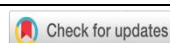


CURRICULUM MANAGEMENT IN VOCATIONAL EDUCATION: A SYSTEMATIC REVIEW OF DEVELOPMENT, IMPLEMENTATION, INNOVATION, AND QUALITY ASSURANCE (2019–2026)

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ABSTRACT

Curriculum management is a strategic element in enhancing the relevance of vocational education to the dynamics of industrial development, technology, and labor market needs. However, research on Technical and Vocational Education and Training (TVET) curriculum management remains scattered across various themes and has not yet produced a comprehensive conceptual framework. This study aims to synthesize the development of TVET curriculum management research from 2019 to 2026 and to identify directions for the development of an integrated conceptual framework. The study employed a Systematic Literature Review (SLR) method based on the PRISMA 2020 guidelines, analyzing Scopus-indexed articles obtained through Publish or Perish. A total of 400 initial publications were screened based on inclusion and exclusion criteria, resulting in 34 articles that were analyzed using thematic synthesis and bibliometric mapping assisted by VOSviewer. The results show that the publications were dominated by themes such as vocational education, competencies, employability, and pedagogical innovations like Project-Based Learning, Work-Based Learning, and Problem-Based Learning. Conversely, studies on curriculum management, quality assurance, MBKM, Teaching Factory, and accreditation remain fragmented and have not yet been integrated into a single curriculum management model.

ABSTRAK

Manajemen kurikulum merupakan elemen strategis dalam meningkatkan relevansi pendidikan vokasi terhadap dinamika perkembangan industri, teknologi, dan kebutuhan pasar kerja. Namun, penelitian mengenai manajemen kurikulum Technical and Vocational Education and Training (TVET) masih tersebar pada berbagai tema sehingga belum menghasilkan kerangka konseptual yang komprehensif. Penelitian ini bertujuan untuk mensintesis perkembangan kajian manajemen kurikulum TVET periode 2019–2026 serta mengidentifikasi arah pengembangan konsep yang terintegrasi. Penelitian menggunakan metode Systematic Literature Review (SLR) berdasarkan pedoman PRISMA 2020 terhadap artikel terindeks Scopus yang diperoleh melalui Publish or Perish. Sebanyak 400 publikasi awal diseleksi berdasarkan kriteria inklusi dan eksklusi sehingga diperoleh 34 artikel yang dianalisis menggunakan sintesis tematik dan pemetaan bibliometrik berbantuan VOSviewer. Hasil penelitian menunjukkan bahwa publikasi didominasi oleh tema pendidikan vokasi, kompetensi, employability, serta inovasi pedagogis seperti Project-Based Learning, Work-Based Learning, dan Problem-Based Learning. Sebaliknya, kajian mengenai manajemen kurikulum, penjaminan mutu, MBKM, Teaching Factory, dan akreditasi masih bersifat terfragmentasi serta belum terintegrasi dalam satu model pengelolaan kurikulum.

Kata kunci: TVET; Manajemen Kurikulum; Systematic Literature Review; Penjaminan Mutu; Teaching Factory.

INTRODUCTION

The rapid transformation of the global labor market driven by digitalization, artificial intelligence, automation, and the transition toward a green economy has fundamentally reshaped the competency requirements expected from vocational education graduates. According to the *World Economic Forum Future of Jobs Report 2025*, approximately 170 million new jobs are projected to emerge globally by 2030, while 92 million existing jobs are expected to disappear, resulting in a structural transformation affecting 22% of the global workforce. Moreover, nearly 39% of workers' core competencies are predicted to change within the next five years, requiring education systems to continuously redesign curricula to remain responsive to technological and industrial developments. This challenge is further intensified by the declining half-life of technical knowledge, which has decreased to approximately 2.5 years, indicating that vocational competencies become obsolete much faster than in previous decades.

