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An Integrative Teaching Factory-Industry Model to Improve Communication Skills and Employability Skills of Vocational High School Students

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Abstract

Vocational high schools are expected to supply work-ready graduates, yet many programmes still struggle to translate technical competence into workplace performance, especially in communication-intensive tasks such as customer needs analysis, teamwork coordination, reporting, and quality-related documentation. Teaching Factory (TeFa) has been promoted in Indonesia as a production-based learning approach that simulates or delivers real industry orders within a school environment. However, TeFa initiatives frequently prioritise output volume and technical procedures, while employability skills are treated as implicit by-products rather than explicit learning targets that are taught, practiced, and assessed. This article proposes an Integrative Teaching Factory-Industry Model (iTeFIM) that embeds structured communication and employability competencies into the end-to-end TeFa production/service cycle, supported by governance, industry partnership mechanisms, and competency-based assessment. Using an integrative literature review, policy analysis, and design-synthesis methods, we develop a logic model, implementation roadmap, and assessment toolkit aligning (i) work-based learning principles, (ii) employability competency rubrics, and (iii) Indonesian vocational governance and TeFa policy directions. The model positions communication as a core operational capability across six learning-production stages: order intake, planning, execution, quality assurance, delivery, and after-sales reflection. We discuss design implications for school-industry collaboration, teacher and instructor roles, learning analytics, and continuous improvement using CIPP-informed monitoring. The article contributes a practical, assessment-ready framework that can be adapted across vocational programmes to strengthen graduates' readiness for employment and career mobility.

Keywords: teaching factory; learning factory; work-based learning; communication skills; employability skills; vocational education

INTRODUCTION

The pace of labour-market transformation has accelerated in the last decade, driven by digitalisation, automation, artificial intelligence, demographic shifts, and the green transition. Employers increasingly report that skill gaps are among the biggest barriers to organisational transformation. In its Future of Jobs survey, the World Economic Forum projects that job creation and displacement linked to structural transformation will affect around 22% of today's jobs between 2025 and 2030, with 170 million new jobs created and 92 million jobs displaced, resulting in net growth of about 78 million jobs. The same survey also signals high "skill instability": on average, workers can expect that around 39% of their existing skill sets will be transformed or become outdated over the 2025–2030 period (World Economic Forum, 2025). For education systems, these projections underscore an urgent need to prepare learners not only to perform today's tasks, but also to continually learn, adapt, collaborate, and communicate in changing work environments.

For vocational education and training (VET), these trends do not only require updating technical curricula. They also require systematic teaching and assessment of employability competencies, including communication, teamwork, problem-solving, adaptability, and self-management. Evidence from work-based learning (WBL) research suggests that authentic work tasks provide a powerful pathway for developing such transferable skills; students participating in WBL can acquire technical competence alongside transferable and communication skills, and WBL participation is associated with improved entry into the labour market compared with purely school-based VET (International Labour Organization [ILO], 2022). In other words, employability skills are not best taught as decontextualised "soft skills modules"; rather, they emerge through repeated practice in authentic workflows supported by coaching, feedback, and assessment.

In Indonesia, vocational high schools (Sekolah Menengah Kejuruan/SMK) have been encouraged to strengthen industry alignment, work readiness, and entrepreneurial capacity. One widely promoted approach is Teaching Factory (TeFa), a production-based learning model in which the school's learning environment is organised to emulate—or directly participate in—real production and service processes. Recent directorate regulations on SMK learning emphasise that learning should be rooted in actual production and service activities within the school environment, supported by industry partnerships and standards, to strengthen students' work culture, professionalism, and job readiness (Direktorat Jenderal Pendidikan Vokasi, 2025). TeFa is therefore positioned as a strategic instrument to bridge the classic gap between training and employment.

Internationally, related concepts such as "learning factories" and Education 4.0-oriented teaching factories propose integrating production systems, digital tools, and collaborative learning designs to prepare learners for complex work settings. Hybrid teaching factory models, for example, combine face-to-face production environments with online interaction and digital learning resources, enabling greater flexibility and personalisation in learning while sustaining the realism of work tasks (Mourtzis, Panopoulos, & Angelopoulos, 2023). These developments suggest that teaching factories are evolving from purely hands-on production spaces into socio-technical learning ecosystems that require clear governance, data-based decision-making, and competency-focused assessment.

Despite its promise, TeFa implementation often faces recurring challenges: limited industry engagement beyond internship-style interactions; weak integration between production targets and curriculum outcomes; insufficient documentation and quality control procedures; and uneven teacher capacity for managing industry-like workflows. Recent evaluations of TeFa implementation in Indonesian vocational schools highlight that feasibility depends on contextual alignment (vision, industry needs), inputs (infrastructure, teachers, student readiness), process quality (layout, activities, quality control), and product outcomes (student skills and production results), indicating the need for systematic monitoring and improvement (Yoto, Marsono, Qolik, & Romadin, 2024). Similarly, a work-based learning–teaching factory model proposed for bread production emphasises that communication, problem-solving, and teamwork are critical employability indicators that should be facilitated by the learning design rather than assumed to develop automatically (Subekti, Barliana, Khoerunnisa, Dwiyanti, & Saripudin, 2019).

Communication is particularly central because TeFa is inherently a socio-technical system: students must coordinate within teams, negotiate constraints, interpret customer requirements, document processes, present solutions, and handle feedback. In real workplaces, technical performance is evaluated alongside communication performance—clarity, timeliness, documentation quality, and the ability to collaborate across functions. However, in many vocational programmes communication is treated as a generic "soft skill" or restricted to language lessons, and is not explicitly integrated into production workflows, assessed with shared criteria, or used for continuous improvement. As a result, students may complete production tasks without learning how to communicate professionally with customers, supervisors, and teammates.

This article addresses that gap by proposing an Integrative Teaching Factory-Industry Model (iTeFIM) that (1) integrates communication skills and employability skills into the end-to-end TeFa production/service cycle; (2) clarifies governance and partnership roles between schools and industry to support authentic tasks; and (3) provides an assessment toolkit to make employability competencies visible, measurable, and improvable. Rather than presenting a single-site intervention study, the article adopts a design-synthesis perspective to produce a practice-ready framework grounded in empirical findings from prior studies and aligned with policy directions.

The guiding research questions are: What design principles and components are required to integrate communication and employability skills into teaching factory operations without compromising production realism? How can the TeFa production/service cycle be mapped to observable communication and employability indicators that can be assessed reliably? What governance and implementation mechanisms enable sustainable school-industry collaboration and continuous improvement of TeFa as a learning system?

