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A theoretical framework for strengthening occupational safety and health and 5S as a foundation for industrial culture

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Abstract: Despite the rapid expansion of Industry 4.0, a significant gap persists between vocational graduates' technical skills and the professional character required by industry, particularly regarding safety culture and discipline. This study aims to develop an integrative theoretical framework that positions Pancasila Education as a foundational value system to strengthen Occupational Safety and Health (K₃) and 5S practices in fostering holistic work readiness. This research employs a conceptual literature review with a thematic synthesis approach, analysing peer-reviewed national and international literature published between 2019 and 2025. The synthesis reveals that work readiness is a multidimensional construct where technical competence must be balanced with "industrial citizenship"—a workplace civic character characterised by ethical responsibility and safety-oriented behaviour. The findings suggest that Pancasila values provide the normative basis, K₃ acts as the manifestation of respect for human dignity, and 5S serves as the habituation mechanism. Integrating these three elements transforms K₃ and 5S from mere technical procedures into pedagogical tools for professional character formation. This study offers a novel interdisciplinary perspective by integrating civic education, safety culture, and vocational pedagogy to produce ethically grounded, industry-ready graduates.

Keywords: Industrial Vocational School; Occupational Safety And Health (OSH); Work Readiness

Introduction

Despite the rapid expansion of vocational education in the Industry 4.0 era, a persistent gap remains between graduates' competencies and industrial expectations, particularly in safety culture and professional character. While vocational institutions increasingly succeed in delivering technical knowledge, they often fall short in cultivating the behavioural and ethical dimensions required in real workplace settings (Nurjanah et al., 2022; Suharno et al., 2020). International research published in leading Scopus-indexed journals emphasises that non-technical attributes, including work attitudes, adaptability, and professional identity formation, strongly influence employability (Jackson, 2016; Tomlinson, 2017). Similarly, studies on workplace safety highlight that safety performance is not solely determined by procedural knowledge but also by safety citizenship behaviour, which reflects proactive, value-driven actions shaped by organisational norms (Khan & Shrivastava, 2023; Tear & Reader, 2023).

As a result, many graduates enter the workforce without sufficient discipline, safety awareness, and collaborative attitudes, which are essential for sustainable performance in industrial environments (Magalhães et al., 2022; Šenkál et al., 2021). International evidence on school-based safety training underscores this challenge, Nykänen et al. (2021) identified the core active ingredients of effective school-based occupational safety and health training in Finnish vocational schools, demonstrating that safety skills training and safety inoculation training, when implemented with high fidelity and active learning, significantly improved young workers' safety competencies. Their findings confirm that structured safety education in vocational settings can produce measurable behavioural outcomes, but only when grounded in coherent pedagogical frameworks rather than isolated procedural instruction. Therefore, work readiness should be understood holistically as an integration of technical competence and civic or ethical dispositions.

In industrial environments, safety management practices such as Occupational Safety and Health (K3/OHS) and organisational order methodologies such as 5S (*Seiri, Seiton, Seiso, Seiketsu, and Shitsuke*) play a dual role. In addition to improving efficiency and reducing accident risks, both practices shape routine behaviours that reflect discipline, collective responsibility, and concern for the work environment (Yulia, 2024). From a pedagogical perspective, repetitive practices embedded in 5S and K3 implementation provide authentic experiential contexts (situated learning) that are effective for internalising professional values (Chatigny, 2022; Yulia, 2024).

Pancasila and Civic Education as part of the national curriculum carry a mandate to develop civic dispositions, including discipline, social responsibility, compliance with rules, and concern for others (Cogan, 1999; Luthfi et al., 2020). Contextual and value-based learning models grounded in Pancasila principles effectively strengthen students' character development and civic awareness (Aulia et al., 2025). Many aspects of civic disposition overlap with attributes required in industrial work environments, such as procedural discipline, teamwork, compliance with safety regulations, and attention to cleanliness and workplace organisation. Therefore, Pancasila and Civic Education have the potential to serve as a value-based foundation that transforms technical knowledge into ethical, safe work behaviour.

