

Integrating Preventative Health Education into Formal and Non-Formal Technical Education: A Review

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Abstract

Technical and Vocational Education and Training (TVET) institutions, such as polytechnics and technical colleges, are structurally designed to equip students with practical, industry-relevant competencies. However, the health literacy and preventative health behaviors of trainees within these environments remain vastly under-researched. This review paper evaluates the strategic imperatives, current frameworks, challenges, and prospects of integrating preventative health education into both formal and non-formal technical education sectors in Nigeria, with specific contextual insights relevant to Yobe State. Operating within the conceptual parameters of Human Capital Theory and the Health Belief Model, the study systematically reviews educational policy documentation, institutional architectures, and empirical literature spanning the last decade. The findings reveal that while TVET curricula are heavily oriented toward technical, digital, and mechanical competencies, they suffer from a systemic omission of structured public health modules. This leaves students vulnerable to prevalent regional health challenges, including outbreaks of infectious diseases (such as cholera, meningitis, and Lassa fever), occupational hazards, and a lack of baseline preventative health awareness. Non-formal technical education tracks, such as localized apprenticeship systems, suffer from even steeper health information deficits. The paper proposes a dual-pathway integration framework: the formal anchoring of preventative health modules into General Studies (GNS) curricula across polytechnics, and the development of community-based peer-led health interventions within informal apprenticeship clusters. Operationalizing this structural convergence is essential to protecting the physical capital of the technical workforce and fostering sustainable national industrial development.

Keywords: *Technical and Vocational Education and Training (TVET), Preventative Health Education, Health Literacy, Curriculum Integration, Yobe State.*

1. Introduction

Technical and Vocational Education and Training (TVET) is globally recognized as the foundational bedrock of industrialization, wealth creation, and sustainable economic self-reliance (African Union, 2007; Gazali, 2025). Within the Nigerian tertiary education architecture, polytechnics, monotechnics, and technical colleges are mandated to produce highly skilled, competent technical personnel capable of driving industrial innovation, infrastructure management, and entrepreneurial growth (Chiamogu, 2026). Consequently, significant academic and policy interventions have focused heavily on optimizing mechanical, engineering, digital, and Industry 4.0 competencies within these institutions to bridge severe labor market skills gaps (Chiamogu, 2026; Dike, 2024).

Despite these robust technical frameworks, a critical structural blind spot persists: the systematic exclusion of structured preventative health education within the technical and vocational training lifecycles. While the cognitive and manual skills of the trainee are aggressively developed, the biological and physiological baseline of the trainee their health status and preventative health literacy is largely taken for granted. This discrepancy is particularly glaring in Sub-Saharan African contexts like Northern Nigeria, where public health challenges interact dynamically with educational retention and socioeconomic productivity.

In regions such as Yobe State, communities experience seasonal and endemic outbreaks of communicable diseases, including cholera, cerebrospinal meningitis, Lassa fever, and gastrointestinal infections (Igbokwe et al., 2019). Furthermore, technical students and informal apprentices are routinely exposed to severe occupational safety and health hazards such as

chemical toxicity, poorly shielded mechanical equipment, and inadequate particulate filtration without corresponding health literacy to mitigate risks. When technical trainees suffer from preventable illnesses or occupational injuries, their educational journey is disrupted, resulting in high attrition rates, reduced institutional efficiency, and an eventual drain on the skilled workforce.

Preventative health education represents a highly cost-effective, evidence-based mechanism that empowers individuals with the exact cognitive skills, health numeracy, and behavioral habits required to avert disease transmission and manage chronic risks (Rudwan, 2025). Historically, however, health education within the Nigerian pedagogical system has been restricted. It is either confined to specialized medical and nursing colleges or poorly combined with physical education at the primary and junior secondary school tiers, disappearing entirely by the time a student enters a tertiary technical track (Igbokwe et al., 2019).

