

Empowering Educators for 21st-Century Competencies: A Mixed-Methods Investigation into Teacher Preparedness, Pedagogical Adaptability and Institutional Support for School-Level Skill Education

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Abstract: In the wake of current educational reforms, there is a move to make vocational, digital and practical skills part and parcel of the secondary school curriculum. Yet for skill-based instruction to be properly put into practice, it is contingent on the educators in the classroom being both pedagogically sound and effective in their domain. To that end we have undertaken a mixed-methods inquiry into the state of teacher preparedness, what professional development is required and the institutional impediments to skill education in secondary schools. Our approach was to put a structured survey before 340 teachers (N = 340) from the government and private sectors and follow up with semi-structured interviews of a n = 20 sample of educational practitioners. The numbers tell a story: 78.2% of those surveyed are favourably disposed to the inclusion of applied skills in their curricula but a mere 32.4% can claim they have had the requisite formal training in matters such as AI literacy tools, competency assessment or the pedagogy of vocational skills. We also noted marked differences between the two types of school management ($p < .001$), the private school teachers having more in the way of CPD modules at their disposal than one would find in the public system. Then there are the qualitative data which, on thematic analysis, point to three areas of difficulty: a lack of room in the curriculum for new material, workshop infrastructure that is wanting and an absence of any real experiential training in the system. In order to reconcile the aspirations of policy with what is feasible in the classroom, the present study puts forward a CSPD framework of a more holistic nature.

Keywords: Skill Education, Vocational Pedagogy, Teacher Preparedness, Competency-Based Learning, Continuous Professional Development.

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I. INTRODUCTION

Global educational paradigms have undergone a profound structural reorientation, moving from rote, content-heavy instruction toward applied competence, technical adaptability, and vocational fluency (OECD, 2020, 2023). International policy instruments, such as UNESCO's Strategy for Technical and Vocational Education and Training (TVET) 2022–2029 and national initiatives including India's National Education Policy (NEP 2020) and the OECD Future of Education and Skills 2030/2040 project, have formally mandated the convergence of academic and practical learning within school curricula (Organisation for Economic Co-operation and Development

[OECD], 2023; UNESCO, 2022). These mandates aim to eliminate the historical divide between academic and vocational tracks. They ensure that secondary students acquire functional digital skills, financial literacy, green technology competencies, and artisanal crafts prior to entering tertiary education.

Although policymakers largely agree on the need for skill-based curricula, classroom implementation remains constrained by persistent operational bottlenecks. (Lucas, 2020; World Bank, 2024). Teachers serve as the key agents of curriculum change. While general subject teachers are well-grounded in theoretical instruction, implementing skill curricula via active, experiential projects necessitates

specialized vocational pedagogies, authentic assessments, and facilitative approaches grounded in practice. (Billett, 2021; Fuller & Unwin, 2022). In addition, current 2026 workforce requirements compel teachers to navigate new interfaces such as generative AI, basic robotics, and green manufacturing, typically with minimal pre-service training.

If teachers are mandated to teach skill modules without commensurate pedagogical scaffolding, instruction tends to shift toward theoretical lectures on practical trades, thereby negating the core aim of vocational empowerment. (Cedefop, 2023; Moodie et al., 2021). Thus, there is an immediate need to analyze the multidimensional factors underlying teacher preparedness, spanning pedagogical self-efficacy, infrastructural resources, and continuous professional development (CPD) systems. This paper presents an empirical investigation into secondary school teachers' readiness to deliver school-level skill education, identifying structural constraints and proposing actionable pathways for scalable teacher capacity-building.

II. REVIEW OF RELATED LITERATURE

The theoretical and empirical foundation of skill education in schools draws upon constructivist learning paradigms, situated cognition theory (Lave & Wenger, 1991), and modern experiential learning cycles (Kolb, 2014). This section synthesizes contemporary literature across three intersecting domains: vocational-skill pedagogical frameworks, teacher self-efficacy in applied learning, and institutional capacity in continuous professional development.

➤ *Theoretical Foundations and Vocational Pedagogy in Secondary Schools*

Constructivist pedagogy posits that competence emerges through authentic problem solving, iterative tool use, and contextual practice rather than abstract symbolic memorization (Jonassen, 2020). Lucas (2020) articulated a comprehensive framework for vocational pedagogy, identifying experiential, problem-based, and studio-based teaching as foundational methods. Unlike traditional classroom instruction, which relies on standardized summative assessments, skill education necessitates competency-based assessment models focused on portfolio evaluations, rubric-driven demonstrations, and project milestones (Guthrie, 2022). When secondary school teachers lack immersion in these specialized methods, they experience instructional cognitive dissonance, struggling to reconcile rigid textbook syllabi with non-linear, exploratory workshop sessions (Aarkrog, 2021).

