Instructors' and Students' Perceptions of AI-Supported Teaching and Learning in Technical-Vocational Education: A Systematic Literature Review

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ABSTRACT

The integration of Artificial Intelligence (AI) within Technical-Vocational Education and Training (TVET) is increasingly shaping the educational landscape, presenting both novel pedagogical opportunities and complex challenges. This systematic literature review investigates how instructors and students perceive and experience the implementation of AI-supported teaching and learning approaches in TVET settings. This review addresses the growing need to understand the human dimensions of AI adoption in vocational education, particularly from the perspectives of those directly involved in teaching and learning. As AI technologies become increasingly embedded in educational practices, examining the experiences, perceptions, and concerns of instructors and students is essential for informing effective and responsible implementation strategies. By synthesizing evidence across diverse TVET contexts, this review provides insights into emerging opportunities, challenges, and implications for policy and practice. Following the PRISMA 2020 framework, an initial database search on Lens.org yielded 580 records. After applying rigorous inclusion and exclusion criteria, including filters for publication date, document type, and subject matter, 19 empirical studies were selected for final qualitative synthesis. The findings reveal three overarching themes. First, while instructors exhibit optimism regarding efficiency gains, they express significant concerns about dehumanization, cognitive decline, and threats to academic integrity. Second, students experience enhanced psychological safety through instant feedback, yet face a paradox of being "Engaged but Amotivated" alongside risks of severe technological dependency. Third, AI implementation in TVET is uniquely constrained by the necessity for tactile skill mastery, industry precision, and alignment with local cultural practices. Ultimately, maximizing AI's potential in vocational education requires addressing systemic infrastructure barriers and preserving the hands-on, human-centric core of TVET.

Keywords: Vocational education and training, Artificial intelligence, Teaching and learning, Perception, Systematic review

INTRODUCTION

Artificial Intelligence (AI) is increasingly transforming educational systems by reshaping how teaching, learning, assessment, and instructional support are delivered. Recent advances in machine learning and generative AI technologies, particularly large language models such as ChatGPT, have expanded opportunities for personalized learning, automated feedback, intelligent tutoring, and content generation (Kasneci et al., 2023). These developments have encouraged educational institutions to explore AI as a tool for enhancing learning experiences and preparing students for participation in a rapidly evolving digital economy. Research suggests that AI can support learner-centered education by providing adaptive learning pathways and data-driven instructional interventions (Holmes et al., 2019). Consequently, AI has emerged as a significant area of interest among educators, policymakers, and researchers seeking innovative approaches to improve educational quality and effectiveness.

Despite its potential benefits, the integration of AI in education has raised important pedagogical and ethical concerns. Scholars have highlighted risks associated with academic dishonesty, overreliance on AI-generated outputs, algorithmic bias, data privacy issues, and the possible erosion of critical thinking skills (Kasneci et al., 2023; Rahman & Watanobe, 2023). UNESCO (2023) emphasizes that AI adoption in education should follow a human-centered approach that safeguards learners' agency, promotes equitable access, and supports meaningful cognitive and social development.

These developments are particularly relevant to Technical-Vocational Education and Training (TVET), which plays a critical role in preparing individuals for employment through competency-based and industry-oriented learning. The emergence of Industry 4.0 technologies, including automation, robotics, and AI, has significantly altered workforce requirements, increasing demand for workers with digital competencies and the ability to interact with intelligent technologies. Consequently, TVET institutions are under growing pressure to align educational practices with changing labor market needs and technological advancements. AI has therefore attracted considerable attention as a tool for supporting vocational instruction, facilitating personalized learning, and enhancing workplace readiness.

However, implementing AI in TVET presents unique challenges. Unlike general academic education, vocational learning relies heavily on practical skill development, psychomotor competence, workplace simulations, and hands-on experiences. Although AI can support learning through virtual simulations, intelligent tutoring systems, and adaptive platforms, it cannot fully replicate the experiential aspects of vocational training. Furthermore, concerns remain regarding the cultural relevance of AI systems, their alignment with local industry practices, and their potential influence on learners' independence and critical thinking (UNESCO, 2023).

Although research on AI in education has expanded rapidly, evidence regarding its implementation within TVET remains fragmented. Existing studies have largely focused on technological effectiveness, adoption factors, and learning outcomes, while less attention has been devoted to understanding how instructors and students perceive and experience AI-supported teaching and learning. Examining these perspectives is important because the success of educational innovations depends not only on technological capabilities but also on stakeholder acceptance, pedagogical suitability, and contextual relevance.

Given the growing use of AI in vocational education and the limited synthesis of stakeholder experiences in TVET contexts, a systematic review of the literature is warranted. Therefore, this study aims to synthesize empirical evidence on how instructors and students perceive and experience the implementation of AI-supported teaching and learning approaches in TVET settings.

Accordingly, this review is guided by the following research question:

How do instructors and students perceive and experience the implementation of Artificial Intelligence-supported teaching and learning approaches within Technical-Vocational Education and Training (TVET) settings?

METHODS

Research Design

This study employed a Systematic Literature Review (SLR) to identify, evaluate, and synthesize empirical evidence on the implementation of Artificial Intelligence (AI)-supported teaching and learning in Technical and Vocational Education and Training (TVET). The SLR approach was chosen for its rigorous, transparent, and replicable process, enabling a comprehensive synthesis of existing research while minimizing bias.

The review was guided by clearly defined research questions, predetermined eligibility criteria, and a structured search and screening process. The PICOC (Population, Intervention, Comparison, Outcome, and Context) framework informed the development of the research question, search strategy, and study selection criteria.

Literature searches were conducted using Lens.org, while Rayyan was utilized to facilitate systematic screening and study selection.

Following the PRISMA 2020 framework, the review involved four stages: identification, screening, eligibility assessment, and inclusion of studies. Eligible studies underwent quality appraisal before inclusion in the final synthesis. Given the study's focus on understanding stakeholder perceptions and experiences, a qualitative synthesis approach was adopted to integrate findings from qualitative and mixed-methods research.

This systematic review provides an evidence-based understanding of how instructors and students perceive and experience AI-supported teaching and learning in TVET, while highlighting key opportunities, challenges, and implications for practice.