Similarly, UNESCO emphasizes that Technical and Vocational Education and Training (TVET) institutions must accelerate curriculum transformation to equip graduates with digital, green, entrepreneurial, and lifelong learning competencies aligned with the Sustainable Development Goals (SDGs). OECD also highlights that curriculum responsiveness and institutional adaptability have become critical determinants of workforce competitiveness in the era of Industry 5.0 and sustainable development. These global trends clearly demonstrate that curriculum management is no longer merely an administrative activity but has become a strategic instrument for ensuring the relevance, quality, and sustainability of vocational education in preparing graduates capable of responding to continuously evolving labor market demands (Miró-Pérez, 2020; (World Economic Forum, 2025);(Knudsen & Lien, 2023).

Table 1. Global Indicators Underlining the Urgency of TVET Curriculum Management

Indicator		Latest Findings	Implications for TVET Curriculum Management
New jobs by 2030		170 million new jobs	Curriculum must continuously adapt to emerging occupations
Jobs displaced		92 million jobs	Curriculum redesign is essential to reduce skills mismatch
Core skills expected to change		39% by 2030	Continuous curriculum updating is required
Half-life of technical skills		Approximately 2.5 years	Vocational competencies become obsolete more rapidly
Global priorities	TVET	Digital skills, green skills, entrepreneurship, lifelong learning	Curriculum should integrate SDGs and sustainability competencies
OECD recommendation		Flexible and responsive curriculum systems	Curriculum management becomes a strategic governance function

The evidence presented in **Table 1** demonstrates that vocational education institutions worldwide are facing unprecedented pressure to redesign curriculum systems that are adaptive, competency-based, and responsive to technological, industrial, and environmental transformations. Consequently, effective curriculum management has become a strategic prerequisite for ensuring graduate employability, institutional competitiveness, and the long-term sustainability of Technical and Vocational Education and Training (TVET).

In Indonesia, strengthening curriculum management in Technical and Vocational Education and Training (TVET) has become increasingly urgent due to the persistent mismatch

between graduates' competencies and labor market demands, as reflected by vocational high school graduates consistently recording one of the highest unemployment rates among educational levels according to the national labor force statistics (Badan Pusat Statistik, 2025). This condition prompted the government to implement the Merdeka Belajar Kampus Merdeka policy and Instruksi Presiden Nomor 9 Tahun 2016 tentang Revitalisasi SMK, emphasizing industry-oriented, competency-based, and flexible curriculum development to improve graduate employability (Suharno et al., 2020; Indrawati & Kuncoro, 2021). Furthermore, the achievement of Indonesian Accreditation Board for Engineering Education as a Full Signatory of the Washington Accord has reinforced the necessity for outcome-based curriculum management aligned with international quality assurance standards (Li & Pilz, 2023; IABEE, 2023). Therefore, curriculum management has become a strategic mechanism for ensuring curriculum relevance, institutional quality, and the global competitiveness of Indonesian TVET graduates (Billett, 2020; McGrath & Yamada, 2023).

Curriculum management in Technical and Vocational Education and Training (TVET) is conceptually understood as a systematic process involving curriculum planning, development, implementation, evaluation, and continuous improvement to ensure alignment between educational outcomes and labor market needs (Tyler, 2013; Taba & Spalding, 1962). The competency-based education (CBE) framework emphasizes that vocational curricula must be designed based on occupational standards, workplace competencies, and industry expectations to enhance graduate employability (Finch & Crunkilton, 1999; Billett, 2020). Furthermore, experiential learning theory highlights the importance of integrating theoretical knowledge with authentic workplace experiences through work-based learning and industry collaboration (Kolb, 1984; Billett, 2020). Therefore, effective TVET curriculum management requires adaptive governance that integrates pedagogical innovation, technological transformation, and quality assurance mechanisms (Sudira, 2016; Li & Pilz, 2023).

Although numerous studies have examined vocational education curriculum transformation, existing research remains predominantly focused on pedagogical innovations such as Project-Based Learning (PjBL), Work-Based Learning (WBL), digital learning, and competency development, while curriculum management as an integrated governance framework has received limited attention (Guo et al., 2020; Chen & Yang, 2019; Billett, 2020). Previous studies have largely investigated curriculum development or implementation separately, resulting in fragmented understanding of how curriculum design, documentation, evaluation, quality assurance, and accreditation interact within TVET systems (Li & Pilz, 2023; Mende et al., 2025). Furthermore, empirical evidence linking curriculum management with industry partnerships, MBKM implementation, and accreditation outcomes remains insufficiently synthesized (Suharno et al., 2020; Wahjusaputri & Bunyamin, 2022). Therefore, a comprehensive systematic review is required to develop an integrated framework for TVET curriculum management.

