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CREATIVE AND CRITICAL THINKING SKILLS AND TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) ENTREPRENEURS' SUSTAINABILITY IN THE VOLATILITY, UNCERTAINTY, COMPLEXITY AND AMBIGUITY (VUCA) ERA

Noor Asmida Mohd Saleh[1,2], Shahlan Surat[1*]

[1]Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Malaysia
[2]TVETMARA Kuala Lumpur
noorasmidamohdsaleh85@gmail.com https://orcid.org/0009-0003-6882-2553

[1]Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Malaysia
drshahlan@ukm.edu.my https://orcid.org/0000-0002-0597-4934

*Corresponding Author

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Abstract:

The business sustainability of TVET entrepreneur has become increasingly important as Malaysia continues to strengthen the TVET ecosystem to produce highly skilled graduates and encourage them to venture into entrepreneurship. While TVET programmes are widely recognised for emphasising practical and hands-on competencies, long-term business sustainability requires entrepreneurs to complement technical expertise with higher-order thinking skills, particularly creativity and critical thinking, to make informed decisions, solve complex problems, and adapt to rapidly changing business conditions. Although creative and critical thinking are widely recognised as essential entrepreneurial competencies, empirical evidence explaining how these cognitive capabilities contribute to the sustainability of TVET businesses remains limited. This study therefore examines the relationship between creative and critical thinking skills and business sustainability among TVET entrepreneurs in Malaysia. A quantitative correlational research design was employed, involving 131 TVET entrepreneurs selected through simple random sampling. Data were collected using the Yanpiaw Creative-Critical Thinking Style Test and a sustainability questionnaire based on the Triple Bottom Line framework. Descriptive statistics, Pearson correlation, and one-way analysis of variance (ANOVA) were used to analyse the data. The results showed that the respondents demonstrated relatively high levels of creative and critical thinking skills. However, no significant relationship was found between thinking skills and entrepreneurial

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sustainability. In contrast, sustainability levels differed significantly according to business structure, with enterprise-based businesses reporting higher sustainability than other business forms. These findings suggest that sustaining a TVET business requires more than cognitive capabilities alone and is likely influenced by organisational characteristics, strategic adaptability, and effective business management practices. The study contributes to entrepreneurship and TVET literature by providing empirical evidence on the factors associated with business sustainability and offers practical guidance for educators, policymakers, and entrepreneurship support agencies for designing entrepreneurship education and support programmes that strengthen the long-term sustainability and resilience of TVET businesses in an increasingly uncertain business environment.

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Keyword:

Business Sustainability, Creative Thinking, Critical Thinking, TVET Entrepreneurs, VUCA

Introduction

Technical and Vocational Education and Training (TVET) has been widely recognized as an important driver of economic development and workforce transformation. In Malaysia, TVET is highlighted under the Shared Prosperity Vision (SPV) 2030 as a strategic sector for building a prosperous, inclusive, and competitive nation. Beyond creating employment opportunities, TVET also plays a significant role in promoting skills-based entrepreneurship that contributes to national economic growth.

In line with this agenda, the Deputy Prime Minister and Chairman of the National TVET Council, Ahmad Zahid Hamidi, emphasized during the National TVET Day 2025 celebration that the government is committed to strengthening the development of technopreneurs among TVET graduates. This initiative aims to produce graduates who are not only technically competent but also capable of transforming technical expertise into sustainable business ventures. Furthermore, efforts are being intensified to reshape the mindset of TVET learners so that they are more inclined toward entrepreneurial pathways rather than relying solely on salaried employment.

The identity of TVET entrepreneurs is often associated with a strong orientation toward practical action. This orientation reflects the integration of three essential elements: hearts-on, heads-on, and hands-on which represent passion, cognitive engagement, and technical competence. Mueller et al. (2012) note that entrepreneurs tend to prioritize concrete actions and experimentation rather than prolonged decision-making processes. In the context of TVET entrepreneurship, particularly within a volatile, uncertain, complex, and ambiguous (VUCA)

environment, this action-oriented approach enables entrepreneurs to respond quickly and pragmatically to environmental changes. Nevertheless, practical competence alone is insufficient. Effective entrepreneurial decision-making requires a balance between technical expertise and higher-order cognitive abilities, including creative and critical thinking.