Table 1. PICOC Framework for the Research Question

Element	Specification
Population	TVET teachers, educators, pre-service teachers, and vocational trainers. TVET learners, apprentices, early-stage practitioners, and Gen Z vocational students.
Intervention	The implementation and integration of Artificial Intelligence (AI)-supported teaching and learning approaches in vocational settings.
Comparison	The study focuses exclusively on reporting and exploring stakeholder perceptions and experiences with AI, without comparing them to a control group or traditional non-AI teaching methods.
Outcome	Stakeholder attitudes, optimism for efficiency and personalized learning, fears of dehumanization, concerns about academic integrity, and overall readiness levels. Actual tool utilization, pedagogical role shifts, the "Engaged but Amotivated" (EBA) phenomenon among students, reductions in academic anxiety, and the practical challenges of integrating AI into hands-on, skill-based learning.
Context	Technical-Vocational Education and Training (TVET) settings. This encompasses vocational high schools, higher vocational colleges, and continuing vocational education and training (CVET) institutions.

To define the scope of the review and guide the literature search, the PICOC (Population, Intervention, Comparison, Outcome, Context) framework was employed (Table 1). The population included TVET instructors, trainers, and vocational learners. The intervention focused on the implementation of AI-supported teaching and learning approaches in vocational education. No comparison group was specified, as the review aimed to explore stakeholder perceptions and experiences rather than compare AI with traditional instructional methods.

The outcomes examined included stakeholder attitudes, perceived benefits and challenges, readiness for AI adoption, and experiences related to AI use in teaching and learning. The review was limited to TVET contexts, including vocational schools, colleges, and continuing vocational education and training institutions, ensuring that findings remained relevant to skill-based and competency-oriented learning environments.

Inclusion and Exclusion Criteria

To ensure that the review remained focused on addressing the research question, explicit inclusion and exclusion criteria were established prior to the screening process. These criteria were developed based on the study objectives and the PICOC framework, enabling a systematic and consistent evaluation of the identified literature. The eligibility criteria guided the selection of studies during the title, abstract, and full-text screening stages conducted in Rayyan. Only studies that directly examined instructors' and students' perceptions, attitudes, perspectives, or experiences regarding the implementation of Artificial Intelligence (AI)-supported teaching and learning within Technical and Vocational Education and Training (TVET) contexts were considered for

inclusion. Studies that did not align with the research focus, methodological requirements, publication standards, or contextual scope of the review were excluded.

Table 2. Eligibility Criteria

Category	Inclusion Criteria	Exclusion Criteria
Population	Instructors, teachers, trainers, educators, or lecturers. Students, trainees, apprentices, or learners.	Studies focusing exclusively on policymakers, administrators, or industry employers without direct student/instructor data. General AI developers or software engineers.
Intervention / Phenomenon of Interest	Core focus is on Artificial Intelligence (AI) tools actively supporting teaching or learning (e.g., adaptive learning, intelligent tutoring systems, generative AI, AI assessment).	Studies on general educational technology, digital tools, or software that do not utilize AI/machine learning (e.g., standard LMS, basic video conferencing, non-AI simulators). Exclude traditional Analytical AI, Predictive AI, or Adaptive Learning Systems.
Context	Strictly within Technical-Vocational Education and Training (TVET) environments. All levels of Technical-Vocational Education and Training (TVET), including Secondary Vocational Schools, Higher Vocational Colleges, Polytechnics, and Vocational Undergraduate Programs.	General K-12 primary/secondary education. Standard academic traditional universities (unless a specific vocational/technical track is isolated).
Outcomes / Focus	Explicitly measures or evaluates user perceptions, lived experiences, attitudes, user acceptance, or pedagogical satisfaction regarding the AI tools.	Exclude studies where the *primary* outcome is measuring academic performance, skill acquisition, or AI literacy test scores, even if they include a minor perception survey at the end.
Publication Type	Peer-reviewed journal articles. Full peer-reviewed conference proceedings.	Secondary literature (systematic reviews, meta-analyses, literature reviews). Grey literature, opinion pieces, editorials, book reviews. Patents.
Language	Published in English.	Published in languages other than English
Publication Period	Published between 2022 and 2026	Published prior to the defined cutoff year, representing outdated AI paradigms.
Accessibility	Full-text articles available through open access, institutional databases, or standard interlibrary loan requests.	Abstract-only papers, extended abstracts, or papers locked behind inaccessible paywalls after all retrieval methods are exhausted.
Research Design	Empirical primary research (qualitative, mixed-methods designs).	Purely theoretical or conceptual frameworks that do not provide primary empirical data from participants.
Uniqueness	The primary, most comprehensive, or most recent version of a study.	Duplicate publications (e.g., a conference paper that was later published as an identical journal article).

Table 2 presents the eligibility criteria used to select studies for inclusion in this review. The criteria were developed based on the research question and PICOC framework to ensure relevance and methodological rigor. Studies were included if they involved TVET instructors or learners and examined the use of AI-supported teaching and learning approaches within vocational education settings.

The review focused on empirical studies that explored participants' perceptions, experiences, attitudes, acceptance, or satisfaction with AI. Studies centered on non-AI educational technologies, general education contexts, learning outcomes alone, or non-empirical publications were excluded. To ensure quality and relevance, only English-language, peer-reviewed journal articles and conference proceedings published within the defined period and available in full text were considered. Duplicate and non-retrievable studies were also excluded.

Systematic Review Process

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure a transparent, systematic, and reproducible review process. The review was conducted through four sequential stages: identification, screening, eligibility assessment, and inclusion. Figure 1 presents the PRISMA flow diagram illustrating the study selection process.

