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Vocational Education and Training Program Design and Employability Outcomes: A Systematic Review and Bibliometric Analysis of School-to-Work Outcomes

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ABSTRACT: *This study synthesizes international research from 2015 to 2025 to evaluate how effective vocational education and training (VET) programs help students achieve sustainable employment. It combines a systematic review of 55 sources with a bibliometric analysis of 7,469 publications using VOSviewer and Dimensions.ai. Employment outcomes ranged widely, from 93% placement rates in Saudi Arabian healthcare VET to 43% competency-matched employment in Indonesia. No pooled effect size was estimable due to heterogeneity in outcome measurement; however, six randomized controlled trials from Sub-Saharan Africa reported positive employment odds among youth, with effects strongest within 12 months of program completion. Fundamental employability skills, including creativity, adaptability, and problem-solving, consistently emerge as key drivers of successful school-to-work transitions. However, post-program support and the alignment between the curriculum and the industry remain major*

obstacles that need to be addressed. VET programs succeed when they collaborate with local industries. Work-based learning (≥70% exposure) and sector-specific curricula increase job opportunities, with direct relevance to international students navigating credential and networking barriers.

Keywords: employability, school-to-work transition, skills training, systematic review, vocational education and training

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INTRODUCTION

The vocational education and training (VET) system is the key mechanism through which human capability can be transformed into workplace productivity. It is therefore the primary means by which individuals acquire the necessary skill sets for productive participation in the economy. To work effectively in today's labor market, workers require specific skills and knowledge that VET courses prepare them for (Beer & Mulder, 2020). The global trend toward new forms of professionalism continues to pose ongoing challenges to graduates entering professional practice. This further reflects on a larger scale the limitations of traditional training methods (Wynne et al., 2024). Formal education lacks consistent career readiness support, especially for international students (Fakunle & Pirrie, 2020). Consequently, their employability transitions represent an under researched yet vital aspect of global VET and workforce integration. Developing countries rely on VET systems as essential tools to narrow the gap between different socioeconomic groups. VET programs promote economic development and environmental sustainability by eliminating obstacles that prevent people from accessing education and work opportunities, including gender discrimination in Bangladesh and autism-related employment challenges in the United States (Fong et al., 2021). The study examines how VET programs develop skills that enable people to find work and adjust to new circumstances by examining program design, population characteristics, transition outcomes,

effectiveness mechanisms, and study quality. The analysis draws on global and regional studies to develop evidence-based frameworks that support both policy development and practical implementation.

The persistent program deficiencies at VET create barriers to successful transitions from education to employment, despite its recognized potential. The technical education program in Bangladesh demonstrates a fundamental disconnect between job requirements and educational curricula through its 12 percent female student participation rate (Affandi et al., 2025). Vocational programs face two major problems: Project SEARCH improves outcomes for individuals with autism spectrum disorders while lacking proper teacher training and facing industry alignment issues and cultural barriers. Only 43% of graduates secured competency-matched employment, while 67% lacked the skills needed to compete in the labor market (Karmilah et al., 2024). Recent global analysis has reinforced this concern: According to the International Labor Organization (2023), approximately 267 million young people (ages 15–24) are currently not in employment, education, or training worldwide. Dahal et al. (2025) and UNESCO-UNEVOC (2022) reported that curriculum-industry misalignment in VET is among the primary barriers preventing young people from accessing quality employment. Makwa et al. (2025) emphasized how career adaptability can be an important determinant of successful long-term workforce integration. There has been a compound annual growth rate (CAGR) of 9.1% in VET-related research output since 2015; however, despite this increased research activity, there remains no comprehensive synthesis of thematic evidence on the effectiveness of different types of VET programs across various economic contexts.

This study utilizes two theoretical frameworks to analyze the effectiveness of vocational training across various subgroups and socioeconomic conditions. First, Becker's (1964) human capital theory posits that investing time in education and skills increases productivity and earnings. Second, social cognitive career theory (Lent et al., 1994) explains how personal factors, such as self-efficacy, interact with contextual variables, such as training quality, to influence career transitions. Together, these complementary models form the conceptual foundation of this review. Therefore, the study was guided by the following overarching research question: What are the ways in which VET programs help with the transition to a job, and which of these VET program design elements, as well as the relevant contextual or population attributes, affect the effectiveness of VET program transitions for employment globally (2015-2025)? The sub-questions include the following:

(i) What are the most effective types of VET programs designed to assist students in the transition from school to work?

(ii) How do the various demographic groups and geographically different contexts influence the outcome of their employment after they participate in a VET program?

(iii) What are the barriers, and how can they achieve successful paths from a VET program to employment?

MATERIALS AND METHODS

Inclusion and Exclusion Criteria

The criteria for including and excluding the literature were defined in advance; a broad semantic search strategy was employed; screening was thorough; and the data were extracted systematically.

Table 1: **Inclusion and Exclusion Criteria**

Inclusion Criteria	Exclusion Criteria
Publication Type: Peer-reviewed empirical studies, systematic reviews and meta-analyses, rigorous policy evaluations	*Publication Type:* Non-peer-reviewed sources, theoretical or conceptual papers
Publication Date: 2015 to 2025	*Publication Date:* Before 2015
Language: English	*Language:* Non-English
Study Focus: Formal VET/TVET programs (apprenticeships, technical education, work-based learning)	*Study Focus:* Informal training, noncertified workshops, or workplace-only training without formal VET
Population: Individuals enrolled in, completing, or having completed formal VET/TVET	*Population:* General/academic education without vocational elements
Outcomes: Employment-related outcome (employability skills, job placement, employment rates, school-to-work transition)	*Outcomes:* No empirical data on employment-related transition outcomes

Search and Screening Procedures

This review employed a semantic search with targeted screening to identify the most relevant studies.