International literature on safety culture and organisational citizenship behaviour supports this perspective. The concept of safety citizenship or safety citizenship behaviour, a variant of organisational citizenship behaviour (OCB) that focuses on voluntary actions enhancing organisational safety, demonstrates that

collective identity and organisational norms play a crucial role in promoting pro-safety behaviour (Tear & Reader, 2023). Khan and Shrivastava (2023) synthesised 301 publications from the Scopus database over 20 years, confirming that safety citizenship behaviour is a growing and theoretically robust field with implications for organisational safety management and education. The integration of K3 education into vocational training has also been recognised as an important strategy for building a culture of prevention among future workers (Chatigny, 2022; Şenkal et al., 2021)

The urgency of this research arises from the persistent gap between vocational education outcomes and industrial expectations, particularly regarding safety culture, discipline, and professional character. Although K3 and 5S practices are widely implemented in industrial settings, vocational education often treats them primarily as technical procedures rather than as value-based behavioural systems. Consequently, students may understand safety regulations cognitively without fully internalising them as part of their professional identity. Research on safety culture emphasises that long-term accident prevention depends not only on compliance but also on shared values and collective norms (Tear & Reader, 2023). Within the Indonesian context, where Pancasila serves as the philosophical foundation of national education, the theoretical integration between Pancasila Education and the formation of an industrial safety culture remains limited in the international literature, underscoring the need for a value-based framework to strengthen students' holistic work-readiness.

Research on work readiness, safety culture, and civic education remains fragmented across disciplines. Studies highlight that employability is shaped not only by technical competence but also by identity formation, values, and social responsibility (Jackson, 2016; Tomlinson, 2017), yet these dimensions are rarely integrated into vocational safety training frameworks. Safety citizenship behaviour has been extensively examined within organisational psychology but has received limited attention in vocational pedagogy (Tear & Reader, 2023). Within the Indonesian context, the potential of Pancasila Education to serve as a value-based foundation for industrial behaviour remains underexplored in internationally indexed literature. There is therefore a need for an integrative framework that reconceptualises work readiness as workplace civic character, grounded in ethical values and safety-oriented practices, and that bridges vocational education, civic education, and safety culture theory.

Building on this foundation, this article proposes an integrative theoretical framework in which Pancasila values, as expressed through Pancasila dan Civic Education, shape vocational students' civic dispositions. These civic dispositions are then internalised through contextual learning and repeated practices of K3 and 5S. This internalisation process produces what can be described as industrial citizenship, namely, workplace civic character that emphasises safety, discipline, and collective responsibility, thereby enhancing students' holistic work readiness. Such a framework shifts the understanding of K3 and 5S from merely technical procedures to pedagogical media for professional character formation grounded in Pancasila values. By bridging civic education, safety culture, and vocational training, this study offers a novel interdisciplinary perspective and a conceptual foundation for developing ethically grounded, safety-oriented, and industry-relevant graduates.

Method

This study employs a qualitative approach, drawing on a conceptual literature review. This approach was selected because the primary objective is to develop and formulate a theoretical framework for Pancasila Education to strengthen K3 and 5S practices as a basis for work readiness among industrial vocational students, rather than to empirically test variable relationships. A theoretical review allows researchers to systematically integrate and synthesise interdisciplinary concepts drawn from diverse fields (Nurjanah et al., 2022; Snyder, 2019). Snyder's (2019) provides the foundational procedural guide for this study, distinguishing between systematic reviews, semi-systematic reviews, and integrative reviews, and affirming that integrative conceptual reviews are appropriate and rigorous when the objective is framework development rather than effect estimation.

The data sources consist of national and international journal articles relevant to Pancasila Education, civic disposition, work readiness, industrial vocational education, K3, and 5S. Literature was selected from scholarly publications published over the last seven years (2019 to 2025) to ensure the review's relevance and currency. Articles were identified through Scopus-indexed journals, Google Scholar, and institutional repositories, with a focus on peer-reviewed publications in the fields of education, occupational safety, and organisational studies.