The novelty of this study lies in developing an integrated framework of TVET curriculum management that connects curriculum philosophy and policy, curriculum design, documentation management, implementation strategies, pedagogical innovation, and quality assurance within a unified conceptual model. Previous studies have predominantly focused on specific aspects, such as competency development, digital transformation, or learning innovation, without comprehensively examining curriculum management as a systemic process (Billett, 2020; Li & Pilz, 2023). Furthermore, existing reviews have emphasized vocational learning approaches such as Project-Based Learning, Work-Based Learning, and technology integration, while the relationship between curriculum governance, accreditation,

and continuous quality improvement remains limited (Chen & Yang, 2019; Guo et al., 2020). Therefore, this study contributes a comprehensive synthesis framework that strengthens evidence-based curriculum management in TVET institutions (Mende et al., 2025; McGrath & Yamada, 2023).

Based on the identified challenges and research gaps, this study aims to systematically synthesize the development, implementation, innovation, and quality assurance practices of curriculum management in Technical and Vocational Education and Training (TVET) through a Systematic Literature Review approach. This study seeks to identify theoretical perspectives, curriculum management practices, emerging innovations, and quality assurance mechanisms that shape contemporary TVET curriculum systems (Page et al., 2021; Li & Pilz, 2023). Specifically, this review addresses three research questions:

1. RQ1: what theoretical frameworks influence TVET curriculum management?
2. RQ2: how curriculum development, implementation, and innovation are applied;?
3. RQ3: how quality assurance and accreditation contribute to curriculum effectiveness?

RESEARCH METHODOLOGY

This study employed a Systematic Literature Review (SLR) combined with bibliometric mapping, following the PRISMA 2020 guidelines (Page dkk., 2021). PRISMA 2020 provides up-to-date reporting guidelines covering the identification, screening, and inclusion phases. This review uses Scopus exclusively, given its broad coverage of TVET (including Asian and European publications), structured metadata suitable for processing by VOSviewer, and quality thresholds consistent with doctoral research. The search was conducted using Publish or Perish version 8 connected to the Scopus API. The main search strings are presented below:

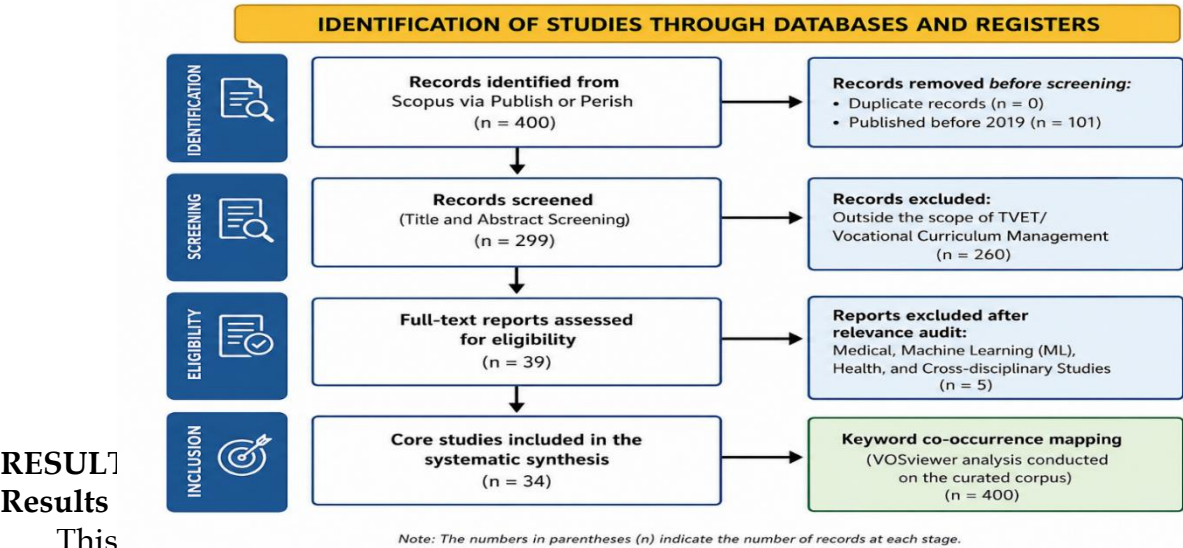
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( TITLE-ABS-KEY ( "vocational education" OR "TVET" OR "vocational high school" OR "polytechnic" OR "vocational training" ) AND TITLE-ABS-KEY ( "curriculum" OR "curriculum management" OR "curriculum development" OR "curriculum design" OR "curriculum evaluation" OR "competency-based curriculum" OR "curriculum 4.0" OR "Merdeka Belajar" OR "MBKM" OR "teaching factory" OR "project-based learning" OR "work-based learning" OR "apprenticeship" OR "accreditation" OR "quality assurance" ) ) AND PUBYEAR > 2018 AND PUBYEAR < 2027 AND ( LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "re" ) OR LIMIT-TO ( DOCTYPE , "cp" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )
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The inclusion and exclusion criteria are presented in Table 1.