Table 2: Summary of the Search and Screening Methods

Step	Description	Papers
Initial Search	Semantic search across over 138 million papers via Elicit (Semantic Scholar and OpenAlex) using a query focusing on VET/TEVT and employability/employment outcomes.	920
Screening	Sources screened against inclusion criteria (publication date, empirical design, formal VET focus, employment outcomes)	55 final

The database search returned 920 papers that matched the review question requirements. The screening process used (Figure 1) to determine study eligibility, which maintained the established criteria. The study selected only

research articles that provided strong empirical evidence and direct ties to formal VET/TVET transitions.

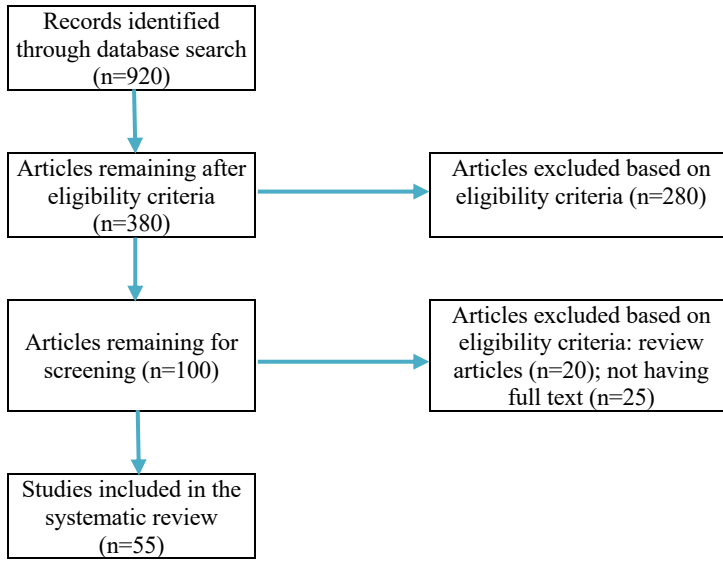

Figure 1: PRISMA Flow Chart to Illustrate the Article Search and the Inclusion Process

The methodological quality of the included studies was assessed using a modified mixed methods appraisal tool (MMAT; Hong et al., 2018). Studies were rated on (i) clarity of research design and objectives; (ii) representativeness of the sample; (iii) adequacy of outcome measurement; (iv) consideration of confounders; and (v) completeness of reporting. Studies rated below 60% on the quality scale were included but flagged for lower confidence in the findings (n=8 studies). This systematic review followed the 2020 PRISMA guidelines (Page et al., 2021).

Data Extraction

Data extraction was independently conducted by two reviewers. Disagreements were resolved through discussion and consensus. The data extraction columns and instructions are summarized in Table 3.

Table 3: Data Extraction Columns and Instructions

Column	Extraction Focus
VET Program Details	Program type, components, operational design
Population & Context	Participant characteristics, sample size, geography, institutional setting, target groups
Transition Outcomes Measured	Employability skills, job placement, employment quality, career progression, labor market integration, school-to-work transition, job retention

Effectiveness & Key Findings	Quantitative results, qualitative findings, comparison data, success rates, barriers, and subgroup effects
Mechanisms & Success Factors	How VET facilitated transition; critical success factors; barriers; role of industry partnerships, work-based learning, support services
Study Design & Quality	Methodology, data sources, sample size, follow-up period, strengths/limitations, bias assessment

The process of extracting information from LLMs proved beneficial because it increased processing speed, delivered uniform outcomes, and decreased human bias.

Bibliometric Analysis

Data Source and Search Strategy

In this study, the Dimensions.ai database, which contains more than 140 million indexed publications together with their complete citation records, funding details, and research categories, was used to obtain bibliometric data (Hook et al., 2018). The search strategy used the following query structure to match the systematic review's defined research boundaries. ("vocational education and training" OR "VET" OR "TVET" OR "apprenticeship" OR "work-based learning") AND ("employability" OR "employment" OR "job placement"). **The search parameters** include **the following**:

- *Time* period: 2015–2025 (matching the systematic review timeline)
- *Document Types:* Articles, reviews, book chapters, and conference proceedings
- *Language:* English
- *Fields of Research:* Education, Economics, Sociology, Policy and Administration

Data Extraction and Cleaning

The raw data processing included deduplication, keyword standardization, author name disambiguation, and citation verification. The final dataset included 7469 publications, but only 2500 were selected for analysis due to export restrictions.

Analytical Tools and Procedures

Two primary software tools were employed for bibliometric analysis: Dimensions.ai Analytics and VOSviewer (version 1.6.20). Analyses were performed through co-authorship, keyword co-occurrence, citation, and bibliographic coupling. The geographic analysis in this section used the latest 2,500 publications, which constitute the study sample and align with the overall publication patterns observed in Analytical Views.

Reliability and Validity

The reliability of the bibliometric study was supported by the use of a structured query string in an identical manner for all queries to search the Dimensions.ai database. Concerns regarding validity, given the maximum number of publications exported (2,500), were addressed by examining the geographic and temporal distributions of the exports relative to those in the larger set of 7,469

publications. A VOSviewer term co-occurrence network was independently replicated to confirm the stability of the clustering outputs.