This review paper explicitly addresses this structural division. By looking at both formal technical education (polytechnics and monotechnics governed by formal curricula) and non-formal technical education (community-based apprenticeships, trade centers, and informal skill acquisition hubs), this paper provides a comprehensive synthesis of existing literature. It establishes the conceptual justification for integrating public health into technical training, evaluates contemporary implementation barriers, and outlines a practical, integrated framework designed to build a healthy, resilient, and highly productive technical workforce.

2. Theoretical and Conceptual Framework

The structural integration of preventative health education into technical education tracks is conceptually guided by two prominent theoretical frameworks: Human Capital Theory and the Health Belief Model (HBM).

2.1 Human Capital Theory

Popularized by economists such as Adam Smith, Gary Becker, and Theodore Schultz, Human Capital Theory posits that individuals possess a set of skills, knowledge, capabilities, and cognitive attributes that constitute an economic asset (Chiamogu, 2026). Education and technical training are conceptualized as direct investments that upgrade the quality of this capital, thereby increasing labor productivity and accelerating national development.

Crucially, modern expansions of Human Capital Theory explicitly recognize that health is a foundational component of human capital. A highly trained mechanical engineer or software developer who is incapacitated by a preventable waterborne epidemic or a chronic non-communicable disease cannot deploy their technical skills. Therefore, dedicating institutional resources to technical training while ignoring the preventative health literacy of the student represents an incomplete investment model. Integrating health education into technical curricula directly secures the physical capacity of the technical workforce, maximizing the return on educational investments.

2.2 The Health Belief Model (HBM)

While Human Capital Theory provides the macro-economic justification for this integration, the Health Belief Model (HBM) provides the micro-behavioral framework necessary to

understand how health literacy converts into disease prevention. Developed by social psychologists, the HBM dictates that an individual's willingness to adopt a preventative health behavior is fundamentally driven by six primary cognitive constructs:

- **Perceived Susceptibility:** The student's assessment of their likelihood of contracting an illness (e.g., assessing the risk of cholera on a campus with shared water infrastructure).
- **Perceived Severity:** The individual's evaluation of the medical and social consequences of the illness (e.g., recognizing that an occupational injury could permanently end an engineering career).
- **Perceived Benefits:** The belief that adopting a specific preventative measure will successfully reduce susceptibility or severity.
- **Perceived Barriers:** The structural, financial, or cultural costs associated with executing the health action.
- **Cues to Action:** Direct environmental or educational prompts that trigger the protective behavior.
- **Self-Efficacy:** The individual's internal confidence in their ability to successfully perform the behavior.

By embedding structured health education directly into the technical learning environment, institutions act as a continuous Cue to Action. This intervention equips students with the scientific clarity required to accurately calibrate their Perceived Susceptibility and Severity, while simultaneously building the Self-Efficacy needed to implement preventative habits in both school workshops and their wider communities.

3. The Landscape of Technical and Vocational Education in Nigeria

Technical and Vocational Education and Training (TVET) in Nigeria operates across a highly stratified binary ecosystem: the formal sector and the non-formal sector. Understanding these two tracks is essential for designing any successful curriculum integration.

3.1 The Formal Technical Education Sector

The formal TVET sector is highly structured and regulated by the state through specialized bodies, most notably the National Board for Technical Education (NBTE). This sector comprises Federal and State Polytechnics, Monotechnics, Colleges of Technology, and Government Technical Colleges (GTCs).

Admission into these institutions requires formal academic qualifications (such as SSCE or UTME scores). The training is delivered sequentially over fixed academic durations, culminating in the award of the National Diploma (ND), Higher National Diploma (HND), or National Technical Certificate (NTC).

The operational mandate of these institutions is governed strictly by the National Policy on Education (NPE). It emphasizes the acquisition of practical skills, applied scientific knowledge, and entrepreneurial capabilities designed to meet real-world industrial demands (FRN, 2004, as cited in Gazali, 2025). The curriculum is rigid, heavily packed with departmental core courses, and leaves very little room for non-technical electives outside of standardized General Studies (GNS) requirements.