The literature search was conducted using keywords including "vocational education," "work readiness," "occupational safety and health (OHS/K3)," "5S," "safety culture," "civic education," and "Pancasila Education." The inclusion criteria covered: (1) articles published in peer-reviewed journals; (2) studies addressing conceptual, empirical, or review-based discussions related to the selected themes; and (3) publications available in English or Indonesian. Exclusion criteria included non-scholarly sources, opinion-based articles without clear methodological grounding, and studies not directly relevant to vocational or industrial contexts.

Data analysis was conducted using thematic synthesis techniques. This technique aims to identify, categorise, and integrate key conceptual themes from various literature sources to construct a coherent theoretical understanding (Snyder, 2019). The analysis process involved three stages: (1) coding and identifying recurring concepts across the literature; (2) grouping these concepts into broader thematic categories such as civic disposition, safety culture, and work readiness; and (3) synthesising the relationships among these themes to develop an integrative conceptual framework. The results of the thematic synthesis were then used to construct a theoretical model explaining how Pancasila Education values can be internalised through K3 and 5S practices to holistically shape work readiness among industrial vocational students.

Findings and Discussion

Pancasila Education as a Foundation of Values, Work Ethics, and Industrial Citizenship

The results of the literature review indicate that Pancasila Education plays a fundamental role in shaping the character, value orientation, and work ethic of vocational students in ways relevant to industrial demands. Pancasila values such as discipline, responsibility, cooperation, compliance with rules, and professional ethics constitute core attributes that are highly required in industrial work environments that demand safety, order, and collective performance (Andri et al., 2024; Saputri et al., 2022). Accordingly, Pancasila Education provides a normative

foundation that serves as the starting point for developing vocational students' work-readiness.

In the context of work readiness, Pancasila Education does not merely function as a normative subject but as a medium for value internalisation that influences work attitudes and behaviours. Students with a strong understanding of Pancasila values tend to demonstrate higher levels of compliance with standard operating procedures, greater awareness of workplace risks, and stronger responsibility for personal and environmental safety (Nurjanah et al., 2022). At this stage, Pancasila Education contributes to work readiness not only in terms of employability, but also ethical employability, which is readiness to work accompanied by ethical awareness and social responsibility. This concept resonates with Tomlinson's (2017) conceptualisation of employability in Studies in Higher Education, which encompasses not only skills and knowledge but also the values, identities, and social dispositions that shape how graduates engage with professional environments.

The literature indicates that Pancasila Education serves as a foundation for industrial citizenship. This concept views workers not merely as executors of technical tasks but as ethical subjects who bear responsibility for collective safety, workplace environments, and organisational sustainability. Pancasila values, particularly those related to humanity and social justice, closely align with occupational safety principles that prioritise human protection within production systems. Consequently, safety violations should be understood not only as technical errors, but also as violations of humanitarian values and social responsibility. The concept of "industrial citizenship" proposed in this study parallels the broader discourse on civic character formation in vocational contexts, connecting Pancasila's normative framework to safety culture theory. He (2022) emphasises that ethical workplace behaviour is fundamentally a civic practice mediated by values formed through education. This theoretical alignment supports the argument that Pancasila Education is uniquely positioned to provide the normative foundation for industrial citizenship.

Nevertheless, the literature also reveals that the implementation of Pancasila Education in vocational education remains predominantly cognitive and disconnected from real workplace practices. As a result, Pancasila values have not been fully internalised in students' work behaviours in workshops, laboratories, or industrial internships (Saputri et al., 2022). This condition underscores the urgency of integrating Pancasila Education with concrete workplace practices, particularly through strengthening K3 and implementing 5S work culture. Research by Suharno et al. (2020) confirms that the disconnect between normative curriculum content and practical workplace behaviour is a structural challenge that requires deliberate pedagogical integration strategies.

K3 as a Core Competence, Value Manifestation, and Indicator of Work Readiness

Within this context, Occupational Safety and Health (K3) occupies a strategic position as a core competence in vocational education. K3 is one of the primary indicators of work readiness among vocational graduates, especially in high-risk industrial sectors such as manufacturing, chemical industries, and petrochemicals. Systematic reviews indicate that K3 knowledge, safety attitudes, and accident prevention skills are positively correlated with job performance, graduate adaptability, and the sustainability of workplace practices (Nurjanah et al., 2022; Sudarsono & Pratama, 2024).