RESULTS

The following results address the three sub-questions outlined in the introduction. Sections 3.1 and 3.2 provide the study characteristics and bibliometric context, Section 3.3 responds to RQ1 (program design effectiveness) and RQ2 (differential outcomes by population and context), and Section 3.4 addresses RQ3 (barriers and success factors in VET-to-employment pathways).

Characteristics of Included Studies

Table 4 summarizes the key features of the 55 included studies, grouped by theme, geographic coverage, and target population.

Table 4: Characteristics of Included Studies—Grouped by Theme

Theme	Key Studies (Year)	Geographic Coverage	Target Population
Apprenticeship & Dual Training	Appiah-Kubi et al. (2025); Cheng & Wee (2025); Han & Jamaludin (2025); Hussain et al. (2021); Wibowo et al. (2022)	China; Germany/Malaysia/China; Sub-Saharan Africa; Indonesia; Malaysia	TVET/vocational students; youth under 25; TVET graduates
Healthcare & Nursing VET	Alshamsan et al. (2025); Christidis (2019); Jamaludin et al. (2025); Khan-Gökkaya et al. (2019); Markowski et al. (2021); See et al. (2023);Tchoualeu et al. (2023); Wynne et al. (2024)	Saudi Arabia; Not specified; 8 countries; Sweden/international; 32 countries; Mostly high-income	Healthcare trainees; nursing students; immigrant health professionals
Work-Based & Experiential Learning	Fania et al. (2025); Haruna & Kamin (2019); Jwasshaka & Amin (2019); Makwa et al. (2025); Pianda et al. (2024); Somantri & Pramudita (2024)	Global; Not specified; Developing/Nigeria; Nigeria; USA; Not specified	Vocational students; TVET students; vocational graduates
Digital & Technology-Integrated VET	Akoodie et al. (2025); Hur (2019); Michalski et al. (2021); Momoh et al. (2025); Mustaffa et al. (2025); Rajamanickam et al. (2024)	Jordan/Malaysia/Serbia; Not specified; Not specified; Not specified; Multicountry	TVET students; individuals with ASD/neurodevelopmental disorders; youth 15–20
Inclusive VET (Disabilities & Marginalized Groups)	Biswal et al. (2024); Che Mat & Omar (2022); Coñoman et al. (2024); Fong et al. (2021); Gilson et al. (2017); Husni & Min (2025); Jobir (2024); Thompson et al. (2022)	Multi-Africa/Asia; Not specified; Not specified; Not specified; USA; Not specified; Malaysia; India	Students with disabilities; youth with ASD; youth with psychiatric conditions; tribal youth; SEN students
TVET Reform & Policy	Beer & Mulder (2020); Che Rus et al. (2023); Harun et al. (2023); Salleh & Sulaiman (2020); Wei & Nga (2024); Zhao & Selvaratnam (2024)	Malaysia; Europe/N. America; China; Malaysia; Malaysia; Not specified	Workers; TVET graduates; not specified

School-to-Work Transition (Youth)	Affandi et al. (2025); Alvunger (2024); Beber et al. (2024); Maïga et al. (2020); Puji Hartini et al. (2025); Rahman et al. (2017); Shi & Bangpan (2022)	17 LMICs; Africa/Asia; 14 Sub-Saharan Africa; Indonesia; Indonesia; Bangladesh; Sweden	Youth 15–35; youth; female students; vocational school graduates; students 16–19
Internship & Industry Partnerships	Dogara et al. (2020); Heydemans et al. (2025); Hussain et al. (2021); Pianda et al. (2024);	USA; Indonesia; Malaysia; Nigeria	Vocational students; TVET students; not specified
Specialized/Other Programs	Karmilah et al. (2024); Mustaffa & Husain (2024); Newton et al. (2018); Oh et al. (2021); Wilkinson (2016); Xu (2024); Yun & Nasir (2025)	Not specified; UK; USA; Not specified; China; Not specified; Not specified	Adult offenders; asylum seekers; low-income individuals; higher vocational students; health vocational students; surveyor graduates

The studies included reveal a wide range of geographical and programmatic diversity across different economic categories of countries: high-income (the USA and Sweden), middle-income (China, Malaysia, and Indonesia), and low-income or developing countries (Sub-Saharan Africa, Nigeria, and Bangladesh). The main types of VET programs are apprenticeships, work-based learning, internships, and dual training, with notable attention given to training in specific sectors (healthcare and nursing) and to the needs of disadvantaged groups (youths with disabilities, low-income individuals, and special needs students). Many studies lack explicit geographic or population details, suggesting opportunities for more targeted reporting in future research.

Bibliometric Analysis Results

Publication Trends and Growth Patterns

The Dimensions.ai search yielded 7,469 publications meeting the inclusion criteria for the period from 2015 to 2025.

Table 5: Annual Publication Trends with Growth Rates

Year	Publications	Annual Change	Cumulative Growth (from 2015)
2015	410	—	—
2016	454	+10.7%	+10.7%
2017	534	+17.6%	+30.2%
2018	546	+2.2%	+33.2%
2019	662	+21.2%	+61.5%
2020	676	+2.1%	+64.9%
2021	713	+5.5%	+73.9%
2022	830	+16.4%	+102.4%
2023	785	-5.4%	+91.5%
2024	882	+12.4%	+115.1%
2025	977	+10.8%	+138.3%

Table 5 and Figure 2 show the yearly publication pattern, revealing substantial growth in research output in VET and employability transitions over the decade.

