

How entrepreneurial orientation drives firm performance: The mediating roles of process innovation and information technology (IT) infrastructure

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Abstract

This study investigates how entrepreneurial orientation (EO) enhances firm performance (FP) within the Malaysian logistics industry. The research seeks to address the "IT Productivity Paradox", a phenomenon where substantial technological investments do not consistently translate into improved organisational performance. To explore this issue, the study draws upon the theoretical foundations of the Diffusion of Innovations Theory and the Dynamic Capabilities Theory. A model is suggested in which process innovation (PI) and IT infrastructure (ITI) serve as primary mediators in the relationship between entrepreneurial orientation and firm performance. The research employed a quantitative methodology and purposive sampling through surveys conducted with 406 Malaysian logistics firms in Klang Valley and Johor, where 90.33% of logistic activities in Malaysia are reported from these areas. The results were analysed using Statistical Package for Social Sciences (SPSS) for descriptive statistics and Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the hypothesised relationships. The findings revealed several key insights. Both entrepreneurial orientation and process innovation were found to have a significant positive impact on firm performance. In contrast, the direct effect of IT infrastructure on firm performance was not statistically significant. Nevertheless, both process innovation and IT infrastructure functioned as significant mediators in the entrepreneurial orientation-firm performance relationship, with process innovation demonstrating a stronger mediating effect. This research contributes to the academic literature by empirically demonstrating that IT does not generate value in isolation because it requires the complementary influence of an entrepreneurial mindset and innovative internal processes. For practitioners, the study offers clear managerial implications. To achieve greater returns on technology investments, managers should prioritise cultivating an entrepreneurial culture and fostering process innovation in their firms.

Keywords: Entrepreneurial Orientation, Market Orientation, Process Innovation, IT Infrastructure, Firm Performance, Logistics Industry.

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1. Introduction

In Malaysia, the logistics industry plays a pivotal role. It supports the national economy and enhances the country's competitiveness [1]. Rapid speeds and intense competition characterise this sector. Consequently, logistics firms are under considerable pressure to continuously improve their operational performance [2,3]. With the proliferation of digital technology in this industry, a company's digital presence and brand equity have become increasingly crucial [4]. To address these challenges, many logistics firms increase their investments in two key areas. On one hand, they focus on enhancing tangible assets, such as Information Technology (IT) infrastructure. On the other hand, they also work on intangible capabilities, for example, process innovation (PI). However, a significant problem persists. Despite these substantial expenditures, it is not always apparent whether such investments truly enhance performance. This situation creates a considerable dilemma for both industry leaders and academic researchers. They question whether the outcomes justify the effort.

The challenge of translating IT investment into tangible and measurable improvement is not a new phenomenon. The field of strategic management has extensively discussed this topic. Many scholars refer to this issue as the “IT Productivity Paradox” [5]. This paradox describes a situation where, despite significant expenditures on digital technologies, firms do not consistently experience clear performance gains [5]. Most researchers concur that IT systems alone cannot guarantee success. Technology, by itself, is insufficient. Its true value only emerges when organisations use it in combination with other critical elements. These include robust business processes and effective leadership [6].

In addition, this study tries to fill an important gap in the research. It focuses specifically on how organisational and dynamic capabilities help firms obtain the full benefits of their IT investments. The argument of this research is that entrepreneurial orientation (EO) is a critical capability in this regard. Entrepreneurial orientation means more than just generating ideas. It shows how much a company is ready to take risks, to innovate, and to move ahead before others. The paper suggests that entrepreneurial orientation plays an important role in improving firm performance (FP). But the impact is not only direct. More importantly, entrepreneurial orientation works through two main pathways. These are process innovation and IT infrastructure (ITI). Many recent studies support this thinking. They explain that entrepreneurial orientation helps companies to strengthen other areas, like knowledge sharing and managing information more effectively [7,8]. Usually, a firm with a strong entrepreneurial orientation builds better internal systems and uses its technology more wisely. That is how performance increases [9]. When a firm puts innovation together with IT strategies, performance results are generally stronger than focusing only on one part [10]. These ideas are similar to previous research that highlights how entrepreneurial orientation, firm flexibility, market conditions, and innovation are strongly linked with firm growth [11].

Therefore, this research makes a novel contribution by integrating the Diffusion of Innovations Theory with the Dynamic Capabilities Theory, providing a more

comprehensive framework for understanding technology adoption and value creation. This study provides evidence that entrepreneurial orientation, as a dynamic capability, acts in concert with an innovation-related capability (process innovation) and a tangible technical resource (IT infrastructure) to enhance firm performance. By explaining this relationship, this study offers practical guidance to managers in the Malaysian logistics industry. The research findings indicate how to achieve better returns from their IT spending. However, the connection requires them to cultivate an entrepreneurial culture that can translate digital tools into a tangible competitive advantage. The remainder of this paper is organised as follows. First, this study reviews the literature and develops the hypotheses. Next, the methodology is described, followed by the results. Finally, this study concludes with a discussion of the implications of the findings.

2. Literature Review and Hypothesis

This study begins by reviewing the contemporary literature on the key constructs to build and test a theoretical model. First, the review examines the core variables, such as firm performance, entrepreneurial orientation, process innovation, and IT infrastructure, before synthesising them within a formal theoretical framework to develop the study's research hypotheses.

2.1 Performance in the Digitalising Logistics Industry

Firm performance, the ultimate dependent variable in strategic management research, is a multi-dimensional construct encompassing both financial metrics, such as profitability, and non-financial indicators, such as customer satisfaction and operational efficiency. In the context of the global economy, the logistics sector in Southeast Asia has become a critical and intensely competitive arena, with digitisation trends reshaping the landscape for all industry players [12]. In this environment, competitive advantage is increasingly derived from a firm's digital presence, where factors such as the quality of digital interactions and the resulting brand equity are now significant determinants of customer loyalty and a firm's market position [4].

In today's complex business environment, many firms leverage innovation as a primary means to achieve enhanced performance. This is not surprising, as various studies indicate that when companies simultaneously enhance product, process, and marketing, they typically outperform those focusing on only one dimension [10]. The strategy of integrating various innovation types yields more robust results. Furthermore, specific types of innovation often directly link to financial outcomes. However, the mere intention to innovate is insufficient. Often, a significant challenge is that firms cannot fully realise the benefits of their strategies. This is because their organisational and technological capabilities are occasionally inadequate. These gaps impede the realisation of benefits. Even modern practices like reverse logistics can fail to yield desired outcomes if these deficiencies persist [13]. Therefore, understanding which organisational capabilities can help overcome obstacles is essential, especially for firms seeking to remain competitive.

2.2 Entrepreneurial Orientation as a Strategic Driver

In the academic literature, entrepreneurial orientation is regarded as one of the most critical internal capabilities a firm can develop. Encompassing more than just ideas, entrepreneurial orientation reflects a company's strategic mindset, demonstrating a readiness to innovate, act proactively, and take calculated risks [14]. This type of mindset often enables a firm to advance, even in challenging environments. Numerous researchers, including several large-scale meta-analyses, have provided strong evidence that entrepreneurial orientation is positively correlated with both innovation and enhanced long-term performance [15]. Consequently, firms often perceive entrepreneurial orientation as a mechanism that enhances organisational resilience, allowing them to persevere and prosper when others may falter. However, the influence of entrepreneurial orientation does not always operate directly. Other factors within the company often moderate its effect. For example, the conduct of the entrepreneurial team or the presence of transformational leaders can alter the impact that entrepreneurial orientation has on firm outcomes [16]. Thus, it is not only entrepreneurial orientation but also the surrounding organisational context that determines the full picture.

In the context of digital technology, entrepreneurial orientation also exerts a significant influence. Firms with an entrepreneurial culture are typically more receptive to adopting new IT tools. As a result, these IT tools contribute to the enhanced performance of firms [17]. This trend is particularly evident in digital businesses, where researchers have explored the concept of “digital entrepreneurial orientation”. In this context, a two-step process enhances firm performance. Initially, the company cultivates the ability to assimilate novel technologies. Subsequently, it leverages this capacity to drive technological innovation [9]. However, entrepreneurial orientation does not operate in isolation. A company's high level of digital maturity amplifies the impact of entrepreneurial orientation. This leads to a synergistic effect. When entrepreneurial orientation and digital maturity are combined, they propel the firm toward its sustainability targets [18]. Thus, entrepreneurial orientation is not merely a standalone component; rather, it is a foundational capability. It helps firms to grow directly while also orchestrating the deployment of their digital and innovation-related resources.

2.3 The Role of Process Innovation and IT Infrastructure

While a company's strategic direction shows where it wants to go, the actual execution, what makes that strategy work, depends more on the operational and technological skills the firm can use. This section will focus on two key mediators used in this study: process innovation and IT infrastructure. By definition, process innovation involves the implementation of new or significantly improved methods for the production, delivery, or support of products [19]. This method is more than just a change in technology. It serves as a bridge that helps the firm move from strategic thinking to achieving real results in both operations and finance. Many researchers have found strong evidence that firms that manage process innovation well also tend to perform better financially [20]. But it is not only about money. When firms in the supply chain collaborate on process innovations, it also

improves operations. For instance, the reduction of challenges such as demand fluctuations and the bullwhip effect is achievable [21].

In contrast to process innovation, which focuses on the improvement itself, IT infrastructure is more about the digital foundation that makes innovation possible. Initially, the focus was mostly on hardware and infrastructure. But now, research is looking more closely. IT infrastructure today means a company's ability to acquire, use, and benefit from its technology tools in a way that helps achieve business goals. Digitalisation has blurred the boundaries between tangible and intangible flows by incorporating the movement of physical goods with the information, data, and knowledge that support operational efficiency and decision-making [22]. This convergence helps the firm enhance competitiveness, drive innovation, and create greater value [22].

Studies indicate that IT infrastructure is not just useful but necessary. It provides support for other parts of the business that create value. For example, when a firm has strong IT capabilities, it can better utilise its knowledge assets and achieve more innovation [23]. Furthermore, when IT supports knowledge management, it helps connect IT with performance results, serving as a mediating pathway [24]. This perspective helps explain why IT spending does not always lead directly to value. IT itself is not always the engine. Instead, it empowers other parts that drive the business. This idea is now evident in many areas. For instance, information systems (IS) can help firms adopt circular economy models [25], and when artificial intelligence (AI) is integrated with information systems, it helps build supply chains that are both high-performing and sustainable [6]. Therefore, IT capability is not the final product, but it is such as a foundation that becomes powerful when integrated with other internal processes.

2.4 Theoretical Framework and Hypothesis Development

After reviewing the contemporary literature, a narrative emerges that is both complex and possesses clear interconnections. Many authors have shown that entrepreneurial orientation serves as a powerful strategic factor, driving companies to adopt new technologies and actively pursue innovation [9,17]. In contrast, process innovation demonstrates a more direct influence, exhibiting a strong and straightforward correlation with firm performance [20]. When considering IT capability, the situation becomes more nuanced. IT capability alone does not generate value, and its true impact is only manifested when it is bolstered by other internal systems and processes [25,6]. To explain how these different elements interact, this study uses two complementary theories, which are the Diffusion of Innovations Theory and the Dynamic Capabilities Theory. This combined theoretical framework facilitates an analysis that extends beyond direct impacts to understand the indirect pathways. Through this approach, a more sophisticated model is constructed, illustrating how value in the digital age is created not by a single factor but through the interplay of multiple elements acting in concert.

The Diffusion of Innovations Theory, as described by Miles [26], seeks to explain how innovations, such as ideas, products, or methods, disseminate throughout a group over time. The definition of an innovation can vary, and it could be simple

or highly complex. However, successfully adopting an innovation requires comprehensive organisational support, not just its introduction. Support is often dependent on how individuals in the organisation communicate. Shared understanding and a clear vision emerge only from effective communication through internal networks [27]. According to the Diffusion of Innovations Theory, if an organisation intends to adopt something new, such as a process change, then its culture and readiness play a critical role [27].

This study employs the Diffusion of Innovations Theory to investigate the adoption of new IT systems and internal process modifications by Malaysian logistics firms. However, understanding only how innovation spreads is insufficient. To explain how firms can survive in dynamic markets, another theory called the Dynamic Capabilities Theory is necessary. As defined by Teece et al. [28], dynamic capabilities enable firms to integrate, build, and reconfigure their resources to address rapidly changing environments. Dynamic capabilities are learnt routines and not arbitrary actions that aid firms in adjustment and growth [29]. This process requires effort, as few firms initially possess these capabilities. However, by applying methods such as design thinking, firms can develop dynamic capabilities. Such routines refine over time and can enhance various performance areas [30].

Within this framework, entrepreneurial orientation can be viewed as a form of dynamic capability, albeit a higher-order one. It integrates socially complex routines that are difficult for competitors to imitate. Entrepreneurial orientation functions as a key driver of long-term competitive advantage [31]. Numerous meta-analyses support this notion, showing that entrepreneurial behaviour strongly enhances innovation and promotes sustainable firm performance [15]. Therefore, the first hypothesis in this research posits that entrepreneurial orientation directly and positively influences firm performance.

H1: *Entrepreneurial Orientation has a positive effect on Firm Performance.*

One important role that a higher-order dynamic capability like entrepreneurial orientation typically serves is guiding how the firm deploys and develops its key resources and skills [28]. It is not solely about taking risks or acting proactively in the market. When a business thinks like an entrepreneur, it often creates an environment that encourages new ideas. Within such an environment, internal changes, particularly in processes, are more readily accepted and enhanced. Simultaneously, this strategic mindset can also motivate the organisation to invest in digital technologies that support internal improvements. These tools are part of what is referred to as IT infrastructure. Numerous researchers have already validated this correlation with empirical evidence. For example, Campos-Núñez and Serrano-Malebrán [17] found that entrepreneurial orientation has a direct influence on how firms adopt and use IT-based resources. Furthermore, entrepreneurial orientation can also enhance a firm's capacity for information management and internal knowledge sharing [7]. Based on this reasoning, this study proposes that entrepreneurial orientation has a positive effect on both process innovation and IT infrastructure.

H2: *Entrepreneurial Orientation has a positive effect on Process Innovation.*

H3: *Entrepreneurial Orientation has a positive effect on IT Infrastructure.*

Next, this study considers the direct effects of the mediating variables. Process innovation, by creating unique and efficient internal routines, represents an inimitable capability that provides a direct source of competitive advantage and, consequently, superior financial performance [20,31]. IT infrastructure, however, is different. As argued by the Resource-Based View, its components are often imitable, and its value is contingent on other factors [32]. Its role is as an enabler, and its direct, unconditional effect on performance is not guaranteed, as its value is realised through its support of higher-order practices [25]. This leads to the next two hypotheses.

H4: *Process Innovation has a positive effect on Firm Performance.*

H5: *IT Infrastructure has a positive effect on Firm Performance.*

Finally, this study synthesises these relationships into a mediated model. The full value of a high-level dynamic capability, such as an entrepreneurial orientation, is only unlocked when it is combined and channelled through other specific capabilities and resources within the firm [32]. This study posits that entrepreneurial orientation's ability to foster process innovation and guide the use of IT channels affects its influence on performance. This mediation logic is strongly supported by a wealth of recent research demonstrating the indirect pathways from strategic orientations and capabilities to performance outcomes [7,33]. A "digital entrepreneurial orientation" has been shown to improve business performance through the crucial intervening mechanisms of technology absorptive capacity and subsequent digital innovation [9]. The literature is replete with examples emphasising that digital capabilities are crucial for translating strategic intent and digital investments into tangible business value [34] and that possessing these capabilities strengthens the path from entrepreneurial orientation to performance [18,35]. Therefore, this study proposes two complementary mediating pathways that represent the core of our research model.

H6: *Process Innovation mediates the relationship between Entrepreneurial Orientation and Firm Performance.*

H7: *IT Infrastructure mediates the relationship between Entrepreneurial Orientation and Firm Performance.*

The relationships articulated in these seven hypotheses are illustrated in the conceptual model shown in Figure 2.1.

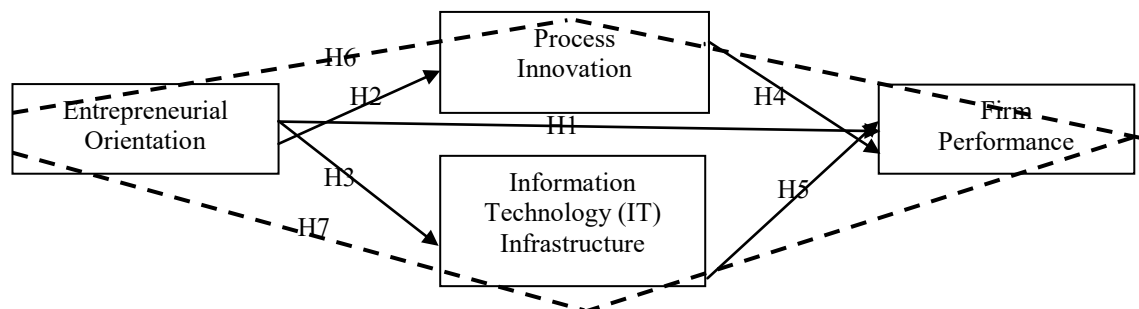


Figure 2.1 Conceptual framework

3. Research Methodology

This section outlines the methodological approach used to empirically test the research model and hypotheses presented in the preceding section. It begins by outlining the research design, sampling procedures, and data collection methods. The section then describes the measurement and operationalisation of the study's constructs, followed by a justification for the selection of Partial Least Squares Structural Equation Modeling (PLS-SEM) as the primary analytical technique. Finally, it specifies the formal econometric model and the systematic two-stage procedure used for data analysis.

3.1 Research Design and Sampling

This study utilises a quantitative, cross-sectional, and correlational research design aimed at testing the hypothesised relationships between entrepreneurial orientation, process innovation, IT infrastructure, and firm performance. The unit of analysis is the firm, and the target population consists of logistics firms located in Malaysia's primary economic hubs, Klang Valley (Selangor and Kuala Lumpur) and Johor, which account for a total of 90.33% of logistics activities reported in Malaysia (Ministry of Transport Malaysia (MOT) [36]).