Tabel 2. Kriteria Inklusi dan Eksklusi

No	Criteria	Inclusion	Exclusion
1	Period	2019–2026	Before 2019 or after 2026
2	Database	Scopus-indexed publications	Not indexed in Scopus; predatory journals
3	Document type	Articles, reviews, conference papers	Books, theses, editorials, retracted articles
4	Language	English	Non-English works without translation
5	Topic	TVET curriculum management/innovation/quality assurance	Outside of TVET (medicine, K-12 general education)
6	Method	Empirical, conceptual, or review studies with explicitly stated	Opinion pieces, news articles

No	Criteria	Inclusion	Exclusion
		methods	
7	Quality	Clear research questions, methods, and results	Insufficient methodological details



RESULTS
Results

This relevance audit, as well as the results of a bibliometric analysis of keyword co-occurrence conducted in VOSviewer on the curated corpus. The presentation is organized into three layers: corpus characteristics, intellectual structure based on two maps at different minimum occurrence thresholds, and a thematic synthesis mapped to the proposed five-component curriculum management framework.

1. Corpus Characteristics

Thirty-four core studies span the years 2019–2024, with a focus on the pandemic and post-pandemic periods: 2019 (n = 5); 2020 (n = 15); 2021 (n = 4); 2022 (n = 4); 2023 (n = 3); 2024 (n = 3). The peak occurred in 2020 (n = 15), coinciding with the disruption of learning due to COVID-19, which spurred studies on the implementation of online curricula in vocational settings. The majority of the documents are journal articles, supplemented by a number of reviews and conference papers, with prominent sources including the Journal of Vocational Education and Training, the International Journal of Educational Development, Education and Information Technologies, as well as a number of Indonesian publications.

Table 3. The Ten Most-Cited Studies in the Core Corpus (n = 34)

No	Author (Year)	Citation	Short Title	Source
1	Guo dkk. (2020)	796	A review of project-based learning in higher education: Student outcomes and measures	International Journal of Educational R
2	Chen & Yang (2019)	471	Revisiting the effects of project-based learning on students' academic achievement: A meta-anal	Educational Research Review
3	Almulla (2020)	377	The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in L	Sage Open
4	Antonietti dkk. (2022)	235	Can teachers' digital competence influence technology acceptance in	Computers in Human Behavior