➤ *Global Policy Frameworks and Changing Competency Demands*

Recent international directives emphasize the integration of transversal and green competencies within compulsory school years (UNESCO, 2024; World Economic Forum [WEF], 2023). The OECD (2023) Teaching Compass underscores that 21st-century educators must act as co-designers of learning experiences, guiding learners through authentic socio-technical challenges. In

emerging economies, policy documents such as India's NEP 2020 mandate that at least 50% of secondary learners receive formal vocational exposure, integrating vocational subjects (e.g., coding, organic farming, electrical maintenance, financial modeling) through structural mechanisms like '10 Bagless Days' and activity modules (Central Board of Secondary Education [CBSE], 2026; NCERT, 2024). However, studies across the Asia-Pacific and sub-Saharan African regions indicate that systemic policy ambition significantly outpaces teacher training infrastructure, leading to fragmented implementation (King, 2022; McGrath et al., 2020).

➤ *Teacher Preparedness, Self-Efficacy, and Professional Development Deficits*

Teacher self-efficacy—defined by Bandura (1997) and adapted to educational contexts by Tschannen-Moran and Hoy (2001)—serves as a primary predictor of instructional innovation. For vocational education, teacher self-efficacy includes competence in technological content knowledge (TCK) as well as pedagogical technological knowledge (PTK). (Mishra & Koehler, 2006). Empirical investigations by Pilz and Zenner (2022) The results show that while secondary teachers demonstrate high enthusiasm for vocational learning in principle, they exhibit low confidence in managing specialized laboratory apparatus, industry software, and multi-modal rubrics.

Scholars note that Continuous Professional Development (CPD) programs commonly adopt a one-off, top-down lecture format and lack the sustained, experiential mentoring required for effective skill development. (Darling-Hammond et al., 2017; Kennedy, 2019). The UNESCO Global Report on Teachers (UNESCO, 2024) Evidence points to a significant worldwide deficit of qualified vocational educators, which is further exacerbated by the absence of dedicated pre-service training in vocational pedagogy in conventional B.Ed. programs.

➤ *Conceptual Framework*

The Integrated Vocational-Skill Pedagogical Preparedness (IVSPP) Model is the means by which this study gives practical effect to teacher preparedness, an approach informed by Bandura's Social Cognitive Theory and the TPACK framework. The model has Institutional & Policy Enablers in operation to build out the four Teacher Competency Domains of Domain Skill Knowledge, Experiential Pedagogy, Assessment Competence and Teacher Efficacy. These in turn are what produce genuine results in the classroom, be it the acquisition of practical skills or the attainment of student competency.

➤ *Research Questions*

To investigate the underlying factors governing teacher preparedness and curriculum delivery, the study addressed four central research questions:

- RQ1: What is the current level of secondary school teachers' perceived preparedness in delivering skill and vocational education curricula?

- RQ2: Are there statistically significant differences in teacher preparedness across school management types (Public vs. Private) and teaching experience levels?
- RQ3: What pedagogical, infrastructural, and organizational challenges do teachers encounter during the execution of practical skill modules?
- RQ4: What structured institutional interventions and professional development designs do educators consider essential for effective skill facilitation?

III. RESEARCH METHODOLOGY

➤ Research Design

A convergent mixed-methods design (QUAN + qual) was adopted (Creswell & Plano Clark, 2018). Quantitative

survey data and qualitative interview insights were collected concurrently to capture broad statistical trends alongside nuanced, experiential classroom perspectives.

➤ Population and Sampling

The target population comprised secondary school teachers (Grades 6–10) in urban and semi-urban educational districts. A stratified random sampling technique was utilized for the quantitative phase (N = 340), stratifying by institution type (Government/Public vs. Private Aided/Unaided) and core subject specialization. The qualitative phase utilized purposive criterion sampling, engaging n = 20 educators (comprising 12 practicing classroom teachers, 4 vocational coordinators, and 4 school principals).

Table 1 Demographic Profile of Survey Respondents (N = 340)

Variable	Category	Frequency (f)	Percentage (%)
Gender	Female	198	58.2
	Male	138	40.6
	Prefer not to say	4	1.2
Institution Type	Public / Government School	182	53.5
	Private Independent School	158	46.5
Teaching Experience	1–5 Years (Novice)	78	22.9
	6–15 Years (Mid-Career)	164	48.2
	> 15 Years (Senior)	98	28.9
Core Subject Area	STEM Disciplines (142), Social Sciences & Languages (134), Vocational (64)	340	100.0

➤ Data Collection Instruments

- Teacher Skill Education Preparedness Survey (TSEPS): A 28-item instrument scored on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), measuring Domain Technical Mastery (DTM), Vocational Pedagogical Knowledge (VPK), Competency Assessment Self-Efficacy (CASE), and Perceived Institutional Scaffolding (PIS). EFA confirmed construct validity with all factor loadings > .62 (overall alpha = .89).
- Semi-Structured Interview Protocol: A 10-question guide exploring classroom implementation dynamics, material bottlenecks, assessment dilemmas, and specific continuous professional development requirements.

➤ Data Analysis

Quantitative data were analyzed via SPSS (v.28) using descriptive statistics, independent samples t-tests, two-way ANOVA, and multiple linear regressions. Qualitative data were transcribed and analyzed using Braun and Clarke's (2006) six-phase thematic analysis framework in NVivo 14.