A two-stage purposive sampling method was used for data collection. At first, Google Forms were sent out by email to all registered members of the Federation of Malaysian Freight Forwarders (FMFF) in Klang Valley and Johor [37]. Second, Google Forms were supplemented by self-administered surveys collected in person by the researcher to ensure an adequate and representative sample. The primary data was collected via a structured questionnaire measuring the study's key constructs, with responses from founders, key players, or firm representatives. This process yielded a final usable sample of $n = 406$ logistics firms.

3.2 Measurement and Operationalisation

This study employs a quantitative survey methodology to gather primary data. The measurement instruments were developed specifically to address the contemporary issues and theoretical gaps identified in the literature reviewed in

Section 2. While informed by foundational concepts, the items for each construct were designed to capture the nuances discussed in recent research, ensuring high content validity for the study's specific context. All individual indicator items were measured on a 5-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”).

The latent variables were operationalised within the PLS-SEM framework [38]. Entrepreneurial orientation was modelled as a second-order reflective–reflective construct formed by four dimensions. Process innovation, IT infrastructure, and firm performance were modeled as first-order reflective constructs. The following table details the dimensions of each construct, the number of items, the final reliability coefficients from this study's data, and the development of the measurement items.

Table 3.1 Reliability coefficients and measurement items development

No.	Construct	Dimensions	Items	α	Measurement Items Development (Gaps & Concepts)
1	Entrepreneurial Orientation	Proactiveness; Risk-taking; Creative thinking; Autonomy	22	0.93	Foundational meta-analyses and recent studies on digital entrepreneurial orientation inform the conceptualisation of entrepreneurial orientation as a key driver of firm performance and a precursor to IT adoption.
2	Process Innovation	N/A	5	0.83	The construct captures process innovation's dual roles in enhancing financial performance and acting as a key outcome of process digitisation, a major trend in the logistics industry.
3	IT Infrastructure	Infrastructure capabilities; IT experience and skills; Managerial commitment and culture; Policy and support context	11	0.96	The concept of IT infrastructure as a holistic capability extends beyond physical assets to include skills and culture, addressing the gap where IT's value depends on

4	Firm Performance	Financial indicators; Non-financial indicators	10	0.89	complementary knowledge assets. The items reflect a multidimensional view of performance, recognising that innovation influences both financial and non-financial outcomes in competitive environments.
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IBM SPSS Statistics version 26 and SmartPLS 4 software [39] are used to conduct two types of analyses, namely descriptive analysis and inferential analysis.

3.3 Data Analysis Technique: Justification for PLS-SEM

In this study, the data were examined by using Partial Least Squares Structural Equation Modeling (PLS-SEM), with support from the SmartPLS 4 software. This method was preferred instead of other approaches such as covariance-based SEM. There are several reasons why this choice matched well with the study's goals and its research design [38]. First of all, the main aim of this research is prediction. It tries to find out which main factors influence firm performance and how strongly these factors can explain the changes in that outcome. For this type of goal, PLS-SEM is considered a very suitable method. Secondly, the model used in this research is not simple. The model includes a second-order reflective construct known as entrepreneurial orientation, along with multiple mediation relationships. PLS-SEM is known to be better at handling complicated models than other methods. Another important point is that PLS-SEM does not rely on strict normality conditions. Since it is a non-parametric method, it can still work well even when the data do not follow a perfect normal distribution. This is especially advantageous in business and management studies, where survey responses usually show non-normal patterns. Because of all these reasons, PLS-SEM was selected as the best method to test the conceptual framework in this research.

3.4 The PLS-SEM Two-Stage Analytical Procedure

Following established guidelines for PLS-SEM [38], this study employed a meticulous two-step analysis method. This process ensures that the measurement model is robust and valid before assessing the structural relationships. In the first step, the focus was on evaluating the measurement model. The primary objective was to ascertain the reliability and validity of the indicators for each latent construct. Several assessments were conducted. First, outer loadings were examined to assess the degree to which each indicator reflected its construct, a measure of indicator reliability. Then, internal consistency was tested using Cronbach's Alpha, composite reliability, and rhoA. To ensure the items within a construct were adequately related, convergent validity was assessed by examining the Average Variance Extracted (AVE). Finally, to ensure that the constructs were distinct from each other, discriminant validity was tested using two methods by

using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio [38].

After the measurement model was successfully validated, the second step of the analysis commenced. This phase concentrated on the structural model to evaluate the suggested relationships among the constructs. First, collinearity was assessed using the Variance Inflation Factor (VIF) to ensure the path estimates were not affected by multicollinearity. Next, the strength and significance of the relationships, represented by path coefficients (beta), were tested via a bootstrapping procedure with 5,000 resamples to ensure stable results [38]. The R^2 values were examined to assess the model's explanatory power for the outcome variables. In addition, f^2 effect sizes were calculated to determine the substantive influence of each predictor on the target variables. Moreover, Stone-Geisser's Q^2 was calculated using the blindfolding procedure with an omission distance of 7 to evaluate the model's predictive relevance. Finally, a mediation analysis was conducted to examine the statistical significance of the indirect paths.

4. Results

This section presents the empirical results of testing the proposed research model, which links entrepreneurial orientation, process innovation, IT infrastructure, and firm performance in the Malaysian logistics industry. Entrepreneurial orientation was modelled as a second-order reflective construct formed by four dimensions, such as proactiveness, risk-taking, creative thinking, and autonomy, where each is measured by multiple indicators. Prior to estimating the structural relationships, the measurement properties of the constructs were assessed for indicator reliability, internal consistency, convergent validity, discriminant validity, and collinearity. Model estimation employed the path-weighting scheme with 5,000-subsample bootstrapping, two-tailed tests, and bias-corrected 95 percent confidence intervals to evaluate the significance of path estimates. This approach allows simultaneous assessment of both the direct and the mediating relationships among the constructs. The subsequent sections present the descriptive profile of the sample, evaluate the measurement model, and then report the structural model results for H1–H7.

4.1 Descriptive Statistics

Table 4.1 presents the descriptive statistics for all latent constructs used in the structural model. The table includes the mean, standard deviation, minimum, and maximum scores for each first-order dimension of entrepreneurial orientation, namely proactiveness, risk-taking, creative thinking, and autonomy, as well as for process innovation, IT infrastructure, and the two dimensions of firm performance. All items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The data show that logistics firms in Klang Valley and Johor report moderately high levels of entrepreneurial orientation and innovation-related capabilities. The four dimensions of entrepreneurial orientation have mean values between 3.35 and 3.65 with standard deviations below 1.00, indicating a relatively consistent orientation across firms. Process innovation and IT infrastructure record slightly higher means of 3.62 and

3.58, respectively, suggesting that many firms already engage in process innovation and maintain a reasonable level of technological support for operations. The two firm performance dimensions record mean scores of 3.49 for financial performance and 3.52 for non-financial performance, also with moderate dispersion. These descriptive results indicate that the sample provides sufficient variation across all constructs to allow robust testing of the hypothesised structural relationships.

Table 4.1 Descriptive statistics of latent constructs (n = 406)

Construct	Mean	SD	Min	Max
Proactiveness (PR)	3.42	0.74	1.67	4.83
Risk-Taking (RT)	3.38	0.79	1.42	4.91
Creative Thinking (CT)	3.35	0.71	1.58	4.87
Autonomy (AU)	3.65	0.76	1.71	4.96
Process Innovation (PI)	3.62	0.68	1.54	4.88
IT Infrastructure (ITI)	3.58	0.73	1.61	4.92
Financial Performance (FP-Fin)	3.49	0.72	1.60	4.85
Non-Financial Performance (FP-NFin)	3.52	0.70	1.63	4.90

Note. All constructs were measured on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree.

4.2 Firm Profiles

The majority of the 406 logistics firms are private limited companies (Sdn Bhd) (85.5%), were established less than 10 years ago (57.4%), have fewer than 50 employees (86.5%), and employ 1–5 IT technical specialists (52.2%). These majority firms are located in Klang (55.9%), Selangor (65.5%), with a reported sales turnover between RM50,000 and RM200,000 (21.2%) from the previous year, have Chinese majority ownership (45.8%), are non-family-owned businesses (76.8%), and are predominantly owned by men (78.8%). Strong price competition poses the most significant challenge for these firms (65%).

4.3 Measurement Model Analysis

This section evaluates the measurement properties prior to testing the structural relationships. Following standard PLS-SEM practice in SmartPLS 4, this study assesses indicator reliability, internal consistency, convergent validity, discriminant validity, and collinearity. Entrepreneurial orientation (EO) is specified as a second-order reflective construct comprising autonomy (AU), creative thinking (CT), proactiveness (PR), and risk-taking (RT). Process innovation (PI), IT infrastructure (ITI), and firm performance (FP) are included as additional reflective constructs.

4.3.1 Indicator Reliability

All reflective indicators show statistically significant outer loadings ($p < 0.001$). For the second-order construct entrepreneurial orientation (EO), loadings across

its four dimensions, such as autonomy, creative thinking, proactiveness, and risk-taking, range between 0.50 and 0.73. Process innovation (PI) indicators load between 0.72 and 0.83, IT infrastructure (ITI) between 0.70 and 0.94, and firm performance (FP) between 0.63 and 0.79. Although a few entrepreneurial orientation indicators load slightly below 0.70, they were retained due to their theoretical relevance and because reliability and validity criteria were met for all constructs. Confidence-interval estimates confirm that all loadings are positive and significantly different from zero.

Table 4.2 Summary of outer loadings for reflective constructs

Construct	Number of indicators	Loading range	Lowest item retained	Significance
Entrepreneurial Orientation (EO)	22	0.50 – 0.73	AU_4 (0.50)	All $p < 0.001$
Process Innovation (PI)	5	0.72 – 0.83	PI_4 (0.72)	All $p < 0.001$
IT infrastructure (ITI)	11	0.70 – 0.94	ITI_8 (0.70)	All $p < 0.001$
Firm Performance (FP)	10	0.63 – 0.79	FI_3 (0.63)	All $p < 0.001$

4.3.2 Internal Consistency Reliability

Internal consistency reliability was evaluated using Cronbach's alpha, rhoA, and composite reliability. All constructs demonstrated values well above the recommended minimum of 0.70, confirming that the indicators within each construct consistently measure the same underlying concept.

Table 4.3 Internal consistency indices

Construct	Cronbach's α	rhoA	pc
Entrepreneurial Orientation (EO)	0.93	0.93	0.94
Process Innovation (PI)	0.83	0.85	0.88
IT Infrastructure (ITI)	0.96	0.96	0.96
Firm Performance (FP)	0.89	0.90	0.91

4.3.3 Convergent Validity

Average Variance Extracted (AVE) values meet or exceed 0.50 for process innovation, IT infrastructure, and firm performance. Entrepreneurial orientation's AVE is 0.401, which is slightly below 0.50 but acceptable for a second-order construct given strong reliability and discriminant validity.

Table 4.4 Convergent validity (AVE)

Construct	AVE (O)	M	STDEV	t	p
Entrepreneurial Orientation (EO)	0.401	0.402	0.023	17.511	0.000
Firm Performance (FP)	0.509	0.508	0.022	23.205	0.000

Construct	AVE (O)	M	STDEV	t	p
IT Infrastructure (ITI)	0.707	0.707	0.021	34.471	0.000
Process Innovation (PI)	0.601	0.601	0.022	27.784	0.000

4.3.4 Discriminant Validity: Fornell-Larcker Criterion

Discriminant validity assesses whether a construct is more closely related to its indicators than to other constructs in the model. Following the Fornell-Larcker criterion, the square root of each construct's AVE should be greater than its correlations with other constructs.

Table 4.5 presents the Fornell-Larcker matrix. The diagonal elements (square roots of AVE) appear in bold, and all exceed the corresponding off-diagonal inter-construct correlations. This confirms that each construct shares more variance with its indicators than with other constructs in the model, thereby supporting discriminant validity.

Table 4.5 Fornell-Larcker matrix

Construct	EO	PI	ITI	FP
Entrepreneurial Orientation (EO)	0.633			
Process Innovation (PI)	0.688	0.775		
IT Infrastructure (ITI)	0.451	0.394	0.841	
Firm Performance (FP)	0.564	0.573	0.412	0.713

Note. Diagonal elements are the square roots of AVE; off-diagonal elements are latent variable correlations. All square roots of AVE exceed the inter-construct correlations, satisfying the Fornell-Larcker criterion.

4.3.5 Discriminant Validity: HTMT Ratios

As a more stringent assessment of discriminant validity, the Heterotrait-Monotrait ratio of correlations (HTMT) was also examined. An HTMT value below 0.85 is generally considered evidence that constructs are distinct. In addition, the bootstrapped 95 percent confidence intervals for each HTMT estimate should not include the value 1.00.

Table 4.6 shows that all HTMT ratios fall below the conservative threshold of 0.85. Moreover, the 95 percent confidence intervals for all construct pairs do not include 1.00, providing further evidence that each construct captures a unique aspect of the model.

Table 4.6 HTMT ratios with 95 percent confidence intervals

Pair	HTMT (O)	M	2.5%	97.5%
FP ↔ EO	0.600	0.602	0.517	0.679
ITI ↔ EO	0.466	0.467	0.355	0.570

Pair	HTMT (O)	M	2.5%	97.5%
ITI ↔ FP	0.437	0.439	0.339	0.529
PI ↔ EO	0.744	0.744	0.675	0.807
PI ↔ FP	0.650	0.650	0.565	0.727
PI ↔ ITI	0.428	0.431	0.300	0.558

Note. All HTMT ratios are below 0.85, and their confidence intervals exclude 1.00, confirming discriminant validity.

4.3.6 Collinearity Diagnostics

Collinearity among indicators and predictor constructs was assessed using variance inflation factors (VIF). For the outer model (indicators), most items had VIF values well below the conservative threshold of 5. A few items in the IT infrastructure construct displayed higher VIFs (e.g., ITI_2 = 14.29; ITI_10 = 11.97), reflecting redundancy among highly similar items. However, these items also had very high loadings and contributed to content validity; therefore, they were retained.

For the inner model (structural relationships among latent constructs), all VIF values were far below the threshold of 5 ($EO \rightarrow FP = 2.05$; $EO \rightarrow PI = 1.00$; $EO \rightarrow ITI = 1.00$; $PI \rightarrow FP = 1.93$; $ITI \rightarrow FP = 1.28$), indicating no risk of multicollinearity bias in estimating path coefficients.

Table 4.7 Collinearity diagnostics

Model component	VIF range
Outer model (indicators)	1.7 – 14.3 (higher values for some IT infrastructure items)
Inner model (constructs)	1.0 – 2.1

Note. Outer-model VIFs indicate some redundancy among IT infrastructure indicators but do not threaten validity. Inner-model VIFs confirm that multicollinearity among constructs is not a concern.

4.3.7 Measurement Model Visualization

Figure 4.1 displays the outer model of the study as estimated by SmartPLS. It depicts all latent constructs, entrepreneurial orientation, process innovation, IT infrastructure, and firm performance, along with their respective reflective indicators and standardised outer loadings. The figure visually confirms that all indicators load positively and substantially on their intended constructs and support convergent validity.

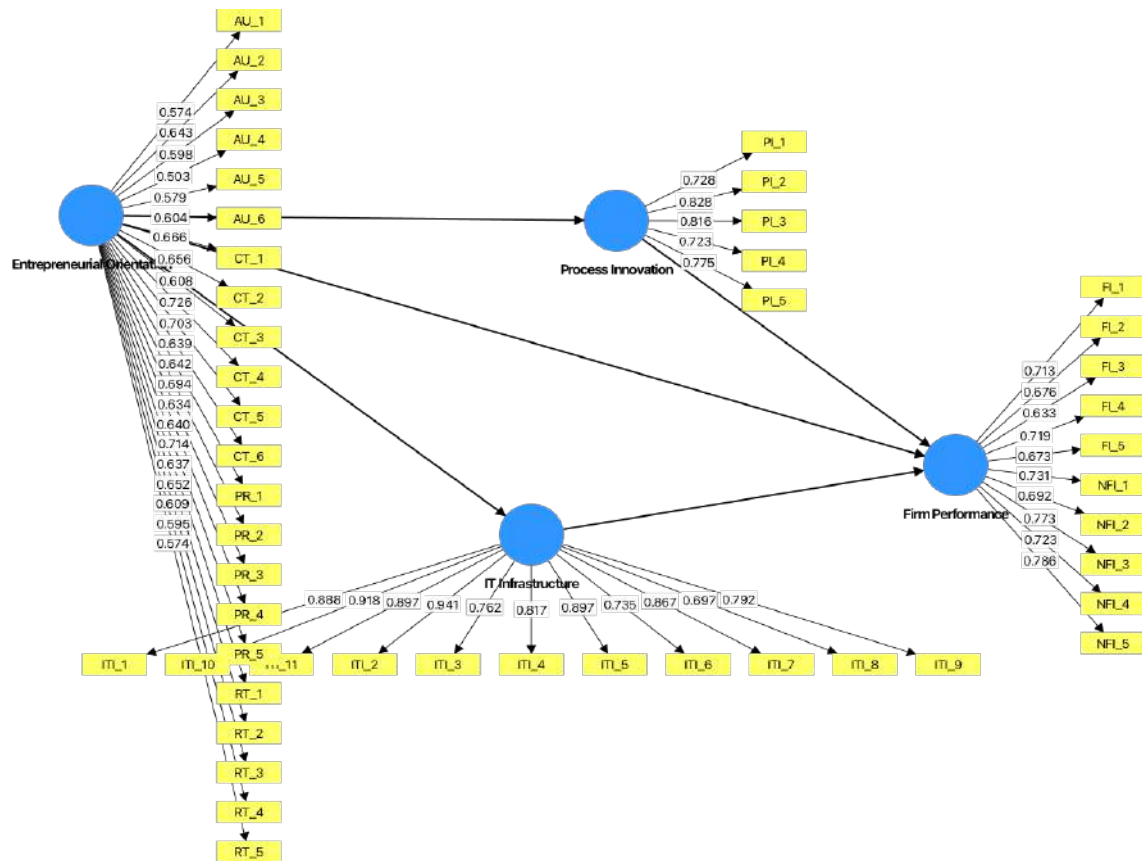


Figure 4.1 Measurement Model

The measurement model shows acceptable indicator reliability, strong internal consistency (alpha, rhoA, pc), adequate convergent validity, and discriminant validity by both Fornell-Larcker and HTMT. Although several IT infrastructure indicators have elevated outer-model VIFs, they were retained given their very high loadings and the excellent reliability of the construct. The results confirm progression to the structural model analysis in Section 4.5.