METHOD

Research Design

This paper uses a design-synthesis methodology combining an integrative literature review, policy analysis, and model development. The goal is to generate a practice-ready framework, not to test a particular intervention in a single site. Design-synthesis is suitable when a field has fragmented evidence and diverse implementations; it enables the researcher to aggregate findings, identify design patterns, and propose a coherent model that can be adapted to local constraints.

To strengthen transparency, the methodological workflow follows five iterative phases: (1) scoping and question refinement; (2) evidence search and selection; (3) data extraction and thematic synthesis; (4) model construction (logic model and component architecture); and (5) validation-by-argument through cross-checking against policy requirements, established competency rubrics, and implementation constraints documented in empirical studies.

Data Sources and Search Strategy

The literature review focused on (a) teaching factory/learning factory models in vocational secondary education, (b) work-based learning and employability skills development, and (c) assessment frameworks for communication and employability competencies. Sources included peer-reviewed journals, conference papers, policy briefs, and international organisation reports published between 2015 and 2025, prioritising the last six years when possible. Key sources for TeFa and vocational governance were identified from Indonesian vocational education journals and official documents, while employability and competency assessment frameworks were drawn from international literature.

Search strings combined terms such as “teaching factory”, “learning factory”, “work-based learning”, “vocational students”, “employability skills”, “communication skills”, “assessment rubric”, “CIPP evaluation”, “ADDIE”, and “school governance”. Inclusion criteria required that sources either (i) explicitly discuss teaching factory or closely related WBL implementation in VET contexts, or (ii) provide validated frameworks for employability and communication competencies that can inform assessment. Exclusion criteria removed sources lacking methodological transparency or those unrelated to vocational contexts.

Policy Analysis Procedure

Policy analysis aligned the proposed model with Indonesian vocational education directions, particularly directorate regulations describing intended characteristics of SMK learning and industry alignment. Policy documents were treated as design constraints and enabling conditions: they inform required components (e.g., industry standards alignment, work culture, quality assurance), the expected roles of schools and industry, and the accountability mechanisms likely needed for sustainable implementation.

A structured reading protocol was applied: (1) identify relevant policy statements about TeFa, industry collaboration, and competency outcomes; (2) code statements into categories (governance, curriculum, resources, assessment, partnership); and (3) map coded requirements onto the model architecture to ensure coherence and feasibility.

Synthesis and Model Construction

Evidence synthesis used thematic coding to extract recurring elements of successful teaching factory/WBL implementation: authenticity of tasks, depth of industry partnership, alignment of production processes with curriculum, assessment of learning outcomes, and continuous improvement mechanisms. These themes were organised into a logic model specifying inputs, activities, outputs, and outcomes, and into a component architecture describing governance, learning design, production/service operations, assessment, and quality management.

To ensure employability competencies are operationalised, the model integrates competency descriptors from validated rubrics. For example, Sánchez-Ramírez, Íñigo-Mendoza, Marcano, and Romero-García (2022) propose seven employability competencies—problem-solving, teamwork, adaptive capacity, communication, creativity, leadership, and decision-making—and demonstrate that rubric indicators can achieve strong content validity through expert judgement (Aiken's $V \geq 0.80$). Such evidence informed the indicator definitions and the selection of observable evidence types (work logs, customer interaction records, presentations, and quality documentation).

RESULT AND DISCUSSION

Synthesis of Design Patterns in Teaching Factory and Work-Based Learning

Across the reviewed literature, teaching factory and work-based learning initiatives share a common ambition: to reduce the distance between school learning and workplace performance by embedding authentic work processes into instruction. In Indonesian contexts, TeFa is repeatedly framed as a learning model that integrates production units with curriculum outcomes so that students practice in an environment resembling industry operations. Studies that analyse TeFa implementation at school level emphasise operational management functions—planning, organising, implementation, and evaluation—as central pillars of TeFa management (Azizah, Muslim, Achmad, & Lukmantoro, 2019). This management orientation is significant because authenticity does not automatically emerge from equipment availability; it emerges from how work is organised, how standards are applied, and how responsibilities are distributed.

A second recurring pattern is the importance of partnership depth. WBL research highlights that the effectiveness of authentic learning depends on fruitful collaboration between VET providers and employers, including shared responsibility for training design, supervision, and assessment (ILO, 2022). In TeFa, partnerships are needed not only for internship placement but also for defining product specifications, quality standards, service procedures, and market feedback loops. When partnerships are shallow—limited to occasional guest teaching or ad-hoc

orders—students' exposure to the full work cycle and to professional communication demands becomes partial and inconsistent.

A third pattern is the role of structured assessment. Many programmes assume employability skills will be acquired through participation in authentic tasks, yet evidence suggests that making these skills explicit supports learning and equity. In a validated rubric for employability competencies, communication is treated as a competency that can be observed through behaviours such as presenting ideas clearly, adapting language to audience, and using appropriate communication channels; similar indicators exist for teamwork and problem-solving (Sánchez-Ramírez et al., 2022). Such rubrics provide a shared language between teachers and industry mentors and can reduce the subjectivity often associated with "soft skills" evaluation.

Finally, the literature indicates a tension between production realism and educational intentions. Schools sometimes experience pressure to prioritise production output and income generation, which can shift TeFa into an enterprise activity rather than a learning system. However, recent TeFa evaluation studies suggest that feasibility and quality depend on how production activities are translated into learning activities, including student role assignment, workflow design, quality control, and reflection processes (Yoto et al., 2024). Therefore, the design challenge is not merely to increase production volume, but to align production workflows with competency learning outcomes, including communication and employability skills.

The Integrative Teaching Factory-Industry Model (iTeFIM)

Based on the synthesis, iTeFIM is proposed as a component-based model with five interacting subsystems: (1) governance and partnership; (2) production/service operations; (3) learning design and facilitation; (4) assessment and credentialing; and (5) quality assurance and continuous improvement. The model is "integrative" in two senses: it integrates industry and school responsibilities across the full work cycle, and it integrates employability competencies into operational routines rather than adding them as separate lessons.

The governance and partnership subsystem defines roles, decision rights, and accountability. It specifies an industry advisory structure, a school TeFa management team, and standard operating procedures (SOPs) for order management, safety, quality, and documentation. Governance also includes mechanisms to align TeFa products/services with curriculum outcomes and national or sector standards. School governance is not a bureaucratic add-on; it enables consistent communication practices, for example by requiring documentation templates, meeting routines, and feedback protocols that students must use.