The publication rate increased over time at a 9.1% compound annual growth rate, which led to a 2.4-fold increase in publications from 410 in 2015 to 977 in 2025.

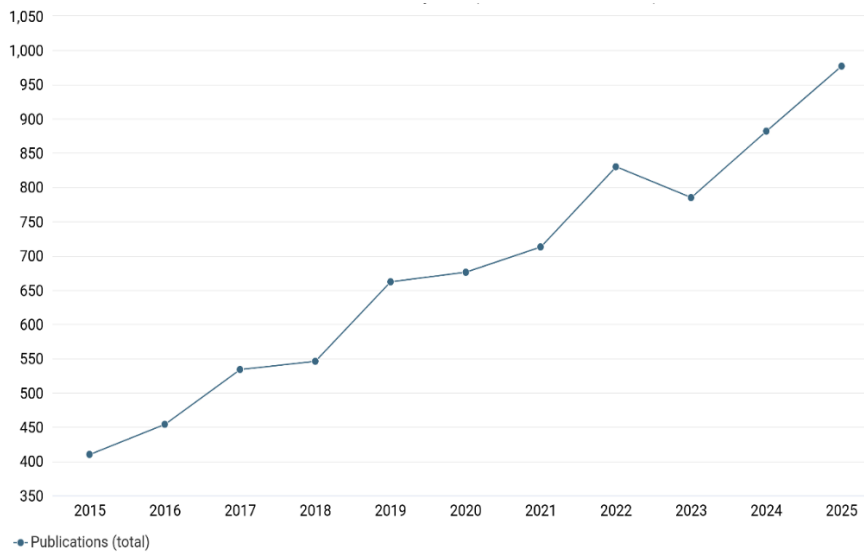

Figure 2. Annual Publication Trends in VET and Employability Research (2015-2025)

Note: *Bar chart showing the number of publications per year retrieved from* Dimensions.ai *using the search query: ("vocational education and training" OR "VET" OR "TVET" OR "apprenticeship" OR "work-based learning") AND ("employability" OR "employment" OR "job placement"). The compound annual growth rate (CAGR) for 2015–2025 is 9.1%, with a prominent acceleration after 2020.*

This growth reflects increased policy focus on workforce development after COVID-19, the digital transformation of labor markets, and the recognition of VET's role in addressing youth unemployment globally (Appiah-Kubi et al., 2025; Beer & Mulder, 2020).

Leading Journals and Publication Venues

Table 6 shows the leading journals that publish VET and employability research from 2015 to 2025, ranked by journal publication volume and citation research impact.

Table 6: Top 10 Publishing VET and Employability Research (2015–2025)

Rank	Journal Title	Publi-cations	Total Citations	Citations Mean	Publisher	Publication Landscape
1	Advances in Social Science, Education and Humanities Research	580	648	1.12	Atlantis Press (Springer Nature)	Proceedings-based Publication
2	Higher Education Skills and Work-based Learning	569	6,521	11.46	Emerald	Specialized VET Journal
3	Journal of Vocational Education and Training	397	5,372	13.53	Taylor & Francis	Specialized VET Journal
4	International Journal of Academic Research in Business and Social Sciences	305	726	2.38	Human Resource Management Academic Research Society	Society-based Publication
5	Education + Training	297	5,990	20.17	Emerald	Interdisciplinary Education Journal
6	Education Sciences	242	2,921	12.07	MDPI	Interdisciplinary Education Journal
7	Journal of Education and Work	207	3,012	14.55	Taylor & Francis (Routledge)	Higher Education Journal
8	International Journal of Environmental Research and Public Health	202	5,584	27.64	MDPI	Interdisciplinary Health Journal
9	Studies in Higher Education	181	5,466	30.20	Taylor & Francis (Routledge)	Higher Education Journal
10	Cogent Education	174	1,559	8.96	Taylor & Francis	Higher Education Journal

The data in Table 6 reveal that specialized VET journals (e.g., Higher Education, Skills and Work-Based Learning; Journal of Vocational Education and Training) achieve the greatest citation impact, whereas proceedings-based outlets publish more but attract fewer citations, reflecting the field's dual focus on applied and scholarly work.

Geographic Distribution and International Collaboration

The geographic distribution of VET research focuses primarily on European and English-speaking countries, while Southeast Asia and Africa are emerging centers of research. The top 15 countries, ranked by publication output, total citations, and total link strength, which measures their collaborative connections with other countries, are displayed in Table 7.

Table 7: Top 15 Countries by Publication Output in VET Research (2015–2025)

Rank	Country	Publications	Total Citations	Total Link Strength
1	United Kingdom	302	3,983	128
2	Germany	229	3,771	103
3	United States	192	2,793	81
4	Australia	191	2,286	63
5	South Africa	143	1,201	44
6	Switzerland	97	1,304	42
7	China	116	1,361	40
8	Italy	36	361	39
9	Norway	46	369	35
10	Canada	70	2,794	33
11	Netherlands	41	622	28
12	Sweden	49	479	27
13	Malaysia	76	927	26
14	Austria	24	403	25
15	India	56	799	23

Data source note: *Due to the limits of the free dimensions analytics account, the geographic distribution analysis was based on the bibliometric export of 2,500 publications (representing approximately one-third of the total 7,469 publications).*

The co-authorship network presented in Figure 3 displays the international research collaboration patterns between researchers.