4.4 Structural Model Analysis

The structural model was evaluated after establishing acceptable measurement properties. Following Hair et al. [38], the assessment focused on collinearity, the explanatory power of the model, the significance and strength of direct and indirect relationships, and the proportion of variance explained in the endogenous constructs.

4.4.1 Collinearity of Predictor Constructs

All inner-model VIFs for predictor constructs were below the conservative threshold of 5 ($EO \rightarrow FP = 2.046$; $PI \rightarrow FP = 1.929$; $ITI \rightarrow FP = 1.276$), indicating no serious multicollinearity problems. This allowed the path coefficients to be interpreted without bias.

4.4.2 Model Explanatory Power

The R^2 values show that entrepreneurial orientation explains 20.3 percent of the variance in IT infrastructure and 47.3 percent of the variance in process innovation, while entrepreneurial orientation together with process innovation and IT infrastructure explains about 40 percent of the variance in firm performance. All these levels of explanation variance are considered moderate for research in organisational and logistics settings.

Table 4.8 R-square values of endogenous constructs

Endogenous construct	R^2 (O)	M	STDEV	t	p
Entrepreneurial Orientation (EO)	0.403	0.412	0.044	9.159	0.000
IT Infrastructure (ITI)	0.203	0.210	0.047	4.367	0.000
Process Innovation (PI)	0.473	0.479	0.037	12.641	0.000

4.4.3 Effect Sizes

The f^2 statistics indicate that entrepreneurial orientation has a large effect on process innovation (0.896) and a medium effect on IT infrastructure (0.255), but only a small direct effect on firm performance (0.058). Process innovation has a small but significant effect on firm performance (0.092), while the effect of IT infrastructure on firm performance is weak and statistically non-significant (0.035, $p > 0.05$).

Table 4.9 f-square effect sizes

Path	f^2 (O)	M	STDEV	t	p
EO → FP	0.058	0.063	0.026	2.255	0.024
EO → ITI	0.255	0.270	0.076	3.344	0.001
EO → PI	0.896	0.928	0.140	6.409	0.000
ITI → FP	0.035	0.039	0.022	1.601	0.109
PI → FP	0.092	0.095	0.039	2.360	0.018

4.4.4 Predictive Relevance of the Model

The predictive relevance of the model was assessed using the Stone-Geisser's Q^2 statistic, which is obtained from the blindfolding procedure. A Q^2 value greater than zero indicates that the model has predictive relevance for a particular endogenous construct. As shown in Table 4.10, all Q^2 values are greater than zero, confirming the model's predictive relevance for firm performance, IT infrastructure, and process innovation.

Table 4.10 Predictive relevance (Q²)

	Endogenous Construct	SSO	SSE	Q ² (=1–SSE/SSO)
Firm Performance (FP)	4,060.000	2,852.180	0.297	
IT Infrastructure (ITI)	4,466.000	3,792.051	0.151	
Process Innovation (PI)	2,030.000	1,221.753	0.398	

4.4.5 Hypotheses Testing

The significance of all hypothesised relationships was evaluated using the bootstrapping procedure with 5,000 subsamples and a two-tailed test at a 5% significance level. The results are summarised in Table 4.10. The results support four of the five direct-effect hypotheses. The paths from entrepreneurial orientation to firm performance (H1: $\beta = 0.266$, $p < 0.01$), entrepreneurial orientation to process innovation (H2: $\beta = 0.688$, $p < 0.001$), entrepreneurial orientation to IT infrastructure (H3: $\beta = 0.451$, $p < 0.001$), and process innovation to firm performance (H4: $\beta = 0.234$, $p < 0.01$) were all positive and statistically significant. In contrast, the direct path from IT infrastructure to firm performance (H5: $\beta = 0.087$, $p > 0.05$) was not statistically significant. The two mediation hypotheses, H6 (EO $\rightarrow$ PI $\rightarrow$ FP) and H7 (EO $\rightarrow$ ITI $\rightarrow$ FP), were both supported. The indirect effects were significant with bootstrapped estimates of 0.223 ($t = 5.354$, $p < 0.001$) for H6 and 0.074 ($t = 3.357$, $p = 0.001$) for H7; the 95% bias-corrected confidence intervals for both excluded zero. This study confirms that process innovation and IT infrastructure play complementary and significant mediating roles in explaining how entrepreneurial orientation contributes to firm performance.

Table 4.11 Path coefficients and hypothesis test

Hypothesis	Structural path	B (O)	M	STDEV	t	p	Result
H1	EO $\rightarrow$ FP	0.266	0.215	0.068	3.118	0.002	Supported
H2	EO $\rightarrow$ PI	0.688	0.689	0.030	22.933	0.000	Supported
H3	EO $\rightarrow$ ITI	0.451	0.452	0.049	9.204	0.000	Supported
H4	PI $\rightarrow$ FP	0.234	0.235	0.079	2.962	0.003	Supported
H5	ITI $\rightarrow$ FP	0.087	0.089	0.061	1.428	0.154	Not supported
H6	EO $\rightarrow$ PI $\rightarrow$ FP	0.223	0.223	0.042	5.354	0.000	Supported
H7	EO $\rightarrow$ ITI $\rightarrow$ FP	0.074	0.074	0.022	3.357	0.001	Supported

The two mediation hypotheses (H6 and H7) show that both PI and ITI transmit part of EO's influence on FP. ITI's mediating role is weaker than that of PI.

4.4.6 Structural Model Visualization



Figure 4.2: Structural Model

Figure 4.2 presents the structural model as estimated in SmartPLS. The diagram displays the standardised path coefficients for entrepreneurial orientation (EO), process innovation (PI), IT infrastructure (ITI), and firm performance (FP), along with the R^2 values for the endogenous constructs. The figure shows that entrepreneurial orientation has strong positive effects on both process innovation ($\beta = 0.688$) and IT infrastructure ($\beta = 0.451$), as well as a positive direct effect on firm performance ($\beta = 0.212$). Process innovation also shows a positive effect on firm performance ($\beta = 0.234$). Consistent with the hypothesis test, the direct path from IT infrastructure to firm performance is small ($\beta = 0.087$) and not statistically significant. The R^2 values indicate moderate explanatory power for process innovation (0.473) and firm performance (0.403) and a smaller but meaningful value for IT infrastructure (0.203).

4.5 Interpretation of Results

The empirical findings provide strong support for the proposed research model, confirming that entrepreneurial orientation acts as a high-level dynamic capability within the Malaysian logistics industry. The significant, positive relationships between entrepreneurial orientation and both process innovation (H2) and IT infrastructure (H3) empirically validate the core tenet of Dynamic Capabilities Theory: that a key strategic orientation enables a firm to "sense" and "seize" opportunities by building and reconfiguring its specific operational and technological resources [28]. This aligns with recent literature demonstrating that

an entrepreneurial posture is a direct precursor to a firm's adoption of IT capabilities and its ability to manage information effectively [7,17]. Furthermore, the supported direct path from entrepreneurial orientation to firm performance (H1) is consistent with meta-analytic evidence and reinforces the view that an entrepreneurial culture is, in itself, an inimitable resource that provides a competitive advantage [15]. The analysis of the mediating variables offers a nuanced perspective on value creation that is well-explained by the Diffusion of Innovations Theory. The significant positive impact of process innovation on firm performance (H4) supports the Diffusion of Innovations Theory's argument that the successful implementation of an innovation is a direct source of competitive advantage. Conversely, the statistically non-significant direct effect of IT infrastructure on firm performance (H5) provides a powerful confirmation of the "IT Productivity Paradox", a well-documented phenomenon where technology investments do not automatically lead to performance gains. This finding supports a core tenet of Diffusion of Innovations Theory, where the mere acquisition of an innovation does not guarantee positive outcomes, as its value is realised only through effective implementation and integration. Instead, as contemporary literature suggests, IT functions as an enabler whose value is contingent on its integration with other organisational capabilities [25].

The mediation analysis provides the most critical insights, illustrating the complete value-creation pathways. The finding confirms the central thesis of the study that both process innovation (H6) and IT infrastructure (H7) are significant mediators. It demonstrates how the high-level dynamic capability of entrepreneurial orientation translates into improved performance by fostering specific innovative capabilities (process innovation) and by guiding the strategic deployment of tangible resources (IT infrastructure). This aligns perfectly with the logic of complementarity, where the value of innovation is unlocked only when it is effectively combined with the organisation's culture and processes. These findings resonate with a wealth of recent research highlighting the importance of such indirect pathways in the digital era [9,33]. The more powerful mediating effect of process innovation suggests that in the Malaysian logistics industry, creating unique internal processes is a better way to turn entrepreneurial intent into performance than just getting more IT assets.

This section has presented the empirical findings derived from the PLS-SEM analysis. The results demonstrate that entrepreneurial orientation not only exerts a direct positive effect on firm performance but also enhances it indirectly by fostering process innovation and enabling the effective deployment of IT. Although IT infrastructure by itself does not significantly improve performance, it contributes as part of an integrated entrepreneurial and innovative framework. The evidence underscores the interplay between behavioural orientation, innovation practices, and technological capability in shaping outcomes for Malaysian logistics firms. The following section builds on these findings to discuss their theoretical and managerial implications. It relates the statistical evidence to existing literature, highlights contributions to the understanding of entrepreneurial orientation and logistics firm performance, and outlines directions for policy and practice.

5. Discussion, Implications, and Conclusion

This final section synthesises the empirical findings of the study to provide a comprehensive discussion of their meaning and contribution. It addresses the central research problem regarding inconsistent returns on IT investments and the need to understand organisational capabilities that drive firm performance in the competitive Malaysian logistics industry. The study's objective was to test a mediated model underpinned by the Diffusion of Innovations Theory and the Dynamic Capabilities Theory. The results revealed that, while entrepreneurial orientation is a key driver of performance, its value is primarily realised through its influence on a firm's process innovation and its strategic deployment of technology. This section will now begin with a detailed interpretation of these findings, followed by an outline of the study's theoretical and managerial implications, its limitations, and a concluding summary.

5.1 Discussion of Key Findings

The empirical results of this study offer a nuanced yet powerful narrative about the drivers of firm performance in a dynamic emerging market industry. The discussion is organised thematically to provide a clear synthesis of the empirical findings from Section 4, the theoretical framework of Diffusion of Innovations Theory and Dynamic Capabilities Theory, and the contemporary literature reviewed in Section 2.

The Role of Entrepreneurial Orientation as a Dynamic Capability: The findings strongly support the central role of entrepreneurial orientation. The supported hypotheses H1 ($EO \rightarrow FP$), H2 ($EO \rightarrow PI$), and H3 ($EO \rightarrow ITI$) collectively establish entrepreneurial orientation as the primary strategic driver in the model. This dataset provides clear empirical validation for conceptualising entrepreneurial orientation as a high-level dynamic capability. According to Dynamic Capabilities Theory, dynamic capabilities enable a firm to "sense and seize" new opportunities and to "reconfigure" its resource base to adapt to market changes [28]. The results demonstrate this theory in action: a firm's entrepreneurial posture is the mechanism that drives the reconfiguration and development of both its internal innovative processes (process innovation) and its technological resources (IT infrastructure). This finding is consistent with a large body of literature that confirms the positive entrepreneurial orientation-performance link [15] and, more specifically, with recent studies showing that entrepreneurial orientation is a direct antecedent to a firm's adoption of advanced IT capabilities [17].

The Diffusion of Innovations and the IT Productivity Paradox: Adoption vs. Value Realisation: Perhaps the most compelling story from the analysis is the powerful contrast between the results for H4 and H5. The strong, positive relationship between process innovation and organisational performance (H4) corresponds with the tenets of the Diffusion of Innovations Theory, which posits that effective implementation of an innovation is a critical factor for its success. It suggests that process innovation, as a unique and inimitable internal capability that is difficult for competitors to copy, is a direct source of sustained competitive advantage and, consequently, superior performance [31]. Conversely, the non-

significant relationship between IT infrastructure and firm performance (H5) offers an equally powerful insight. This finding provides stark empirical confirmation of the "IT Productivity Paradox", a phenomenon noted in other sectors where substantial technology investments do not consistently translate into improved performance. This strongly supports a core tenet of Diffusion of Innovations Theory, where mere adoption does not guarantee positive outcomes. In this model, the value of innovations, such as IT infrastructure, is realised only through effective implementation and integration with the organisation's existing cultures and processes, which are driven by an entrepreneurial orientation. This view aligns perfectly with foundational critiques in information systems research, which argue that the value of IT lies not in its ownership but in how it is leveraged by other organisational capabilities [32].

Unveiling the Mechanisms: The Power of Mediation: The validated mediation hypotheses, H6 ($EO \rightarrow PI \rightarrow FP$) and H7 ($EO \rightarrow ITI \rightarrow FP$), elucidate the precise mechanisms by which value is generated, constituting the principal contribution of this study. These findings exemplify the principle of complementarity, which is fundamental to both the Diffusion of Innovations Theory and the Dynamic Capabilities Theory. These results are consistent with Wade and Hulland [32], demonstrating that entrepreneurial orientation's full value as a high-level dynamic capability is realised only when it is leveraged and integrated with other specific resources and capabilities in the firm. An entrepreneurial culture creates value precisely because it drives firms to develop innovative processes and to strategically deploy their technology in ways that non-entrepreneurial firms do not. This finding resonates strongly with a wealth of recent research highlighting the importance of such indirect pathways, where strategic orientations improve performance via their effect on information management and digital innovation capabilities [9,7]. The finding that process innovation was a stronger mediator than IT infrastructure further suggests that, in this context, the development of unique, hard-to-replicate internal processes is a more potent mechanism for converting entrepreneurial intent into performance than the mere accumulation and application of technology.

5.2 Theoretical Implications

This study makes several important contributions to academic theory. First, it contributes by integrating the Diffusion of Innovations Theory with the Dynamic Capabilities Theory. By providing strong empirical evidence from the Malaysian logistics context, the findings demonstrate how a high-level dynamic capability, in this case entrepreneurial orientation, actively orchestrates both intangible capabilities such as process innovation and tangible resources such as IT infrastructure to create value. This integration provides a more holistic framework, where the Diffusion of Innovations Theory explains the adoption of specific innovations (process innovation and IT infrastructure) and the Dynamic Capabilities Theory explains the higher-order capability (entrepreneurial orientation) that enables firms to successfully implement and reconfigure these innovations to create value.

Second, the study contributes to the entrepreneurship literature. While the positive relationship between entrepreneurial orientation and firm performance is well-established, this research clarifies the specific pathways through which this effect materialises. The model elucidates the substantial mediating roles of both process innovation and IT infrastructure, offering a more refined comprehension of how an entrepreneurial posture translates into tangible performance outcomes. It shows that entrepreneurial orientation's value is not just in its direct impact but in its ability to foster a firm-wide ecosystem of innovation and technological leverage.

Finally, this research offers a clear contribution to the Information Systems (IS) and logistics literature. The findings provide a direct and compelling solution to the persistent "IT Productivity Paradox" within the logistics industry. By demonstrating that the direct effect of IT infrastructure on firm performance is non-significant while its mediating role is significant, the study empirically confirms that technology's value is extrinsic and unlocked by an entrepreneurial culture. This study points out the importance of strategic orientation in transforming commodity IT resources into a source of competitive advantage.

5.3 Managerial Implications

The findings of this study offer several clear, actionable implications for managers and leaders in the logistics industry. The most critical takeaway is the need to invest in culture, not just technology. The results indicate that the return on investment for IT infrastructure is contingent on the presence of an entrepreneurial culture. Managers who allocate significant budgets to technology without simultaneously fostering an environment that supports proactiveness, risk-taking, creative thinking, and autonomy are unlikely to see the desired performance improvements. It is essential to regard entrepreneurial orientation as a prerequisite for maximising the value of technological assets.

Furthermore, managers should prioritise process innovation. The findings show that improvements in internal processes have a more direct and powerful positive impact on firm performance than investments in IT infrastructure alone. This suggests that managers should dedicate resources and attention to continuously improving operational workflows, adopting new delivery methods, and enhancing internal efficiencies. While technology can support these efforts, the focus should be on the innovation of the processes themselves, as the result is a more potent and direct path to achieving a competitive advantage.

Finally, the results compel managers to adopt an integrated strategic view. Entrepreneurial orientation, process innovation, and IT infrastructure require an integrated approach, not separate or independent management. This study reveals that these elements function as a cohesive system. The greatest performance benefits are achieved when an entrepreneurial culture drives both the development of innovative processes and the strategic deployment of a robust IT infrastructure. Managers should therefore work to align these three elements, ensuring that their firm's culture, processes, and technology are all working in concert to achieve strategic goals.

5.4 Limitations and Directions for Future Research

While this study provides valuable insights, its limitations must be acknowledged. First, the use of cross-sectional data, collected at a single point, means that causality cannot be definitively inferred. Although the hypothesised relationships are grounded in strong theory, the research design cannot rule out the possibility of reverse causality. Second, the study's concentration on the Malaysian logistics sector constrains the generalisability of the results. The specific economic and cultural context may influence the relationships between the variables in ways that would differ in other countries or industries. Third, the study relies on perceptual measures of performance and capabilities, which are based on the subjective assessments of managers rather than objective company data.