The production/service operations subsystem represents the socio-technical workflow through which products or services are delivered. It includes order intake, planning, execution, quality assurance, delivery, and after-sales reflection. In iTeFIM, each stage is mapped to explicit communication tasks and employability indicators. This mapping turns the production cycle into a competency development cycle, ensuring that communication is practiced in context: students do not merely "learn communication", they communicate to make work happen.

The learning design subsystem clarifies how teachers and industry instructors facilitate learning within TeFa. It includes instructional strategies (briefing, demonstration, coaching, peer review), scaffolds (job sheets, checklists, documentation templates), and reflection routines (after-action reviews, customer feedback analysis). The model is compatible with hybrid or blended learning variants where digital tools support documentation, quality tracking, and remote consultation, reflecting recent developments in hybrid teaching factory initiatives (Wahjusaputri, Nastiti, & Liu, 2024).

The assessment and credentialing subsystem provides the evidence architecture for evaluating both technical competence and employability competence. It integrates performance

assessment (quality outcomes, safety compliance) with behavioural evidence of communication and teamwork. The output can be used for formative feedback, summative grading, and micro-credentials. Finally, the quality assurance subsystem uses monitoring and evaluation cycles (such as CIPP-informed monitoring) to track context readiness, input adequacy, process quality, and product outcomes, enabling continuous improvement and accountability (Yoto et al., 2024).

Communication-Embedded TeFa Cycle

A distinctive contribution of iTeFIM is the explicit embedding of communication tasks into each stage of the TeFa cycle. Communication is treated as a set of observable practices that support work quality, safety, customer satisfaction, and learning. The model adopts six stages that can be applied across vocational programmes and production types: (1) order intake and needs analysis; (2) planning and briefing; (3) execution and coordination; (4) quality assurance and documentation; (5) delivery and customer interaction; and (6) after-sales reflection and improvement.

Stage 1 (order intake and needs analysis) focuses on gathering customer requirements, clarifying constraints, and translating needs into measurable specifications. Students practice questioning techniques, active listening, note-taking, and requirement documentation. This stage helps address a common weakness in school-based projects where tasks are pre-defined and do not require negotiating expectations with real stakeholders.

Stage 2 (planning and briefing) converts requirements into work plans: roles, timelines, resource allocation, risk assessment, and quality checkpoints. Communication practices include briefing meetings, role negotiation, and producing work instructions that are understandable to peers. These practices relate to employability competencies such as planning, teamwork, and leadership. They also reflect broader workforce trends where analytical thinking remains a core skill sought by employers (World Economic Forum, 2025).

Stage 3 (execution and coordination) is where production or service delivery occurs. Communication here is not limited to verbal interaction; it includes using standard terminology, reporting progress, coordinating handovers, managing conflicts, and maintaining safety communication. In well-designed TeFa, students rotate roles (operator, quality checker, documentation officer, customer liaison) to ensure distributed communication practice rather than concentrating it in a single "team leader" student.

Stage 4 (quality assurance and documentation) requires students to measure outputs against standards, record deviations, and perform corrective actions. This stage helps integrate employability skills with technical skills: quality outcomes depend on accurate measurement and on clear documentation and escalation. In industry settings, quality and communication are inseparable—a defect that is not documented or communicated becomes a systemic risk. Therefore, iTeFIM recommends introducing simple quality tools (checklists, control charts where relevant, nonconformance reports) with language adapted to vocational student levels.

Stage 5 (delivery and customer interaction) includes presenting the product/service, explaining usage and maintenance, handling questions, and negotiating acceptance criteria. Students practice professional language, persuasive explanation, and customer service communication. This stage also provides a natural context for building confidence and managing anxiety, which are linked to adaptability and resilience skills emphasized by current workforce analyses (World Economic Forum, 2025).

Stage 6 (after-sales reflection and improvement) closes the learning loop. Students collect feedback, conduct a brief root-cause analysis of problems, reflect on teamwork and communication, and propose improvements. The reflection is documented and used to update SOPs and learning resources. This stage operationalises continuous improvement as a learning

outcome: students see that professional work involves learning from feedback, not only completing tasks.

Table 1. Mapping TeFa stages to communication tasks, employability skills, and portfolio evidence.

TeFa stage	Core communication tasks	Employability skills emphasised	Typical evidence (portfolio)
1) Order intake & needs analysis	Active listening; questioning; requirement clarification; writing a requirement brief; professional messaging	Communication; customer orientation; problem-solving	Requirement brief; call/meeting notes; customer confirmation message
2) Planning & briefing	Briefing meeting; role negotiation; timeline communication; risk/safety briefing; producing work instructions	Teamwork; planning; leadership; communication	Work plan; minutes; job sheet; briefing checklist
3) Execution & coordination	Progress reporting; handovers; conflict management; safety communication; cross-role coordination	Teamwork; self-management; adaptability; communication	Daily log; handover notes; photos/videos of procedure with narration
4) Quality assurance & documentation	Reporting deviations; documenting checks; communicating corrective actions; escalation protocols	Attention to detail; problem-solving; communication	QC checklist; nonconformance record; corrective action note
5) Delivery & customer interaction	Product/service explanation; demonstration; handling questions; negotiation of acceptance criteria	Communication; customer service; confidence	Delivery checklist; customer briefing script; customer satisfaction form
6) After-sales reflection & improvement	Feedback collection; presenting analysis; proposing improvements; updating SOPs	Learning agility; creativity; communication; responsibility	Reflection report; improvement proposal; updated SOP section

Assessment Toolkit for Communication and Employability Skills

To make employability skills actionable, iTeFIM proposes a multi-evidence assessment toolkit consisting of (a) a competency map; (b) a rubric for employability competencies (including communication); (c) evidence collection instruments; and (d) feedback routines. The toolkit is designed for feasibility in SMK contexts: it uses short observation checklists during production, student work logs, peer assessment, and structured reflection prompts, rather than relying on time-consuming testing.

Competency mapping starts by selecting a small set of employability competencies that are most relevant to the vocational programme and TeFa product/service type. Drawing on validated rubrics, iTeFIM recommends at minimum: communication, teamwork, problem-solving, adaptive capacity, and work discipline. The rubric structure follows three levels (emerging, developing, proficient) and uses behavioural descriptors that can be observed in TeFa workflows. The rubric

approach is consistent with evidence that employability competencies can be assessed reliably when indicators are clearly defined and validated (Sánchez-Ramírez et al., 2022).