Chatigny (2022) examined occupational health and safety in initial vocational training and found that effective integration of safety education requires moving beyond prescription to genuine internalisation in teaching and learning activities. The study emphasises that safety behaviour among vocational graduates is shaped not only by regulatory compliance but also by the pedagogical approaches through which safety norms are taught and practised, a finding with direct implications for the integration of Pancasila values into K3 instruction. Similarly, Nykänen et al. (2021) demonstrated, through a cluster-randomised trial, that safety skills training and active learning facilitated by engaged teachers constitute the core active ingredients of effective school-based safety programs, confirming that safety competence development requires a structured pedagogical design rather than incidental exposure.

Contextual and simulation-based learning approaches emphasise active engagement, real-world problem solving, and reflective practice, making them particularly effective in shaping sustainable safety behaviour compared to purely lecture-based instruction (Nugraha & Haryanto, 2025). In vocational settings, simulations of workplace hazards, case analyses, and scenario-based training allow students to experience risk identification, decision-making, and procedural compliance in environments that closely resemble actual industrial contexts. This experiential process strengthens not only cognitive understanding of safety standards but also affective dimensions such as responsibility, vigilance, and moral commitment to protecting oneself and others. Consistent with this perspective, research Suparmi et al. (2025) demonstrates that contextual problem-based learning models enhance students' critical thinking, responsibility, and reflective dispositions by situating knowledge within meaningful real-life contexts.

In the developed theoretical framework, K3 is positioned not only as a technical competence but also as a concrete manifestation of values such as responsibility, concern for others, and respect for human dignity embedded in Pancasila. By integrating Pancasila Education into K3 learning, students are guided to understand workplace safety as a moral and social obligation rather than merely a regulatory or administrative requirement. The literature confirms that vocational graduates' work readiness is influenced not only by technical skills but also by safety attitudes, risk awareness, and compliance with work procedures (Gherardi & Nicolini, 2002; Nurjanah et al., 2022). From an educational standpoint, K3 also serves as a medium for value internalisation, as safety practices require discipline, responsibility, concern for others, and respect for human life, all of which align substantively with Pancasila principles.

International research emphasises that a strong safety culture does not emerge solely from technical training, but rather from the systematic integration of values and attitudes from the educational stage onward (Cooper, 2009). The concept of safety citizenship behaviour, as analysed by Tear & Reader (2023) through the lens of social identity theory, further demonstrates that safety culture is fundamentally shaped by collective identity, shared values, and organisational norms. Workers who identify strongly with safety-oriented groups and internalise safety values as part of their professional identity demonstrate significantly higher levels of proactive safety behaviour. This finding implies that effective safety education must cultivate identity-level value internalisation rather than surface compliance, precisely the kind of deep internalisation that Pancasila Education is designed to promote.

Despite its importance, several studies in Indonesia indicate that K₃ learning in vocational education continues to face challenges. K₃ is often positioned as a standalone subject separate from vocational practice, leading students to perceive it as an administrative requirement rather than an inherent component of professional competence (Nurjanah et al., 2022). Limitations in practical facilities, insufficient instructor training in value-based K₃ pedagogy, and weak integration of K₃ into work readiness assessment systems remain major barriers to the sustainable internalisation of K₃.

Implementation of 5S as Work Culture and a Medium for Value Internalisation

As a mechanism for reinforcing work behaviour, the implementation of 5S (*Seiri, Seiton, Seiso, Seiketsu, and Shitsuke*) plays an important role in cultivating industrial work culture within vocational education. Numerous studies indicate that 5S implementation contributes to improved work discipline, reduced accident risk, and the formation of systematic, sustainable work habits (Mirza, 2023). The *Shitsuke* (Sustain) dimension of 5S is particularly significant from a character education perspective, as it represents the formation of disciplined habits through repetitive practice, which is theoretically parallel to the habituation mechanisms described in Aristotelian virtue ethics and contemporary character education theory.