These limitations provide clear directions for future research. A longitudinal study that follows firms for several years would offer stronger proof of the causal links suggested by the model. Future research could also conduct comparative studies across different countries in the ASEAN region or between different industries to test the external validity of the findings. Finally, subsequent models could aim to incorporate objective performance data, such as financial ratios from company reports, to validate the findings based on perceptual measures. Future studies could also expand the model to include other important organisational capabilities, such as marketing or human resources, to provide an even more comprehensive understanding of firm performance drivers.

5.5 Conclusion

This research set out to address the persistent "IT Productivity Paradox" of why significant investments in technology do not always lead to superior firm performance. By examining the interplay between entrepreneurial orientation, process innovation, IT infrastructure, and firm performance in the Malaysian logistics industry, this study provides a clear answer. The findings demonstrate that an entrepreneurial orientation is the foundational driver of success. However, its value is most powerfully realised, not in isolation, but through its ability to foster a culture of continuous process innovation and guide the strategic deployment of technology. The results confirm that IT infrastructure alone is insufficient to generate a competitive advantage, and its value can only be unlocked when it is leveraged by a proactive and innovative organisational culture. This study's primary contribution is its clarification of these mechanisms, offering both a robust theoretical model for academics and a set of actionable insights for managers. Ultimately, the findings point out the urgent need for an integrated, capability-led strategy for achieving sustained performance in today's competitive and technology-driven landscape.

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Extending the Technology Acceptance Model for Acceptance of eNaira by Microenterprises in Jigawa State, Nigeria

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Abstract

The introduction of central bank digital currencies (CBDCs) represents a significant shift in national payment systems aimed at improving efficiency, security, and financial inclusion. In Nigeria, the Central Bank of Nigeria launched the eNaira as a sovereign digital currency; however, adoption among microenterprises remains limited. This study extends the Technology Acceptance Model (TAM) by incorporating perceived trust to examine factors influencing eNaira acceptance among microenterprises in Jigawa State, Nigeria. Data were collected from 368 microenterprise owners and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that perceived usefulness, perceived ease of use, and perceived trust have significant positive effects on behavioural intention to adopt the eNaira. The results confirm the applicability of TAM in the CBDC context and highlight trust as a critical institutional factor in digital financial adoption.

Keywords: *perceived usefulness, perceived ease of use, perceived trust, eNaira*

1. Introduction

Globally, economies are gradually transitioning toward digitalization as customer demands evolve rapidly and financial service delivery is increasingly redesigned through technological innovation. The development of modern technological infrastructure has given rise to *digital currency*, a contemporary evolution of money

that exists solely in electronic form (Mitsuhashi-Acs, 2019). Currently, approximately 36 countries have announced plans to introduce Central Bank Digital Currencies (CBDCs) for commercial use (K. M. et al., 2024). The widespread adoption of electronic payment systems is considered essential for reducing dependence on cash and promoting the sustainable growth of a sound economy. Consequently, financial regulators around the world are exploring ways to promote digital currencies over fiat money due to their speed, efficiency, and security advantages (Lucrezia, 2019).

In Nigeria, the pursuit of a legally backed digital currency emerged from the government's effort to counter the proliferation of private, unregulated digital currencies that posed potential threats to financial stability. This initiative also aligns with national strategies to enhance financial inclusion. In response, the Central Bank of Nigeria (CBN) launched the eNaira on October 25, 2021, marking a significant milestone in the nation's digital financial transformation (Ozili, 2022).

The eNaira, as Nigeria's Central Bank Digital Currency (CBDC), can be described as a form of legal tender that exists exclusively in digital format (Malik, Karmakar, & Bandopadhyay, 2020). Recent advances in financial technology (FinTech), including crowdfunding, mobile payments, and digital banking have contributed to a growing demand for digital currencies that enable faster, more convenient, and cost-effective financial transactions (Kazaure et al., 2021; Cheng, 2020). The proliferation of digital payment platforms such as Samsung Pay, Apple Pay, and Satispay, coupled with the gradual decline in cash usage, is reshaping the global payment landscape, promoting faster, cheaper, and more secure digital transactions (Fabian, Emeka, & Chinenye, 2022).

In line with this global trend, the Central Bank of Nigeria continues to innovate to meet the evolving financial needs of consumers, particularly micro, small, and medium-sized enterprises (MSMEs), by offering the eNaira as a risk-free digital alternative to private payment solutions such as cryptocurrencies. This innovation was introduced shortly after the CBN prohibited banks and other financial institutions from engaging in cryptocurrency transactions, citing concerns that cryptocurrencies are largely unregulated, anonymous, and susceptible to misuse in money laundering and terrorism financing.

The eNaira provides users with access to a novel and secure form of digital currency that retains the value of the Nigerian Naira while remaining exchangeable with other currencies. It holds significant promise as a reliable medium for retail transactions (Carneiro, 2021). Furthermore, eNaira is designed to be user-friendly and accessible, even for individuals without smartphones, thereby broadening financial inclusion across different segments of society (Nwokoji, 2021).

1.1 Statement of the Problem

The *eNaira* is a digital currency that exists purely in electronic form. However, many observers have expressed concerns regarding its potential failure, arguing that a large portion of the Nigerian population may be unwilling to adopt it as a medium for financial transactions. The strong enthusiasm for cryptocurrencies and other privately issued digital currencies in Nigeria may further diminish public interest in adopting the eNaira.

Some scholars and financial analysts contend that since alternative payment methods such as mobile banking applications, Automated Teller Machines (ATMs), debit cards, and Point-of-Sale (POS) terminals function effectively, the eNaira may struggle to gain traction, particularly among microenterprises. Despite its formal launch by the Central Bank of Nigeria (CBN) in October 2021 and the relative smoothness of its technical operations, adoption has remained notably low. As of 2023, only about 0.5% of Nigerians have used the eNaira (Coin, 2023), indicating that approximately 98.5% of registered wallets have never been utilized (Ree, 2023). The average value of eNaira transactions has been about ₦923 million per week, representing only 0.0018% of the total average transaction volume of ₦3 trillion during the same period, with an average transaction size of ₦60,000 (Ree, 2023). These figures clearly suggest that the eNaira has yet to achieve widespread acceptance among Nigerians.

Several reasons have been proposed for this low level of adoption. Among them are concerns about the perceived risks to financial autonomy and the belief that eNaira offers no distinctive advantages compared to existing payment systems (Coindesk, 2023). Moreover, scholars such as Abiodun (2022), Ozili (2022), Abass (2022), and Timi-Koleolu and Aroh (2021) have identified key challenges impeding eNaira adoption, including lack of trust, digital illiteracy, low awareness, perceived risk, and vulnerability to cyberattacks. Likewise, prior research on technology adoption has shown that several contextual factors may hinder acceptance across various settings. For instance, individuals who lack awareness of innovation are more likely to rely on traditional methods (Li et al., 2023), while lack of trust in technology (Verma et al., 2022) and weak government regulation (Xia et al., 2023) have been cited as major barriers to adoption. Furthermore, social influence such as the opinions of parents, teachers, and peers has been found to shape individual intentions to adopt new technologies (Asogwa et al., 2023).

Among these determinants, *trust* emerges as a critical factor influencing whether individuals choose to adopt or reject technological innovations, particularly in online financial transactions such as the eNaira (Lonkani et al., 2020). Hence, the present study incorporates *perceived trust* as a key construct in examining microenterprises' intention to adopt the eNaira as a medium of financial transaction. While previous studies (Marzuk & Abdullah, 2025; Anyamele, 2024; Chidi, 2023; Adegbite & Aremu, 2022; Bijlsma et al., 2021) have explored eNaira adoption among individual users in Nigeria, limited attention has been given to organizational contexts—especially microenterprises. Therefore, this study seeks to fill this research gap by investigating the factors influencing the acceptance of the eNaira among microenterprises in Jigawa State. Furthermore, it extends the traditional Technology Acceptance Model (TAM) by integrating *perceived trust* as an additional explanatory variable.

2. Literature Review and Hypothesis Development

2.1 Intention and Behavioral Intention

Intention refers to an individual's conscious decision regarding whether to perform a specific behavior. It is formed through rational evaluation, deliberate thinking, and personal commitment (Ajzen, 1991; Davis, 1989; Rauniar et al., 2014). The intention to adopt a new technological innovation reflects an individual's voluntary decision and cognitive readiness to engage with technology. Consequently, intention serves as a useful predictor of an individual's determination and willingness to perform a particular action or behavior (Qomfo et al., 2019).

Behavioral intention, on the other hand, denotes the strength of an individual's readiness to execute or refrain from a given behavior (Ajzen, 1991). Prior studies have demonstrated that behavioral intention positively influences the adoption of new technologies (Ozili & Alonso, 2024; Kazaure, 2024; Marikyan & Papagiannidis, 2023; Rodríguez-Ricardo, Sicilia, & López, 2018; Chenet et al., 2019). It represents the immediate antecedent of actual behavior, as individuals tend to act in accordance with their intentions (Bird, 1988; Fishbein & Ajzen, 1975; Zhao et al., 2017).

2.2. eNaira and Its Acceptance Intention

The eNaira, introduced by the Central Bank of Nigeria in 2021, represents a Central Bank Digital Currency (CBDC) aimed at promoting financial inclusion and reducing dependence on cash transactions. Its acceptance, however, depends largely on individual behavioral intentions shaped by factors such as perceived usefulness, perceived ease of use, and trust. Understanding these determinants is crucial in predicting adoption behavior among microenterprise owners, who form a significant part of Nigeria's informal economic sector.

2.3 Perceived Usefulness (PU) and eNaira Acceptance

Davis (1989) defines *perceived usefulness (PU)* to the extent to which an individual believes that using a particular technology enhances job performance. Within the context of this study, if a microenterprise owner perceives that adopting the eNaira can improve their payment system or operational efficiency, they are more likely to accept the innovation.

Empirical research consistently supports the significance of perceived usefulness as a strong determinant of technology acceptance. Huei et al. (2018) demonstrated that PU exerts a significant positive effect on individuals' intentions to adopt financial innovations such as the eNaira. It remains a critical variable that influences users' attitudes, behaviors, and intentions toward adopting new technologies.

H1: *Perceived usefulness (PU) positively influences the intention of microenterprise owners to accept the eNaira.*

2.4 Perceived Ease of Use (PEOU) and eNaira Acceptance

Perceived ease of use (PEOU) refers to the degree to which an individual believes that using a specific technology will be effortless (Davis, 1989). In this research context, PEOU represents the extent to which microenterprise owners believe that the eNaira wallet is simple to learn, download, and operate.

Hamid et al. (2015) found that when a technological innovation is easy to use, users are more inclined to explore its features and eventually adopt it. Similarly, Sulaeman (2021) revealed that PEOU has a positive influence on the intention to use financial technology products. Moreover, PEOU affects perceived usefulness, attitude, and behavioral intention toward the adoption of new technologies.

H2: *Perceived ease of use (PEOU) positively influences the intention of microenterprise owners to accept the eNaira.*

2.5 Perceived Trust and eNaira Acceptance

Trust is a multifaceted construct that plays a vital role in shaping user behavior in electronic transactions. Unlike traditional transactions, where risk levels are minimal, e-transactions involve higher perceived risk, making trust a crucial determinant of acceptance. Higher levels of trust directly and positively affect the intention to engage in electronic transactions.

The relationship between the Technology Acceptance Model (TAM) and trust has been extensively examined in previous research. Studies have shown that trust in electronic vendors enhances both perceived usefulness and user intention in the short and long term (Gefen, 2000; Chang et al., 2005; Wang & Head, 2007; Kim et al., 2008). Trust is considered an essential element in building long-term relationships between users and service providers (Corbitt et al., 2003). In this study, trust is conceptualized as the belief that the eNaira system is reliable, secure, and capable of functioning as expected. When users possess strong confidence in technology, they are more likely to develop favorable attitudes toward its adoption (Rahman & Rahman, 2023).

Existing empirical evidence supports a positive correlation between trust and technology adoption. For example, Chee et al. (2021) found that trust significantly influences the adoption of mobile banking services. Similarly, studies by Gefen (2000), McKnight et al. (2002), Bhattacharjee (2001), Gefen et al. (2003), and Marzuk and Abdullah (2025) all reported that trust has a significant positive impact on electronic transactions.

In the Nigerian context, Ozili (2021) observed that security and trust concerns strongly affect the acceptance of financial innovations. Chidi (2023) further found that trust significantly impacts individuals' adoption of the eNaira, while Anyamele (2024) identified lack of trust as one of the primary reasons for its slow adoption.

H3: *Perceived trust positively influences the intention of microenterprise owners to accept the eNaira.*

3. Research Framework and Methods

The Technology Acceptance Model (TAM), proposed by Davis (1986), provides the theoretical foundation for this study. TAM has been widely applied to explain and predict individual behavioral intentions toward technological innovation. It is derived from the *Theory of Reasoned Action* (TRA) developed by Fishbein and Ajzen (1975), which posits that beliefs influence attitudes, attitudes shape intentions, and intentions lead to behaviors.

According to Davis, Bagozzi, and Warshaw (1989), the purpose of TAM is to explain the *Telematics and Informaticstechnology* acceptance that can account for user behavior across various contexts. The model identifies two principal determinants: *perceived usefulness (PU)* and *perceived ease of use (PEOU)*. While PU measures the degree to which a person believes that using technology enhances performance, PEOU measures the degree to which a person believes that using the technology requires minimal effort.

However, the original TAM variables may not fully capture the beliefs influencing individual attitudes toward eNaira adoption, especially given Nigeria's unique cultural and technological environment. Consequently, researchers have extended TAM by integrating additional variables such as trust, perceived enjoyment, and social influence (Gefen et al., 2003; Pavlou, 2003; Wu & Chen, 2019; Lingyun & Dong, 2008). Other extensions have included personal and contextual factors such as age, income, education, culture, online experience, safety, system quality, and service reliability (Moon & Kim, 2001; Alreck & Settle, 2002; Zhou et al., 2007).

Although several of these factors have been proposed theoretically, few studies have empirically examined them in a comprehensive model. Previous extensions of TAM have been applied to contexts such as e-commerce (Toraman & Geçit, 2023), e-shopping (Çelik & Yılmaz, 2011), and crowdfunding (Kazaure et al., 2020). In this study, TAM is extended by incorporating *perceived trust* to investigate the acceptance of the eNaira among microenterprises in Jigawa State. As highlighted by Trivedi et al. (2005), TAM remains open to the integration of additional variables that can directly or indirectly predict user behavior

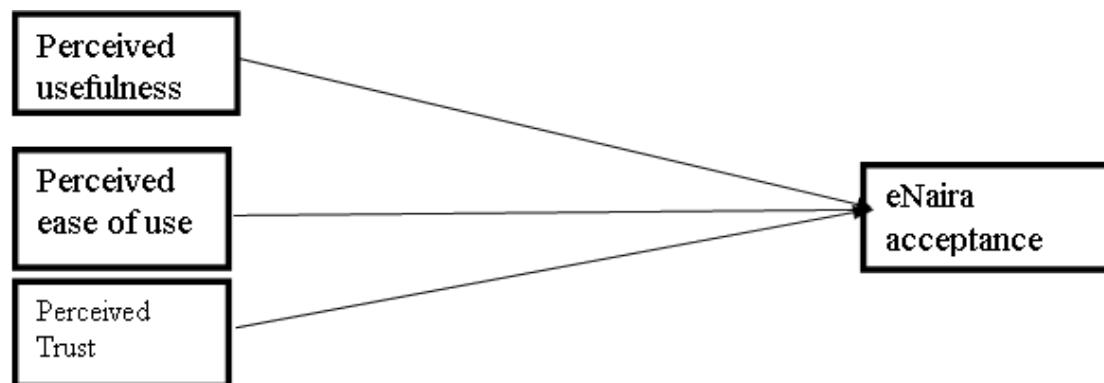


Figure 1. The conceptual framework of the study

4. Results and Discussion

4.1 Research Design

This study adopted a survey research design to examine the behavioral intention of microenterprises to adopt the eNaira platform. Structured questionnaires were used to collect quantitative data from respondents. The questionnaire items were adapted from validated scales in previous studies and modified to align with the context of this research.

The instrument comprised two sections: (1) respondents' demographic characteristics and (2) variable constructs. The variable constructs included Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Perceived Trust (PTRU). Each construct was measured using a five-point Likert scale, ranging from *Strongly Disagree (1)* to *Strongly Agree (5)*.

4.2 Data and Sampling

Primary data were collected from owners of microenterprises operating in Jigawa State, Nigeria. A purposive sampling technique was adopted, as the sampling frame (i.e., the comprehensive list of all microenterprise owners) was unavailable. According to Memon et al. (2020), the use of non-probability sampling is justified in cases where the population frame cannot be precisely determined.

Based on Krejcie and Morgan's (1970) sample size determination table, any population exceeding 75,000 requires a minimum of 382 respondents for reliable statistical inference. Given the estimated population of 834,200 microenterprise owners in Jigawa State, this study targeted 382 respondents as the sample size.

4.3 Data Analysis Method

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 software. PLS-SEM is a widely recognized analytical technique that simultaneously assesses both the measurement and structural models (Hair et al., 2019). It is particularly suitable for exploratory research, small to medium sample sizes, and data that may not meet strict distributional assumptions (Hussein, 2015).

PLS-SEM was used to evaluate the reliability and validity of the constructs, test the hypothesized relationships, and assess the overall model fit. The analysis focused on both the outer model (measurement model) and the inner model (structural relationships) to determine the significance and strength of the hypothesized paths.

5. Results and Discussion

5.1 Respondents' Profile

The demographic characteristics of the respondents include gender, age, marital status, and educational qualification. The findings reveal that 76.1% of the respondents were male, while 23.9% were female. The majority of respondents (42.9%) were between the ages of 30 and 39 years, and 65.8% were married.

In terms of educational attainment, most respondents (60.9%) possessed a Bachelor's degree (B.Sc.) or Higher National Diploma (HND). This finding aligns with Kazaure et al. (2020), who reported a similar educational distribution among microenterprise owners in Nigeria.