Evidence types are aligned with TeFa stages. For example, in Stage 1 students produce a requirement brief; in Stage 2 they create a work plan and conduct a briefing; in Stage 4 they complete quality documentation; in Stage 5 they deliver a customer explanation; and in Stage 6 they write a reflection and improvement proposal. Each evidence type is scored using rubric indicators and combined into a portfolio. This portfolio supports both formative feedback and summative reporting, and can be shared with industry partners as a transparent record of student performance.

Feedback routines are built into daily or weekly operations. Brief "stand-up" meetings at the beginning and end of a TeFa session can be used to set communication targets (e.g., clarity, turn-taking, documenting decisions) and to reflect on whether targets were met. Teachers and industry mentors provide short feedback based on specific rubric indicators, ensuring that communication is coached as a performance skill. Over time, students internalise communication standards, which supports workplace readiness.

Table 2. Excerpt of a three-level rubric for selected employability competencies (adaptable).

Competency	Emerging	Developing	Proficient
Communication	Conveys information with frequent ambiguity; limited audience awareness; documentation incomplete.	Conveys information clearly in routine tasks; adjusts language with some guidance; documentation mostly complete.	Communicates clearly and professionally across channels; adapts to audience; produces accurate, timely documentation.
Teamwork	Participates inconsistently; needs reminders to coordinate and share information.	Contributes reliably; coordinates with peers; shares updates using agreed routines.	Facilitates team coordination; resolves conflicts constructively; supports others to meet shared goals.
Problem-solving	Identifies problems but proposes limited solutions; needs strong guidance to analyse causes.	Analyses problems using evidence; proposes feasible options; learns from feedback.	Systematically diagnoses causes; tests solutions; communicates evidence-based recommendations to stakeholders.

Implementation Roadmap and Partnership Mechanisms

For implementation, iTeFIM proposes a staged roadmap that balances readiness building with iterative improvement. The roadmap includes: (1) readiness and alignment; (2) co-design with industry; (3) pilot operation; (4) stabilisation and quality assurance; and (5) scaling and sustainability. Each stage specifies deliverables, roles, and minimal documentation so that schools can implement with limited resources.

During readiness and alignment, schools clarify their TeFa scope (product/service), identify priority competencies, map curriculum units to TeFa tasks, and assess resource gaps. The assessment should include not only equipment, but also human resources (teacher workload, mentor availability) and market feasibility. This aligns with the "context" and "input" elements in CIPP evaluation, where clarity of goals and adequacy of resources determine feasibility (Yoto et al., 2024).

In co-design with industry, partners agree on product standards, order workflow, quality criteria, customer communication protocols, and data sharing. The partnership agreement should

specify who provides what: technical standards, mentoring hours, materials, access to digital tools, and evaluation input. Recent policy briefs on vocational learning reform emphasise strengthening SMK industry linkages and the relevance of learning to labour market needs (Pusat Standar dan Kebijakan Pendidikan, 2024).

Pilot operation focuses on running TeFa cycles with a manageable order volume so that teachers can stabilise learning routines and assessment. Students should rotate roles to ensure broad competency exposure. Stabilisation and quality assurance then formalise SOPs and documentation templates, and establish regular review meetings with industry partners. Scaling and sustainability involve expanding order volume or product lines, integrating digital tools (for instance, online order tracking or digital portfolios), and training new teachers and student cohorts to maintain continuity.

A key mechanism for partnership sustainability is mutual value: schools need authentic tasks and mentoring, while industry can benefit from school-based prototyping, community service, talent pipelines, or CSR-related projects. Hybrid teaching factory approaches suggest that digital collaboration tools can broaden partnership opportunities, enabling remote consultation and the use of emerging technologies (e.g., AR/VR) to enrich learning (Wahjusaputri et al., 2024; Mourtzis et al., 2023).

Monitoring, Evaluation, and Continuous Improvement

Because TeFa combines educational and production objectives, monitoring must address both learning quality and operational quality. iTeFIM recommends using a CIPP-informed monitoring framework: Context (alignment with school mission and industry needs), Input (infrastructure, teacher readiness, student readiness), Process (workflow quality, communication routines, safety, documentation), and Product (student competencies, product/service quality, customer satisfaction). This approach is consistent with recent evaluations of TeFa feasibility that use context-input-process-product lenses (Yoto et al., 2024).

Monitoring instruments should be simple but consistent: a short readiness checklist (context/input), a weekly process observation sheet (including communication indicators), and a monthly product review that combines quality metrics and competency portfolio review. Customer feedback can be captured through short surveys or interviews and used as both a quality indicator and a learning resource in reflection sessions.

Continuous improvement cycles (Plan–Do–Check–Act) can be integrated with student learning. For example, students can participate in "Check" and "Act" steps by analysing defects or customer complaints and proposing changes to SOPs. This helps students experience quality culture and shared responsibility, and also reinforces problem-solving and communication skills as they explain evidence and negotiate solutions.

Discussion: Implications for Skills Development and Future Work

The proposed model responds to a central challenge in vocational education: employability skills must be developed in authentic contexts, yet authenticity alone is insufficient without explicit learning goals, scaffolds, and assessment. By embedding communication tasks into each stage of the TeFa cycle, iTeFIM operationalises communication as a performance capability that supports work quality. This is aligned with broader workforce findings that, alongside technological literacy, human-centred skills such as resilience, leadership and social influence, and creative thinking remain important and continue to rise in relevance (World Economic Forum, 2025). Communication is a cross-cutting enabler of these skills.

The model also strengthens the argument that vocational reforms should integrate governance and pedagogy. In practice, teachers often struggle to run TeFa because production management competes with instructional responsibilities. iTeFIM therefore emphasises role clarity (e.g., production coordinator, documentation officer, industry liaison) and standardised documentation to reduce cognitive load and to make work processes teachable. In addition, the rubric-based assessment toolkit provides a common language for teachers and industry mentors, supporting consistent feedback and reducing subjectivity in employability assessment (Sánchez-Ramírez et al., 2022).