3.2 The Non-Formal Technical Education Sector

In contrast to the school-based model, the non-formal technical education sector is largely decentralized, adaptive, and market-driven. It primarily manifests as the Traditional Apprenticeship System, alongside vocational training centers managed by Non-Governmental Organizations (NGOs), faith-based organizations, and community development groups (African Union, 2007).

This sector serves as the primary engine for skill acquisition for millions of Nigerian youths, particularly those from vulnerable socioeconomic backgrounds, school dropouts, or rural populations who face financial and academic barriers to entering formal higher education (African Union, 2007). In settings like Yobe State, informal apprentices spend years under master craftsmen learning specialized trades such as automotive mechanics, welding, carpentry, tailoring, and electrical installations.

The pedagogy is purely observational, experiential, and competency-based, lacking formal classrooms, written syllabi, or standardized examinations. Crucially, oversight is highly fragmented, typically split or outright neglected between ministries of labor, youth empowerment, and local trade guilds (African Union, 2007). This complete lack of centralized regulation makes the non-formal sector highly inaccessible to conventional state-sponsored health communication campaigns.

4. Current State of Health Education in Technical Curricula: The Gaps

A systematic analysis of the current curriculum designs within both the formal and non-formal

technical training sectors reveals severe structural deficits regarding health literacy.

Table 1: Comparison of Formal and Non-formal in Health Awareness

Sector	Current Focus	Curricular	Core Health Gaps	Institutional Impact
Formal (Polytechnics / Colleges)	TVET Tech	Heavy focus on Core Engineering, Digital Skills, and General Studies (GNS) English/Civics.	Omission of modern epidemic management, disease prevention, and reproductive/mental health.	High student absenteeism during regional disease outbreaks; low preventative health literacy.
Non-Formal (Informal Apprenticeships)	TVET	Purely experiential, trade-specific manual skills (e.g., mechanics, welding).	Complete lack of basic occupational safety protocols, hygiene literacy, and health hazard awareness.	High rates of severe physical injuries, toxic chemical exposure, and chronic untreated illnesses.

4.1 Structural Gaps in the Formal Sector

In formal polytechnics, health-related content is nearly invisible outside of highly specialized programs (such as environmental health or science laboratory technology). For the vast majority of students studying engineering, computer science, business administration, and environmental studies, there is no mandatory baseline health education course.

Historically, the National Policy on Education merged health topics with physical education at the lower school levels, which effectively minimized health tracking and shifted instructional focus primarily toward competitive sports rather than preventative public health

competencies (Igbokwe et al., 2019). By the time students transition into tertiary technical environments, health instruction ceases completely.

The standardized General Studies (GNS) curriculum, which could serve as an effective delivery vector for health communication, remains limited to citizenship education, basic communication skills, and entrepreneurial studies. Consequently, formal technical students leave school with advanced technical competencies but possess severe health literacy gaps. They remain ill-equipped to handle modern health crises, parse health misinformation, or practice preventative care (Rudwan, 2025).

4.2 Structural Gaps in the Non-Formal Sector

The health literacy deficit in the non-formal sector is even more severe. Because traditional apprenticeship systems operate entirely outside formal academic structures, apprentices receive zero orientation regarding personal hygiene, sanitation, disease transmission, or reproductive health.

More critically, there is a dangerous lack of awareness regarding Occupational Health and Safety (OHS). Apprentices in roadside mechanical workshops, welding bays, and woodwork clusters are routinely exposed to highly toxic environments inhaling metallic dust, chemical paint fumes, and burnt engine oils without the use of personal protective equipment (PPE).

Because master craftsmen themselves were trained under the same health-deficient conditions, unsafe habits are passed down through generations. The lack of structured public health interventions within these trade networks leaves millions of young informal workers highly vulnerable to both infectious diseases and chronic, preventable occupational illnesses.