The importance of these thinking skills has become even more evident in the post-COVID-19 era, where entrepreneurs must adapt to rapidly changing market conditions, technological disruptions, and evolving consumer demands. Nor Azaruddin Husni Nuruddin (2021) highlights that entrepreneurs must embrace paradigm shifts in both mindset and lifestyle in order to remain competitive in emerging economic environments. Within the VUCA landscape, business sustainability is closely linked to the ability to make accurate and timely decisions that generate value and maintain competitiveness. Consequently, creative problem-solving and critical evaluation have become essential competencies for entrepreneurs.

Despite their importance, numerous studies indicate that critical thinking skills among TVET students remain relatively underdeveloped. López et al. (2023) and Omar et al. (2022) argue that this issue largely stems from the strong emphasis on practical skill mastery in TVET education, while cognitive development and media literacy receive comparatively less attention. Traditional teaching approaches that rely heavily on lecture-based instruction further limit opportunities for active engagement, creativity, and innovation among students (Fadipe et al., 2021; Wahab et al., 2022). Additional barriers such as fear of assessment and passive learning attitudes also contribute to the limited development of independent thinking skills (Aouaf et al., 2023).

The shift to online learning during the COVID-19 pandemic further intensified these challenges. While digital platforms enabled continuity in education, excessive reliance on them has been associated with declining levels of critical thinking among students (Tommasi et al., 2023). Technological constraints, insufficient teacher preparedness, and language barriers have also been identified as factors that negatively influence students' cognitive development (Aouaf et al., 2023; Cahyaningrum et al., 2022). Moreover, socio-cultural influences and curricula that place limited emphasis on creative thinking continue to reinforce this gap within TVET education (Wahab et al., 2022).

Within technical and vocational disciplines, strong thinking skills are particularly crucial. Many technical professions require individuals who can analyze complex problems, identify root causes, and design effective solutions. Problem-solving competence is therefore regarded as a core capability in technical and vocational fields (Saud, 2021; Ismail et al., 2021). Creative thinking further enhances this competence by enabling individuals to generate innovative solutions aligned with real-world technical challenges (Nordin, 2017). Critical thinking, meanwhile, supports systematic analysis and informed decision-making, allowing individuals to evaluate information and anticipate the consequences of their actions (James et al., 2017).

From an entrepreneurial perspective, the integration of creative and critical thinking plays a crucial role in sustaining business performance. Entrepreneurs operating in uncertain environments must be capable of analyzing complex situations while simultaneously generating innovative strategies (Burk, 2019). Sustainability frameworks also highlight the importance of balanced decision-making. The triple-bottom-line perspective introduced by Elkington emphasizes the need for organizations to balance economic, environmental, and social responsibilities. Similarly, stakeholder theory suggests that businesses must consider the

interests of various stakeholders, including employees, customers, suppliers, and communities (Freeman et al., 2006). These perspectives underline the importance of responsible and strategic decision-making for long-term organizational viability.

In addition, organizations that promote innovation, experimentation, and creative problem-solving tend to demonstrate greater resilience in uncertain environments (Sarkar, 2016; Hepner, 2019). Evans and Bahrami (2020) highlight the importance of rapid strategic decision-making during crises, while Horney et al. (2010) emphasize organizational agility as a key capability for navigating VUCA conditions. These insights suggest that cultivating both creative and critical thinking skills is essential for enabling entrepreneurs to respond effectively to uncertainty and sustain their ventures.

Although creativity, critical thinking, and entrepreneurship have been widely discussed in previous studies, little is known about how these cognitive skills contribute to the long-term sustainability of TVET-owned businesses, particularly within the challenges of a VUCA environment. This issue is becoming increasingly relevant as Malaysia continues to strengthen its TVET agenda to produce a highly skilled workforce while encouraging more graduates to pursue entrepreneurship. Although TVET education has traditionally focused on developing practical and technical competencies, sustaining a business requires entrepreneurs to go beyond technical expertise. They must also be able to think critically, generate innovative solutions, and make sound decisions in response to changing market conditions. Technical competence helps entrepreneurs start a business, but cognitive competence helps them sustain it.

In general, this study focuses on three main research objectives, namely; (i) To identify the level of creative and critical thinking skills among TVET entrepreneurs in the VUCA era, (ii) To examine the differences between creative and critical thinking skills and the sustainability of TVET entrepreneurs based on their business structures and (iii) To analyze the relationship between creative and critical thinking skills and the sustainability of TVET entrepreneurs.