No	Author (Year)	Citation	Short Title	Source
			vocational education?	
5	Dahalan dkk. (2024)	191	Gamification and Game Based Learning for Vocational Education and Training: A Systematic Litera	Education and Information Technologies
6	Cattaneo dkk. (2022)	172	How digitalised are vocational teachers? Assessing digital competence in vocational education a	Computers and Education
7	Suharno dkk. (2020)	170	Vocational education in Indonesia: History, development, opportunities, and challenges	Children and Youth Services Review
8	Beer & Mulder (2020)	145	The effects of technological developments on work and their implications for continuous vocatio	Frontiers in Psychology
9	Chiang dkk. (2022)	144	Augmented reality in vocational training: A systematic review of research and applications	Computers in Human Behavior
10	Li & Pilz (2023)	144	International transfer of vocational education and training: a literature review	Journal of Vocational Education and Tr

The most frequently cited studies focus on project-based or problem-based learning in higher education (Almulla, 2020; Chen & Yang, 2019; Guo dkk., 2020), Digital Competencies of Vocational Teachers (Antonietti dkk., 2022; Cattaneo dkk., 2022), as well as gamification and vocational education policies (Dahalan dkk., 2024; Suharno dkk., 2020). This pattern suggests that curriculum management is discussed more implicitly through pedagogical innovation and the strengthening of competencies, rather than as an explicit managerial construct. Intellectual Structure: Co-occurrence Analysis of Keywords (VOSviewer). Clustering was performed at two minimum occurrence thresholds to test the stability of the clusters. Keywords were derived from the titles and standardized using a thesaurus file because the metadata export did not include author keywords. Figure 2 shows the clustering results at a minimum threshold of 5 occurrences; Figure 3 shows the results at a minimum threshold of 2 occurrences.

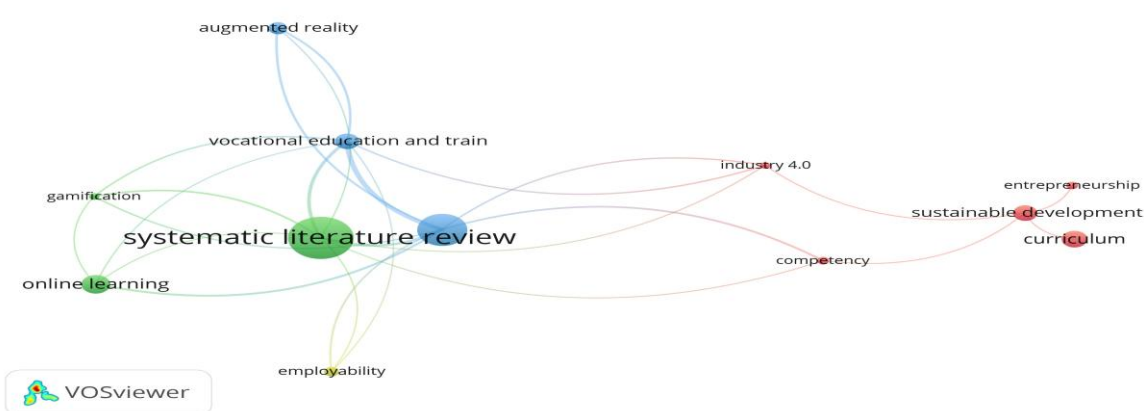


Figure 2. Co-occurrence Network Map of Keywords (minimum occurrence threshold = 5)

At the strict threshold (Figure 2), twelve terms remained, with the largest clusters centered on “systematic literature review” and “vocational education.” Four clusters emerged: the green cluster (systematic literature review, online learning, gamification) represents methodology and online learning; the blue cluster (vocational education and training, augmented reality) represents immersive technologies; the red cluster (curriculum, competency, Industry 4.0, sustainable development, entrepreneurship) represents the curriculum and its external drivers; and the yellow cluster (employability) represents employment outcomes. It is important to note that “curriculum” has only emerged as a peripheral node with low connectivity, linked to competency and sustainability, rather than as the network’s center.

