peters (2020)	✓	✓	✓		✓	✓	✓	
Boud & Soler (2016)		✓	✓	✓			✓	
Ifenthaler & Schumacher (2023)	✓		✓	✓			✓	✓
UNESCO - UNEVOC (2024)	✓	✓			✓	✓		
OECD (2024)	✓		✓		✓	✓	✓	
Hashim et al. (2024)	✓	✓	✓	✓	✓		✓	
CEDEFO P (2024)	✓	✓	✓		✓	✓	✓	✓

Competency Framework Development

The most prominent research theme identified across the reviewed literature concerns the development of competency frameworks that define the knowledge, skills, attitudes, and professional behaviors expected of vocational graduates. Competency frameworks provide the structural basis for designing competency-based curricula, learning outcomes, and assessment instruments. Mulder (2023) emphasized that competencies should integrate cognitive, psychomotor, and affective dimensions to reflect authentic occupational performance. Similarly, UNESCO-UNEVOC (2024) highlighted that clearly defined competency standards facilitate curriculum alignment, assessment consistency, and workforce readiness. Within Culinary Arts education, competency frameworks commonly encompass food preparation techniques, food safety and sanitation, menu planning, communication, teamwork, creativity, problem-solving, and professional ethics.

Authentic Assessment

Authentic assessment emerged as one of the most frequently discussed themes in competency-based assessment research. Unlike traditional examinations, authentic assessment requires learners to demonstrate competencies through realistic workplace activities that mirror professional practice. Boud and Soler (2016) argued that authentic assessment strengthens student learning because it promotes reflection, continuous improvement, and meaningful feedback. Likewise, Gessler and Peters (2020) reported that workplace simulations, practical demonstrations, portfolios, and project-based assessment produce more valid evidence of occupational competence than conventional testing. For Culinary Arts education, authentic assessment may include meal production, kitchen operations, customer service simulations, and food presentation evaluated under industry conditions.

Performance Assessment

Performance assessment constitutes another central research theme identified in the knowledge mapping analysis. The reviewed studies consistently indicate that competency should be evaluated based on observable

workplace performance rather than theoretical knowledge alone. OECD (2024) emphasized that performance assessment enhances graduate employability by ensuring alignment between educational outcomes and labor market expectations. Similarly, Hashim et al. (2024) observed that Malaysian TVET institutions increasingly recognize the importance of performance-based evaluation, although implementation remains inconsistent across institutions. Performance assessment therefore represents a fundamental component of competency-based assessment systems designed for vocational education.

Assessment Rubric Development

Assessment rubrics play an essential role in ensuring fairness, transparency, and consistency during competency evaluation. Several studies emphasized that well-designed rubrics enable assessors to evaluate learner performance using standardized criteria linked directly to occupational competency standards (Boud & Soler, 2016; Hashim et al., 2024). Effective competency rubrics typically include performance indicators, achievement levels, observable behaviors, assessment evidence, and scoring guidelines. Within Culinary Arts education, rubric-based assessment supports consistent evaluation of food preparation, hygiene compliance, time management, teamwork, creativity, and customer satisfaction.

Industry Competency Standards

Alignment between educational assessment and industry competency standards represents another dominant research theme. Numerous publications stress that competency-based assessment should be grounded in nationally recognized occupational standards developed through collaboration between educational institutions and industry stakeholders. UNESCO-UNEVOC (2024) and CEDEFOP (2024) argued that industry participation enhances assessment authenticity while improving graduate employability. In the Malaysian context, competency assessment should align with the National Occupational Skills Standards (NOSS) and Malaysian Skills Certification framework to ensure that graduates demonstrate competencies expected by employers within the hospitality and food service industries.

Workplace-Based Assessment

The literature consistently identifies workplace-based assessment as an effective strategy for evaluating vocational competence. Rather than relying exclusively on institutional assessment, workplace-based assessment enables learners to demonstrate competencies within authentic professional environments under the supervision of qualified assessors. Gessler and Peters (2020) reported that this approach strengthens collaboration between educational institutions and industry while improving graduates' workplace readiness. Within Culinary Arts education, workplace assessment may occur during industrial training, apprenticeships, restaurant placements, or simulated commercial kitchens where learners perform authentic occupational tasks.