Despite the growing recognition of these competencies, empirical studies examining the relationship between creative and critical thinking skills and the business sustainability of TVET entrepreneurs remain limited, particularly within the Malaysian context. Existing research has largely focused on student learning outcomes or general entrepreneurial competencies, while the role of thinking skills in supporting the sustainability of TVET-based businesses has received comparatively less attention. Therefore, this study aims to examine the level of creative and critical thinking among TVET entrepreneurs and to explore how these competencies influence the sustainability of their businesses within a VUCA environment. By addressing this gap, the study seeks to contribute to the understanding of entrepreneurial capability development in TVET and provide insights that may inform educational practices, entrepreneurial training programs, and policy initiatives in Malaysia.

Literature Review

There are five points will be discussed in Literature Review which are VUCA Era, Entrepreneurial Sustainability, Creative Thinking Skill and Critical Thinking Skill.

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

VUCA Era

VUCA is an acronym for Volatility, Uncertainty, Complexity, and Ambiguity. The term was introduced by the U.S. Army War College in the early 1990s to describe the unpredictable conditions of the post–Cold War world. The concept was later expanded into the fields of management and business by Bennett and Lemoine (2014), who emphasized that organizations must be both strategic and flexible to navigate rapid and destabilizing changes. According to Gandhi (2017), VUCA has become the "new normal" in the business landscape, requiring organizations to be continuously prepared for disruptions and uncertainty.

Each VUCA component represents a distinct challenge:

- Volatility: Rapid and unpredictable changes (e.g., economic crises, market fluctuations).
- Uncertainty: Difficulty in predicting future outcomes (e.g., technological disruptions, emergence of new competitors).
- Complexity: Multiple interconnected factors that influence decision-making (e.g., global supply chains).
- Ambiguity: Situations with unclear meanings or outcomes (e.g., new industries, unknown risks).

To address these challenges, organizations must engage in continuous analysis, trend monitoring, and proactive strategic planning. The capability to navigate VUCA environments ultimately determines long-term business sustainability. Therefore, creative and critical thinking skills are essential competencies for ensuring business sustainability within VUCA conditions.

Entrepreneurial Sustainability

The 2030 Agenda for Sustainable Development, adopted by United Nations member states, outlines 17 Sustainable Development Goals (SDGs) addressing key global sustainability issues. These goals aim to promote prosperity for both people and the planet, now and in the future.

According to the European Sustainable Investment Forum (Eurosif), socially responsible investment—also known as sustainable or responsible investment—is an investment approach that integrates financial objectives with environmental, social, and governance (ESG) criteria. Vitor (2019) explains that sustainable investment combines financial goals with a broad spectrum of non-financial indicators. ESG-driven investment incorporates fundamental analysis and ESG assessments to achieve optimal long-term returns while influencing companies toward more responsible practices.

Sustainability promotes a community-oriented vision, prioritizing prudent resource use to ensure strong economic stability while preserving ecological integrity and systemic harmony. Embedding sustainability principles into investment strategies enhances long-term resilience and can increase competitiveness through cost efficiency, risk reduction, consumer alignment, resource optimization, and fiscal incentives.

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

The Global Entrepreneurship Monitor (GEM) reports that experienced entrepreneurs in Romania place high importance on sustainable entrepreneurship by prioritizing social (71.25%) and environmental (82.33%) considerations at rates exceeding those of middle-income economies and the overall GEM average. A large proportion of experienced entrepreneurs (67.98%) believe that social and/or environmental impacts should take precedence over profit-driven or business-expansion objectives. In contrast, Poland shows considerably lower proportions in these categories.

These findings indicate that organizations practicing sustainable investment are better equipped to manage sudden changes in VUCA environments. This is because striking a balance between economic growth, environmental stewardship, and human well-being encourages entrepreneurs to develop innovative solutions or explore new business opportunities. Consequently, creative and critical thinking skills are highly relevant in addressing sustainability-related challenges.