Digitalisation and hybrid learning represent both an opportunity and a risk. Hybrid teaching factory initiatives suggest that digital platforms can make TeFa more flexible and innovative, improving interaction and discussion and enabling more personalised learning (Wahjusaputri et al., 2024). However, digital tools can also amplify inequality if schools lack infrastructure or teacher capacity. Consequently, iTeFIM recommends "minimum viable digitalisation": start with lightweight tools such as shared documentation templates, simple digital portfolios, and messaging protocols, then scale to more advanced tools as capacity grows.

A limitation of this article is that it presents a synthesized model rather than results from a controlled empirical trial. Future research should pilot test iTeFIM in diverse SMK programmes and examine its impact on communication and employability outcomes using mixed methods. A feasible evaluation design could combine (a) pre-post rubric-based assessment, (b) portfolio analysis, (c) customer satisfaction measures, and (d) qualitative interviews with students, teachers, and industry mentors. Researchers should also explore implementation fidelity: which components (governance, assessment, role rotation, customer interaction) are most critical under different resource constraints.

Another future research direction involves credentialing and labour-market signalling. As skill instability increases and employers seek evidence of transferable competencies, micro-credentials based on authentic TeFa portfolios could strengthen students' employability. This aligns with calls for upskilling and reskilling at scale as a response to labour-market transformation (World Economic Forum, 2025) and with WBL-oriented recommendations for smoother school-to-work transitions (ILO, 2022).

Design Principles Underpinning iTeFIM

The iTeFIM architecture is guided by six design principles that were repeatedly implied in the reviewed literature and in policy expectations for vocational reform. First, authenticity must be preserved at the level of workflow, standards, and accountability—not merely at the level of equipment. Authenticity is achieved when students experience real constraints (time, cost, quality, safety) and must communicate and coordinate to meet those constraints, while being supported by teachers and mentors to prevent exploitation or unsafe practices.

Second, employability outcomes must be explicit. The OECD Education 2030 position paper argues that future-ready learners will need to mobilise knowledge, skills, attitudes, and values to meet complex demands, including collaboration and self-regulation (OECD, 2018). In iTeFIM, employability competencies are specified as intended outcomes and are linked to observable evidence across TeFa stages. Explicit outcomes allow teachers to plan scaffolds and make feedback precise.

Third, learning requires scaffolding and gradual release. TeFa workflows can be complex; novices may not know how to ask clarifying questions, write professional messages, or document decisions. Therefore, iTeFIM recommends structured templates (requirement brief, meeting minutes, work orders, quality checklists) and coaching scripts (how to brief, how to hand over

tasks, how to respond to customer complaints). Over repeated cycles, the scaffolds are simplified as students gain proficiency.

Fourth, reflection and feedback are non-negotiable. WBL research distinguishes between learning (a personal process) and education (the provision of experiences) and highlights the importance of workplace affordances such as mentoring and guided reflection (Billett, 2011; UNESCO-UNEVOC, 2019). In TeFa, reflection is often skipped due to production pressure. iTeFIM therefore institutionalises reflection in Stage 6 and integrates short "after-action reviews" even in daily sessions.

Fifth, assessment should be multi-source and low-burden. Employability skills are best captured through triangulation: teacher observation, peer feedback, self-reflection, and artefact analysis (portfolios). Rubrics provide a common language and help reduce bias (Sánchez-Ramírez et al., 2022). iTeFIM recommends collecting small pieces of evidence throughout the cycle rather than relying on a single high-stakes evaluation.

Sixth, equity and learner agency should be protected. OECD emphasises learner agency and co-agency as critical for navigating uncertainty (OECD, 2018). In TeFa, agency is built when students are entrusted with real responsibilities and can see how their decisions affect outcomes. However, agency can be undermined when a few high-performing students dominate communication roles. Therefore, iTeFIM recommends role rotation and structured participation protocols (e.g., turn-taking in briefings) to ensure all students practice communication and leadership.

Operational Roles and Capacity Building

Implementing iTeFIM requires clarifying operational roles in the school because TeFa combines learning, production, and partnership management. At minimum, the school should define: (a) a TeFa manager (overall coordination); (b) a production/service supervisor (workflow and safety); (c) an assessment coordinator (rubrics, portfolios, reporting); and (d) an industry liaison (orders, feedback, communication protocols). In smaller schools, one person may hold multiple roles, but the functions should still be explicit to reduce role conflict.

Teacher capacity building is also essential. Teachers may have strong technical knowledge but limited experience with industry-standard documentation or customer communication. Training can focus on industry-style communication (briefing, reporting, negotiation), basic quality tools, facilitation skills (coaching instead of lecturing), and assessment literacy. Hybrid teaching factory initiatives indicate that teacher readiness influences the success of integrating digital tools into TeFa and students' engagement (Wahjusaputri et al., 2024).

Industry mentors should be prepared as well. WBL guidelines emphasize that workplace mentors play a crucial role in providing learning-rich experiences and feedback, not only supervising output (ILO, 2022). In iTeFIM, industry mentors contribute by validating standards, participating in key review points (planning review, quality audit, customer feedback discussion), and co-scoring employability portfolios when feasible.

Curriculum Integration and Learning Outcomes Mapping

A practical barrier in many TeFa initiatives is the perceived separation between curriculum units and production tasks. iTeFIM proposes a mapping process in which each TeFa cycle is linked to a set of learning outcomes from the vocational curriculum: technical competencies, safety competencies, and employability competencies. Mapping is performed at two levels: (1) unit-to-task mapping (which units are practiced in which stage), and (2) task-to-evidence mapping (what artefacts will demonstrate learning). This mapping helps teachers justify TeFa activities as curricular learning rather than extracurricular production.

The mapping also supports differentiated instruction. Students can be assigned tasks based on their current competence while still practicing communication. For example, novice students might focus on executing a limited set of operations and documenting them, while advanced students handle planning or customer explanation. Role rotation ensures that over time each student experiences communication demands in multiple contexts. This aligns with UNESCO's view that WBL programmes should provide structured workplace experiences that target employability and sustained vocational commitment (UNESCO-UNEVOC, 2019).

Illustrative Application Scenarios

To illustrate adaptability across programmes, consider three scenarios. In an automotive engineering programme, TeFa may operate as a vehicle maintenance service unit. Stage 1 involves receiving customer complaints and translating them into diagnostic questions and a job order. Stage 2 involves planning the diagnostic steps, parts needed, and timeline; Stage 3 includes coordinated servicing; Stage 4 includes documenting test results, quality checks, and safety compliance; Stage 5 includes explaining the repair to the customer and providing preventive maintenance advice; and Stage 6 includes reflecting on errors, delays, and customer feedback.