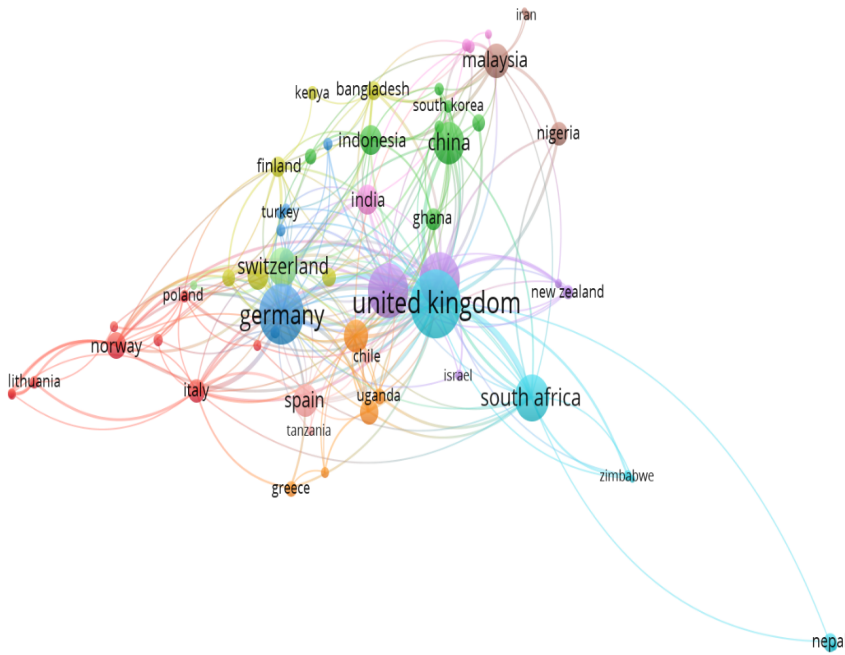

Figure 3: Co-authorship Network Map of Countries Contributing to VET Research

Three major collaborative clusters emerged based on term cooccurrences across all the countries: Europe (led by the UK and Germany), the Asia-Pacific region (led by Australia), North/South Africa, Scandinavia and a developing country cluster (Kenya/Nigeria/India/Bangladesh), which has very few global linkages. There was no presence of Latin America, which represents an important gap in the international VET research community.

Term Co-occurrence Analysis and Thematic Mapping

The term co-occurrence analysis examined the conceptual links between VET and employability research across 2,500 publication titles. The text mining process used binary counting to identify 48 terms, which included 29 of the most relevant terms that displayed a 60% match to VOSviewer's relevance score. The term co-occurrence network in Figure 4 illustrates the intellectual structure through which VET research has developed, while Table 8 presents the most common terms along with their occurrence counts and relevance scores.

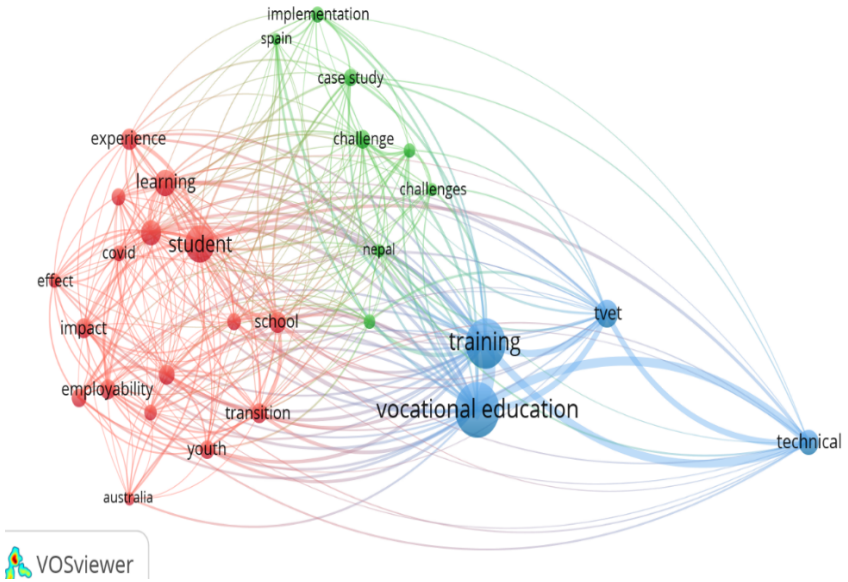

Figure 4: Keyword Co-occurrence Network in VET and Employability Research

COVID-19 received the highest relevance score (2.3452), indicating its transformative impact on VET research. The core thematic clusters span technical vocabulary (VET, TVET, apprenticeship), learner outcomes (transition to work, employability, employment), and methodological evidence (case study, systematic reviews), confirming the field's growing focus on evidence-based program design.

Table 8: Top 29 Most Frequent Keywords in VET Research (2015–2025)

Rank	Keyword	Occurrences	Relevance Score
1	vocational education	507	1.3771
2	training	410	1.3314
3	student	223	0.5947
4	tvet	127	0.544
5	learning	120	1.597
6	technical	112	0.9366
7	work	111	1.4221
8	experience	79	0.9697
9	school	79	1.3371
10	transition	69	1.2311
11	employability	68	0.9234
12	employment	66	0.5924
13	impact	66	0.9368
14	youth	62	0.4757
15	challenge	60	0.7469
16	evidence	55	1.2804
17	case study	54	0.4646
18	apprenticeship	48	0.8183
19	higher education	48	0.7228
20	covid	43	2.3452
21	implementation	43	0.4445
22	germany	42	0.7117
23	effect	37	1.4643
24	technical vocational education	37	0.9133
25	opportunity	35	1.695
26	challenges	33	1.6109
27	australia	32	0.8108
28	nepal	32	0.2254
29	spain	28	0.4768

Effects on Employment Outcomes

Employment and Job Placement Rates

The quantitative evidence, as shown in Table 9, indicates that VET programs mainly yielded favorable employment outcomes, but there were also significant discrepancies across contexts and populations. A VET program in the healthcare sector in Saudi Arabia reported that as many as 93% of alumni secured jobs in the field (Alshamsan et al., 2025), which is among the highest placement rates recorded. In Malaysia, the employment rate after graduation for students with special needs ranges from 69.7% to 70% (Che Mat & Omar, 2022).