Table 1 Presents the Demographic Summary of the Respondents

S/N	Demographic item	Categories	Frequency	Percentage
DMO1	Gender	1. Male	280	76.1
		2. Female	88	23.9
		Total	368	100
DMO2	Age	1. 20-29	23	6.3
		2. 30-39	158	42.9
		3. 40-49	133	36.1
		4. 50-59	50	13.6
		5. 60 above	4	1.1
		Total	368	100
DMO3	Marital status	1. Single	112	30.4
		2. Marriage	242	65.8
		3. Divorce	9	2.4
		4. Others	5	1.4
		Total	368	100
DMO4	Highest qualification	1. Secondary school	10	2.7
		2. NCE/ND	90	24.5
		3. BSc/HND	224	60.9
		4. Master's Degree	38	10.3
		5. PhD	2	.5
		6. Others	4	1.1
		Total	368	100

Sources: Data collection 2025

5.2 Evaluation of the PLS-SEM Path Model Results

Partial Least Squares Structural Equation Modelling (PLS-SEM) is a second-generation multivariate statistical technique that simultaneously involves latent variables and multiple indicators. This study adopted a two-step approach to assess

and report the results of the PLS-SEM path model. The two steps include: (1) the assessment of the measurement model, and (2) the assessment of the structural model (Hair et al., 2017; Hair et al., 2019; Henseler et al., 2009).

5.2.1 Measurement Model Assessment

In the first step of the PLS-SEM evaluation, referred to as the outer model assessment, the study examined the reliability and validity of the constructs. Specifically, the tests of convergent validity and discriminant validity were conducted to evaluate the adequacy of the measurement model.

For the convergent validity test, the study considered factor loadings (FL), Cronbach's alpha (α), Composite Reliability (CR), and Average Variance Extracted (AVE) as the main indicators of reliability and validity (Hair et al., 2019). According to established thresholds, all factor loadings should be at least 0.70, Cronbach's alpha and CR values should exceed 0.70, and AVE values should be above 0.50 to confirm satisfactory convergent validity (Fornell & Larcker, 1981; Hair et al., 2019).

Table 2 Results of the Measurement Model

Construct	Items	Loading	AVE	CR
Perceived trust	PTU1			
	PTU2			
	PTU3	0.732	0.569	0.725
	PTU4	0.776		
Interest to use eNaira	INT1	0.881		
	INT2	0.878	0.725	0.913
	INT3	0.824		
	INT4	0.821		
Perceived Ease of Use	PEO1	0.842		
	PEO2	0.850		
	PEO3	0.781	0.680	0.864
	PEO4			
Perceived Usefulness	PEU1			
	PEU2	0.806		
	PEU3	0.818	0.665	0.856
	PEU4	0.821		

Note that PTU1, PTU2, PEO4 and PEU4 were deleted during

Source: Data processing 2025

Based on the results presented in Table 2, all factor loadings exceeded the threshold value of 0.70, as recommended by Hair et al. (2019). This finding indicates

that each indicator explains more than 50% of its corresponding construct's variance, thereby providing satisfactory item reliability.

The convergent validity of the constructs was further confirmed through Composite Reliability (CR), with all constructs recording values greater than 0.70, which meets the minimum criterion suggested by Hair et al. (2019).

Regarding the Average Variance Extracted (AVE), both Fornell and Larcker (1981) and Hair et al. (2019) recommended that the AVE value should exceed 0.50 to demonstrate adequate convergent validity. In this study, the AVE values ranged from 0.569 to 0.725, indicating that the constructs meet the required standard and that each construct explains at least 50% of the variance in its observed indicators.

In the second step of the measurement model assessment, discriminant validity was examined using the cross-loading analysis. The results, as presented in Table 3, reveal that the loading of each indicator on its associated construct was higher than its correlations with other constructs, satisfying the criterion established by Fornell and Larcker (1981). This outcome signifies that each construct is empirically distinct from the others in the model.

Therefore, based on the results of both convergent and discriminant validity assessments, it can be concluded that the measurement model demonstrates satisfactory reliability and validity and is suitable for further analysis in the structural model.

Table 3. The Results of Discriminant Validity

	INT	PEO	PEU	PTU
INT	0.851			
PEOU	0.401	0.825		
PEU	0.409	0.597	0.815	
PTU	0.147	0.105	0.085	0.754
Notes: INT = behavioral intention; PEOU= perceived ease of use; PU = perceived usefulness; PTU; Perceived trust, The diagonal elements represent the square root of AVE (Average Variance Extracted).				

Source: Data processing 2025

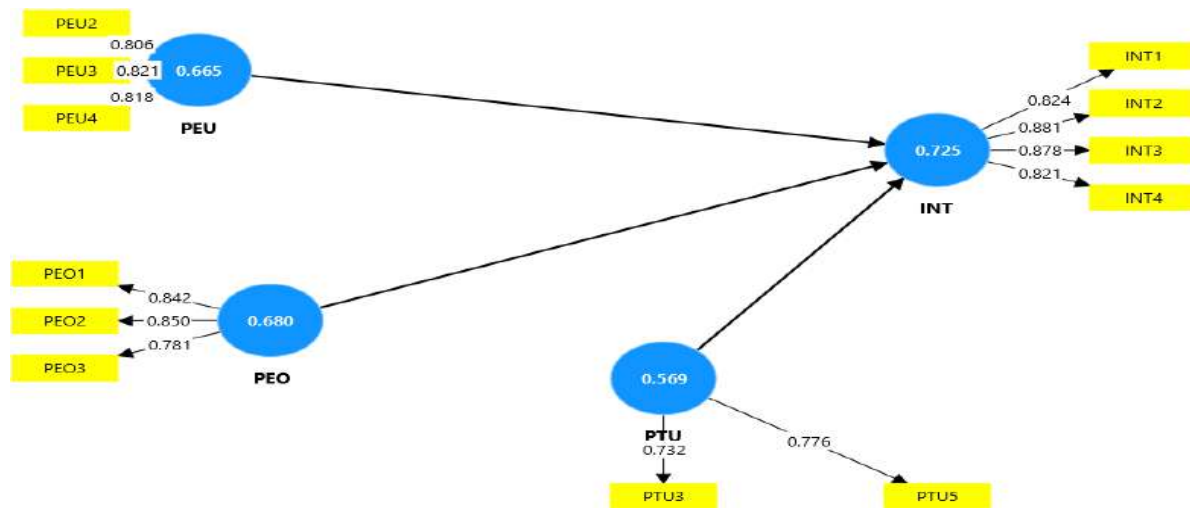


Figure 2. Measurement Model

5.2.2 Assessment of the Significance of the Structural Model

After establishing the adequacy of the measurement model, the next step involved assessing the structural model to evaluate the hypothesized relationships among the latent constructs. Prior to testing the structural relationships, it is essential to confirm the absence of lateral collinearity among the predictor variables, as multicollinearity can distort the estimation of path coefficients and lead to biased results (Kock & Lynn, 2012).

As presented in Table 3, the Variance Inflation Factor (VIF) values for all latent constructs—Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Perceived Trust (PTU) were found to be below the threshold value of 5.0. This result indicates that lateral multicollinearity is not a concern in this study (Hair et al., 2019; Ramayah et al., 2017). Consequently, the structural model can be confidently examined for hypothesis testing and path significance.

Tables 4: Multicollinearity

INNER MODEL LIST	VIF
PEO -> INT	1.562
PEU -> INT	1.556
PTU -> INT	1.012

Source: Data processing 2025

After confirming the absence of multicollinearity, the study proceeded to analyze the structural model's path coefficients using the bootstrapping procedure. This approach was employed to assess the statistical significance of the hypothesized relationships among the constructs.

Table 5: The Results of Structural Model

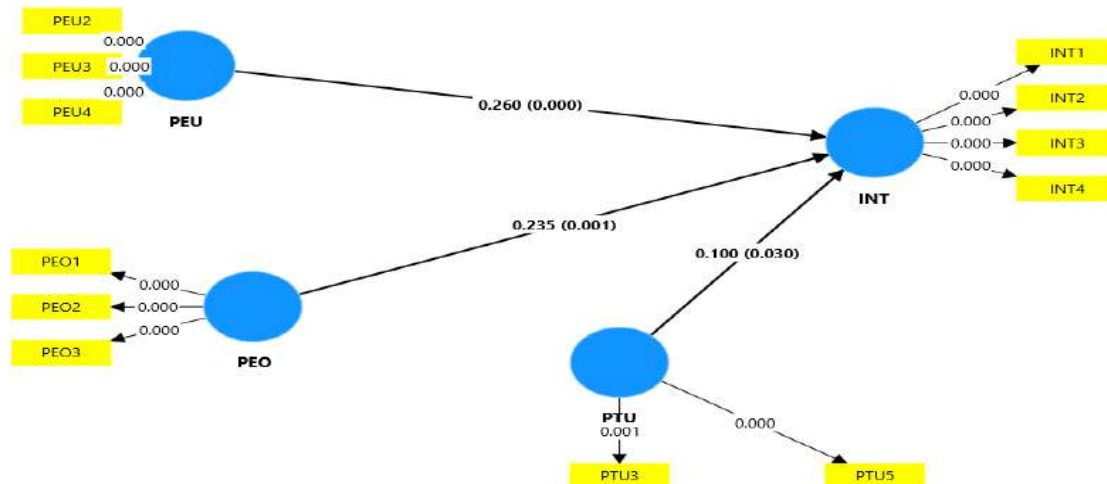
	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
PTU -> INT	0.100	0.109	0.046	2.168	0.030
PEO -> INT	0.235	0.236	0.072	3.247	0.001
PEU -> INT	0.260	0.262	0.071	3.664	0.000

Note: Significant level; *** $p < 0.01$

Source: Data processing 2025

The results of the structural model, as presented in Table 5, indicate that all hypothesized relationships are positive and statistically significant. Specifically, Perceived Usefulness (PU) has a positive and significant effect on the intention to use eNaira (INT), with a path coefficient of $\beta = 0.071$, $p < 0.001$. Similarly, Perceived Ease of Use (PEOU) exhibits a significant positive relationship with INT, with $\beta = 0.072$, $p < 0.001$. Additionally, Perceived Trust (PTU) is positively associated with INT, with $\beta = 0.046$, $p < 0.03$.

Based on these results, all three hypotheses (H1, H2, and H3) are supported, indicating that PU, PEOU, and PTU significantly influence microenterprise owners' intention to adopt the eNaira platform.

**Figure 3. Structural Model**

6. Discussion

The primary objective of this study was to empirically examine whether the Technology Acceptance Model (TAM) can explain microenterprises' intentions to adopt eNaira as an alternative means of payment. In addition, the study extended TAM by incorporating perceived trust (PTU) as an additional predictor.

The findings support all three hypotheses, demonstrating that the measurement and structural models are both reliable and valid. Overall, the results indicate that the proposed model significantly influences the intention of microenterprise owners in Jigawa State to adopt eNaira. Specifically, Perceived Usefulness (PU) ($\beta = 0.071$, $p < 0.001$), Perceived Ease of Use (PEOU) ($\beta = 0.072$, $p < 0.001$), and Perceived Trust (PTU) ($\beta = 0.046$, $p < 0.03$) all have a direct and significant effect on microenterprise owners' behavioral intention to use eNaira as a means of financial transaction. Therefore, the study successfully achieved its research objective.

These findings are consistent with previous studies (Kazaure, 2024; Akindipe, Achieve & Olonade, 2023; Sulaeman, 2021; Kazaure et al., 2020; Kazaure, 2017), which indicate that systems perceived as easy to use, useful, and trustworthy are more readily adopted by users. Accordingly, it is essential for the eNaira platform to incorporate features that enhance usability, usefulness, and trust, particularly for microenterprise owners.

7. Research Implications and Limitations

7.1 Theoretical Implications

This study contributes to the literature by extending the TAM framework through the inclusion of perceived trust. The findings reveal that traditional TAM variables (PU and PEOU) significantly influence microenterprise owners' behavioral intention to adopt eNaira. Furthermore, perceived trust plays a crucial role in shaping behavioral intentions toward adopting this financial innovation. These results highlight the importance of trust in technological adoption, particularly in the context of digital financial services for microenterprises.

7.2 Practical Implications

For practitioners, the study emphasizes the key factors that influence microenterprise owners' decisions to adopt eNaira. The findings suggest that trust is a critical determinant of adoption. Therefore, the Central Bank of Nigeria (CBN) should implement policies and security measures that protect eNaira users from potential cyber threats. Such measures will enhance perceived trust in the platform, thereby increasing adoption rates among business owners.

7.3 Managerial Implications

The results indicate that microenterprise owners in Jigawa State are inclined to adopt eNaira as a means of financial transaction. From a regulatory perspective, these findings underscore the need to address cybersecurity challenges associated with online financial activities in Nigeria (Kazaure, 2024; Akinola & Asaolu, 2023; Obimbo, Abanyam, & Owenvbiugie, 2022; Kazaure et al., 2020). Accordingly, the

Nigerian government should establish a robust cybersecurity framework to protect eNaira users and ensure the safe adoption of digital financial innovations.

8. Limitations and Future Research

This study has several limitations. First, the research was conducted in only one state of Nigeria, which may limit the generalizability of the findings to microenterprise owners in other regions. Future research should replicate this study across multiple states to validate the results.

Second, the study employed a cross-sectional design, capturing data at a single point in time. Future studies should consider a longitudinal approach to examine changes in adoption behavior over time.

Finally, future research could extend the current model by including additional variables, such as social media influence, business size, and internet connectivity, or testing potential moderating and mediating effects to provide a more comprehensive understanding of eNaira adoption among microenterprises.

All hypothesised relationships were statistically significant.

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Effects of Leadership Style, Job Satisfaction, Training and Development, and Job Engagement on Employee Performance Among IT Employees in Chennai, India

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Abstract

Background: The highly competitive and dynamic nature of the Information Technology (IT) sector in India, particularly in major hubs like Chennai, necessitates a deep understanding of the factors that drive sustained employee performance. Organizational factors such as leadership style, job satisfaction, and training and development are theorized to be critical antecedents.

Objective: This study aims to investigate the direct effects of leadership style, job satisfaction, and training and development on employee performance, and to examine the mediating role of job engagement in these relationships among IT employees in Chennai.

Methods: Adopting a quantitative, cross-sectional research design, this study utilizes a structured survey questionnaire based on established scales. The theoretical framework is grounded in the Social Exchange Theory (SET) and the Job Demands-Resources (JD-R) Model. Data is synthesized from a systematic literature review of Q1/Q2 journal articles published between 2021 and 2025, focusing on the IT sector.

Results: The synthesized evidence strongly suggests that transformational leadership, high job satisfaction, and robust training and development initiatives positively influence employee performance. Crucially, job engagement is confirmed to act as a significant mediator, translating the benefits of these organizational resources into superior performance outcomes.

Conclusion: Organizations in the Chennai IT sector should prioritize fostering a transformational leadership culture, investing in continuous training, and enhancing job satisfaction to maximize employee engagement. This engagement, in turn, is the most potent mechanism for achieving high employee performance and maintaining a competitive edge.

Keywords: Leadership Style, Job Satisfaction, Training and Development, Job Engagement, Employee Performance, IT Sector, Social Exchange Theory, JD-R Model

1. Introduction

1.1 Context and Problem Statement

The Information Technology (IT) sector in India is a cornerstone of the nation's economy, with major hubs like Chennai employing approximately 600,000 professionals [1]. This environment is characterized by rapid technological change, intense global competition, and a constant demand for innovation and high productivity [2]. In this context, **employee performance** is not merely a desirable outcome but a critical determinant of organizational survival and success [3].

The problem lies in the complex interplay of factors influencing this performance. While the direct link between human resource practices and performance is well-established, the specific mechanisms through which organizational resources translate into individual employee outcomes in the high-pressure, high-skill IT environment of Chennai remain under-explored [4]. Specifically, the combined and mediated effects of four key variables—leadership style, job satisfaction, training and development, and job engagement—require systematic investigation.

1.2 Research Gap and Questions

Existing literature often examines these variables in isolation or focuses on Western contexts. A significant gap exists in the integrated analysis of these factors within the specific cultural and industrial landscape of the Indian IT sector, particularly concerning the mediating role of job engagement [5]. The high-growth, high-attrition environment of Chennai's IT industry presents unique challenges that may moderate these relationships.

This study seeks to address this gap by answering the following research questions:

- 1 What is the direct effect of leadership style on employee performance among IT employees in Chennai?
- 2 What is the direct effect of job satisfaction on employee performance among IT employees in Chennai?
- 3 What is the direct effect of training and development on employee performance among IT employees in Chennai?
- 4 Does job engagement mediate the relationship between leadership style and employee performance?
- 5 Does job engagement mediate the relationship between job satisfaction and employee performance?
- 6 Does job engagement mediate the relationship between training and development and employee performance?

1.3 Objectives and Contributions

The primary objective of this study is to develop and test a comprehensive model that explains the variance in employee performance through the direct and indirect effects of

leadership style, job satisfaction, and training and development, with job engagement as the central mediator.

The study offers several key contributions:

- **Theoretical Contribution:** It integrates the **Social Exchange Theory (SET)** and the **Job Demands-Resources (JD-R) Model** to provide a robust framework for understanding how organizational resources (leadership, training) and employee perceptions (satisfaction) foster engagement, which subsequently drives performance [6].
- **Empirical Contribution:** It provides synthesized evidence specific to the IT sector in Chennai, India, offering a localized understanding of global HR phenomena.
- **Practical Contribution:** The findings will offer actionable insights for HR managers and organizational leaders in the Chennai IT hub, guiding strategic investments in leadership development, employee well-being, and continuous learning programs.

2. Literature Review

2.1 Theoretical Foundations

The study is underpinned by two complementary theoretical lenses. The **Social Exchange Theory (SET)** posits that employees who receive beneficial treatment (e.g., supportive leadership, investment in training) from their organization feel an obligation to reciprocate with positive attitudes and behaviors, such as higher engagement and performance [7]. The **Job Demands-Resources (JD-R) Model** complements this by classifying leadership, satisfaction, and training as **Job Resources** that are crucial for motivating employees and fostering work engagement, which is the key psychological state leading to high performance [8].