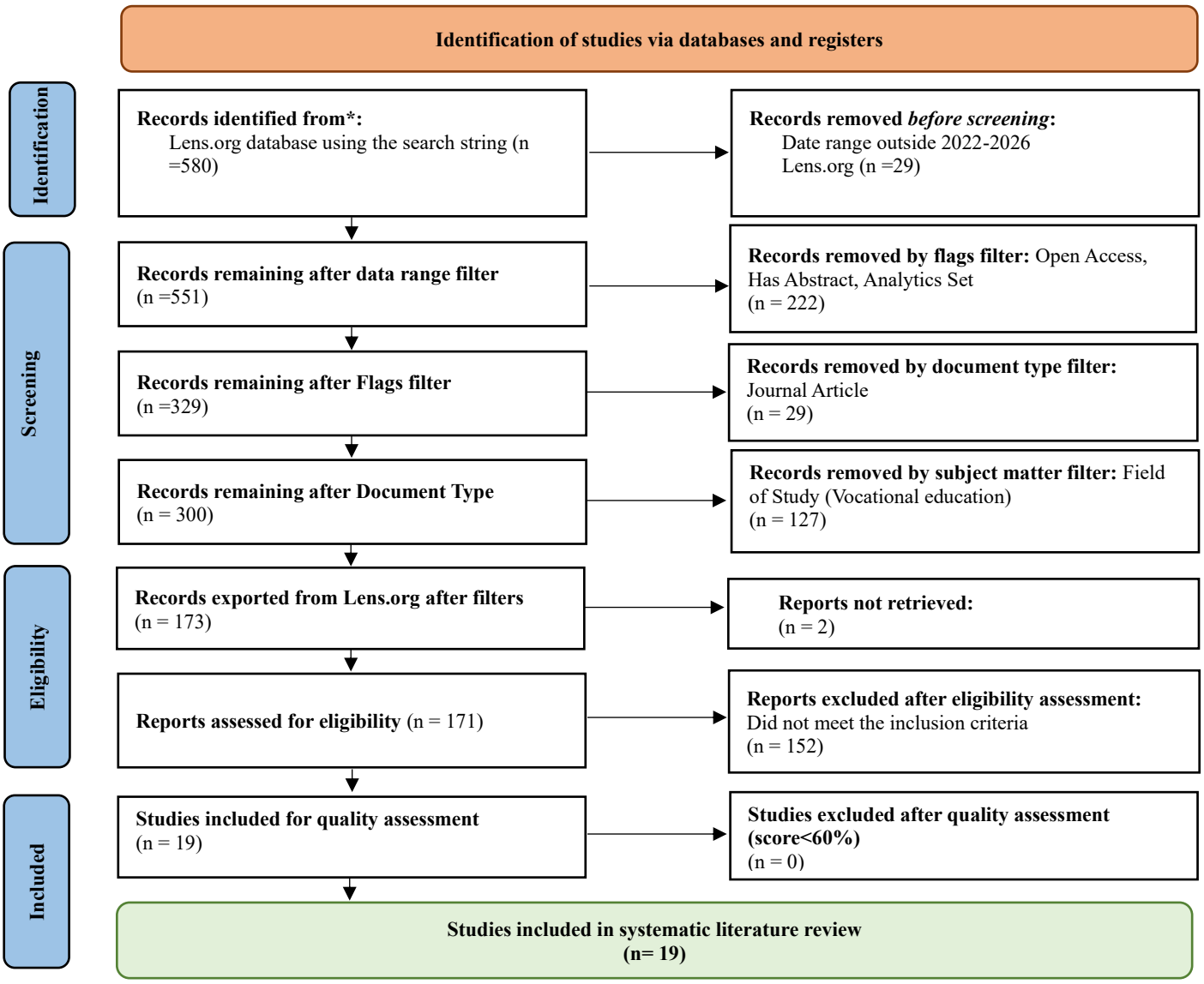


Figure 1. Flow Diagram of Literature Selection

Identification

The identification phase involved a comprehensive search of the Lens.org database. The search strategy was developed using the PICOC framework to align the search terms with the study's research question concerning the perceptions and experiences of instructors and students regarding Artificial Intelligence (AI)-supported teaching and learning in Technical and Vocational Education and Training (TVET).

The following search string was employed:

title:(AI OR "artificial intelligence" OR "generative AI" OR ChatGPT) AND abstract:(vocational OR TVET OR "technical education" OR VET) AND abstract:(perception OR attitude* OR experience* OR perspective* OR view* OR opinion*)*

The search yielded an initial total of 580 records. These records represented potentially relevant studies addressing AI applications in vocational and technical education contexts.

Screening

A systematic screening process was conducted to refine the search results and retain only studies relevant to the review objectives. Initially, 29 records published outside the predetermined publication period of 2022–2026 were removed, leaving 551 records. Subsequently, Lens.org filters, including Open Access, Has Abstract, and Analytics Set, were applied, resulting in the exclusion of 222 records and reducing the dataset to 329 records.

Document type filtering was then performed to retain only peer-reviewed journal articles, removing 29 records. Finally, a subject-area filter focusing on vocational and technical education was applied, leading to the exclusion of 127 records. Following these screening procedures, 173 studies remained and were exported for further assessment.

To enhance transparency and consistency in the review process, all retrieved records were imported into Rayyan, a web-based systematic review management platform. Rayyan facilitated the systematic application of the inclusion and exclusion criteria during the title and abstract screening stages.

Eligibility

During the eligibility phase, the full texts of the retrieved studies were assessed against the predetermined inclusion and exclusion criteria. Of the 173 records identified during screening, two reports could not be retrieved and were therefore excluded. Consequently, 171 full-text articles were evaluated for eligibility.

A detailed review of each article's title, abstract, methodology, findings, and relevance to the research question was conducted. Studies were excluded if they did not focus on AI-supported teaching and learning within TVET settings, did not report the perceptions or experiences of instructors and students, or failed to satisfy the established methodological and contextual requirements. As a result, 152 studies were excluded during this stage.

Inclusion

Following the eligibility assessment, 19 studies met all inclusion criteria and proceeded to methodological quality appraisal. A quality assessment threshold of 60% was established to ensure the inclusion of studies with adequate methodological rigor. No studies scored below the threshold; therefore, no additional articles were excluded.

The final review corpus consisted of 19 empirical studies that were included in the qualitative synthesis. Among these, 13 employed qualitative research designs, utilizing methods such as interviews, focus group discussions,

and classroom observations, while 6 adopted mixed-methods approaches that combined quantitative survey data with qualitative findings. These studies provided rich evidence regarding how instructors and students perceive, experience, and respond to the implementation of AI-supported teaching and learning approaches in TVET environments.

Quality Assessment

To ensure the methodological rigor and credibility of the evidence synthesized in this systematic literature review, a formal quality assessment was conducted on all included studies. Given that the final corpus comprised heterogeneous research designs, specifically qualitative studies (n = 13) and mixed-methods studies (n = 6), the Mixed Methods Appraisal Tool (MMAT), Version 2018, was selected as the quality appraisal instrument. The MMAT is a widely recognized and validated tool designed to assess the methodological quality of empirical studies across multiple research traditions within a single review (Hong et al., 2018). Its flexibility and applicability to diverse study designs make it particularly suitable for systematic reviews involving qualitative and mixed-methods evidence.