Assessment Validity and Reliability

Ensuring the validity and reliability of competency assessment remains a recurring concern across the reviewed literature. Researchers consistently emphasize that assessment instruments should accurately measure intended competencies while producing consistent evaluation outcomes across different assessors and assessment contexts. Mulder (2023) argued that assessment quality depends upon clearly defined competency standards, standardized assessment procedures, assessor training, and systematic moderation processes. Likewise, OECD (2024) highlighted that reliable competency assessment increases stakeholder confidence in vocational qualifications and enhances graduate mobility within national and international labor markets.

Digital Competency Assessment

Recent publications indicate increasing interest in integrating digital technologies into competency-based assessment systems. Advances in educational technology have enabled the adoption of electronic portfolios, online competency tracking systems, digital assessment rubrics, artificial intelligence-assisted feedback, and learning analytics to support competency evaluation (Ifenthaler & Schumacher, 2023). CEDEFOP (2024) further noted that

digital assessment systems improve documentation, assessment efficiency, transparency, and continuous monitoring of learner progress. These technological developments provide new opportunities for designing comprehensive competency-based assessment kits that support both formative and summative assessment within Malaysian Culinary Arts vocational education.

Overall, the systematic review demonstrates that competency-based assessment research has evolved from emphasizing occupational competency standards toward more comprehensive assessment systems that integrate authentic assessment, workplace performance, standardized rubrics, digital technologies, and industry collaboration. These interconnected themes provide the conceptual and empirical foundation for the development of a comprehensive Competency-Based Assessment Kit tailored to the Malaysian Culinary Arts Vocational Education context.

6. Discussion and Conclusion

The present study employed a PRISMA 2020-guided systematic literature review integrated with CiteSpace bibliometric knowledge mapping to examine the global knowledge landscape of competency-based assessment (CBA) within Technical and Vocational Education and Training (TVET). The study specifically sought to identify dominant research themes, intellectual structures, and emerging research frontiers that could inform the development of a Competency-Based Assessment Kit for Malaysian Culinary Arts Vocational Education. The integration of systematic review procedures with bibliometric visualization enabled both qualitative synthesis and quantitative analysis of scholarly publications, providing a comprehensive understanding of how competency-based assessment has evolved across educational contexts. The findings reveal that competency-based assessment has transitioned from conventional skills testing toward comprehensive assessment systems that integrate authentic learning, workplace performance, competency standards, digital technologies, and industry collaboration.

The first objective of this study was to identify the major research themes associated with competency-based assessment in TVET. The bibliometric findings demonstrated that competency framework development, authentic assessment, performance assessment, assessment rubric development, workplace-based assessment, industry competency standards, assessment validity and reliability, and digital competency assessment constitute the principal research domains. These themes collectively indicate that competency-based assessment has become increasingly holistic, emphasizing not only technical competence but also professional behaviors, critical thinking, communication, teamwork, ethical practice, and lifelong learning. This observation is consistent with competency theory, which conceptualizes competence as an integrated combination of knowledge, skills, attitudes, and values demonstrated through successful workplace performance (Mulder, 2023). Similarly, UNESCO-UNEVOC (2024) argues that contemporary TVET systems should emphasize comprehensive competency development that aligns educational outcomes with rapidly changing workforce requirements. The emergence of multidimensional competency assessment reflects a broader shift toward learner-centered education in which assessment becomes an integral component of professional learning rather than merely a mechanism for certification.

Another important finding concerns the increasing prominence of authentic and workplace-based assessment within competency-based education. The knowledge mapping analysis revealed extensive scholarly attention to performance-based evaluation, practical demonstrations, simulations, portfolios, industrial placements, and competency verification in authentic occupational settings. These findings support previous studies demonstrating that authentic assessment provides more valid and reliable evidence of occupational competence than traditional written examinations because it requires learners to apply integrated competencies in realistic professional contexts (Boud & Soler, 2016; Gessler & Peters, 2020). Within Culinary Arts education, authentic assessment is particularly significant because culinary competence cannot be adequately evaluated through theoretical examinations alone. Professional performance requires learners to demonstrate food preparation techniques, hygiene practices, customer service, teamwork, creativity, time management, and problem-solving under workplace conditions. Consequently, the proposed competency-based assessment kit should incorporate diverse authentic assessment strategies capable of evaluating these multidimensional competencies systematically and consistently.