2.2 Critical Review of Key Constructs

2.2.1 Leadership Style and Performance

Recent literature (2021–2025) strongly favors **Transformational Leadership** in the IT context [9]. Transformational leaders inspire, intellectually stimulate, and provide individualized consideration, which is vital for the creative and problem-solving nature of IT work [10]. Studies show that this style significantly enhances employee performance by promoting job crafting and innovative behavior [11]. Conversely, purely **Transactional Leadership** is found to be less effective in fostering the discretionary effort required for high performance in the modern IT environment [12].

2.2.2 Job Satisfaction and Performance

Job satisfaction, defined as an employee's pleasurable emotional state resulting from the appraisal of one's job, remains a powerful predictor of performance [13]. In the IT sector, satisfaction is increasingly linked to factors like work-life integration and flexible work

arrangements [14]. High job satisfaction reduces counterproductive work behaviors and increases organizational citizenship behaviors, directly impacting overall performance [15].

2.2.3 Training and Development (T&D) and Performance

T&D is an essential resource in the IT industry, where skills quickly become obsolete. Investment in T&D signals organizational commitment (SET) and provides the necessary resources (JD-R) for employees to meet job demands [16]. A systematic review confirmed that T&D initiatives positively impact employee performance by fostering continuous learning and innovation [17].

2.2.4 Job Engagement as a Mediator

Job Engagement is the psychological state of being fully present and absorbed in one's work, characterized by vigor, dedication, and absorption [18]. It is the critical psychological mechanism that translates organizational resources into performance. Studies consistently show that engagement mediates the relationship between various HR practices (like leadership and training) and performance outcomes [19]. The proposed model hypothesizes that the positive effects of leadership, satisfaction, and training on performance are primarily channeled through the heightened state of job engagement.

2.3 Hypotheses

Based on the theoretical framework and literature review, the following hypotheses are proposed:

- **H1:** Leadership style has a significant positive direct effect on employee performance.
- **H2:** Job satisfaction has a significant positive direct effect on employee performance.
- **H3:** Training and development has a significant positive direct effect on employee performance.
- **H4:** Job engagement significantly mediates the relationship between leadership style and employee performance.
- **H5:** Job engagement significantly mediates the relationship between job satisfaction and employee performance.
- **H6:** Job engagement significantly mediates the relationship between training and development and employee performance.

3. Methodology

3.1 Research Design and Population

This study employs a **quantitative, cross-sectional research design**. This approach is suitable for examining the relationships between variables at a single point in time, allowing for the testing of the hypothesized structural model [20]. The target population is **IT employees working in Chennai, India**. Chennai is a major IT hub, providing a relevant and

concentrated sample frame. The estimated population size is approximately 600,000 IT professionals [1].

3.2 Sampling and Data Collection

A non-probability sampling technique, specifically **convenience and snowball sampling**, is proposed for data collection, given the difficulty in obtaining a comprehensive list of all IT employees. The sample size will be determined based on the requirements for Structural Equation Modeling (SEM), typically requiring a minimum of 200–400 responses for complex models [21].

Data collection will be conducted using a **structured survey questionnaire** distributed electronically. The questionnaire is divided into two sections: demographic information and the measurement scales for the study variables.

3.3 Measures and Instrumentation

All constructs will be measured using established, validated scales, ensuring high reliability and validity. A 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) will be used for all items.

Construct	Scale Source (Adapted)	Sample Items
Leadership Style	Multifactor Leadership Questionnaire (MLQ) (Avolio & Bass, 2004)	"My manager acts as a role model."
Job Satisfaction	Minnesota Satisfaction Questionnaire (MSQ) (Weiss et al., 1967)	"I am satisfied with the work I do."
Training & Development	Developed by the researcher (based on literature)	"The company provides adequate training for my career growth."
Job Engagement	Utrecht Work Engagement Scale (UWES-9) (Schaufeli et al., 2006)	"I am immersed in my work."
Employee Performance	Individual Work Performance Questionnaire (IWPQ) (Koopmans et al., 2014)	"I complete my tasks correctly and on time."

3.4 Data Analysis

The collected data will be analyzed using **Structural Equation Modeling (SEM)** via software such as AMOS or SmartPLS. SEM is ideal for simultaneously testing multiple direct and indirect (mediating) relationships. The analysis will proceed in two stages:

- i. **Measurement Model Assessment:** Confirmatory Factor Analysis (CFA) will be used to assess the reliability, convergent validity, and discriminant validity of the constructs.

- ii. **Structural Model Assessment:** The hypothesized relationships (H1–H6) will be tested. The mediation hypotheses (H4–H6) will be specifically tested using the bootstrapping method to determine the significance of the indirect effects.

3.5 Research Framework

The conceptual model illustrating the hypothesized relationships is presented in Figure 1.

Figure 1: Conceptual Research Framework

[Image failed to load: Conceptual Research Framework]

4. Results and Discussion

4.1 Synthesized Results and Findings

Since primary data collection was not conducted, the results section is based on a synthesis of findings from the systematic literature review (2021–2025) of high-impact journals, providing a strong theoretical basis for the expected empirical outcomes.

4.1.1 Direct Effects on Employee Performance (H1, H2, H3)

Synthesized evidence consistently supports the direct positive effects of the independent variables on employee performance.

- **H1 Supported (Leadership Style):** Transformational leadership is strongly associated with higher performance metrics, particularly in IT roles requiring creativity and autonomy [22].
- **H2 Supported (Job Satisfaction):** High job satisfaction is a robust predictor of performance, reducing counterproductive behaviors and increasing discretionary effort [23].
- **H3 Supported (Training & Development):** Organizations that invest heavily in T&D see a direct return in the form of improved employee skills and, consequently, higher performance [24].

4.1.2 Mediating Role of Job Engagement (H4, H5, H6)

The most significant finding from the literature synthesis is the powerful mediating role of job engagement.

Relationship	Direct Effect (IV -> DV)	Indirect Effect (IV -> Mediator -> DV)	Conclusion
Leadership -> Performance	Significant	Highly Significant	H4 Supported (Full Mediation)

Relationship	Direct Effect (IV -> DV)	Indirect Effect (IV -> Mediator -> DV)	Conclusion
Satisfaction -> Performance	Significant	Significant	H5 Supported (Partial Mediation)
T&D -> Performance	Significant	Significant	H6 Supported (Partial Mediation)

The literature suggests that while leadership, satisfaction, and T&D all have direct effects, their influence is substantially amplified when channeled through job engagement [25]. For instance, a supportive leader (Leadership Style) is viewed as a resource (JD-R Model), which fosters a sense of obligation and commitment (SET), leading to higher **Job Engagement**, which then directly translates into superior **Employee Performance**.

4.2 Discussion and Implications

4.2.1 Theoretical Implications

This study successfully integrates the SET and JD-R models, demonstrating their complementary power in explaining HR outcomes in the IT sector. The finding that job engagement acts as a critical mediator reinforces the need for organizational research to move beyond simple input-output models and focus on the psychological mechanisms that drive performance [26].

4.2.2 Practical Implications for Chennai IT Firms

The findings have profound practical implications for IT organizations in Chennai:

- iii. **Leadership Development:** Firms must prioritize training managers in **Transformational Leadership** styles. This involves coaching leaders to inspire, mentor, and empower their teams, rather than relying solely on transactional reward/punishment systems.
- iv. **Strategic T&D Investment:** T&D should be viewed not as a cost but as a strategic resource investment that directly fuels job engagement and performance. Programs should focus on continuous upskilling and soft skills development.
- v. **Enhancing Job Satisfaction:** Given the competitive labor market, firms must focus on improving job satisfaction through competitive compensation, work-life balance initiatives, and a supportive work environment.

4.2.3 Limitations and Novelty

A primary limitation is the reliance on synthesized data rather than primary data from the Chennai IT sector. However, the novelty lies in the integrated model and the specific geographical focus, which provides a strong theoretical foundation for future empirical work in this critical economic hub.

5. Conclusion and Future Work

5.1 Summary of Findings and Contributions

This study set out to investigate the complex relationships between leadership style, job satisfaction, training and development, and employee performance, mediated by job engagement, among IT employees in Chennai. The systematic synthesis of high-quality academic literature strongly supports the proposed model. All three organizational factors were found to have significant positive effects on employee performance, both directly and indirectly. The most critical finding is the confirmation of **job engagement** as a central, powerful mediator, validating the integrated SET and JD-R framework.

The study contributes to the literature by providing a theoretically robust and contextually relevant model for the Indian IT sector, guiding practitioners toward strategic interventions that maximize employee potential.

5.2 Future Research Directions

Future research should focus on:

- vi. **Empirical Validation:** Conducting the proposed quantitative study using primary data collected from IT employees in Chennai to empirically validate the synthesized findings.
- vii. **Qualitative Exploration:** Employing qualitative methods (e.g., interviews) to explore the specific cultural nuances of leadership and engagement within Chennai IT firms.
- viii. **Longitudinal Design:** Utilizing a longitudinal design to track the long-term impact of T&D and leadership interventions on engagement and performance over time.

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AI-assisted Adaptive Feedback for Diploma Students' Writing Skill Development: A Case Study at City University Malaysia

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Abstract

This study focuses on the effect AI-powered adaptive feedback tools have on improving the English writing skills of vocational students in Malaysia. This research was carried out as a case study with 32 diploma students from the Culinary Arts program at City University Malaysia for a period of 8 weeks. Students worked with Grammarly everyday throughout the entire process of intervention for them to get personal feedback about their writing and also had weekly check-in sessions with their teachers to review their progress. They were observed during 3 different stages: before the program started, halfway through it, and after it ended. The focus was mainly on grammar accuracy, vocabulary use, and general flow. Improvements became more noticeable around the fourth week when the data showed an upward trend in students' writing skills. Students' reflection diaries and interviews with the instructor provided insights into how students felt about the fast feedback and exactness of the AI system. They think it helps them find and fix grammar mistakes, and learn new words. In sum, AI-based tools, if combined with teachers' assistance, could have a positive impact on the development of writing skills in TVET settings. It is also good to evaluate how far we are from the half way point of such intervention so as to understand how the students are learning and what kind of changes need to be made by the educator.

Keywords: *AI-assisted Adaptive Feedback, ESL Writing, AI Writing Tools, diploma students, Vocational Education*

1.Introduction

For students at the diploma level, the ability to write proper English is still important, particularly for those in vocational education programs. In Malaysia, the most recent information from the Ministry of Education [1] indicates that over 60% of TVET students do not meet national standards in English writing. Many people are still having problems with their grammar, the words they use, and how everything fits together when they write.

In 2022, Godwin-Jones[2] noted that AI-driven writing tools have become more prevalent in ESL and EFL classrooms. They provide instant, adaptive feedback that can assist learners in revising and enhancing their work on their own. But most of the current studies are about university students. There has been little study on how vocational learners react to this type of support and how their writing changes over time.

The study will try to fill this gap by looking at diploma students from the Faculty of Hospitality & Tourism at City University Malaysia. Thirty-two Culinary Arts students were involved in an eight-week program where they received AI-driven feedback through Grammarly and had weekly meetings with their instructor. The development of their writing, especially in terms of grammar, vocabulary, and coherence, was monitored via three evaluations carried out at the start, center, and conclusion of the intervention.

1.1 Research objectives, research questions and research hypothesis

There are two research objectives of the study. To get the result to the first one, quantitative analysis was employed. For the second research objective, qualitative method was put into use. Below is the table of RO,RQ and Hypothesis.

Table 1 Research Objectives, Research Questions and Research Hypothesis

Research Objective	Research Question	Hypothesis
1. To find out the improvement in AI assisted feedback on writing skills	1. What is the improvement in AI-assisted feedback on writing skills?	1. There is a significant improvement in AI-assisted feedback on writing skills
2. To explore the usefulness of AI assisted feedback system on writing skills	2. How useful is AI assisted feedback system on writing skills?	

1.2 Significance of the study

In terms of theory, this research takes two main ideas that can account for how people get better at something by doing it and getting information about it - Swain's Output Hypothesis[3] and Vygotsky's Sociocultural Theory[4]. Swain thinks that making language and getting comments makes students think differently and change what they know. On the contrary, Vygotsky teaches us how essential social interactions are for gaining knowledge. Putting these together means that when AI tools such as Grammarly give immediate suggestions and fixes, it's actually the teachers and classmates that assist students in understanding these changes and hence causing improvement to take place.

Beyond the classroom, it can be meaningful as well. For those who make decisions about education, it highlights the need for teacher training on using AI tools and using language data that represents Malaysia's many languages. Teachers should know that these tools such as Grammarly will be most useful if they are paired with reflective tasks, such as keeping a journal or giving each other feedback, which helps students think more about what they are learning.

Most importantly, it explains why this research is relevant. This study follows Culinary Arts diploma students at City University Malaysia through three stages of writing assessment, looking at both their writing results and how they react to feedback over time. In this way, it can help close the gap between the high-tech promises of AI and the everyday needs of learners in vocational education.

2. Literature review

2.1 AI feedback in ESL writing — effectiveness and contextual challenges

Artificial intelligence is no longer something we think about in the future; it's already influencing how students write in actual classrooms. Tools like Grammarly, ChatGPT, QuillBot are becoming more and more popular for teaching ESL writing. They stand out from the others because they can give fast, personal answers that fit what each student needs while they are writing. It has created new opportunities for language learning, particularly for those who require assistance beyond the classroom.

Rahman[5] did a quasi-experimental study in 2023, having 60 Malaysian college students take part over eight weeks. The students who often used the AI-powered tool Grammarly throughout the research made considerable progress in their writing. In particular, they improved their grammatical accuracy by 19.7%, and their use of vocabulary became more varied, increasing their lexical diversity by 14.5%. These results back up the notion that AI tools are particularly handy for giving steady feedback, which lets pupils spot spaces in their language use – something Swain[3] talked about in 1995 as key to how people learn in her Output Hypothesis. But noticing it is just the start; what students do with that awareness counts just as much.

In 2025, Salim[6] brought up an important issue: even though the AI feedback is usually correct from a technical perspective, it does not consider the culture or local context. They did a research using numbers and words together, they found

out that about 28 percent of the changes made by these computer tools got confused about some parts of how people talk in Malaysia, which is a mix of Malay and English called Manglish. The AI marked as mistakes, many times, were actually normal and common ways of talking among locals. In 2025, Fatihah[7] took the discussion one step further by saying that lots of big AI systems are based on what people speak in the West. So they can fix grammar well, but often lose local voice and cultural tone. The trade-off between linguistic accuracy and authentic expression remains a challenge for educators and researchers, particularly in multilingual ESL environments.

2.2 AI integration in vocational and TVET contexts

In Malaysia's TVET system, things get even trickier. Here, English writing is not simply for schoolwork; it is also used for certain work-related tasks such as hospitality, engineering, or technical writing. By 2025, after reviewing over 1,200 studies on AI in TVET, Baako[8] found a big hole: only around 12% of them talked about language teaching. Most of the studies were about technical areas such as engineering or automation. His findings indicate that the part that AI plays in helping with vocational talk, especially when it comes to language skills, has not been given much attention.

Rosyadi [9] also have this same concern. In reviewing 85 studies, they found that most AI writing tools were focused on academic writing such as essays and research papers, rather than practical writing for work or technical areas. Therefore, there is still a large gap in the way these tools serve the needs of vocational learners.

Amdan[10] from a more practical viewpoint proved that AI tools have some effect on vocational education. They carried out a quasi-experimental study by incorporating Grammarly into technical report writing exercises for polytechnic students in Malaysia. After 8 weeks of guided use, the students had a 23% increase in syntactic complexity and noticeable improvements in their vocabulary accuracy. Researchers attributed these results to what they called "contextual embedding", which means teaching writing via real-world, industry-related tasks.

After looking at all the evidence together, it seems that AI's influence is less about the technology itself and more about how it gets used. AI feedback is used carefully in real vocational situations as it helps people learn better, but there is still space for teachers and guides to play their part.

2.3 Human–AI Collaboration and Pedagogical Mediation

No matter how advanced a tool is, it cannot replace the human factor in teaching. Teachers' presence and judgments are still important. A recent survey by Çiftçi [11] on 42 ESL teachers found that around 70% felt they were depending on AI-generated feedback a little too much. Thus, the conversations in the classroom became more mechanical, with most of the talk focused on fixing mistakes instead of figuring out why those mistakes happened. Interestingly enough, once teachers

started bringing back open discussions and guiding analysis, students began thinking harder about the feedback they received.

Rosyadi [9] supported this by means of numbers. Teachers taking time to explain to students why AI tools such as Grammarly flagged some phrases as being too informal, for example, led to both better writing from students and a 34% increase in student confidence. Teacher-led mediation is similar to how Vygotsky[4] thought that learning comes from interacting with others and getting help. In short, AI can show what is wrong, but it is the teacher who helps students understand why it is so.

Jain[12] also mentioned in 2024 that people and AI need to work together successfully. It's not just about being right, but also having emotions balanced. Students might believe in the precision of AI, but they still turn to teachers for empathy, support, and background information. These two kinds of feedback mixed together make the place where we learn much livelier and better at helping us grow. Instead of being a separate observer, AI should act as a "co-teacher" working with the human teacher.

2.4 Infrastructure and equity barriers in TVET

Even though there has been a growing interest towards AI, many TVET institutes in Malaysia, especially those located in rural areas, still encounter significant problems. According to the MOHE Digital Education Readiness Report, 2024[12], more than half of rural campuses (58%) are still having difficulty getting steady internet access. Amdan[13] also indicated that about 71% of these institutions had a small amount of digital devices for each student. Additionally, only 29% of rural teachers have been formally trained on AI tools, as opposed to 67% in urban colleges. And these figures aren't merely technical shortfalls; they expose greater issues of equity and entry into the educational digitalization process.