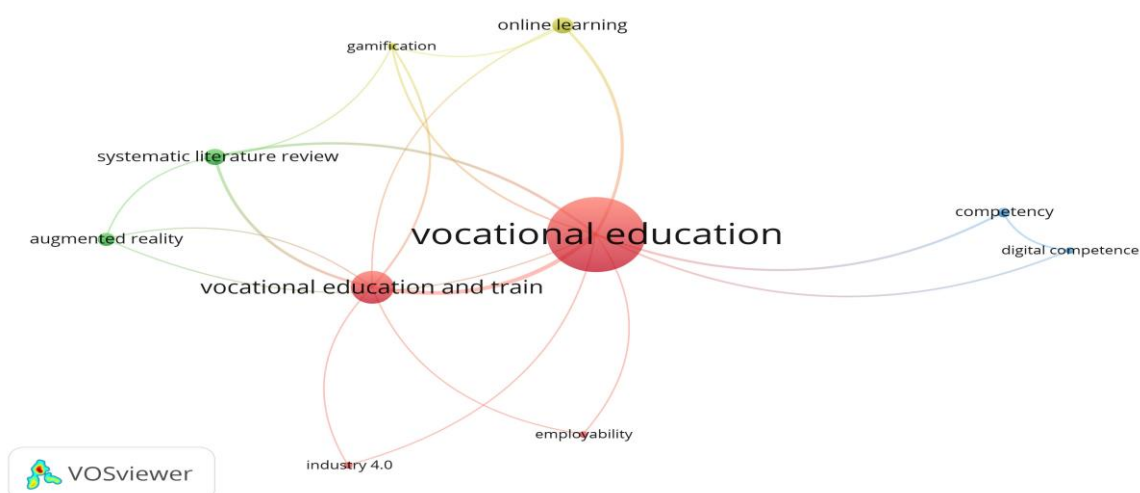


Figure 3. Co-occurrence Network Map of Keywords (minimum occurrence threshold = 2)

In the loose network (Figure 3) regenerated from the core corpus ($n = 34$), “vocational education” emerges as a central node with the highest total link strength and is closely connected to “vocational education and training.” Four clusters emerged: the red cluster (vocational education, vocational education and training, Industry 4.0, employability) represents the vocational axis, industrial transformation, and employment outcomes; the yellow cluster (online learning, gamification) represents learning innovations; the green cluster (systematic literature review, augmented reality) represents immersive technologies and their methodological synthesis; and the blue cluster (competency, digital competence) represents the competency agenda. A comparison of the two maps reveals stable core elements: vocational education, online learning, augmented reality, and systematic literature review. Most notably, none of the explicit curriculum management nodes (MBKM, Teaching Factory, quality assurance, accreditation) reached the threshold of emergence, affirming the empirical foundation for the integrative curriculum management framework proposed by this review.

2. Thematic Synthesis

Theme 1: Philosophy, policy, and system strengthening (philosophy/policy component). This study group frames the curriculum at the system level: the history and challenges of vocational education in Indonesia (Suharno dkk., 2020), international transfer of TVET systems (Li & Pilz, 2023), skills trends for development (McGrath et al., 2020; McGrath & Yamada, 2023), vocational governance reforms in China (Ling dkk., 2023), strengthening the standing of vocational education (Billett, 2020), the contribution of vocational institutions to the manufacturing sector (Lund & Karlsen, 2020), and the vision for Indonesia’s competitiveness and human capital (Indrawati & Kuncoro, 2021).

Theme 2: Competency-based curriculum design and instructor capabilities (design components). This theme emphasizes competencies as the cornerstone of design: challenges in implementing 21st-century skills (Mutohhari dkk., 2021). vocational teachers' digital competencies and technology adoption (Antonietti et al., 2022; Cattaneo et al., 2022), and the adoption of technology for vocational education (Chatterjee et al., 2021) A recurring design indicator is the alignment of competencies with workplace needs.

Theme 3: Curriculum Implementation: Online Learning and Post-Pandemic Transformation (Implementation Component). The 2020 surge was driven by studies on online implementation: distance learning in vocational high schools (Mulyanti et al., 2020), student perceptions of online learning (Syauqi et al., 2020), the development of LMS-based e-learning (Wagino et al., 2024), instructional design for online learning based on self-regulated learning (Sangsawang, 2020), and analysis of laboratory content through an expert system (Ana, 2020).