The strength of 5S lies in its practical nature, ease of implementation, and immediate observability in daily activities. Values such as discipline, responsibility, and concern for the work environment, which are taught in Pancasila Education, can be concretely internalised through consistent 5S practices in workshops and laboratories. In this sense, 5S serves as a bridge between normative values and actual work behaviour. Magalhães et al. (2022) in a study on occupational health and safety, confirmed that workplace organisation practices, including 5S-related methodologies, are significantly associated with improved worker safety and health outcomes, underscoring the value of systematic workplace order as a preventive strategy with both technical and behavioural dimensions.

However, the literature also notes that 5S implementation in vocational education is often temporary and unsustainable. Weak institutional commitment, inconsistent evaluation systems, and limited involvement of facilitators and students are common causes (Mirza, 2023). Therefore, integrating 5S into learning systems, assessment frameworks, and institutional culture is a key prerequisite for transforming 5S into a sustainable work culture rather than a short-term program. This sustainability challenge mirrors the broader problem identified by Nykänen et al. (2021) regarding the fidelity of implementation of safety training programs: without consistent delivery by engaged educators and systematic evaluation, even well-designed programs fail to produce lasting behavioural change.

Synergy of Pancasila Education, K₃, and 5S in a Work Readiness Framework

The synthesis of the literature demonstrates a synergistic relationship among Pancasila Education, K₃, and 5S in shaping vocational students' work-readiness. Pancasila Education functions as the foundation of values and character, K₃ as the safety competence, and 5S as the operational work culture that connects values with practice. Theoretically, integrating these three elements forms a holistic work-readiness pathway, beginning with value internalisation (Pancasila), followed by the development of safety awareness and attitudes (K₃), and culminating in disciplined, orderly, and sustainable work behaviours (5S). This framework aligns

with the concept of holistic work readiness, which emphasises the balance between technical competence, work attitudes, and professional character (Wahyuningsih et al., 2023).

The framework draws on the concept of safety citizenship behaviour, as articulated by Tear & Reader (2023) and on social identity theory. Safety citizenship, characterised by voluntary, proactive behaviours that enhance collective safety beyond minimum compliance requirements, represents the behavioural manifestation of the industrial citizenship that this framework seeks to cultivate. When students internalise Pancasila values through deliberate pedagogical integration with K3 and 5S practices, they develop the social identity of safety-conscious industrial citizens whose compliance with safety norms is driven by internalised values rather than external enforcement. This identity-based mechanism is more durable and generalizable than compliance-based approaches, as it persists even when supervision is absent. Khan & Shrivastava (2023) confirm in their bibliometric analysis that the research literature on safety citizenship behaviour consistently emphasises the role of shared values, organisational norms, and collective identity in sustaining voluntary safety behaviours, which is precisely the normative terrain that Pancasila Education is designed to cultivate.

In high-risk industrial contexts, this integration becomes increasingly relevant, as workplace safety must be supported by value consciousness and moral responsibility. The Senkal et al. (2021) study provides comparative international evidence that contextually integrated OHS education in vocational settings produces measurably better safety knowledge, attitudes, and behavioural intentions than traditional standalone safety courses. Their findings reinforce the framework's argument that integration, contextualization, and habituation are the mechanisms through which safety education achieves its formative potential.

Pedagogical Implications, Structural Challenges, and Theoretical Contributions

The pedagogical implications of these findings indicate that Pancasila Education should be contextually integrated into practical courses, K3 instruction, and 5S activities so that national values can be internalised through direct experience. Experiential learning approaches, such as industrial projects, accident simulations, 5S audits, and ethical reflection, are effective in fostering safety awareness and professional responsibility (Kolb, 2015; Nugraha & Haryanto, 2025). Authentic assessment methods, including observation, behavioural rubrics, and practice portfolios, are essential for evaluating the integration of Pancasila values, K3, and 5S (Wahyuningsih et al., 2023).