Table 9: Quantitative Evidence

Study Context	Employment Rate/Outcome	Effect Measure	Population
Saudi Arabia healthcare VET	93% employment	Job placement rate	Healthcare trainees
Malaysia SEN vocational	69.7-70% employment	Job placement rate	Special needs graduates
Project SEARCH (ASD)	Higher employment at 9-month and 1-year follow-up	Comparative rate	Youth with ASD
Virtual reality training	Increased job offers	Job offers received	Neurodevelopmental disorders
Sub-Saharan Africa apprenticeships	Positive employment odds for under25s	Employment probability	Youth
US HCD programs	Earnings above the poverty threshold	Income level	Low-income individuals

A systematic review of randomized controlled trials conducted in Sub-Saharan Africa revealed that out of eleven studies examining vocational training, six reported positive outcomes for both employment and income measures. Vocational skills training played a significant role in increasing the employment probabilities of young people, especially those younger than 25 years. However, training effects decline over time, with few programs demonstrating long-lasting effects. The wide variation in the percentage of students who find work after completing their vocational training (43%-93%) shows that just because there is a vocational training program available does not mean that students will be employed after graduating.

The success of vocational training programs depends on whether or not they have aligned their curricula with industry requirements, how long postgraduation support for job placement lasts, and what socioeconomic background students come from. Vocational education must evolve because of rapid technological changes to continue providing relevant education for employment. As noted by Beer and Mulder (2020), if vocational training programs do not regularly assess and update their competency models, graduates may enter the workforce with a mismatched set of skills and employers' expectations of the skills required to perform the job. Misaligned curriculum patterns have been observed in three different countries, namely, Indonesia (Affandi et al., 2025), Nigeria (Dogara et al., 2020), and Bangladesh (Rahman et al., 2017), indicating a systemic failure to govern VET rather than just failures within individual programs. The results from each country also support that aligning the curriculum with industry is not a one-time change, as Makwa et al. (2025) reported that it is an ongoing institutional process that requires the ongoing engagement of employers, decentralized governance and continuing communication through feedback loops (Zhao & Selvaratnam, 2024).

Skills Development and Employability

Research over time has revealed the very important employability skills developed through VET programs. In terms of context, six main factors were identified: creativity, communication skills, adaptability, problem-solving, critical thinking, and self-confidence (Dahal et al., 2026; Joshi et al., 2023; Puji Hartini et al., 2025). These results are similar to those of Mustaffa and Husain (2024), who reported that the ten most important employability competences for graduates were communication skills, leadership skills, teamwork skills, critical thinking skills, and emotional intelligence. Project-based learning strategies, among others, were found to have a very positive impact on the construction of 21st-century skills such as critical thinking, communication, collaboration, and creativity (Xu, 2024). Experiential learning models help increase technical skills, critical thinking, and the ability to adapt to new careers (Fania et al., 2025). Self-directed learning has also been acknowledged as a significant enabler of job exploration and workforce readiness among young graduates (Ghimire et al., 2023). Research has pointed to digital competence as a decisive factor while simultaneously highlighting the combined effects of technical proficiency, problem-solving, and effective use of the internet and related technologies on the success of entrepreneurs (Mustaffa et al., 2025). The synthesized data reveal a structured employability development pattern spanning three core competencies. These include foundational social skills such as communication and teamwork, industry-specific technical skills, and metacognitive skills, including adaptability and self-directed learning.

Differential Effects by Population

Compared with men, women often receive more benefits from skills-training programs implemented in Sub-Saharan Africa (Beber et al., 2024). Among individuals with autism spectrum disorder, programs focused on vocation, such as Project SEARCH, showed positive changes in employment outcomes, with participants having higher employment rates than control groups did (Fong et al., 2021). The virtual reality job interview training method resulted in an increase in the number of job offers received by people with ASD who took part in the program. Vocational training in simulated environments resulted in significant gains in actual work performance across nine of the ten domains assessed among people with neurodevelopmental disorders (Michalski et al., 2021). Those who completed virtual reality training were more likely to obtain a job than those without training. Early and structured vocational education was a plus for the employment outcomes and self-determination of students with special needs (Husni & Min, 2025).

Thematic Analysis

Programme Design and Pedagogical Approaches

- *Dual training systems and work-based learning:* Dual training systems that integrate classroom instruction with workplace experience have consistently proven to be the most effective practices for improving employability and

meeting industry education requirements. The modern apprenticeship approach showed impressive results when it was characterized by the involvement of several authorities, school-enterprise cooperation in stages, work-study alternation, real production tasks, mentors, and teachers with dual qualifications (Cheng & Wee, 2025). Although work-based learning (WBL) benefits employability skills and attitudes, implementation remains low in higher education institutions in developing countries (Haruna & Kamin, 2019). Affandi et al. (2025) reported seven models of effective vocational education: learning and training within industry, teaching factories, blended learning, project-based learning, problem-based learning, lean-based learning, and work-based learning. These models integrate the 21st-century skills that are critical for industry demand. Internships have become the most important way to connect academic knowledge and practical skills while also allowing for the establishment of employer connections. The most important factors that influence employability through internships are student satisfaction, the quality of experiential learning, employer engagement, and the overall structure of the program (Pianda et al., 2024).