Creative Thinking Skills

According to Mohd and Hassan (2000), creative thinking is characterized by the ability to view situations from multiple perspectives, leading to various possible approaches for accomplishing tasks. When thinking creatively, individuals generate diverse perceptions, concepts, ideas, problem-solving strategies, conflict-resolution methods, inventions, and more. DeGraff and Lawrence (2002) describe creativity as a core competency involving the generation of new ideas and innovative solutions. Creative individuals typically possess high curiosity, risk-taking tendencies, self-confidence, and divergent thinking abilities. Runco (2008) and Sumarwati & Jailani (2011) assert that creativity results in original and useful ideas, while Green (2001) conceptualizes creativity as a thinking process that helps produce new solutions. Yee et al. (2011) highlight that creative ideas are essential for decision-making, whereas Idris (2006) explains that the creative mind links activities with imagination to interpret situations in exceptional ways.

Every individual has the potential to develop creativity, depending on their experience and depth of knowledge. Thus, TVET entrepreneurs should expand their experiences and knowledge to sharpen their creative capacities.

Critical Thinking Skills

Critical thinking involves the ability to evaluate information rationally and logically, draw inferences, and make evidence-based decisions. Zaharah Hussin (2005) and Sulaiman (2021) define critical thinking as the capacity to assess the validity of ideas and make judgments grounded in factual evidence. It includes skills such as evaluating arguments, solving problems, and avoiding misinterpretations or errors (Cheah & Hiew, 2022). Zulkifeli and Ishar (2022) emphasize the importance of critical thinking in technical and vocational fields, especially as entrepreneurs frequently encounter complex problems requiring deep analysis and prompt decisions.

Problem-solving requires integrating both critical and creative thinking. According to Saud (2021), critical thinking enables individuals to analyze information, identify root causes, and make evidence-based decisions. Mita et al. (2019) stress the importance of accurately identifying problems, while Umam (2018) views critical thinking as a tool for evaluating

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

alternative solutions. Individuals with strong critical thinking skills can assess the strengths and weaknesses of various options, make rational decisions, and learn from prior actions (Ahmatika, 2017). Azli (2018) highlights that creative thinking is essential for generating innovative and "out-of-the-box" solutions.

In technical fields, practical skills must be complemented by strong problem-solving abilities that use appropriate tools and techniques (Nordin, 2017). Thus, critical thinking in such contexts involves creativity in addressing technical challenges, analytical thinking to examine issues from various perspectives (Zhaffar et al., 2018), and sound decision-making grounded in factual evidence (Kartheges, 2017).

Conceptual Framework

The conceptual framework of this study illustrates the relationship between several variables used in the research, as presented in Figure 1. The figure shows the relationship between two independent variables, namely creative thinking skills and critical thinking skills, and the dependent variable, which is the sustainability of TVET entrepreneurs.

In this study, the conceptual framework is developed based on the assumption that creative and critical thinking skills play an important role in ensuring the sustainability of TVET entrepreneurs. These skills enable entrepreneurs to adapt to the challenges of the VUCA era, make strategic decisions, and identify innovative solutions in their business activities. Therefore, this study examines the direct relationship between the level of creative and critical thinking and the level of sustainability among entrepreneurs in the TVET sector.

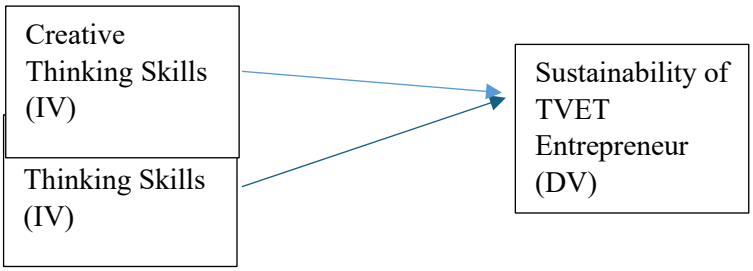

Figure 1: Relationship Between Two Independent Variables, Namely Creative Thinking Skills and Critical Thinking Skills, And the Dependent Variable, Which Is the Sustainability of TVET Entrepreneurs.

Methodology

We conducted a cross-sectional survey using stratified random sampling across eight MARA IKM/KKTM colleges. The final sample comprised n = 131 TVET entrepreneurs spanning multiple technical fields (e.g., air-conditioning; electrical & electronics).

Creative–Critical Thinking: Yanpiaw Creative–Critical Thinking Style Test (34 items) yielding categorical profiles: creative, critical, balanced, superior-creative, superior-critical.