5. Challenges to Successful Integration

- **Curriculum Overload in Polytechnics:** The formal polytechnic system is governed by dense, credit-heavy academic schedules regulated by the NBTE. Faculty and students often push back against introducing new mandatory courses, viewing them as an unnecessary academic burden that could dilute core technical training hours (Chiamogu, 2026).

- **Severe Resource Constraints:** Many technical institutions in developing regions encounter structural funding shortages, lack modern health clinics, and face deficits in updated learning materials (Dike, 2024). Budgets are prioritized for technical lab machinery and engineering equipment, leaving little to no funding to purchase health education resources or hire certified health educators.
- **Pedagogical and Staffing Deficits:** Effectively teaching preventative health requires specialized instructional skills. Most polytechnic lecturers are engineers, technologists, or scientists who lack formal training in public health communication, epidemiology, or health education methodologies (Igbokwe et al., 2019). Without structured train-the-trainer initiatives, introducing health components risks low-quality delivery.
- **Socio-Cultural Barriers in Non-Formal Sectors:** In rural and semi-urban communities across Northern Nigeria, health behaviors are closely intertwined with local traditions, religious convictions, and deep-seated cultural norms. Health communication interventions especially those covering reproductive health, family planning, or vaccine literacy often trigger community resistance if they are not explicitly localized, translated, and designed to respect local sensitivities.
- **Structural Fragmentation of Apprenticeship Clusters:** Because informal apprenticeships are decentralized and scattered across numerous small workshops, there is no centralized administrative office or single campus where a health education curriculum can be uniformly rolled out. Coordinating interventions across these fragmented groups requires intensive community engagement.

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6. Proposed Integrated Framework

To overcome these structural limitations, this paper proposes a dual-pathway integration framework tailored specifically to the operational realities of the Nigerian technical education sector.

6.1 The Formal TVET Pathway: Structural Curricular Reform

For formal polytechnics and technical colleges, the most sustainable strategy is to integrate preventative health modules directly into the mandatory General Studies (GNS) framework, which all students must take to graduate.

1. Curriculum Realignment: The National Board for Technical Education (NBTE) should design and mandate a core course component tentatively titled GNS: Preventative Health and Occupational Safety. This module must replace abstract electives with highly actionable health competencies.

2. Modular Composition: The course content must focus on three core areas: Epidemic and Infectious Disease Prevention (localized transmission dynamics, sanitation protocols, and vaccine literacy specifically tailored to combat regional threats like cholera and meningitis); Occupational Health (workshop ergonomics, toxic chemical management, eye safety, and emergency first aid); and Lifestyle and Wellness (prevention of non-communicable diseases through nutrition and the mitigation of substance abuse) (Rudwan, 2025).

3. Applied Health Interventions: Moving beyond classroom lectures, technical schools should mandate practical campus health days. Students can actively participate in peer-led health awareness campaigns, community sanitation planning, and structured health debates,

transforming abstract medical concepts into active civic habits (Igbokwe et al., 2019).

6.2 The Non-Formal TVET Pathway: Community-Led Interventions

Because the non-formal sector lacks centralized classrooms, health education must be integrated into the physical spaces where apprentices work.

1. Partnership with Local Trade Guilds: Interventions must be funneled through recognized trade associations, such as the Nigerian Association of Road Transport Owners (NARTO), mechanic unions, and metalwork guilds. Securing buy-in from senior master craftsmen ensures that apprentices are permitted time to participate in health sessions.

2. The Peer-Led Health Champion Model: Selected apprentices from various geographic clusters should undergo short, intensive public health training programs. These individuals are equipped with basic medical kits and informational charts, returning to their respective workshops to act as 'Health Champions' who provide peer-to-peer instruction, display safety materials, and distribute basic first-aid supplies.