Appraisal Process and Scoring Rubric

The quality assessment followed a two-phase process. First, all studies were screened using the two MMAT screening questions to determine whether they had clear research questions and adequate data to address them. Studies meeting these criteria proceeded to the second phase.

In the second phase, studies were assessed according to their research design using the relevant MMAT criteria for qualitative or mixed-methods studies. Although the MMAT (2018) recommends descriptive reporting, this review adopted a scoring system to facilitate systematic comparison and transparent inclusion decisions. Each criterion was rated as: 2 (Yes), 1 (Can't Tell), or 0 (No).

The two screening questions and five methodological criteria resulted in a maximum score of 14 points. Studies scoring 80% and above were classified as high quality, 60%–79% as moderate quality, and below 60% as low quality. A minimum score of 9 out of 14 points (60%) was required for inclusion in the final synthesis.

Table 3. Quality Assessment Criteria adapted from the MMAT (2018)

Category	Item No.	Methodological Criterion Evaluated
Initial Screening (All Studies)	S1	Are there clear research questions?
	S2	Do the collected data allow to address the research questions?
Category 1: Qualitative Studies	1.1	Is the qualitative approach appropriate to answer the research question?
	1.2	Are the qualitative data collection methods adequate?
	1.3	Are the findings adequately derived from the data?
	1.4	Is the interpretation of results sufficiently substantiated by data?
	1.5	Is there coherence between qualitative data sources, collection, analysis and interpretation?
Category 2: Mixed Methods Studies	2.1	Is there an adequate rationale for using a mixed methods design to address the research question?
	2.2	Are the different components of the study effectively integrated?
	2.3	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?
	2.4	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?

	2.5	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

As shown in *Table 3*, the methodological quality of the included studies was assessed using criteria adapted from the Mixed Methods Appraisal Tool (MMAT, 2018). All studies were initially evaluated for the clarity of their research questions and the adequacy of the data collected to address those questions.

Additional criteria were applied according to study design. Qualitative studies were assessed for the appropriateness of the research approach, data collection methods, interpretation of findings, and methodological coherence. Mixed-methods studies were evaluated based on the rationale for using mixed methods, the integration of qualitative and quantitative components, interpretation of integrated findings, and adherence to the quality standards of both methodological traditions.

This quality assessment ensured that only studies demonstrating sufficient methodological rigor contributed to the final synthesis.

Table 4. Quality Assessment Results

Reviewer	Total No. of Papers	Qualitative Case Studies & Phenomenological Approaches Meeting the ≥60% Threshold	Mixed-Methods Designs Meeting the ≥60% Threshold	Total No. of Papers Meeting the ≥60% Threshold	Percentage
Reviewer 1	19	13	6	19	**100.0%**
Reviewer 2	19	13	6	19	**100.0%**
Reviewer 3	19	13	6	19	**100.0%**

Table 4 presents the results of the methodological quality assessment conducted on the 19 studies included in the review. Three independent reviewers evaluated all selected studies using the adapted MMAT criteria for qualitative and mixed-methods research. The final corpus consisted of 13 qualitative studies and 6 mixed-methods studies.

The results indicate a high level of methodological quality across the included studies. All three reviewers consistently determined that the 19 studies met or exceeded the established quality threshold of 60%, resulting in a 100% inclusion rate. Consequently, no studies were excluded during the quality appraisal stage. This level of agreement among reviewers demonstrates the robustness of the selected evidence base and provides confidence in the credibility and trustworthiness of the synthesized findings. The results further suggest that the included studies possessed sufficiently rigorous research designs, data collection procedures, and analytical approaches to contribute meaningful evidence regarding instructors' and students' perceptions and experiences of AI-supported teaching and learning in TVET settings.

Inter-Rater Reliability and Consensus Building

To mitigate individual reviewer bias and ensure absolute objectivity, the quality appraisal was conducted independently by three separate evaluators. Each evaluator utilized an isolated appraisal matrix to grade the 19 studies without prior consultation.

Upon completion of the independent appraisals, an Inter-Rater Reliability (IRR) analysis was conducted. The initial independent percent agreement across all evaluators and criteria was calculated at 100% indicating a strong foundational alignment in interpreting the methodological quality of the literature.

For the remaining criteria where the three evaluators did not initially align, discrepancies were flagged and resolved through a structured consensus meeting. During this session, the evaluators discussed their rationales and cross-referenced the official MMAT guidelines until a unanimous final score was agreed upon for every data point. This dual process of calculating independent IRR followed by collaborative consensus building ensured a highly rigorous, transparent, and objective final quality evaluation. The finalized quality scores determined the weight and context given to each study during the subsequent thematic synthesis.

RESULTS

This section presents the findings of the systematic literature review and provides a synthesis of the evidence addressing the research question: *How do instructors and students perceive and experience the implementation of Artificial Intelligence (AI)-supported teaching and learning approaches within Technical-Vocational Education and Training (TVET) settings?* The findings are derived from 19 empirical studies that satisfied the predefined eligibility criteria and demonstrated adequate methodological quality based on the adapted Mixed Methods Appraisal Tool (MMAT) assessment.

Overview of Included Studies

The review synthesized data from 19 empirical studies that specifically investigate AI integration within the TVET context. To establish the context for the findings of this systematic review, an analysis of the geographical and methodological distribution of the 19 selected empirical studies reveals a diverse yet regionally concentrated research landscape, as illustrated in Figure 2 (Geographical Distribution of the Included Studies). The literature demonstrates a significant focus on Asian educational settings, with Indonesia contributing the largest share of eight studies (e.g., Apoko, 2025; Fitriantinah, 2026; Raharjo et al., 2025), followed closely by China with four studies (e.g., Cao & Abdullah, 2025; Yang & Balazon, 2026). The remaining research provides European and other Southeast Asian perspectives, encompassing contexts from Germany (Petridou & Lao, 2024; Rott et al., 2022), Slovakia (Pondelíková, 2026), Lithuania (Kankeviciene et al., 2026), the Philippines (Navasca, 2025), and Singapore (Lin, 2026).

Methodologically, as shown in Figure 3 (Distribution of Included Studies in Terms of Research Methodology), the included studies predominantly employed qualitative approaches (n = 13), utilizing interviews, classroom observations, and case studies to explore the lived experiences and perceptions of participants. The remaining studies adopted mixed-methods designs (n = 6), integrating quantitative survey data with qualitative evidence to provide a more comprehensive understanding of AI implementation. The predominance of qualitative and mixed-methods research aligns with the review's focus on stakeholder perceptions and experiences.