Entrepreneurial sustainability in this study refers to the entrepreneur's ability to maintain and develop business performance over time in response to economic, social, and environmental challenges. Business sustainability was measured using an 11-item questionnaire adapted from

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

a previously validated instrument based on the Triple Bottom Line (TBL) framework, encompassing the economic (profit), social (people), and environmental (planet) dimensions of sustainability. The instrument assesses respondents' perceptions of sustainability practices and outcomes within their businesses rather than objective financial performance. All items were measured using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The instrument has been widely applied in entrepreneurship and sustainability research and demonstrated satisfactory validity and reliability in previous studies.

The Triple Bottom Line framework was selected because it provides a comprehensive assessment of business sustainability by considering not only financial performance but also social responsibility and environmental stewardship. This multidimensional perspective is particularly relevant for TVET entrepreneurs, whose business sustainability extends beyond economic success to include responsible and sustainable business practices.

Data analysis employed SPSS for descriptive statistics, one-way ANOVA (sustainability by business structure), and Pearson correlation (thinking vs. sustainability). Normality checks (skewness and kurtosis within ±1.0) supported parametric testing; significance was set at $\alpha = 0.05$.

Findings

Descriptive Analysis

Respondents were predominantly male and young-to-mid-career; most held certificate or diploma qualifications and operated under enterprise structures typical of micro/small ventures. The business structure variable was classified into three categories: sole proprietorship, private limited company and others. This classification was used to examine whether differences in entrepreneurial sustainability existed across different forms of business ownership. These structures are chosen because most TVET entrepreneurs run the business under these types of business structures.

Major fields included air-conditioning (32.1%) and electrical & electronics (23.7%) as shown in table 1 while descriptive analysis (SPSS) show a moderately high level of critical thinking (mean = 6.05), balanced thinking style (mean = 5.11) and creative thinking (mean = 4.36) as shown in table 2.

Table 1: Sample Characteristics (n = 131)

Variable	Categories	Percentage
Age	<20	21.4
	21–30	33.6
	31–40	30.5
	41–50	14.5
Gender	Male	68.7
	Female	31.3
Highest qualification	Certificate	19.8
	Diploma	74.0
	Bachelor	4.6

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

	Master	1.5
Field (top)	Air-conditioning	32.1
	Electrical & Electronics	23.7
Structure	Enterprise	74.0
	Sdn Bhd	18.3
	Others	7.7

Table 2: Yanpiaw Score (Descriptive Statistics)

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Balanced Thinking Style	53	5	6	5.11	.353	-.557	.327	-1.094	.644
Valid N (listwise)	53								

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Creative Thinking Style	17	3.90	4.80	4.3647	.24223	-.129	.550	.821	1.063
Valid N (listwise)	17								

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Critical Thinking Style	61	5.60	7.10	6.0508	.40687	.905	.306	-.052	.604
Valid N (listwise)	61								

Inferential Analysis

One-way ANOVA indicates there is significant differences in sustainability by business structure **F (2,128) = 4.197, p = .017** as show in table 3.

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

Table 3: ANOVA — Sustainability by Business Structure

Descriptives								
Score								
					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Enterprise	97	5.470395280886490	.709654936714407	.072054541856111	5.327368145728201	5.613422416044779	3.909090909090909	7.000000000000000
Sdn. Bhd	24	5.560754604872252	.703585067088600	.143618700417412	5.263656687255299	5.857852522489205	4.272727272727273	7.060606060606061
Others	10	4.990909090909090	.625404851031784	.197770378897874	4.543521411695949	5.438296770122232	4.272727272727273	6.176470588235294
Total	131	5.450347661618431	.710876294795903	.062109550254735	5.327471344403363	5.573223978833499	3.909090909090909	7.060606060606061

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Score	Based on Mean	.086	2	128	.918
	Based on Median	.131	2	128	.877
	Based on Median and with adjusted df	.131	2	127.035	.877
	Based on trimmed mean	.071	2	128	.931

ANOVA					
Score					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.442	2	1.221	2.471	.089
Within Groups	63.252	128	.494		
Total	65.695	130			

Correlation Analysis

Pearson correlation reveals in table 4 that there is no significant relationship between creative, critical, and balanced thinking styles and the sustainability of TVET entrepreneurs. The results revealed that **Balanced Thinking Style was not significantly correlated with Sustainability (**$r = -0.115$, $p = .414$). This indicates that balanced thinking does not have a statistically significant association with sustainability in this sample. Similarly, **Creative Thinking Style showed no significant relationship with Sustainability** ($r = 0.052$, $p = .842$), suggesting that creative thinking does not meaningfully influence sustainability outcomes among the respondents. Furthermore, **Critical Thinking Style was also not significantly related to Sustainability** ($r = -0.079$, $p = .547$), indicating that higher levels of critical thinking are not associated with higher sustainability levels in this study.