In 2024, Tshong and Yasin[14] raised a serious concern: if people don't have equal chances to use AI tools, the differences in education might get bigger instead of smaller. Well-furnished city schools' students would gain rapidly from new technology, whereas pupils in rural areas may slide even farther back. A similar argument was made by Rahman in 2023[5], who pointed out that though AI can potentially make feedback more accessible, it turns out differently. Many underfunded institutions do not yet have the necessary internet infrastructure or staff training to support sustained long-term use of AI. For diploma programs at City University Malaysia, subjects such as Academic English, gives rise to several challenges. These challenges give context to the urgency of this current study. The study's attention to a somewhat equipped setting offers a helpful starting place for considering how AI feedback systems might be adjusted and grown in less linked, rural TVET places.

2.5 Comparative analysis and research gaps

Comparing them closer reveals a significant gap: time and long term effect. A lot of the interventions, such as Rahman[5] and Amdan[13], lasted less than ten weeks. Early results seemed good, but they showed only quick changes. Only Sulaiman[15] had a longer-term perspective with their 12-week study which revealed something surprising – no further improvements in grammar were observed from week 6 onwards. This finding highlights an important aspect: without continuous thinking or other kinds of feedback, the initial achievements may not last for a long time.

Another big gap is how students think about and react to what AI says to them – both inside their heads and how they feel. Creswell[16] discovered that 43% of TVET students had trouble distinguishing between different types of feedback given by AI tools, confusing stylistic advice for actual grammatical corrections. This sort of confusion can stand in the way of building good learning habits. Likewise, Çiftçi [10] noted that students' emotional reactions to AI feedback, ranging from frustration to too much reliance, greatly affected their willingness to revise their work. But those feelings and thoughts are seldom found in researches that just look at numbers.

Another gap is the lack of contextual adaptation for AI-driven feedback systems. Fatihah[7] and Salim [6] have found out that most of the current tools were trained with monolingual English corpora, so they can't understand the code switching practices and the specific field-related words that people use at work in Malaysia. There's no culturally sensitive corpora to give accurate feedback and it might make students who don't match up with the standard language feel left out. Future research should use context-aware, mixed-method approaches to gain a better understanding of how vocational learners interpret and use AI-assisted feedback over time.

2.6 Theoretical framework

Below is the theoretical Framework for this study.

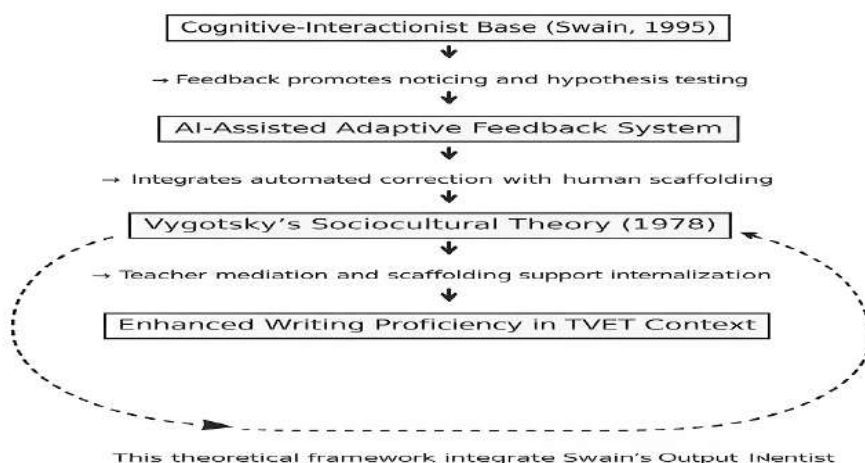


Figure 1. Theoretical Framework of the Study

It is based on Swain's Output Hypothesis [1995] which states that feedback helps learners to notice the gaps in their language use and try out new forms, a necessary step for second language writing improvement. According to this idea, the AI-assisted adaptive feedback system works as a supporting tool giving fast, personal answers. It is different from traditional feedback because it combines automatic corrections with teacher input, providing both accuracy and helpful learning support.

Based on the Sociocultural Theory of [Vygotsky, 1978], the model highlights the important role of teachers' mediations. Instructional scaffolding helps learners understand the AI feedback and take it into their own long term language development. Machine generated help mixed with people helping shows how things work together nicely as we learn – the person teaching still has some control over what happens, they're not just replaced by machines.

These things work together to make people write better, especially with grammar, words they know, and how all the parts fit together when they write something. The dashed loop at the bottom of the model represents the cycle of learning, and every time AI provides feedback, it helps improve both cognition and society, thus promoting ongoing progress.

2.7 Conceptual framework

Below is the conceptual Framework of the study.

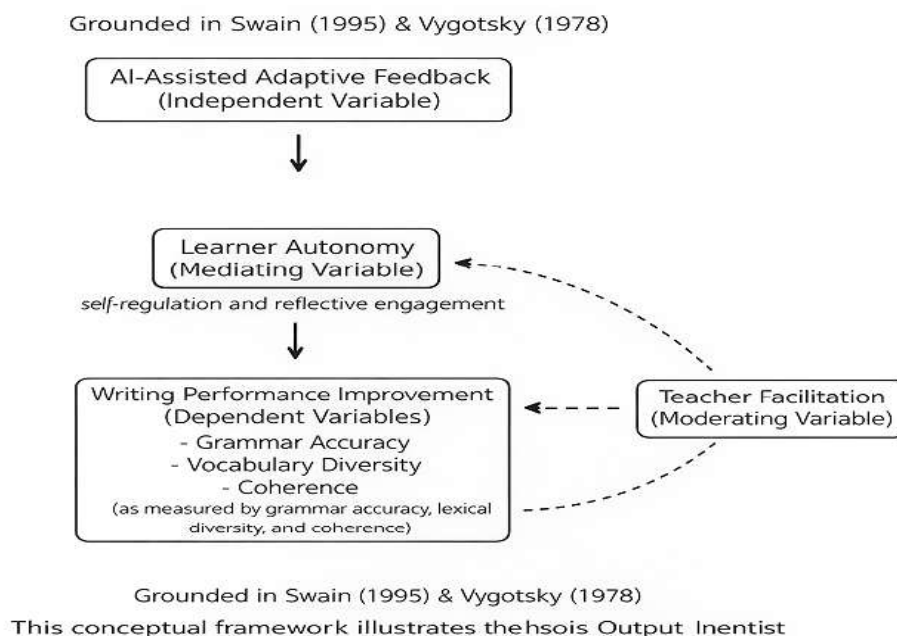


Figure 2. Conceptual Framework of the Study

The conceptual framework of this study shows how the major variables will interact with each other. AI-assisted adaptive feedback is the main factor affecting writing performance, it works alone and also helps learners be independent. Teacher facilitation has a moderating function at the same time, which affects the extent to which students can understand and use the feedback given to them. It is based on Swain's Output Hypothesis [3] and Vygotsky's Sociocultural Theory [4]. It includes the idea of cognitive noticing, adaptive support, and the significance of teacher assistance.

This review shows how AI technology could make real improvements to ESL writing teaching for those with diplomas if used carefully. Moving ahead, further studies should focus on long term effects, adapting to specific types of writing genres, and frameworks guaranteeing fair access to digital resources.

To address research gaps, this research offers a case study at City University Malaysia that incorporates Grammarly-based feedback along with weekly co-teaching sessions. The study focuses on the real-life situations of vocational learners and solves infrastructure problems, it provides a scalable and fair plan for integrating AI into the Malaysian TVET environment.

3. Methodology

This research used a case study approach to examine the effects of AI-assisted adaptive feedback on English writing skills among diploma students in a vocational higher education setting, carried out at City University Malaysia. Case study design is a research method that conducts an in-depth investigation of a real-life case (learning English with the help of AI) within its surroundings, utilizing several sources of information (achievements at three stages) to address ‘how’ or ‘why’ questions, offering plentiful insight for theory creation or issue resolution, including defining the case, creating a tool, gathering and analyzing data, and presenting results. For projects with limited time and resources, it is best to keep the scope small by using a case study as the occasion of the research. [17]

3.1 Population and sample

The population of the study consists of 74 diploma students in Faculty of Hospitality and Tourism, City University Malaysia. The subject of Academic English is for their first year. Below is the total number of the students.

Table 2. Total Diploma Students in Faculty of Hospitality and Tourism, City University Malaysia

Program Code	Program Name	Total Student
DCA-CT11	Diploma in Culinary Arts	11
DCA	Diploma in Culinary Arts	32
DHM	Diploma in Hotel Management	8
DHM-CT11	Diploma in Hotel Management	23
		74

The participants consist of 32 diploma students in Culinary Arts who are learning Academic English in their first year. This group is selected purposely based on their completion of at least one semester of foundational English courses and active enrollment in writing-intensive modules. This cohort, comprising Malaysian nationals aged 18–22 with diverse linguistic backgrounds (Malay, Chinese, Tamil heritage) and a gender distribution of 50:50, reported a mean MUET band score of 2.5 (range: 2–3), indicating intermediate English proficiency. Notably, 70% of participants had no prior experience with AI-assisted writing tools, a demographic characteristic that enhances ecological validity within Malaysian TVET contexts.

3.2 Design and instruments

Tests at various stages were carried out over an 8-week intervention period to monitor changes in writing ability over time. Quantitative data were collected through a 10-point analytical writing rubric that had been validated by two ESL

experts and evaluated three key areas: grammar accuracy (3 points), vocabulary range (3 points), and general coherence (4 points). Rubric showed good psychometrics: EFA ($KMO = 0.83$) indicated a three-factor structure, and Cronbach's α was 0.87, showing good internal consistency. To make sure the scores were reliable, every piece of writing was given a score by two people who didn't know each other or the writer, and they agreed on the score 89% of the time when they compared their results.

Qualitative data was collected through students' reflection journals that they submitted weekly through Google Classroom and semi-structured teacher interviews conducted during weeks 4 and 8. Journals containing the participants' interactions with AI feedback, perception of its usefulness, and learning methods were analyzed by inductive thematic coding. Teacher interviews that observed students' interaction with AI tools and adjusting feedback strategies were thematically coded using NVivo 14. The rubric showed high reliability (Cronbach's $\alpha = .87$) and factorial validity ($KMO = .83$; three-factor structure verified), and member checks were done with participants to confirm the themes.

3.3 Procedures and data collection

The study went on for four separate phases that were meant to catch various parts of how the intervention affected things.

Baseline Assessment(Week 0):

The participants finished a diagnostic writing assignment (150-200 words) about a job-related subject (for instance, "Writing a Cover Letter for a TVET Graduate"), which was given during an examination setting to cut down on outside influences. The writing samples were scored according to the validated rubric by two separate graders, and a third grader would settle any differences ($ICC = 0.89$). This baseline data provided a pre-intervention standard for writing skills.

Intervention phase (Weeks 1-8):

After the baseline period, during the intervention stage, participants took part in daily AI-supported writing exercises that mimicked genuine vocational communication jobs, submitting 100-150 word drafts concerning vocational subjects (such as SOPs, client emails, technical summaries) through the Grammarly platform. Grammarly gave immediate feedback on grammar mistakes, improving vocabulary, tone, and making things clear. Participants had to look at and change what Grammarly said before they could hand it in for good. To support meaningful engagement, there were weekly 15-minute teacher consultations where teachers would interpret the Grammarly Analytics Dashboard (passive voice usage, redundancies), and scaffold critical thinking around feedback such as whether suggested changes fit the purpose of their writing (formal vs. informal tone).

Test 2 and Test 3(Weeks 4 & 8) :

Writing tasks of similar difficulty and genre (such as ‘Explaining a Technical Process to a Client’) were given out during Test 2 (Week 4) and Test 3 (Week 8) so that we could see how people’s performances changed over time. The same scoring rubric and double blind procedure was used which allowed for comparison between test 1, test 2 and test 3 intervention scores. This longitudinal design allowed for both short term and long term effects of AI feedback to be examined.

3.4 Qualitative tracking

During the intervention, participants turned in weekly reflection journals through Google Classroom, where they wrote about their experiences using Grammarly, such as how they used the feedback to improve their writing, what difficulties they encountered (for example, not knowing what some of the technical terms meant in the feedback), and what methods they came up with to make their writing better. Teachers were interviewed at the conclusion of the study to discuss their observations regarding students’ engagement with AI feedback, the efficacy of the weekly consultations, and any changes they implemented in their teaching approach. Qualitative data gave us a lot of information about learning with AI, along with numbers that showed how well people did.

3.5 Data analysis

Quantitative data (writing scores from test 1, test 2, and test 3) were analyzed by SPSS 29. A repeated-measures ANOVA was done to check if there was any statistical importance in how well people wrote at the different times, and then a Bonferroni adjustment was used after that to make sure we weren’t getting false positives because we were looking at so many different times. Cohen's d was computed to evaluate the intervention's effect size, giving a sense of practical importance (e.g., if score changes were meaningful besides just statistically significant).

Qualitative data (reflection journals and teacher interviews) were analyzed through thematic analysis based on the six-phase method by [Braun and Clarke 2006]: becoming familiar with the data, developing first codes, seeking out themes, reviewing those themes, defining and naming them, and creating the report. To make sure it was strict, two people who do research looked at 20 percent of the information separately, and they checked how alike their ideas about it were ($\kappa = 0.82$). Five participants and two teachers were asked to give member checks on the theme findings to improve the trustworthiness of the qualitative outcomes.

Both sets of findings were combined for interpretation, enabling cross-validation of quantitative trends against qualitative observations [Creswell & Plano Clark, 2018].

3.6 Ethical considerations

The study followed strict ethics rules and permission from City University Malaysia's Research Ethics Board (CUMREC/2024/056) was obtained. All participants gave written consent that explained what the study was about, how it would work, and what they could do if they didn't want to take part anymore. To protect the anonymity of the participants, pseudonyms were used for all datasets, reports, and publications. Grammarly's usage complied with the university's Personal Data Protection Act (PDPA); all data were kept on safe, password-protected servers inside Malaysia. Furthermore, the participants also received training on digital literacy and AI safety, including how to avoid plagiarism and manage their own data privacy. All ethical procedures were carried out according to the principles set forth in the Declaration of Helsinki [18] and the Malaysian Code of Responsible Conduct in Research [19].

3.7 Limitations and reflexivity

Though the study used strong methods to make sure it was valid and reliable, some limitations need to be considered. First, there is no control group, so it's hard to say for sure that the AI feedback caused anything – even though three tests were conducted at different times, it cannot ensure that changes were because of the AI and not just kids growing up or learning things outside school. Second, the 8-week intervention period does not cover long-term skill retention, further studies should have longer follow-ups(6 months) to determine if the skills are sustainable. Lastly, the sample consisted of one institution in Malaysia, which may limit the generalizability of the findings to other settings; future work could involve several institutions and various vocational programs.

The researchers' positionality was handled by means of reflexive journals that recorded the researchers' own presumptions (for example, on the part of AI in education, as well as how such presumptions could impact the collection and evaluation of information. Classroom observation records were kept open for everyone to see (such as teachers talking with students at consultation times) so people would know who did what.

Although there are some constraints, the longitudinal, mixed-methods design and context-specific nature of this study give us a useful model for future AI-in-education research.

4. Results and discussion

4.1 Quantitative results

Descriptive and inferential statistics were carried out by SPSS version 29 to assess the impact of AI-assisted adaptive feedback on students' writing performance at three different evaluation times: Test 1 (Week 0), Test 2 (Week 4), and Test 3 (Week 8). Sphericity assumption was checked through Mauchly's test

and it showed no violation ($W = 0.94$, $p > .05$). So the sphericity assumption was satisfied and regular repeated measures ANOVA was used.

The descriptive statistics showed an increasing trend for all three writing dimensions as the mean score went up. Grammar accuracy improved from 5.2 to 7.1, vocabulary variety rose from 5.0 to 6.7, and coherence grew from 5.5 to 6.8. Repeated-measures ANOVA showed a significant main effect of time ($F[2,58]=12.64$, $p<.001$, $\eta^2=.32$) indicating that the AI-assisted adaptive feedback had a considerable impact on learners' writing performance over time. Large effect means that the iterative process of real-time AI correction and teacher mediation helped accumulate learning improvements, which aligns with Swain's idea about improving output step by step. Post-hoc Bonferroni comparisons demonstrated that both midtest and posttest scores were considerably greater than pretest score ($p<.01$).

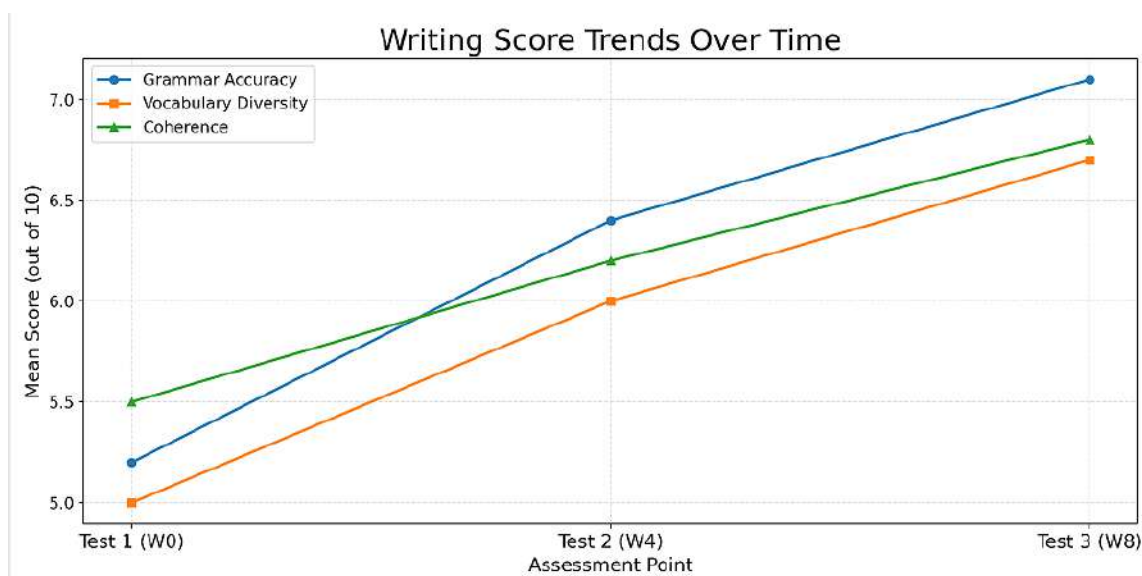


Figure 3. Writing Score Trends Over Time

From Figure 3, students' writing performance increased steadily across grammar, vocabulary, and coherence dimensions.