From a global perspective on vocational education, the challenge of producing work-ready graduates with strong character, a safety culture, and ethical awareness is not unique to Indonesia. Research on vocational identity development Wuttke et al., 2024) establishes that professional and vocational identification processes are key to forming strong commitment to a profession, improving performance, and sustaining career engagement. The industrial citizenship framework proposed in this study contributes to this literature by specifying how value-based civic education (Pancasila), safety culture formation (K3), and behavioural habituation (5S) collectively shape the vocational identity that underpins sustainable professional performance.

Nevertheless, the integration of Pancasila-K3-5S still faces structural challenges, particularly fragmented curricula, limited practical facilities, and uneven educator

competence in linking technical aspects with ethical and industrial citizenship dimensions (Nurjanah et al., 2022). Research by Suharno et al. (2020) identifies that Indonesian vocational education has historically emphasised the delivery of technical skills at the expense of character and professional identity formation, a structural tendency that this framework directly addresses by repositioning Pancasila Education as a central integrative element.

From a theoretical perspective, this article contributes to the field of vocational education by expanding the discourse on work readiness to include national values, industrial ethics, and safety culture. At the same time, it extends the scope of Pancasila and Civic Education from political and social citizenship to industrial citizenship. Thus, Pancasila Education is no longer positioned as a supplementary subject but as a strategic element in developing an industrial workforce characterised by strong character, safety culture, and sustainability orientation. This theoretical contribution bridges the gap identified by Tear & Reader (2023) between safety culture research grounded in organisational psychology and educational frameworks for character and citizenship development, offering a new conceptual lens through which vocational education can be understood and redesigned.

Conclusion

Based on the results and discussion, it can be concluded that work readiness among industrial vocational students is a multidimensional construct that cannot be achieved solely through mastery of technical skills. Pancasila Education plays a strategic role as a foundation of values, work ethics, and industrial citizenship, shaping students' attitudes, moral awareness, and social responsibility in high-risk industrial environments that demand strict safety and discipline standards.

The strengthening of Occupational Safety and Health (K3) is a core competence and a primary indicator of vocational students' work readiness. K3 functions not only as a technical competence but also as a concrete manifestation of Pancasila values, particularly responsibility, concern for others, and respect for human dignity, expressed through safety attitudes, risk awareness, and procedural compliance. This positions K3 as a critical bridge between vocational students' cognitive readiness and affective readiness, consistent with international evidence from Chatigny (2022) and Nykanen et al. (2021) on the importance of pedagogically integrated, values-grounded safety education.

Meanwhile, the implementation of 5S functions as a mechanism for habit formation and work culture development, enabling the sustainable internalisation of values and safety principles. Through 5S practices, normative Pancasila values and K3 principles are translated into disciplined, orderly, and safe work habits within workshops, laboratories, and industrial practice settings.

Overall, the synthesis of findings demonstrates that integrating Pancasila Education, K3, and 5S forms a holistic theoretical framework for work readiness that progresses from value internalisation to the development of a safety attitude and the formation of professional work behaviour. This framework is particularly relevant for high-risk industrial vocational education, as it positions workplace safety as the outcome of value awareness and moral responsibility rather than mere procedural compliance. The concept of industrial citizenship introduced in this study, grounded in safety citizenship behaviour theory (Tear and Reader, 2022; Khan and Shrivastava, 2023) and social identity theory, offers a theoretically robust

and practically applicable reconceptualisation of vocational work readiness for the Indonesian and global context.

Pancasila Education should be repositioned from a normative subject to a strategic element within an integrated vocational education system that incorporates K3 and 5S. Such integration not only enhances graduates' work readiness but also strengthens the development of an industrial workforce characterised by strong character, a safety-oriented culture, and sustainability. Future research is recommended to empirically and longitudinally examine the effectiveness of this theoretical framework across diverse vocational institutions and industrial sectors, particularly through quasi-experimental designs that test the causal relationships among Pancasila value internalisation, K3 competence, 5S habituation, and measured work-readiness outcomes.

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Conflict of Interest

The authors declare no conflict of interest in relation to this study.

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