International Journal of Entrepreneurship and Management Practices
IJEMP
EISSN : 2600-8750
Volume 9 Issue 34 (June 2026) PP. 603-620

Table 4: Correlation — Thinking style vs. Sustainability

Correlations		MIN sustainability
Balanced Thinking Style	Pearson Correlation	-.115
	Sig. (2-tailed)	.414
	N	53
Creative Thinking Style	Pearson Correlation	.052
	Sig. (2-tailed)	.842
	N	17
Critical Thinking Style	Pearson Correlation	-.079
	Sig. (2-tailed)	.547
	N	61
MIN sustainability	Pearson Correlation	1
	Sig. (2-tailed)	
	N	131

Sustainability (Item-Level Summary)

High agreement across community contribution, employee welfare, and long-term partnerships. Profit dimension items (profitability, customer attraction/retention, competitiveness) were positively endorsed. Environmental practices and green technology adoption registered moderate endorsement with many neutral responses, suggesting capability/cost barriers among micro and small ventures.

Discussion

Level Of Creative and Critical Thinking Skills Among TVET Entrepreneurs

The descriptive analysis of thinking styles provides important insights into the distribution, tendency, and consistency of respondents' cognitive patterns, particularly in terms of balanced, creative, and critical thinking.

For balanced thinking style, the results indicate a relatively high mean score (M = 5.11, SD = 0.35), suggesting that respondents generally perceive themselves as possessing a good ability to integrate different perspectives in decision-making. The skewness value (-0.557) indicates a slight negative skew, meaning that responses are concentrated towards the higher end of the scale. This suggests that most respondents rated themselves highly in balanced thinking. The kurtosis value (-1.094) reflects a platykurtic distribution, indicating a relatively flatter distribution with greater variability across responses.

In terms of creative thinking style, the mean score (M = 4.36, SD = 0.24) is moderately high, suggesting that respondents demonstrate a reasonable level of creativity. The skewness value (-0.129) is close to zero, indicating a fairly symmetrical distribution of responses. Meanwhile, the kurtosis value (0.821) suggests a slightly leptokurtic distribution, indicating that responses

are more concentrated around the mean. This reflects a relatively consistent perception of creative thinking among respondents, although the small sample size (N = 17) should be considered when interpreting these results.

For critical thinking style, the findings show the highest mean score among the three constructs (M = 6.05, SD = 0.41), indicating that respondents perceive themselves as strong in analytical and evaluative thinking. The skewness value (0.905) indicates a positive skew, suggesting that some respondents rated themselves lower, but the majority still fall within the higher range. The kurtosis value (-0.052) indicates a distribution close to normal, suggesting a balanced spread of responses.

Overall, the descriptive findings suggest that respondents tend to report relatively high levels of all three thinking styles, particularly critical thinking. However, the variations in skewness and kurtosis indicate differences in how these thinking styles are distributed across respondents. Balanced and creative thinking appear more consistently rated, while critical thinking shows slightly more variability. Based on the Yanpiaw Creative-Critical Thinking Style Test, which employs a seven-point scale, the mean score of 6.05 indicates a moderately high level of critical thinking among TVET entrepreneurs.

These findings support the view of Facione (2011) that critical thinking skills must be continuously developed and do not emerge automatically without structured and deliberate intervention. Bruyat and Julien (2005) describe entrepreneurs as individuals who not only initiate changes within their environment but are also influenced by those changes. They emphasize that entrepreneurship cannot exist without entrepreneurs, and that the creation of new ventures represents the outcome of entrepreneurial action while simultaneously forming part of the environment that shapes the entrepreneur. This perspective highlights that creative and critical thinking skills are not static traits but rather capabilities that evolve continuously through ongoing interaction with the surrounding environment.