In a culinary programme, TeFa might run a school-based bakery or catering service. Communication skills appear in menu negotiation, allergen information, workflow coordination, and customer service. Employability competencies can be developed through time management under production deadlines, teamwork under pressure, and quality documentation (e.g., temperature logs, hygiene checklists). This aligns with WBL-oriented teaching factory models that emphasise employability outcomes such as teamwork, communication, and problem-solving in product delivery (Subekti et al., 2019).

In a digital marketing programme, TeFa may provide content creation services for local micro-enterprises. The "production" output is digital: campaigns, designs, analytics reports. Communication tasks include requirement interviews, brief writing, client presentations, and reporting. The hybrid nature of digital work makes it suitable for blended teaching factory arrangements where students collaborate using online tools and present deliverables remotely, reflecting hybrid teaching factory approaches (Mourtzis et al., 2023; Wahjusaputri et al., 2024).

These scenarios illustrate that iTeFIM is not tied to a particular product type. The core is the structured integration of communication and employability competencies into a real workflow with customer interaction, documentation, and improvement cycles.

Linking iTeFIM to Emerging Skill Frameworks

Recent skill frameworks emphasise the complementary relationship between technical skills and "essential" or transferable skills. The Essential Skills Tracker 2025, for example, argues that essential skills are crucial for navigating the AI transition and reports that higher essential skill levels are associated with greater AI adoption and wage premiums in the UK workforce (Edge Foundation, 2025). While the report focuses on a UK sample, it offers a relevant insight for vocational education: teaching AI tools or new technologies alone is insufficient if learners lack the communication, planning, teamwork, and adaptability skills that enable effective adoption.

Similarly, the WEF 2025 report stresses that workforce transitions will require upskilling and reskilling, and that a mix of cognitive, self-management, and social skills will remain important alongside technological literacy (World Economic Forum, 2025). iTeFIM operationalises these ideas by positioning employability competencies as part of daily TeFa routines. For example, planning and communication are practiced through briefings and project planning tools; adaptability is

practiced through handling late changes in customer requirements; and teamwork is practiced through role rotation and peer review.

Policy and Practice Implications

For policy-makers, iTeFIM highlights that TeFa policies should be accompanied by assessment guidance. Without shared rubrics and evidence expectations, employability outcomes remain ambiguous and difficult to improve. Directorate regulations that define TeFa as learning rooted in production and service activities provide a strong foundation, but schools require practical tools to translate policy into teaching and assessment routines (Direktorat Jenderal Pendidikan Vokasi, 2025).

For school leaders, the model suggests investing in documentation systems and partnership management capacity, not only equipment. Even simple documentation practices—meeting minutes, work orders, quality checklists, customer feedback forms—serve both operational and educational functions: they structure communication, provide assessment evidence, and support continuous improvement.

For teachers, iTeFIM provides a pathway to integrate communication instruction into technical learning: teach communication through work. Instead of adding a stand-alone communication lesson, teachers can teach how to write a requirement brief, how to conduct a safety briefing, and how to present work results to a customer. This approach is consistent with competency-based employability assessment and can reduce the perception that soft skills are "extra" content.

Standard Operating Procedures and Communication Artifacts

In practice, the difference between a "workshop activity" and a functioning teaching factory is often documentation discipline. Industry-like documentation is not merely administrative; it is a communication technology that makes work traceable, teachable, and improvable. iTeFIM therefore recommends a minimal set of standard operating procedures (SOPs) and artefacts that are introduced early and refined over time. These artefacts serve three simultaneous purposes: (1) operational control (quality, safety, deadlines), (2) learning scaffolding (students know what to do next and how to communicate), and (3) assessment evidence (rubrics can be scored against actual documents and interactions).

A first artefact is the Requirement Brief (Stage 1). For many SMK students, the skill gap is not in executing tasks but in translating vague customer needs into measurable specifications. The brief can be a one-page template with sections such as: customer profile; problem statement; scope and exclusions; functional requirements; quality expectations; constraints (time, cost, materials); and confirmation items. Students learn to ask clarifying questions and to record decisions in a way that prevents later misunderstandings. Teachers can model the difference between ambiguous statements ("make it good") and operational statements ("finish by Friday 16:00; surface finish grade X; tolerance ±Y").

A second artefact is the Job Order and Work Plan (Stage 2). The job order links the customer brief to internal execution by specifying task breakdown, roles, estimated duration, resource needs, and safety precautions. Communication skills appear as the ability to brief peers and distribute tasks using agreed terminology. For example, a work plan can require students to communicate: what "done" means for each task, who must be informed before moving to the next step, and what evidence must be recorded. These practices mirror workplace coordination and reduce the common classroom problem where tasks are completed but not aligned or integrated.

A third artefact is the Daily Log and Handover Note (Stage 3). In authentic production, work is rarely finished in one session; teams need continuity across shifts. Students therefore practice documenting progress, issues encountered, and next actions. Even in small-scale TeFa, a simple handover note trains students in precision and responsibility: what was completed, what is pending, what risks exist, and what decisions were made. The handover note also provides a concrete basis for assessing communication quality (clarity, completeness, timeliness).

A fourth set of artefacts concerns quality: QC Checklists, Nonconformance Records (NCR), and Corrective Action Notes (Stage 4). Vocational students often associate quality with final inspection only. iTeFIM emphasises that quality is built through process control and communication. When a deviation occurs, the NCR template guides students to describe the defect, identify where it was detected, record suspected causes, and propose corrective actions. Teachers can use these artefacts to teach evidence-based communication: students learn to avoid blame and focus on facts, which is a professional communication habit.

A fifth artefact set supports customer interaction: Delivery Notes, Product/Service Explanation Scripts, and Customer Feedback Forms (Stage 5). Many graduates enter jobs where they must explain work to customers or supervisors. Having students practice explanation scripts in TeFa builds confidence and professional language. Feedback forms can include both satisfaction items and open comments; students then learn to interpret feedback and respond constructively.

Finally, Stage 6 requires a Reflection and Improvement Report. This report links learning to continuous improvement and can be brief (one to two pages). Suggested prompts include: What communication moment went well and why? What misunderstanding occurred and what evidence supports your analysis? What change will you propose to the SOP or template? What will you do differently in the next cycle? By using structured prompts, reflection becomes a disciplined practice rather than a subjective narrative.