Regarding stakeholder representation, which is mapped out in Figure 4 (Distribution of Included Studies in Term of Stakeholder Focus), nine (n=9) studies focused primarily on instructors and teachers, four (n=4) concentrated on students and trainees, and six (n=6) examined the perspectives of both groups. This distribution suggests that the literature has given greater attention to educators' experiences while increasingly recognizing the importance of understanding student perspectives. Collectively, these studies form the empirical foundation for the thematic synthesis presented in the succeeding sections.

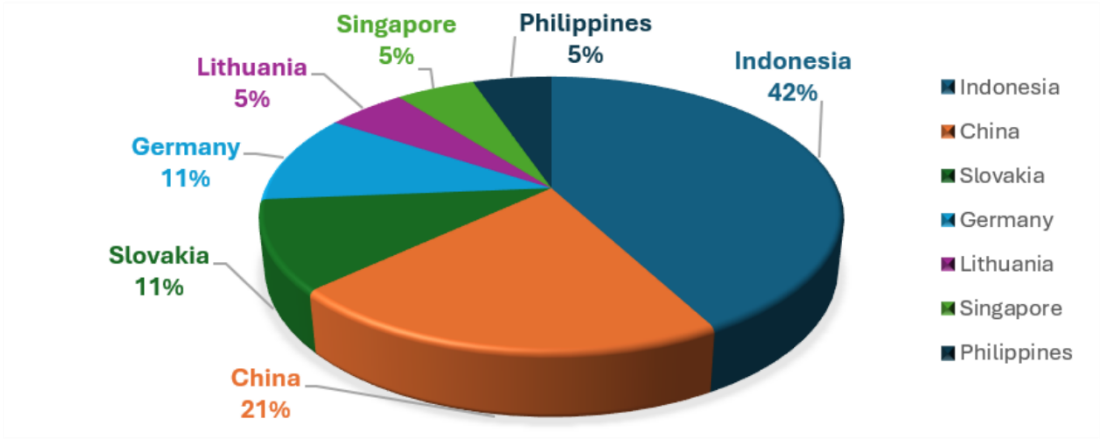
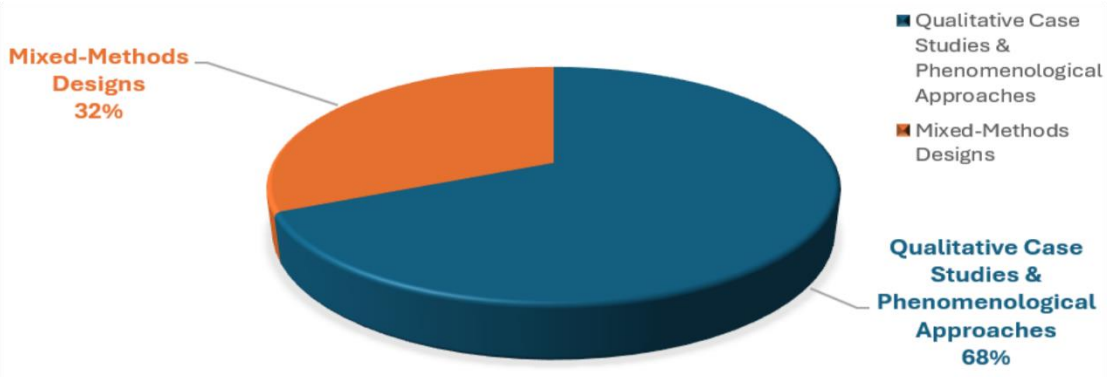


Figure 2. Geographical Distribution of the Included Studies



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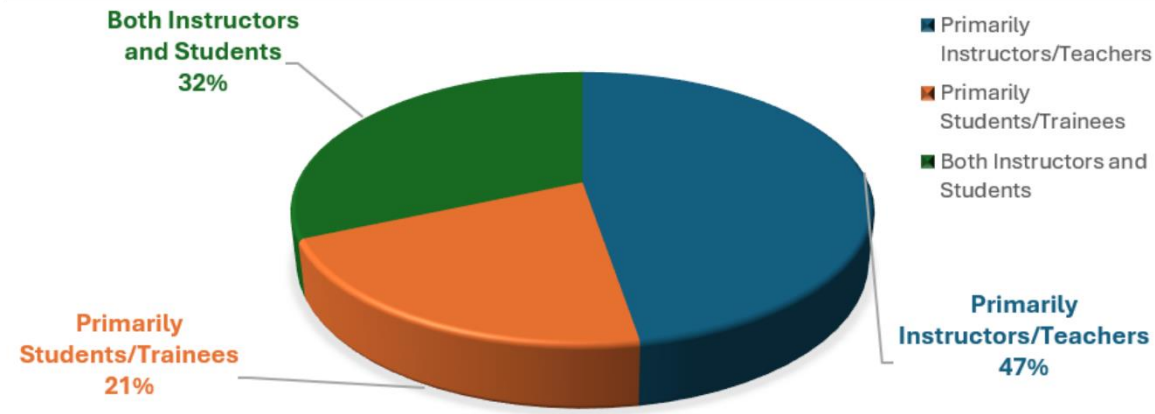

Figure 4. Distribution of Included Studies in Terms of Stakeholder Focus

Theme 1: Instructor Perceptions and Experiences

The synthesis of nine instructor-focused studies and six studies involving both instructors and students revealed that educators hold complex and often contrasting views regarding AI integration in TVET. While instructors generally recognize AI as a valuable tool for enhancing instructional efficiency and supporting pedagogical innovation, they simultaneously express concerns regarding academic integrity, overreliance on technology, and the potential erosion of the human-centered nature of vocational education. Three interrelated subthemes emerged from the analysis: (1) optimism, efficiency, and pedagogical transformation; (2) fears of dehumanization, ethical risks, and cognitive decline; and (3) practical implementation challenges and systemic barriers.

Optimism, Efficiency, and Pedagogical Transformation: TVET educators exhibit a predominantly positive, yet pragmatic, attitude toward AI integration, recognizing its capacity to transform instructional delivery and alleviate administrative burdens (Apoko, 2025). Instructors report substantial efficiency gains, leveraging AI for developing customized lesson plans, tracking real-time student progress, and generating interactive learning contents (Radita & Yuniar, 2025; Apoko, 2025). By automating routine assessments and grammar checks, teachers emphasize that AI frees up their time, allowing them to shift their focus from being mere knowledge transmitters to higher-order pedagogical mentors and facilitators (Raharjo et al., 2025; Deng et al., 2025).