3. Localized Digital and On-Demand Delivery: Given the high rate of low literacy and formal communication gaps within informal sectors, health education should utilize accessible media formats. This includes the production of localized Hausa-language audio messages, interactive community radio programs, and short, visual, mobile-optimized instructional videos that can be easily shared via basic smartphones (Odu et al., 2024; Rudwan, 2025).

7. Discussion

The systematic integration of preventative health education into formal and non-formal technical education tracks represents a vital policy shift for

developing countries. As demonstrated by empirical evaluations of TVET programs, such as the application of the Kirkpatrick evaluation model in Nigerian polytechnics, technical training often yields strong immediate classroom learning but fails to generate a broader social impact if the student's operational environment and personal well-being are ignored (Makinde & Bamiro, 2024).

When technical institutions focus exclusively on manual or mechanical proficiency while remaining completely silent on public health issues, they produce graduates who are highly vulnerable to localized epidemics and severe occupational injuries. This vulnerability introduces avoidable friction into the labor market, directly undermining the overarching goals of human capital development (Chiamogu, 2026; Dike, 2024).

By bridging the historic divide between public health communication and technical training, the dual framework proposed in this paper provides clear institutional benefits. In the formal sector, embedding health education into the GNS curriculum turns polytechnics into defensive walls against regional epidemics. Students who understand the science of disease transmission, sanitation, and vaccine benefits become active health ambassadors within their families and rural communities, extending the institution's developmental reach far beyond the campus perimeter. In the non-formal sector, bringing health literacy directly into informal workshop clusters addresses a deep pocket of health inequality. Protecting informal workers from toxic exposures and infectious diseases preserves the manual workforce that sustains the local economy. Ultimately, treating health education as an indispensable partner to technical training transforms TVET institutions from narrow trade schools into comprehensive centers for human development, capable of building a technical

workforce that is both professionally skilled and physically resilient.

8. Conclusion and Recommendations

8.1 Conclusion

The strength and productivity of Nigeria's technical workforce depends entirely on the physical well-being of its workers. This review paper highlights a clear, systemic omission: public health literacy is largely absent from both formal polytechnic curricula and non-formal apprenticeship systems. While technical trainees spend years mastering complex mechanical, digital, and industrial skills, they are rarely equipped with the foundational health competencies needed to prevent regional infectious outbreaks or protect themselves from severe occupational hazards.

By applying Human Capital Theory alongside the Health Belief Model, this paper demonstrates that investing in technical skills without protecting student health is an incomplete and inefficient strategy. Closing this gap by embedding preventative health education into technical training tracks is a strategic necessity. Taking this step is vital to safeguarding educational investments, lowering student attrition rates, and building a healthy, highly capable workforce ready to drive sustainable economic growth.

8.2 Recommendations

- **NBTE Curricular Mandate:** The National Board for Technical Education (NBTE) must systematically restructure the General Studies (GNS) framework across all polytechnics. It should introduce a compulsory, examinable course dedicated

entirely to Preventative Health Literacy and Occupational Safety.

- **Inter-Ministerial Strategic Alliances:** The Federal and State Ministries of Education must form structured operational partnerships with the Ministries of Health and Labor. This collaboration is necessary to co-design and fund wide-scale public health programs tailored specifically for technical students and informal trade clusters.
- **Institutional Capacity Building:** Polytechnics and technical colleges must establish structured 'train-the-trainer' programs. These initiatives will equip technical lecturers with the communication skills and pedagogical tools necessary to deliver high-quality public health and safety instruction.
- **Formalizing Trade Association Engagement:** State governments should provide financial and technical incentives to local trade associations and artisanal guilds. This support will encourage the adoption of peer-led health training programs and formal safety protocols across informal workshop hubs.
- **Targeted Digital Health Communication:** Public health agencies must invest in creating accessible, localized health content. Developing audio-visual resources in regional languages like Hausa will ensure that vital health and safety information effectively reaches low-literacy technical communities.

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