Inferential Analysis of Creative and Critical Thinking Skills and Business Sustainability Based on Business Structure

The findings indicate that sustainability levels differ significantly according to business structure. Entrepreneurs operating under enterprise structures reported higher sustainability scores than those operating under other forms of business ownership. This suggests that business structure may influence an entrepreneur's ability to maintain and develop business performance over time.

One possible explanation is that enterprise-based businesses tend to be more flexible and less constrained by formal administrative procedures. Such flexibility enables entrepreneurs to respond more quickly to market changes, adjust strategies, and make timely decisions in uncertain business environments.

This finding is consistent with Bennett and Lemoine (2014), who argued that organisations operating in a VUCA environment must remain agile and adaptable to cope with rapid and unpredictable changes. The higher sustainability scores observed among enterprise-based businesses may therefore reflect their greater capacity to respond effectively to emerging challenges and opportunities.

A similar perspective was offered by Gandhi (2017), who described VUCA conditions as the "new normal" of contemporary business environments. Under such circumstances, organisations that are able to adapt quickly are generally better positioned to sustain performance over time. Compared with more formalised business structures, enterprise-based businesses may benefit from fewer bureaucratic constraints, allowing faster responses to environmental uncertainty.

Nevertheless, the findings should be interpreted cautiously. Although the ANOVA results indicated significant differences in sustainability across business structures, post hoc analysis was not performed due to the relatively small number of respondents in the "Others" category (n = 10). As a result, the specific groups responsible for the observed differences could not be determined conclusively.

Overall, the findings suggest that business structure represents one factor associated with entrepreneurial sustainability. However, sustainability in a VUCA environment is likely influenced by a combination of factors, including adaptability, strategic decision-making, resource management, and the entrepreneur's ability to translate ideas into effective action.

Correlation Analysis Between Thinking Skills and Sustainability

The findings of this study indicate that there is no significant relationship between creative, critical, and balanced thinking styles and the sustainability of TVET entrepreneurs. Although theoretical perspectives suggest that thinking abilities play an important role in decision-making and problem-solving, the results of this study imply that these cognitive factors do not directly determine business sustainability. The findings suggest that creative and critical thinking styles alone may not be sufficient predictors of entrepreneurial sustainability among TVET entrepreneurs. Other factors such as business experience, access to resources, market conditions, and organisational support may also contribute to sustainable entrepreneurial performance.

This finding suggests the existence of a gap between cognitive ability and execution capability among entrepreneurs. In the context of TVET, entrepreneurs may possess the ability to think creatively and critically; however, such abilities are not necessarily translated into effective strategic actions in managing their businesses.

Furthermore, this result can be explained within the context of the VUCA environment (Volatility, Uncertainty, Complexity, and Ambiguity), which requires not only the ability to think, but also the ability to act quickly, adapt flexibly, and respond effectively to changes. Heunks (1998) claims that creativity alone does not guarantee superior performance or sustainability unless it is supported by effective execution and sound decision-making. Evans and Bahrami (2020), through their case study on Fabrinet, emphasized the importance of rapid and strategic decision-making during crisis situations. Horney et al. (2010) further suggested that leaders should develop organizational agility in order to remain relevant in a VUCA world. Consistent with this perspective, the findings of the present study indicate that the creative and critical thinking skills of TVET entrepreneurs contribute positively to sustainability only when they are translated into strategic actions and sustainable management practices. Critical thinking serves an essential role in evaluating, filtering, and refining creative ideas to ensure their relevance and feasibility in real-world business contexts. Thus, in a VUCA environment,

critical thinking emerges as a key mechanism linking creativity to sustainable business outcomes.

From a theoretical perspective, the findings extend Human Capital Theory by demonstrating that creative and critical thinking skills alone may not be sufficient to explain entrepreneurial sustainability among TVET entrepreneurs. While cognitive capabilities remain important, sustainability outcomes appear to be influenced by additional factors such as business structure, adaptability, resource availability, and execution capability. The findings also support the Resource-Based View (RBV), which emphasizes that valuable knowledge and skills only contribute to sustainable competitive advantage when they are effectively transformed into strategic actions and business practices.

Implications

The implications of this study can be viewed from three key perspectives: curriculum and pedagogy in TVET, ecosystem and policy development, and entrepreneurial practice.