Fears: Dehumanization, Ethical Risks, and Cognitive Decline: Despite this optimism, educators harbor profound concerns regarding academic integrity, cognitive decline, and the potential dehumanization of vocational training (Majid et al., 2026). A pervasive fear among instructors is that students will blindly accept AI-generated content without verification, eroding their critical thinking skills and leading to academic dishonesty and plagiarism (Deng et al., 2025; Kankeviciene et al., 2026). Furthermore, educators warn that AI cannot replace the emotional connection, cultural context, and tactile mentorship that are fundamental to vocational education, noting that AI systems lack the necessary humanity and social sensitivity required for authentic coaching (Majid et al., 2026; Raharjo et al., 2025).

Practical Implementation and Systemic Barriers: In practice, tech-savvy TVET teachers are adapting their pedagogy to mitigate these risks by using AI strictly as a verification tool rather than a primary source. For example, some instructors employ "reverse prompting," requiring students to perform technical configurations manually and then utilizing AI to troubleshoot or check for errors, thereby preserving human agency in problem-solving (Majid et al., 2026). However, the widespread implementation of such strategies is severely obstructed by a lack of structured professional development (Yang & Balazon, 2026). In many regions, teachers face significant operational burdens due to low AI literacy, compounded by systemic infrastructural deficits such as unstable internet connectivity, outdated hardware, and the high costs associated with premium AI platforms (Pondelíková, 2026; Apoko, 2025; Navasca, 2025).

Table 5. Synthesized Subthemes and Key Findings on Instructor Perceptions and Experiences of AI-Supported Teaching and Learning in TVET

Subtheme	Description	Key Studies
Optimism, Efficiency, and Pedagogical Transformation	AI enhances lesson planning, assessment, and instructional support	Apoko (2025), Radita & Yuniar (2025), Raharjo et al. (2025)
Fears of Dehumanization, Ethical Risks, and Cognitive Decline	Concerns regarding plagiarism, dependency, and loss of human interaction	Majid et al. (2026), Deng et al. (2025), Kankeviciene et al. (2026)
Practical Implementation and Systemic Barriers	Infrastructure limitations, low AI literacy, and lack of training	Yang & Balazon (2026), Pondelíková (2026), Navasca (2025)

The findings presented in Table 5 demonstrate that instructors generally perceive AI as a valuable educational tool capable of enhancing instructional efficiency and supporting pedagogical innovation. However, these

positive perceptions are accompanied by concerns regarding academic integrity, cognitive dependency, and the potential loss of the human-centered aspects of vocational education. The synthesis further reveals that successful AI implementation is influenced not only by teachers' willingness to adopt the technology but also by institutional support, professional development opportunities, and the availability of adequate technological infrastructure.

Theme 2: Student Perceptions and Experiences

The findings indicate that students generally perceive AI-supported learning positively due to its capacity to provide immediate feedback, personalized assistance, and a psychologically safe learning environment. However, the literature also highlights emerging concerns regarding passive engagement, technological dependency, and insufficient AI literacy. Three subthemes were identified: (1) psychological safety and instant feedback; (2) the paradox of engagement and performative participation; and (3) technological dependency and literacy gaps.

Psychological Safety and Instant Feedback: From the learners' perspective, AI acts as a highly effective "psychological catalyst" that reduces academic anxiety by providing a non-judgmental space for trial-and-error (Fitriantinah, 2026; Dahnial et al., 2025). Students highly value the instant, continuous feedback mechanisms of AI tools, which allow them to correct mistakes in real-time without the fear or embarrassment of facing a human instructor (Fitriantinah, 2026; Zahroh et al., 2024). Consequently, learners feel their education is more gamified and personalized, satisfying basic psychological needs for autonomy and competence (Fitriantinah, 2026).

The Paradox of Engagement: Performative Participation (EBA): Conversely, the ease of task completion facilitated by AI introduces a detrimental paradox termed the "Engaged but Amotivated" (EBA) phenomenon (Cao & Abdullah, 2025). In AI-mediated environments, students may exhibit high behavioral participation—such as repeatedly clicking through automated prompts or submitting AI-generated texts—but experience profound cognitive detachment and intrinsic amotivation (Cao & Abdullah, 2025). Learners report feeling like passive "tool users" rather than active participants taking initiative in their education (Cao & Abdullah, 2025).

Technological Dependency and Literacy Gaps:This superficial engagement breeds severe technological dependency, with students expressing withdrawal anxiety and a reluctance to think independently if AI support is removed (Cao & Abdullah, 2025). Additionally, while TVET apprentices strongly recognize AI literacy as mandatory for their future employability in modernized industries (e.g., "Accounting 4.0"), comparative data reveals that their actual utilization of AI for complex problem-solving lags significantly behind that of university students, highlighting a pronounced AI literacy and awareness gap within the vocational sector (Fitriantinah, 2026; Kankeviciene et al., 2026).

Table 6. Synthesized Subthemes and Key Findings on Student Perceptions and Experiences of AI-Supported Learning in TVET

Subtheme	Description	Key Studies
Psychological Safety and Instant Feedback	Reduced anxiety and increased confidence	Fitriantinah (2026), Dahnial et al. (2025)
Performative Participation (EBA)	High participation but low cognitive engagement	Cao & Abdullah (2025)
Technological Dependency and Literacy Gaps	Reliance on AI and limited higher-order AI skills	Cao & Abdullah (2025), Kankeviciene et al. (2026)

As shown in Table 6, students generally view AI-supported learning positively due to its capacity to provide immediate feedback, personalized assistance, and a psychologically safe learning environment. Nevertheless, the findings also highlight emerging concerns related to passive engagement, overreliance on AI systems, and limited higher-order application of AI tools. These results suggest that while AI can enhance the learning experience, its use should be carefully guided to promote active learning, critical thinking, and learner autonomy.

Theme 3: Unique Contextual Nuances of TVET

Beyond stakeholder perceptions, the review identified contextual factors that distinguish AI implementation in TVET from other educational sectors. Unlike general education, vocational learning emphasizes practical skill mastery, industry-specific competencies, and localized workplace practices. Consequently, two context-specific subthemes emerged: (1) tactile skills and the limits of digital simulation and (2) industry precision and cultural misalignment.