The bibliometric analysis further identified assessment rubric development and competency standard alignment as central research priorities. Across the reviewed literature, standardized rubrics were consistently recognized as essential tools for improving assessment transparency, fairness, reliability, and consistency. Well-designed competency rubrics provide explicit performance criteria, observable indicators, evidence requirements, and achievement levels that reduce assessor subjectivity while enhancing the credibility of competency certification (Hashim et al., 2024). These findings are particularly relevant within the Malaysian TVET context, where previous research has reported considerable variation in assessment practices among institutions despite the existence of the National Occupational Skills Standards (NOSS). The findings therefore suggest that developing a standardized competency-based assessment kit aligned with NOSS would contribute to greater consistency in competency evaluation across Culinary Arts programmes while strengthening confidence among educators, employers, and certification agencies.

Another significant contribution of this study lies in its identification of digital transformation as an emerging frontier in competency-based assessment research. The CiteSpace keyword burst analysis revealed increasing scholarly interest in learning analytics, digital portfolios, artificial intelligence, competency tracking systems, and technology-enhanced assessment. Recent studies indicate that digital assessment systems enable continuous monitoring of learner progress, facilitate evidence collection, improve assessor efficiency, and support timely formative feedback (Ifenthaler & Schumacher, 2023). These developments correspond closely with broader educational digitalization initiatives and the evolving demands of Industry 4.0 and Society 5.0. For Malaysian Culinary Arts vocational education, integrating digital technologies into competency assessment could enhance documentation of practical performance, improve moderation procedures, and support competency certification through electronic evidence portfolios. Therefore, the proposed assessment kit should incorporate digital assessment components to improve assessment efficiency while maintaining alignment with contemporary educational practices.

The knowledge mapping analysis also demonstrated the value of bibliometric visualization as a methodological approach for educational assessment research. Unlike conventional narrative reviews, CiteSpace enabled the identification of influential publications, leading scholars, collaborative research networks, thematic clusters, and emerging research frontiers through objective quantitative analysis. The combination of bibliometric analysis and systematic review therefore produced a more comprehensive understanding of competency-based assessment research than either approach could provide independently. Similar conclusions have been reported by Donthu et al. (2021), who emphasized that bibliometric techniques enable researchers to synthesize extensive scientific knowledge while minimizing subjective interpretation. Consequently, this study contributes methodologically by demonstrating how PRISMA-guided systematic review and CiteSpace knowledge mapping can jointly support evidence-based educational innovation and assessment development.

From a practical perspective, the findings provide important implications for Malaysian TVET policymakers, curriculum developers, vocational institutions, and industry practitioners. The identified competency domains establish an empirical foundation for designing standardized assessment instruments that evaluate learners comprehensively across cognitive, psychomotor, and affective dimensions. Furthermore, the integration of authentic assessment, industry competency standards, workplace assessment, and digital technologies supports the development of assessment systems that are more responsive to labor market expectations. Strengthening assessment quality may subsequently enhance graduate employability, improve stakeholder confidence in vocational qualifications, and contribute to the overall quality assurance of Malaysian TVET programmes.

Overall, this study successfully achieved its research objectives by systematically mapping the global knowledge structure of competency-based assessment research and identifying the principal competency domains, assessment approaches, and emerging research trends relevant to vocational education. The systematic review established the current state of knowledge regarding competency-based assessment, while the CiteSpace analysis revealed the intellectual structure and evolution of the research field. The integration of these findings provided robust empirical evidence for the development of a Competency-Based Assessment Kit specifically designed for Malaysian Culinary Arts Vocational Education. The proposed assessment framework has the potential to enhance assessment

validity, reliability, transparency, and industry relevance by aligning competency evaluation with internationally recognized best practices and Malaysian occupational standards. Ultimately, this study contributes both theoretically and practically by advancing scholarly understanding of competency-based assessment while providing evidence-informed guidance for strengthening competency assessment practices within Malaysian Culinary Arts vocational education.