Importantly, these artefacts can be implemented with low cost. The main investment is teacher time to design templates and to enforce consistent use. However, the pay-off is substantial: documentation standardises communication, supports fair assessment, and enables schools to demonstrate TeFa quality to industry partners and auditors. Over time, schools can digitalise these artefacts into simple forms and portfolios, as discussed in the next subsection.

Digital Portfolio, Learning Analytics, and Evidence Management

Hybrid and digital approaches are increasingly feasible for SMK, but iTeFIM recommends a staged digitalisation strategy. Early stages can rely on paper-based documents and a shared folder for photos and scanned forms. As capacity grows, schools can move toward digital portfolios where each student stores evidence across TeFa cycles: requirement briefs, plans, logs, QC documents, delivery scripts, and reflection reports. Such portfolios strengthen employability signalling because they provide concrete evidence of what students can do, including communication artefacts that are often invisible in technical assessments.

Digital portfolios also enable learning analytics. Teachers can track which communication tasks students have practiced, identify students who consistently avoid customer-facing roles, and plan role rotation accordingly. Simple analytics—such as counts of portfolio artefacts, timeliness of submissions, or rubric score trajectories—can provide actionable insights without sophisticated systems. In hybrid teaching factory research, online components are reported to support interaction, discussion, and personalisation (Wahjusaputri et al., 2024), suggesting that digital tools can complement hands-on work when used strategically.

Evidence management requires attention to privacy and ethical use. Customer data, especially if TeFa interacts with external clients, should be minimised and protected. Schools can anonymise customer identities in student portfolios and obtain consent for using feedback as learning

material. Clear rules about photo/video recording in production areas are also necessary for safety and confidentiality.

Digital communication norms should be taught explicitly. Workplace communication increasingly happens through messaging platforms and email; students need to practice appropriate tone, clarity, and response time. iTeFIM suggests adopting a simple "digital etiquette" guideline for TeFa, for example: subject lines, message structure, confirmation messages after agreements, and documentation of decisions. These micro-practices are directly employability-relevant and align with broader frameworks emphasising communication and collaboration for future readiness (OECD, 2018).

Risk Management, Safety Culture, and Ethical Production

Teaching factories involve real equipment, materials, deadlines, and sometimes paying customers; therefore, risk management and safety culture are integral to both learning and operational legitimacy. iTeFIM recommends treating safety as a communication domain: hazard identification must be communicated; near misses must be reported; and safety briefings must be conducted with clear protocols. This approach turns safety from a compliance checklist into a lived employability competence.

A minimal risk register can be maintained for TeFa operations, listing hazards (mechanical, electrical, chemical, food safety, data privacy), likelihood and impact, controls, and responsible persons. Students can participate in identifying hazards and proposing controls, which builds ownership and aligns with the idea of learner agency (OECD, 2018).

Ethical production issues include preventing exploitation of student labour and ensuring that production objectives do not override learning objectives. Schools should set limits on order volume and design learning schedules so that reflection and assessment are not sacrificed. Transparent communication with customers is also ethical: schools should communicate that services/products are delivered within an educational setting, with quality standards but also with learning-related constraints.

Quality ethics also matter. Students should learn that hiding defects or manipulating documentation is unacceptable. By institutionalising NCR and corrective action communication, iTeFIM creates a culture where reporting problems is valued as professional responsibility. Such cultures are crucial for employability in regulated industries and for building trust with industry partners.

Finally, risk management supports sustainability: equipment maintenance, consumable budgeting, and workflow planning reduce downtime. These operational realities offer authentic contexts for teaching problem-solving, communication, and leadership—competencies highlighted in employability rubrics (Sánchez-Ramírez et al., 2022) and valued in workforce reports (World Economic Forum, 2025).

Proposed Empirical Evaluation Plan for iTeFIM

Although this article focuses on model development, iTeFIM is designed to be empirically testable. A feasible evaluation can be conducted using a mixed-method design across one semester or one academic year. The main outcomes are communication skills and employability skills, measured through rubric-based performance assessments embedded in TeFa portfolios. Secondary outcomes may include technical performance (quality metrics), customer satisfaction, and student self-efficacy.

A quasi-experimental design can compare cohorts implementing iTeFIM with cohorts implementing conventional TeFa without explicit employability mapping. Pre-post assessments

can be conducted using the same rubric indicators, with multiple raters (teachers and, when feasible, industry mentors) to strengthen reliability. Inter-rater reliability can be examined using agreement indices, while internal consistency across rubric items can be explored to refine indicators.

Quantitative evidence can be complemented by qualitative evidence. Student focus groups can explore perceived learning of communication practices and confidence in workplace interaction; teacher interviews can explore workload and feasibility; industry partner interviews can assess perceived relevance and authenticity. Portfolio artefacts can be analysed qualitatively to identify growth in documentation quality and professional language.

Process evaluation is also important because implementation fidelity may vary. Using a CIPP-informed monitoring protocol, researchers can document context readiness, input adequacy, process quality (including role rotation and reflection routines), and product outcomes. This enables understanding not only whether iTeFIM works, but how and under what conditions it works, which is essential for scaling across diverse SMK contexts (Yoto et al., 2024).

Finally, longitudinal follow-up can strengthen employability claims. Where feasible, tracer studies can collect graduate outcomes such as time-to-first-job, job retention, and employer feedback on communication performance. Such evidence would connect TeFa learning to labour-market outcomes, aligning with the broader agenda of preparing learners for transitions amid skill instability (World Economic Forum, 2025) and supporting smoother school-to-work pathways (ILO, 2022).

Financial and Operational Sustainability of Teaching Factories

Sustaining a teaching factory requires attention to business-process realities without allowing business interests to dominate learning. Many SMK TeFa units struggle when they depend solely on sporadic orders; inconsistent order flow makes it difficult to plan learning cycles and to maintain student motivation. iTeFIM recommends a balanced portfolio of work: (a) real external orders where feasible; (b) internal school-community service projects; and (c) simulated or "semi-real" orders designed to practice specific competencies when external demand is low. This portfolio approach protects the continuity of learning while maintaining authenticity through standards, documentation, and customer-like feedback.

Basic costing and scheduling should be introduced as part of employability learning. Students can learn to estimate materials, time, and overhead using simplified templates. Costing conversations provide an authentic context for communication and negotiation: students must explain why a particular material is needed, justify timelines, and manage customer expectations. These practices build professional confidence and align with employer expectations for accountability and resource awareness.