Curriculum and Pedagogy in TVET

The findings of this study suggest that TVET education should be designed to expose students to dynamic and uncertain environments that reflect real business conditions, particularly within the context of VUCA. This includes embedding experiential learning, industry engagement, and iterative practice into the curriculum to strengthen students' ability to adapt, respond, and sustain their ventures over time.

Furthermore, the integration of business structure awareness into entrepreneurship education is equally important, as the findings indicate that structural factors may influence sustainability outcomes. Students should not only be trained to generate ideas, but also to organize, manage, and strategically position their businesses within appropriate structural frameworks.

Ultimately, a shift towards a holistic pedagogical model one that integrates cognitive, behavioral, and managerial competencies is crucial in developing resilient and sustainable TVET entrepreneurs. Such an approach ensures that students are not only capable of thinking effectively, but are also equipped to act, adapt, and thrive in increasingly complex and competitive business environments.

Ecosystem and Policy Implications (MARA and Related Agencies)

The findings of this study provide valuable insights for policymakers and educational institutions in designing more effective entrepreneurship training programs. TVET institutions, in particular, should adopt a more integrated approach that combines cognitive skill development with practical exposure and real-world business experiences.

This includes embedding experiential learning, industry collaboration, and problem-based learning into the curriculum to better prepare students for the challenges of the VUCA environment. A more comprehensive approach is essential to develop resilient and sustainable entrepreneurs.

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Implications for Entrepreneurial Practice

From a practical perspective, the findings indicate that entrepreneurship development programs, particularly within TVET institutions, should not focus solely on enhancing thinking skills. While cognitive development remains important, greater emphasis should be placed on execution and implementation skills, business management capabilities and adaptability in dynamic environments.
In addition, the findings highlight the importance of selecting an appropriate business structure, as it may influence sustainability outcomes. Entrepreneurs should be guided not only in developing ideas but also in structuring and managing their businesses effectively.

Limitations And Future Research

This study has several limitations that should be acknowledged. The cross-sectional design of the study limits the ability to establish causal relationships between variables. The findings reflect associations at a single point in time and do not capture changes in entrepreneurial behavior or sustainability over time.

Future research should consider employing longitudinal or mixed-methods research designs to provide a more comprehensive understanding of the relationship between creative and critical thinking skills and entrepreneurial sustainability. The use of objective performance indicators, such as financial performance, operational efficiency, or environmental impact metrics, may also help strengthen the validity of future findings. In addition, future studies could examine the effectiveness of targeted interventions, such as venture studio programs, entrepreneurship incubators, or metacognitive training initiatives, in enhancing entrepreneur sustainability to react in VUCA era.

Conclusion

This study examined whether creative and critical thinking skills are associated with the sustainability of TVET entrepreneurs operating in a VUCA environment. The findings showed that although respondents generally demonstrated relatively high levels of creative and critical thinking, these competencies were not significantly associated with entrepreneurial sustainability. This suggests that cognitive abilities alone may not be sufficient to sustain business performance unless they are supported by effective implementation, strategic decision-making, and adaptive capabilities.

In contrast, business structure was found to be associated with differences in sustainability, indicating that organisational characteristics may influence how entrepreneurs respond to changing business conditions. This finding reinforces the importance of considering structural and managerial factors alongside individual competencies when promoting entrepreneurial sustainability.

Overall, the study contributes to the understanding of business sustainability within the TVET entrepreneur context by demonstrating that sustainable business performance is shaped by multiple interacting factors rather than by thinking skills alone. These findings provide useful insights for entrepreneurship educators, policymakers, and support agencies in designing programmes that integrate cognitive development with practical entrepreneurial capabilities to better prepare entrepreneurs for increasingly dynamic and uncertain environments.

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Declaration of Generative AI and AI-assisted Technologies in the Manuscript Preparation Process

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist with language editing, grammar improvement, sentence refinement, and enhancing the overall readability of the manuscript. All AI-generated outputs were carefully reviewed, revised, and verified by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the content presented in this manuscript.

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Ethics Statement:	This study was conducted in accordance with ethical research standards. All procedures involving human participants were reviewed and approved by Bahagian Kemahiran dan Teknikal MARA. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and anonymity. The data collected were used solely for academic purposes.
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