Theme 4: Pedagogical innovation as the heart of curriculum renewal (implementation component). The most extensive theme relates to PjBL/WBL/PBL and learning technologies: a review of PjBL in higher education (Guo dkk., 2020), the effects of PjBL on learning outcomes (meta-analysis) (Chen & Yang, 2019), PBL approaches for student engagement (Almulla, 2020), the effectiveness of PBL in Malaysian TVET (Jabarullah & Iqbal Hussain, 2019), gamification (Dahalan dkk., 2024; Jayalath & Esichaikul, 2022), and augmented reality in vocational training (Acosta dkk., 2019; Chiang dkk., 2022; Lavrentieva dkk., 2020; Radosavljevic dkk., 2020).

Theme 5: External drivers, employability, and sustainability (philosophy/policy and quality assurance components). This theme links the curriculum to industrial transformation and work outcomes: the impact of the Fourth Industrial Revolution on vocational skills (Spöttl & Windelband, 2021), the application of Industry 4.0 technologies in Nigerian TVET (George et al., 2024), the implications of technological developments for continuous VET (Beer & Mulder, 2020), the impact of TVET on skills and employment (Choi et al., 2019), and a comparison of vocational versus general education regarding employment and earnings (Korber & Oesch, 2019). The appearance of “sustainable development” on the map implies a connection to the SDGs, although the integration of its indicators into the curriculum is still rarely implemented.

Discussion

The purpose here is to provide an interpretation of your results and support for your conclusions, using evidence from your experiment (research) and generally accepted knowledge, where appropriate. Suggest directions for future research, new methods, explanations for deviations from previously published results, etc. Regarding the five objectives of the review, this synthesis concludes: (1) the theoretical framework of TVET curricula is indeed rich, but external influences such as Industry 4.0/5.0, employability, and sustainability dominate the discourse more than the curriculum theory itself; (2) practices in curriculum document development and management are scarcely indexed, creating a significant empirical gap in design and documentation components; (3) explicit curriculum evaluation models (including those aligned with the SDGs) rarely appear; (4) quality assurance and accreditation regimes (BAN-PT, IABEE, AUN-QA, ASIIN, APACC) do not reach the threshold for keyword occurrence, confirming the weak linkage between accreditation and substantive curriculum quality as suspected; and (5) the most frequently documented curriculum innovations are PjBL/WBL/PBL, gamification, and AR, whereas MBKM and Teaching Factory-though central to Indonesia's policy discourse – remain underrepresented in this indexed corpus. Thus, the proposed five-component curriculum management framework finds justification

Several limitations should be noted. First, the metadata was sourced from a Publish or Perish export that lacked abstracts and author keywords, so keywords were derived from titles and standardized using a thesaurus; the map reflects title terminology, not author indexing. Second, the automated search captured cross-disciplinary records; five records were excluded through a relevance audit (medicine, machine learning, and welfare), so the synthesis is based on 34 core studies. Third, this indexed corpus lacks specific curriculum management terms (MBKM, Teaching Factory, quality assurance, accreditation); findings regarding the scarcity of these themes need to be confirmed through targeted Scopus searches using Boolean strings specific to curriculum management. Fourth, the RIS export does not include cited references, so citation analysis and bibliographic coupling are not optimal.

CONCLUSION

This systematic literature review maps and synthesizes Scopus-indexed literature on TVET curriculum management from 2019 to 2026 using a combination of the PRISMA 2020 guidelines and VOSviewer bibliometric mapping. Of the 400 records identified, 34 core studies were thematically synthesized. It was concluded that the high-visibility discourse on TVET curricula is dominated by vocational education as the subject, systematic reviews as the method, and pedagogical innovations (PjBL/WBL/PBL, gamification, augmented reality), competencies, and employability as key issues; while curriculum management as an explicit construct encompassing curriculum development, document management, MBKM, Teaching Factory, evaluation, quality assurance, and accreditation occupies a peripheral and fragmented position. It is this gap, not the strengths, that constitutes the main finding and underpins the proposed five-component curriculum management framework (philosophy/policy, design, documentation, implementation, and quality assurance).

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