REFERENCES

1. Boud, D., & Soler, R. (2016). Sustainable assessment revisited. *Assessment & Evaluation in Higher Education*, 41(3), 400–413. <https://doi.org/10.1080/02602938.2015.1018133>
2. Brown, S., & Knight, P. (2021). *Assessing learners in higher education* (2nd ed.). Routledge. <https://doi.org/10.4324/9781003196907>
3. CEDEFOP. (2024). *Ensuring quality in vocational education and training*. <https://www.cedefop.europa.eu/en>
4. Chan, A.H.A., Beleya, P., Rau, M., Airawaty, D., Salehi, S. (2026). Circular economy and sustainable packaging in the Malaysian courier service industry: Transforming supply chains for a greener future. *International Journal of Sustainable Development and Planning*, Vol. 21, No. 3, pp. 1301-1312. <https://doi.org/10.18280/ijstdp.210328>
5. Chen, C. (2017). Science mapping: A systematic review of the literature. *Journal of Data and Information Science*, 2(2), 1–40. <https://doi.org/10.1515/jdis-2017-0006>
6. Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into Practice*, 39(3), 124–130. https://doi.org/10.1207/S15430421TIP3903_2
7. Department of Skills Development. (2024). *National Occupational Skills Standards (NOSS)*. <https://www.dsd.gov.my>
8. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285–296. <https://doi.org/10.1016/j.jbusres.2021.04.070>
9. Gessler, M., & Peters, S. (2020). Competence-based education and training in vocational education. In M. Gessler & S. Peters (Eds.), *Competence-based vocational and professional education*. Springer. <https://doi.org/10.1007/978-3-030-64363-8>
10. Hashim, S., Rahman, M. N. A., & Abdullah, Z. (2024). Competency-based assessment practices in Malaysian technical and vocational education: Challenges and future directions. *Journal of Technical Education and Training*, 16(1), 1–17. <https://doi.org/10.30880/jtet.2024.16.01.001>
11. Ifenthaler, D., & Schumacher, C. (2023). Learning analytics for competency-based education: A systematic review. *Educational Technology Research and Development*, 71(5), 2469–2494. <https://doi.org/10.1007/s11423-023-10249-4>
12. Kharuddin, D., Ithin, N. S., Mohamad, H., & Kharuddin, A. F. (2026). Determinant Factors of Edge Intelligence System Performance in E-learning: An Advanced Analysis Using Multilayer Perceptron Artificial Neural Networks. *International Journal of Computer Information Systems and Industrial Management Applications*, 18(10s), 323-332. <https://doi.org/10.70917/ijcisim-2026-3587>
13. Kharuddin, Darvinatasya, Nor Shamri binti Ithin, Azrul Fazwan Kharuddin, and Norazura Azid (2026). Validation of Measurement Constructs for Trust, Autonomy, Resilience, and Innovation in Edge Intelligence Systems. *Journal of Daoist Studies* 19, no. S7: 457-467.
14. Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Moher, D., et al. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine*, 6(7), e1000100. <https://doi.org/10.1371/journal.pmed.1000100>
15. Mulder, M. (2023). Competence theory and research: A synthesis. In M. Mulder (Ed.), *Competence-based vocational and professional education* (Updated ed.). Springer. <https://doi.org/10.1007/978-3-031-31490-0>
16. OECD. (2024). *Education at a glance 2024: OECD indicators*. <https://doi.org/10.1787/c00cad36-en>
17. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
18. Rahman, M., Sarwar, H., Hasan, M. K., & Tin, T. T. (2026). Analyzing Digital Addiction through Feature Selection and Machine Learning Techniques. *Educational Process: International Journal*, 23, e2026067. <https://doi.org/10.22521/edupij.2026.23.67>
19. UNESCO-UNEVOC. (2024). *Technical and vocational education and training*. <https://unevoc.unesco.org/home/TVET>
20. Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, 52(5), 546–553. <https://doi.org/10.1111/j.1365-2648.2005.03621.x>
21. World Economic Forum. (2025). *The Future of Jobs Report 2025*. <https://www.weforum.org/reports/the-future-of-jobs-report-2025/>
22. Zhu, J., & Liu, W. (2024). Visual knowledge mapping in educational research: Trends, applications, and future directions. *Education and Information Technologies*, 29, 12075–12098. <https://doi.org/10.1007/s10639-024-12463-y>