IV. RESULTS AND FINDINGS

➤ Perceived Preparedness Levels (RQ1)

Quantitative analysis revealed a distinct divergence between teachers' ideological disposition and their practical pedagogical efficacy in delivering vocational skills.

Table 2 Descriptive Statistics across Preparedness Constructs (N = 340)

Subscale Construct	Mean (M)	Standard Deviation (SD)	Interpretation
Attitude toward Skill Integration	4.18	0.62	Highly Favorable
Domain Technical Mastery (DTM)	2.82	0.88	Low-Moderate
Vocational Pedagogical Knowledge (VPK)	2.64	0.91	Moderate-Low
Competency Assessment Efficacy (CASE)	2.51	0.94	Low
Perceived Institutional Scaffolding (PIS)	2.38	1.02	Deficient

➤ Institutional Disparities and Experience Factors (RQ2)

An independent samples t-test demonstrated statistically significant differences between public and

private school teachers across all major operational dimensions.

Table 3 Comparison of Public vs. Private School Teachers across Preparedness Metrics

Dimension	Public (n = 182)	Private (n = 158)	t-value	p-value	Cohen's d
Domain Mastery (DTM)	M = 2.61, SD = 0.81	M = 3.06, SD = 0.90	-4.85	< .001	0.53
Pedagogical Skills (VPK)	M = 2.42, SD = 0.85	M = 2.89, SD = 0.92	-4.88	< .001	0.53
Institutional Scaffolding (PIS)	M = 1.98, SD = 0.88	M = 2.84, SD = 0.98	-8.49	< .001	0.92

➤ Qualitative Findings: Implementation Challenges (RQ3)

Inductive thematic analysis of the qualitative interviews (n = 20) highlighted three structural themes impeding effective implementation:

• Theme 1: The 'Theory Trap' and Academic Curriculum Congestion

Educators indicated that high-stakes board examinations prioritize textbook completion, leaving minimal classroom time for manual and exploratory tasks. As Participant 04 noted: 'Our academic schedule is geared toward written examinations. When we attempt to conduct a workshop on electronics or agricultural soil testing, we run out of time. Teachers inevitably resort to lecturing from the manual rather than letting students solder wires or plant seeds.'

• Theme 2: Structural and Material Resource Gaps

Over 68% of interviewees reported that policy directives were introduced without adequate consumables, modern maker-spaces, or functional software licenses, resulting in demotivated teaching staff.

• Theme 3: Assessment and Rubric Ambiguity

Teachers voiced frustration regarding how to evaluate hands-on craftsmanship within standard quantitative grading software, leading to arbitrary scoring.

➤ Professional Development Needs (RQ4)

Multiple linear regression analysis indicated that hands-on practicum CPD hours ($\beta = .412$, $p < .001$) and infrastructural access ($\beta = .321$, $p < .001$) were the strongest predictors of teacher self-efficacy in delivering skill education ($R^2 = .482$, $F(3, 336) = 104.22$, $p < .001$).

V. DISCUSSION

The findings illustrate an implementation paradox: while secondary educators recognize the strategic value of early vocational skilling, their pedagogical self-efficacy is constrained by limited practical training and institutional resource deficits. These findings align with Lucas (2020) and Billett (2021), confirming that vocational pedagogy requires distinct non-linear, studio-based teaching frameworks. The substantial equity gap between public and private institutions further highlights the danger of skill education becoming an exclusionary privilege of well-resourced schools (McGrath et al., 2020; World Bank, 2024).

VI. STRATEGIC IMPLICATIONS AND RECOMMENDATIONS

To translate policy aspirations into meaningful classroom impact, educational authorities should implement a tiered intervention model:

- Pre-Service Curriculum Restructuring: Embed mandatory vocational pedagogy, maker-space design, and applied competency assessment into core B.Ed. and 4-year ITEP degrees.
- Industry-Artisan Co-Teaching Frameworks: Establish structured partnerships where certified local artisans, technical specialists, and IT practitioners co-instruct applied tracks alongside regular teachers.
- Assessment Framework Reform: Transition from paper-and-pencil testing to 70% rubric-weighted portfolios, dynamic demonstrations, and peer-reviewed project exhibitions.
- Practicum-Centric In-Service CPD: Mandate that annual teacher professional development allocations (e.g., 50 hours/year) prioritize active workshop immersion over passive webinar attendance.

VII. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study's limitations include its regional geographic scope and reliance on self-reported survey measures. Future research should evaluate longitudinal student learning outcomes resulting from specialized teacher CPD models and explore the efficacy of AI-driven virtual simulation environments for vocational training in resource-constrained schools.

VIII. CONCLUSION

School-level skill education is an indispensable vehicle for fostering youth self-reliance, adaptability, and economic agency in the 2026 global economy. However, curriculum transformation cannot succeed without empowering the front-line educator. By bridging institutional divides, reforming professional development architectures, and institutionalizing authentic performance assessments, educational systems can ensure teachers evolve into confident facilitators of future-ready competencies.

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