Revenue management should follow transparent rules. Schools may reinvest TeFa income into maintenance, consumables, and learning resources, but governance must ensure that income targets do not pressure students to work beyond educational limits. A practical governance mechanism is to set a maximum order load per cycle and to schedule "learning buffers" for reflection, remediation, and assessment. Such scheduling prevents the common failure mode where TeFa becomes production-heavy and learning-light.

Inventory and maintenance systems can be simplified but should be consistent. A small inventory log, preventive maintenance checklist, and tool accountability procedure reduce downtime and improve safety. These systems also serve learning: students practice documentation and responsibility, and they experience the discipline expected in industry workshops.

Partnership models can support sustainability. Some industries may provide materials, mentorship time, or access to equipment as part of corporate social responsibility (CSR) or talent pipeline development. Schools can reciprocate by offering community services, prototyping, or joint showcases. iTeFIM recommends mapping partnership contributions and benefits explicitly in a memorandum of understanding, so that expectations remain realistic and communication remains clear.

Teacher workload is a hidden sustainability factor. Running TeFa requires coordination, customer communication, documentation review, and assessment, which can exceed normal teaching load. School leaders should allocate time, recognise TeFa roles in workload calculations, and provide administrative support for order management. Without such support, TeFa quality may depend on individual heroics and become fragile.

Finally, sustainability is strengthened when TeFa is institutionalised as a school learning strategy rather than a project. Institutionalisation involves integrating TeFa cycles into the annual academic calendar, training new teachers, updating SOPs, and maintaining assessment routines. When TeFa is institutionalised, employability skills development becomes systematic and cumulative across cohorts, which is essential in a context where skill requirements continue to shift and reskilling becomes a lifelong necessity (World Economic Forum, 2025).

Student Support, Differentiation, and Inclusive Communication Practice

Communication skills development is not uniform across students. Some learners may have strong technical skills but low confidence in speaking, while others may communicate well but struggle with documentation. iTeFIM recommends diagnosing students' initial communication practices early in the programme using low-stakes tasks such as short briefings, written summaries, or role-play customer interactions. The goal is not to label students, but to identify support needs and to plan role rotation and coaching accordingly.

Differentiation can be implemented through role design. For instance, in early cycles, students who are anxious about customer interaction can begin as documentation officers who capture customer requirements in writing, then gradually move to co-presenting with a peer, and eventually to leading customer explanations. This gradual exposure aligns with the principle of scaffolding and gradual release. Teachers can also provide language frames—sentence starters for clarifying questions, confirmation statements, and polite disagreement—to reduce cognitive load during stressful interactions.

Inclusive practice also requires attention to group dynamics. In some teams, a small number of students may dominate decision-making and communication, which limits others' opportunities to practice. To counter this, iTeFIM suggests structured meeting roles (facilitator, timekeeper, recorder, presenter) and explicit participation norms (turn-taking, summarising others' points before disagreeing). Such protocols mirror professional meeting practices and help students experience respectful collaboration.

Students with different language backgrounds or disabilities may require specific accommodations. Written templates can improve accessibility because they provide predictable structures. Where possible, teachers can allow multimodal communication evidence (audio recordings, annotated photos) alongside written documents, especially in early stages, while still guiding students toward industry-relevant documentation standards. By treating communication as a teachable set of practices rather than a personality trait, TeFa can become a more equitable platform for employability development.

Finally, student wellbeing should not be ignored. TeFa work can be stressful due to deadlines and customer expectations. Brief reflection routines can include emotional check-ins and stress management strategies, supporting the development of self-management and resilience—

competencies that are increasingly valued in changing labour markets (World Economic Forum, 2025).

Communication Micro-Skills and Teaching Strategies in TeFa

Embedding communication in TeFa requires deliberate teaching of micro-skills that underpin professional interaction. iTeFIM proposes four micro-skill clusters: (1) clarification and confirmation (asking probing questions, paraphrasing customer requests, confirming decisions in writing); (2) structured explanation (using simple frameworks such as "problem–action–result" when reporting progress or explaining repairs); (3) collaborative coordination (using brief, timely updates; negotiating roles; and making explicit handovers); and (4) professional documentation (writing concise logs, using standard terms, recording measurements accurately).

Teachers can teach these micro-skills through short demonstrations and "micro-drills" before students enter production. For example, a five-minute role-play can train students to handle a dissatisfied customer using polite language and evidence, followed by a debrief on what phrases reduced conflict. Similarly, teachers can show examples of good and poor documentation and ask students to revise poor examples. Over time, these micro-skills become habits that improve both work quality and learning outcomes.

Peer feedback is especially effective in TeFa because students can observe each other in action. A simple peer-feedback card—two strengths and one improvement linked to rubric indicators—encourages a culture of constructive communication. When combined with short teacher feedback, peer feedback helps distribute coaching and supports continuous improvement without excessive teacher workload.

For assessment quality, moderation sessions are recommended. Once per cycle, teachers and mentors can review a small sample of portfolios together and agree on rubric interpretations. Moderation strengthens fairness and helps teachers calibrate what counts as "proficient" communication in a given vocational context. It also provides a professional learning opportunity: teachers can share feedback phrases, discuss common student errors, and refine templates. Even a 30-minute moderation meeting can reduce drift in scoring over time and build trust with industry partners when student employability evidence is shared externally

CONCLUSION

This article proposed an Integrative Teaching Factory-Industry Model (iTeFIM) to strengthen communication skills and employability skills of vocational high school students through authentic teaching factory operations. Drawing on an integrative literature review and policy analysis, the model articulates five interacting subsystems—governance and partnership, production/service operations, learning design, assessment, and quality assurance—and maps communication practices across six stages of the TeFa cycle. The resulting framework emphasises that employability skills should be explicit learning outcomes supported by scaffolds, role rotation, rubric-based assessment, and continuous improvement routines.

Practically, iTeFIM contributes (1) a communication-embedded TeFa workflow that can be adapted across vocational programmes; (2) an assessment toolkit based on validated employability competency rubrics and multi-evidence portfolios; and (3) an implementation roadmap aligned with CIPP-informed monitoring for sustainability. The model's key implication is that TeFa should be treated as a learning system rather than merely a production unit: communication and employability must be taught, practiced, observed, and improved as part of operational routines. Future empirical research is recommended to pilot test the model, evaluate outcomes using mixed methods, and refine components under different resource and partnership conditions. The model is designed to be adapted and localised across vocational contexts

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