Tactile Skills and the Limits of Digital Simulation: The integration of AI in TVET is uniquely complicated by the sector's reliance on physical, hands-on, and competency-based training. A primary limitation is AI's inability to replicate the tactile skills and physical execution required for vocational mastery, such as handling culinary ingredients, operating heavy machinery, or assessing physical artifacts (Navasca, 2025; Lin, 2026). To bridge this gap, educators employ blended learning models where AI-driven virtual simulations act as a safe, preparatory step to visualize technical concepts before students execute them in physical workshops (Navasca, 2025).

Industry Precision and Cultural Misalignment: The strict industry standards of vocational training require high precision, which general AI models frequently fail to meet. AI tools often generate mismatched or inaccurate technical vocabulary specific to vocational trades (e.g., assigning incorrect names to tools in electro engineering), causing significant confusion among students (Ihsanurrahmah et al., 2025). Beyond technical constraints, TVET is deeply embedded in local traditions, livelihood practices, and community mentorship. Educators raise concerns about "cultural misalignment," noting that globally trained, Western-centric AI models often fail to reflect indigenous knowledge systems, local agricultural practices, or the emotional realities of community-based entrepreneurship (Navasca, 2025; Wang, 2024).

Table 7. Synthesized Subthemes and Contextual Factors Influencing AI Implementation in TVET

Subtheme	Description	Key Studies
Tactile Skills and the Limits of Digital Simulation	AI cannot fully replicate hands-on vocational training	Navasca (2025), Lin (2026)
Industry Precision and Cultural Misalignment	AI struggles with specialized vocational terminology and local contexts	Ihsanurrahmah et al. (2025), Wang (2024)

Table 7 highlights the unique contextual characteristics that shape AI implementation within TVET settings. Unlike general academic education, vocational learning emphasizes practical skill mastery, industry-specific competencies, and workplace authenticity, which present challenges that AI alone cannot fully address. The findings suggest that AI is most effective when integrated as a complementary tool that supports, rather than replaces, hands-on training, industry practices, and culturally relevant learning experiences.

Comprehensive Codebook of AI Integration in TVET

To provide transparency regarding the thematic synthesis process, Table 8 presents the synthesized codebook derived from the included studies. The codebook illustrates how individual perceptions and experiences reported by instructors and students were consolidated into thematic categories. The identified codes support the three overarching themes presented in this review and demonstrate the recurring patterns associated with AI-supported teaching and learning within TVET settings.

Table 8. Synthesized Codebook of Stakeholder Perceptions and Experiences of AI-Supported Teaching and Learning in TVET

Stakeholder	Category	Thematic Code	Evidentiary Description
Instructor	Perception	Optimism for Efficiency	Teachers widely appreciate AI for its ability to reduce administrative workloads, create lesson plans, and generate interactive, dynamic course materials (Apoko, 2025; Radita & Yuniar, 2025).
	Perception	Fear of Dehumanization	Educators worry that AI cannot replace the emotional connection, cultural sensitivity, and tactile, hands-on experiences fundamental to vocational mentoring (Majid et al., 2026; Raharjo et al., 2025).
	Perception	Threat to Integrity	Instructors fear that over-reliance on AI leads to passivity, plagiarism, and a severe decline in critical thinking among apprentices (Deng et al., 2025; Kankeviciene et al., 2026).
	Experience	Pedagogical Role Shift	Teachers are transitioning from primary information transmitters to mentors who guide students in evaluating AI outputs critically (Raharjo et al., 2025; Yang & Balazon, 2026).
	Experience	Reverse Prompting	Instructors use AI strictly as a verification tool to check for errors in students' manual technical configurations, preserving human cognitive effort (Majid et al., 2026).
	Experience	Technical Vocabulary Mismatch	AI models frequently struggle with specialized vocational terminology, causing confusion by assigning incorrect names to technical tools (Ihsanurrahmah et al., 2025).
	Experience	Infrastructure & Literacy Barriers	Implementation is severely hampered by inadequate school infrastructure (e.g., poor Wi-Fi, hardware) and a lack of structured professional AI training (Apoko, 2025; Pondelíková, 2026; Yang & Balazon, 2026).
Student	Perception	Enhanced Motivation & Safety	Gamified AI tools act as a personalized learning assistant, reducing academic anxiety by providing a non-judgmental space to make mistakes (Fitriantinah, 2026; Dahnial et al., 2025).
	Perception	Performative Participation (EBA)	"Engaged but Amotivated" behavior where students actively complete automated tasks but feel like passive "tool users" lacking intrinsic motivation (Cao & Abdullah, 2025).
	Perception	Technological Dependency	Students report severe withdrawal anxiety at the thought of having AI removed, feeling unable to think independently without it (Cao & Abdullah, 2025).
	Experience	Virtual Skill Simulation	Students use AI-powered virtual simulations as a safe digital environment to visualize and practice technical skills prior to physical execution in workshops (Navasca, 2025).
	Experience	Lack of Tactile Practice	AI is limited by its inability to fully replicate the physical execution and hands-on feel required for vocational skill mastery (Lin, 2026; Navasca, 2025).

Table 8 provides an overview of the thematic synthesis generated from the included studies. The identified themes, subthemes, and codes collectively illustrate the multifaceted nature of AI integration in TVET, encompassing both opportunities and challenges from the perspectives of instructors and students. Together, these findings provide a comprehensive understanding of how AI-supported teaching and learning is experienced within vocational education and serve as the foundation for the discussion and implications presented in the succeeding sections.

DISCUSSION

This systematic literature review synthesized evidence from 19 empirical studies to examine how instructors and students perceive and experience the implementation of Artificial Intelligence (AI)-supported teaching and learning approaches within Technical-Vocational Education and Training (TVET) settings. The findings reveal that AI integration in vocational education is characterized by a complex interplay of opportunities and challenges, shaped by pedagogical, technological, and contextual factors. While both instructors and students generally recognize the potential of AI to enhance teaching and learning processes, concerns regarding dependency, academic integrity, and the preservation of hands-on vocational learning remain prominent.