- *Technology Integration:* The integration of technology was among the major factors that led to the modernization of VET. The use of virtual reality and augmented reality in training simulations has yielded better results in learning (Rajamanickam et al., 2024), while the personalization made possible through the application of analytics to big data indicated the possibility of personalized teaching. On the downside, a lack of access to the latest technology in some areas could further reduce the already disadvantaged students by widening the existing gap in educational outcomes. For people with neurodevelopmental disorders, the use of virtual reality offered a risk-free and reliable method of training (Michalski et al., 2021), and the application of specific prompts and corrective feedback made learning easier. The introduction of game-like features in vocational assessments was seen as a way to increase involvement, motivation, and skill development (Akoodie et al., 2025), but the cultural aspects and ethics surrounding the issue had to be considered during the execution phase. The use of artificial intelligence in the field of industrial education led to higher learner participation and better outcomes (Momoh et al., 2025), with the development of adaptive and personalized learning systems being the most common application cited. However, problems such as the lack of proper infrastructure, untrained educators, and ethical dilemmas surrounding the issue of data privacy still exist.

Industry–Education Alignment

- *Partnership Models:* Public–private partnerships were considered important for sharing resources, aligning curricula, and addressing funding and infrastructure challenges. Local employers' commitment to the curriculum and work placement were aspects of effective programs (Oh et al., 2021), along with post-programme job retention and career advancement services. Strategic industry–education partnerships are central to curriculum responsiveness. Malaysia's government facilitated engagement through tax incentives and

training grants, supporting a National Dual-Training System requiring 70–80% workplace training (Hussain et al., 2021). Indonesia adapted this through virtual teaching factories and VR/AR-enhanced systems (Heydemans et al., 2025).

- *Skill Gap and Alignment Challenges:* Across various contexts, the gap between vocational education curricula and industry needs has persisted over the years (Somantri & Pramudita, 2024). The assessment and certification systems mostly did not accurately reflect the competencies the industry needed. The gap between the competencies of vocational school graduates and industry requirements is among the major factors contributing to youth unemployment (Affandi et al., 2025). A study in Indonesia revealed that only 43% of vocational school graduates were working on the basis of their competencies, while 67% were reported to be unprepared to compete in the labor market (Puji Hartini et al., 2025). Curvary revisions aimed at bridging skill gaps and regular updates to cater to industrial needs were unceasingly recommended (Che Rus et al., 2023). Curriculum–Industry gaps must be closed through institutionalized communication and feedback loops between employers and training providers. Continuous employer consultations for iterative VET reform have allowed for quicker changes to the curriculum when there is greater decentralization of educational governance (Zhao & Selvaratnam, 2024). Without such mechanisms, the gap between graduate competencies and employer expectations is likely to widen further, particularly in rapidly digitizing economies (Mustaffa et al., 2025).

Critical Success Factors

Several factors are essential for the success of vocational education and training (VET) courses. Among these factors, trained mentors and dual-qualified teachers are the most important (Cheng & Wee, 2025). Teacher preparation and professional development were the main issues identified in all the studies, with the limitation of program effectiveness by underprepared educators being the major concern (Fania et al., 2025). Digital upskilling for teachers was identified as a key step in implementing technology-enhanced VET (Heydemans et al., 2025).

The influence of supervisory and mentoring quality on student preparedness and competency for VET programs within the health care field is significant (Jamaludin et al., 2025). Peer learning methods have proven to be an excellent way to increase student confidence and teamwork ability, especially when students with varying degrees of experience are paired (Markowski et al., 2021). Alshamsan et al. (2025) reported that five main enabler elements facilitate VET effectiveness in the Saudi Arabian health care environment: capacity building through competency-based curriculum design, role redefinition supported by regulation, career progression through modularity, the use of digital technology, and public–private partnerships.

Barriers and Challenges

- *Structural and Resource Barriers:* As per Dogara et al. (2020), in Nigeria, inadequate infrastructure, a shortage of qualified technical teachers, insufficient instructional materials, poor funding, and inappropriate instructional methods were the major challenges. According to Haruna & Kamin (2019), curriculum defects, poor policy frameworks, inadequate training, and a lack of implementation frameworks hinder WBL effectiveness. Fania et al. (2025) reported that limited practical facilities, insufficient industry support, and underprepared educators have remained the most pronounced barriers to the successful implementation of experiential learning. Infrastructure gaps, a lack of access to technology, and the need for industry-based curricula are the primary challenges for integrating digital skills (Mustaffa et al., 2025). International students with foreign vocational qualifications face intensified barriers to entry. They must simultaneously overcome language demands, unfamiliar institutional norms, and deep employer skepticism regarding foreign qualifications (Nguyen & Sharma, 2024).