The first major finding highlights instructors' generally positive perceptions of AI as a tool for improving instructional efficiency and supporting pedagogical innovation. Educators reported that AI can reduce administrative workloads, facilitate lesson planning, generate learning materials, and provide timely feedback mechanisms. These findings align with broader educational technology literature suggesting that AI can augment teaching effectiveness by automating routine tasks and enabling teachers to focus on higher-order instructional activities. Within the TVET context, this shift is particularly significant because it allows instructors to devote greater attention to mentoring, coaching, and competency development, which are central components of vocational education. However, the review also reveals that instructors do not view AI as a replacement for teachers but rather as a complementary tool that can enhance, but not substitute for, human expertise and professional judgment.

Despite these perceived benefits, instructors expressed substantial concerns regarding the ethical and pedagogical implications of AI adoption. The findings suggest that educators are particularly worried about the erosion of critical thinking skills, increased academic dishonesty, and excessive reliance on AI-generated content. These concerns reflect ongoing debates in the literature regarding the unintended consequences of generative AI in educational settings. For vocational education, such concerns may be even more pronounced because TVET emphasizes authentic performance, practical problem-solving, and competency-based assessment. The fear that learners may become passive consumers of AI-generated outputs rather than active constructors of knowledge underscores the need for pedagogical approaches that promote critical evaluation and responsible AI use.

The findings further indicate that students generally perceive AI positively, particularly because of its capacity to provide immediate feedback, personalized support, and a psychologically safe learning environment. AI tools appear to reduce anxiety associated with making mistakes by offering non-judgmental assistance and opportunities for repeated practice. These findings are consistent with learner-centered theories that emphasize autonomy, competence, and self-directed learning as important drivers of student engagement. However, the review also identified a paradoxical pattern whereby increased access to AI support can simultaneously promote engagement and diminish intrinsic motivation. The emergence of the "Engaged but Amotivated" phenomenon suggests that students may participate actively in AI-mediated learning activities while remaining cognitively detached from the learning process. This finding raises important questions regarding the balance between technological convenience and meaningful learning engagement.

Another significant finding concerns the development of technological dependency among students. While learners recognize AI literacy as an increasingly important competency for future employment, some studies indicate that students become highly dependent on AI assistance for completing tasks and solving problems. Such dependency may hinder the development of independent thinking and problem-solving skills that are essential in vocational professions. Consequently, AI integration in TVET should be accompanied by strategies

that cultivate critical AI literacy, enabling students to use AI tools effectively while maintaining intellectual autonomy and professional competence.

A particularly important contribution of this review is the identification of contextual factors that distinguish AI implementation in TVET from other educational sectors. Unlike traditional academic disciplines, vocational education relies heavily on hands-on learning, psychomotor skill development, and workplace-based competencies. The findings consistently demonstrate that AI cannot fully replicate the tactile experiences required for vocational mastery. Although AI-driven simulations and virtual learning environments can enhance conceptual understanding and provide safe spaces for practice, they cannot replace direct engagement with tools, equipment, materials, and authentic workplace situations. This suggests that the future of AI in TVET is likely to be characterized by complementary integration rather than full substitution of practical training activities.

The review also highlights concerns regarding industry precision and cultural relevance. Several studies reported that AI systems frequently struggle with specialized vocational terminology and trade-specific knowledge, resulting in inaccurate or misleading outputs. Furthermore, AI models trained predominantly on global datasets may not adequately represent local industry practices, indigenous knowledge systems, or culturally embedded vocational traditions. These findings emphasize the importance of contextualizing AI tools to align with local workforce requirements and educational realities.

Overall, the findings suggest that the successful implementation of AI in TVET requires a balanced and human-centered approach. Educational institutions should invest in teacher professional development, strengthen technological infrastructure, and promote responsible AI use among students. Equally important is the preservation of the experiential and competency-based foundations of vocational education. Rather than replacing instructors or practical training, AI should be leveraged as a supportive technology that enhances teaching effectiveness, enriches learning experiences, and prepares learners for increasingly digitalized workplaces while maintaining the core values and objectives of TVET.

Limitations

Several limitations should be considered when interpreting the findings of this review. First, the literature search was limited to Lens.org, which may have excluded relevant studies indexed in other databases. Second, only English-language publications were included, potentially introducing language bias and limiting the representation of findings from non-English-speaking contexts.

Third, the review focused on studies published between 2022 and 2026 to capture recent developments in AI-supported teaching and learning, which may have excluded earlier foundational research. Fourth, the review examined only instructors' and students' perceptions and experiences, excluding perspectives from policymakers, administrators, industry partners, and technology developers.

Finally, the synthesis was based on 19 empirical studies, primarily qualitative and mixed-methods in nature, with many conducted in Asian contexts. While these studies provided rich insights, the limited number and geographical concentration of studies may affect the generalizability of the findings. Future reviews should incorporate multiple databases, broader stakeholder perspectives, and a wider geographical scope.

CONCLUSION

This systematic literature review examined how instructors and students perceive and experience the implementation of Artificial Intelligence (AI)-supported teaching and learning approaches within Technical-Vocational Education and Training (TVET) settings. Based on the synthesis of 19 empirical studies, the findings indicate that AI has significant potential to enhance instructional efficiency, personalize learning, and support the development of future-ready competencies. However, its implementation also presents important pedagogical, ethical, and contextual challenges.

Three key themes emerged from the review. First, instructors generally view AI as a valuable tool for improving teaching practices and reducing administrative workload, while expressing concerns about academic integrity, cognitive dependency, and the diminishing human element of education. Second, students appreciate AI for its immediate feedback, personalized support, and accessible learning environment, although risks of technological dependency and reduced critical engagement remain evident. Third, the unique characteristics of TVET, particularly its emphasis on hands-on skill development and workplace-based learning, limit the extent to which AI can replace practical training experiences.

Overall, the findings suggest that AI should serve as a complementary tool rather than a substitute for instructors or experiential learning. Effective integration requires investments in teacher professional development, AI literacy, infrastructure, and ethical implementation strategies that preserve the human-centered and competency-based foundations of TVET. Future research should further examine the long-term effects of AI on vocational competencies, workplace readiness, and teaching practices across diverse TVET contexts.

Ethics Statement

This study is a Systematic Literature Review based on previously published, publicly available literature. It did not involve any human or animal participants, and therefore, formal approval from an Institutional Review Board (IRB) or ethics committee was not required. The authors adhered to all standard academic integrity guidelines regarding the transparent reporting of the search strategy, objective analysis of the included studies, and proper citation of all secondary sources.

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