- *Social and Cultural Barriers:* Social stigma was a major barrier for tribal communities in India to accessing vocational training, thereby undermining the potential benefits of the government's push (Biswal et al., 2024). Psychological factors, including self-efficacy and motivation, have also been shown to influence the job-search behavior of university graduates, underscoring the need for psychosocial support within VET pathways (Ghimire et al., 2025). The TVET system continued to suffer from reputation issues linked to male dominance and poor academic performance; demand-side limitations on female participation were specifically created (Rahman et al., 2017). For disabled students in India, the barriers were a lack of funding, social stigma, inaccessible places, and untrained staff (Jobir, 2024). Employer bias and limited opportunities continue to be factors in the negative employment outcomes of disabled people. Overcoming negative perceptions and educating employers about needs still constitute challenges (Husni & Min, 2025). In the UK, the present system was deemed to disregard the principle that unaccompanied asylum-seeking children should first and foremost be considered in terms of their educational and vocational needs (Wilkinson, 2016).

Special Populations

- *Individuals with Disabilities:* According to a study by Gilson et al. (2017), community-based instruction was a crucial part of the transition to integrated employment for more than 60% of the effective studies on students with intellectual and developmental disabilities. Technology-based interventions were successfully used to enhance the vocational skills of individuals with autism spectrum disorder (Hur, 2019), and among the various instructional methods, video-aided, audio-aided, and simulation approaches were the ones that had the most positive outcomes (Gilson et al., 2017). Inclusion in technical

and vocational education and training (TVET) was proposed through a two-pronged approach that addressed how teachers are trained, who provides support to disabled students, and the partnerships that can exist among all interested parties (Jobir, 2024). Counseling services, catering to different learning styles, and making even more accessible by using an inclusive curriculum and infrastructure were some of the successful strategies.

- *Healthcare Professionals:* Qualification programs for immigrant health professionals are effective in the development of language skills and students' self-confidence (Khan-Gökkaya et al., 2019). Additionally, significant improvements were reported in the areas of communication skills and emotional resilience. In contrast, the transparency of the evaluation methods was still highly limited, thus making it very difficult to conduct long-term outcome assessments at all. Nursing graduates, that is, newly qualified professionals, suffer from knowledge deficiencies and face tremendous clinical demands. Colleagues' support proved to be invaluable (See et al., 2023). The transition experience remained highly stressful and was associated with high turnover. Readiness for clinical practice depends on hands-on exposure, supervision quality, and perceived workplace support (Jamaludin et al., 2025). Moreover, the individual placement and support (IPS) model was effective for youth with psychiatric disorders, whereas upgraded versions that included comprehensive educational support and skills training yielded the best results in terms of both education and employment (Thompson et al., 2022).

CONCLUSION

The evidence shows that VET effectiveness depends on three factors: contextual factors, population characteristics, and program design. The outcomes vary dramatically: 93% are placed in Saudi healthcare, whereas 43% are in competency-matched employment in Indonesia. Evidence from randomized controlled trials from Sub-Saharan Africa confirms that sector-specific curricula, employer partnerships, and postplacement support drive success, but these effects fade without continuous follow-through. Malaysia's dual training model (70–80% workplace-based) illustrates how effective governance structures sustain these outcomes. The use of technology in vocational education and training yields beneficial learning outcomes but also raises fairness concerns across different student groups. Virtual environments are most effective for learners who face difficulties with conventional workplace training methods because of neurodevelopmental conditions or limited access to educational resources. For internationally mobile learners, technology-enabled VET pathways also offer a means of bridging geographic and institutional divides, although equitable access remains a key concern.

IMPLICATIONS AND FUTURE SCOPE

There are several limitations associated with this study that need to be considered. The first limitation is that it was limited to English-language articles, potentially excluding significant studies from non-English literature. Second, the use of a single aggregation platform (Elicit/Semantic Scholar/OpenAlex) may have omitted relevant studies indexed only in Scopus or Web of Science. Third, the bibliometric analysis used a 2,500-publication sample because of free-tier export restrictions, which may not fully represent the entire corpus of 7,469 publications. Fourth, the absence of formal meta-analysis limits the ability to derive pooled effect estimates, and the heterogeneity of outcome measures across studies complicates cross-study comparisons. Fifth, potential publication bias toward positive employment outcomes cannot be ruled out, as null or negative findings may be underreported in the VET literature.

The combination of employer involvement and placement assistance in skills-training programs enables young people from developing nations to achieve better employment prospects. The strongest effects of research studies affect people who are younger than 25 years and all female participants. Technology interventions provide advantages to disabled learners, but the results depend on how employers approach disabled employees and make necessary accommodations. Healthcare training needs both clinical placements and supervised practice, whereas IPS methods assist people who require extra support. Systemic barriers (stigma, gender bias, and policy neglect) require integrated solutions:

Policymakers: Sector-centered training programs should be the policy priority and require employer participation in curriculum design and post training support. Programs should prioritize young people under age 25 and women, as these groups show the greatest VET-to-employment gains.

For program designers, program designs should mandate a minimum of 70% workplace training, include regular industry-aligned curriculum reviews, and integrate digital and technical skill development. With respect to disability-inclusive programming, technology-based interventions (virtual reality, video-aided instruction) should be combined with employer education initiatives focused on workplace accommodation methods and bias-reduction training. Systemic support, including counseling services and accessible infrastructure, is an essential element that supports skills training activities.

Future research priorities: (1) Longitudinal studies that track employment outcomes for more than 24 months will determine which employment outcomes demonstrate sustainable results. (2) Comparative effectiveness research studies technology-enhanced VET delivery methods that different student populations use in various educational settings. (3) Implementation science studies different fidelity components that affect the dual system transfer methods used by developing nations. (4) Research investigates how VET programs support emerging fields, which include the green economy and digital transformation. (5) The studies focus on geographic areas that this review found to lack research, particularly in Latin America and South Asia.

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