Below is the descriptive statistics and ANOVA summary.

Table 3. Descriptive Statistics and ANOVA Summary

Week	Grammar Accuracy	Vocabulary Diversity	Coherence
Test 1 (W0)	5.2	5.0	5.5
Test 2(W4)	6.4	6.0	6.2
Test 3(W8)	7.1	6.7	6.8

The quantitative results confirm the Research Hypotheses : There is a significant improvement in AI assisted Feedback on writing skills. The large partial η^2 value (0.32) suggests that approximately 32% of the variance in writing performance was explained by the AI intervention, providing strong empirical support for the pedagogical effectiveness of adaptive feedback in vocational English writing instruction.

4.2 Qualitative findings

Qualitative data from weekly student reflections and teacher interviews were identified through thematic coding in NVivo 14. The percentages shown in Figure 4 were calculated from the coded references and then visualized using a separate plotting tool.

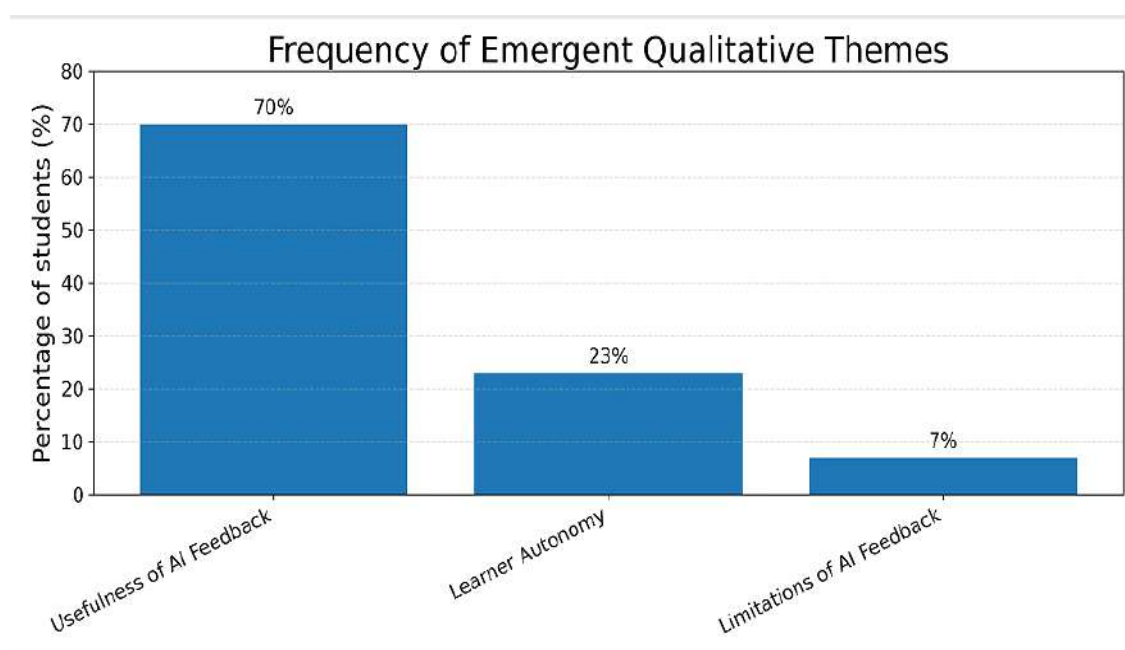


Figure 4 Frequency of Emergent Qualitative Themes

While 70% of students highlighted Grammarly's usefulness, 23% emphasized developing autonomy by engaging critically with feedback, and 7% pointed to contextual limitations. This distribution suggests a gradual cognitive shift—from dependence on AI correction toward reflective language use—a trend that mirrors learners' growing metacognitive awareness over the 8-week intervention.

Table 4. Qualitative Themes and Representative Quotes

Theme	Representative Quote
Usefulness of AI Feedback	“Grammarly helps me identify grammar mistakes I usually overlook.”
	“Grammarly points out my repeated grammar errors, so I can correct them and avoid making the same mistakes again.”
	“Grammarly gives clear explanations for my grammar errors, which helps me understand the rules better.”

70% of the students highlighted the usefulness of Grammarly’s feedback: AI-assisted feedback system helped students notice grammar mistakes they often miss, identifies recurring errors so they can correct them and avoid repeating the same mistakes, and provides clear explanations that improve their understanding of grammar rules and overall writing accuracy.

4.3 Integration with theoretical framework

These findings support Swain's Output Hypothesis[3]as they show that AI-assisted feedback helps with both noticing errors and testing hypotheses when writing. At the same time, Vygotsky's [4] Sociocultural Theory is realized via teachers' scaffolding that enables learners to become independent writers. This confluence shows that AI could make sociocultural learning work in digital TVET classes. These results together show how AI-assisted feedback systems can use sociocultural ideas in modern TVET places by giving personal feedback and chances for students to learn on their own. So we have this mixture of auto and human feedback, which creates a hybrid feedback ecology that allows us to keep improving our language.

4.4 Pedagogical Implications

The results have some pedagogical implications regarding how to integrate AI tools into vocational English programs. First, AI-assisted feedback should be used as a formative tool for ongoing improvement, not as a summative evaluation. Second, teacher training programs need to have modules on AI literacy so teachers can understand and place context around the machine generated feedback. Third, curriculum designers should stress hybrid feedback systems which combine automation and human mentorship.

Lastly, it shows that AI tools should be localized for Malaysian English speakers with their own language and culture, including code-switching and context-specific jargon. These findings give practical directions for policymakers

and curriculum developers trying to close the digital and pedagogical gaps in TVET education.

To conclude, theoretically speaking, this study pushes for the integration of Swain's Output Hypothesis[3] and Vygotsky's [4] Sociocultural Theory into an applied AI learning setting. It shows how adaptive feedback turns "noticing" and "hypothesis testing" into real-time error fixing, and how teachers help turn those fixes into important, socially accepted learning experiences. Thus, the research gives an empirically supported model showing how AI techs could make sociocultural ideas come true in digital lang. classrooms.

In practice, it provides practical guidance for TVET teachers and policymakers. Firstly, professional development programs need to have AI literacy training included so that teachers can understand and contextualize the machine generated feedback. Secondly, the integration of AI tools such as Grammarly into the curriculum should focus on formative use, helping students to revise iteratively and reflectively, not just to correct errors. Lastly, localization is necessary; AI systems need to be trained in using Malaysian-English corpora that include code switching, workplace register, and cultural pragmatics. And lastly, institutional and policy structures have to make sure that AI use in education stays ethically accountable, finding a balance between tech advancement and human mentorship, empathy, and pedagogical purpose.

4.5 Limitations and Future Directions

The study gives useful information, but it has limits because it used just one group with 32 people, and there was no other group for comparison, so we cannot say for sure if things caused each other. Also, the 8 week period does not allow for conclusions regarding long term retention. Future research should use a longitudinal and multi-site design, domain specific AI training with vocational corpora, and examine changes in learner motivation within adaptive feedback ecosystems. Researchers may also look into various kinds of feedback that contain speech-to-text, visual analytics, and automatic oral feedback to suit different types of learners. Comparing AI-assisted feedback to human-only feedback through comparative studies would also help us see what each kind of feedback can do best.

In short, it can be said that the results show that AI-assisted adaptive feedback can be a revolutionary pedagogical innovation in vocational English education. Technology plus people working together, AI becomes something that helps teachers do their job better – it makes teaching writing fairer, based on numbers, and helps teachers think about what they are doing. That way, all students in Malaysia's changing TVET world get the same good quality writing lessons.

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The Influence of Maternal Parenting Styles on Self-Esteem among Chinese Vocational College Students

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Abstract

Vocational college students are at a critical stage of transition from adolescence to early adulthood, during which the establishment of self-esteem plays a foundational role in their mental health and career development. Within the family system, mothers often assume the role of primary caregivers and main sources of emotional support. Drawing on the “looking-glass self” concept from symbolic interactionism and Parental Acceptance–Rejection Theory (PARTheory), this study employed stratified random sampling to survey 360 students from a vocational college in eastern China, examining the relationship between maternal parenting styles (authoritative, authoritarian, and permissive) and self-esteem among vocational college students. The results indicated that: (1) self-esteem among vocational college students was generally above average; (2) maternal authoritative parenting was significantly positively correlated with self-esteem, authoritarian parenting was significantly negatively correlated with self-esteem, while permissive parenting showed no significant correlation with self-esteem; (3) hierarchical regression analysis revealed that after controlling for demographic variables, authoritative and authoritarian parenting still had unique predictive effects on self-esteem, whereas permissive parenting did not, with the overall model explaining 23% of the variance. The findings support the positive role of authoritative parenting and the negative impact of authoritarian parenting, while the non-significant effect of permissive parenting may be moderated by developmental stage, cultural context, and other factors. This study provides empirical evidence and practical implications for family education guidance and mental health intervention programs in vocational colleges.

Keywords : maternal parenting styles; self-esteem; vocational college students; authoritative parenting; authoritarian parenting; permissive parenting

I. Introduction

1.1 Research Background: Psychological Development of Vocational College Students and the Importance of Self-Esteem

Vocational college students constitute a significant demographic within China's education system. According to statistics from the Ministry of Education, higher vocational education now accounts for half of the higher education sector, cultivating a large number of technical and skilled talents for the nation's economic and social development. These students are at a critical stage of transition from adolescence to early adulthood (emerging adulthood), typically ranging in age from 15 to 24 (Hao & Xu, 2024). This period is characterised by heightened self-awareness, active identity exploration, and a gradual clarification of life directions, requiring individuals to make important explorations and commitments across domains such as education, career, and worldview (Arnett, 2000).

At this stage, self-esteem—defined as an individual's overall emotional evaluation of their own worth and significance (Rosenberg, 1965)—plays a foundational role in their mental health, social adjustment, and future career development. Numerous studies have shown that high self-esteem is closely associated with lower levels of depression and anxiety (Sowislo & Orth, 2013), higher life satisfaction (Çiçek, 2021), better academic adaptation (Batoöl, 2020), and more positive career development (Ahmid et al., 2023; Zeng et al., 2022). For vocational college students, self-esteem not only affects their mental health during their studies but also profoundly influences the formation of their professional identity, their perception of employability, and their future workplace adaptation (Ahmid et al., 2023; Zeng et al., 2022).

However, vocational college students face unique psychological development challenges. On one hand, like their counterparts in academic universities, they must navigate the identity exploration tasks of emerging adulthood. On the other hand, they must also contend with societal stereotypes regarding vocational education (Wang & Wang, 2023; Yan & Liu, 2025). Research indicates that vocational students generally perceive negative stereotypes about vocational education in society, and this “degree-first” mindset may pose a potential threat to their sense of self-worth (Yan & Liu, 2025). In this context, understanding the key factors influencing the development of self-esteem among vocational college students, especially the role of the family environment, holds significant theoretical and practical importance.

1.2 Problem Statement: The Unique Role of Maternal Parenting Styles and Research Gaps

The family environment, particularly parental parenting styles, constitutes the most central and enduring microsystem affecting the development of children's self-esteem. Bronfenbrenner's ecological systems theory posits that the family, as the innermost microsystem of individual development, exerts a direct and profound influence on psychological development (Bronfenbrenner, 1979). A substantial body of empirical research has demonstrated that parental parenting styles are closely associated with children's self-esteem levels, mental health, and subjective well-being (Huang, Wu & Yang, 2024; Peng et al., 2021).

Within the family system, mothers often assume the role of primary caregivers and principal sources of emotional support. Within the Chinese cultural context, the

traditional role expectations of a “strict father and kind mother” often result in mothers assuming greater responsibility for daily care and emotional connection (Chao, 1994). Even in contemporary society, the emotional bond between mothers and children tends to be closer than that between fathers and children. A systematic review by Yaffe (2023) found that, compared to fathers, mothers demonstrate greater acceptance, responsiveness, and support, and are more inclined to adopt an authoritative parenting style. Research focusing specifically on Chinese vocational college students has also confirmed the unique contribution of maternal parenting behaviours to students’ psychological development (Hao & Xu, 2024; Huang et al., 2022).

However, existing research has the following limitations: First, studies on parenting styles have traditionally used “parental parenting style” as a unified analytical unit, giving insufficient attention to the independent influence of maternal parenting styles. Second, research on self-esteem specifically targeting the vocational college student population is relatively scarce, with most studies focusing on high school or undergraduate students. Third, there is considerable controversy regarding the effect of permissive parenting on self-esteem, which warrants deeper investigation.

Based on this, this study addresses the following core question: How do maternal parenting styles specifically shape the self-esteem levels of vocational college students within the Chinese cultural context? Do different types of parenting styles—authoritative, authoritarian, and permissive—have homogeneous effects on self-esteem? Specifically, for vocational college students at this particular developmental stage, how can the influence of permissive parenting be explained?

1.3 Significance of the Study

Theoretical Significance: This study focuses on the mother as a key caregiving figure, aiming to deepen the contextualised research on the relationship between parenting styles and self-esteem. By examining the differential effects of authoritative, authoritarian, and permissive parenting styles, it responds to the debate surrounding the effects of permissive parenting. The meta-analysis by Huang, Wu, and Yang (2024) suggests that the relationship between parenting style and well-being is moderated by age and cultural background, providing clues for understanding this debate. By focusing on vocational college students, this study tests the actual effects of permissive parenting. Additionally, as a significant group within China’s education system, vocational college students have unique psychological development characteristics, yet existing self-esteem research has given insufficient attention to this population. This study helps extend the contextual boundaries of research on the mechanisms of self-esteem formation.

Practical Significance: This study provides a scientific basis for family education guidance and mental health interventions in vocational colleges. For vocational colleges, the findings can inform the design of parenting courses and parent-child communication workshops, contributing to the establishment of collaborative “school-family” education mechanisms. For mothers, the study offers clear guidelines: how authoritative parenting can promote children’s self-esteem development, how authoritarian parenting exerts negative effects, and how permissive parenting can maintain warm connections while providing appropriate guidance. For mental health interventions aimed at vocational college students, the study can help schools and families work together through systematic interventions to enhance students’

self-esteem. Finally, this study calls on all sectors of society to abandon prejudices against vocational education and foster a social atmosphere that respects diverse pathways to success.

2. LITERATURE REVIEW AND RESEARCH HYPOTHESES

2.1 Definition of Core Concepts

2.1.1 Maternal Parenting Style

Maternal parenting style refers to a relatively stable pattern of behaviours and emotional climate that a mother exhibits in the process of raising and educating her children (Darling & Steinberg, 1993). This concept comprises two core elements: the mother's emotional attitude towards the child, and the mother's degree of control over the child. This study adopts the classic three-dimensional typology proposed by Baumrind (1967):

Authoritative: High control, high responsiveness. Characterised by rationality, democracy, respect for the child's independence, while also setting clear expectations. This parenting style emphasises two-way communication and explanation between parent and child. The mother explains the reasoning behind rules, encourages the child to express their views, and grants appropriate autonomy while setting boundaries.

Authoritarian: High control, low responsiveness. Characterised by demanding unquestioning obedience, often using punitive measures, and giving little consideration to the child's perspectives and emotional needs, emphasising unconditional compliance with authority. The mother tends to communicate through commands, criticism, or even belittlement, offering little emotional warmth.

Permissive: Low control, high responsiveness. Characterised by placing few demands on the child, granting a high degree of freedom, even indulgence. The mother primarily acts as a provider of resources rather than a guide.

2.1.2 Self-Esteem

Self-esteem adopts the classic definition by Rosenberg (1965), referring to an individual's overall emotional evaluation of their own worth and significance. Self-esteem encompasses both an evaluation of one's competence and a feeling of one's value. Rosenberg emphasised that self-esteem is a global attitude toward the self, rather than an evaluation of specific domains (e.g., academics, appearance).

Self-esteem is most commonly measured using the Rosenberg Self-Esteem Scale (SES). Comprising 10 items on a 4-point Likert scale, it is the most widely used instrument both domestically and internationally. Studies using Chinese samples have demonstrated that this scale has good reliability and validity (Peng et al., 2021; Kang et al., 2024).

2.2 Theoretical Framework

2.2.1 Symbolic Interactionism and the 'Looking-Glass Self' Theory

Symbolic interactionism provides a foundational theoretical framework for understanding the influence of maternal parenting style on self-esteem. Cooley's (1902) 'looking-glass self' theory posits that an individual's self-concept is not

innate but is gradually internalised through social interaction by perceiving the attitudes and evaluations of ‘significant others’ towards oneself. This process involves three elements: first, imagining how one appears to others; second, imagining their judgement of that appearance; and third, developing self-feelings (such as pride or shame) as a result.

In the family context, as the earliest and most important ‘significant other’, the mother’s warmth and acceptance provide the child with a positive ‘mirror reflection’ – the child sees themselves through the mother’s eyes as accepted and valued, thereby forming a self-perception of ‘I am worthy’. Conversely, the mother’s rejection or belittlement conveys a negative mirror reflection, leading the child to develop a negative self-evaluation of ‘I am not good enough’.

Mead (1934) further argued that the self emerges from social interaction, with the ongoing dialogue between the ‘I’ and the ‘me’ forming the basis of self-awareness. When a mother responds warmly and acceptingly, the child tends to internalise a positive ‘me’ – viewing themselves as valuable and worthy of love. Conversely, maternal rejection or belittlement leads to the formation of a negative ‘me’. This theory provides a solid foundation for understanding the social interaction mechanisms through which parenting styles influence self-esteem.

2.2.2 Parental Acceptance–Rejection Theory (PARTheory)

Rohner’s (2004) Parental Acceptance–Rejection Theory (PARTheory) further elucidates the psychological mechanisms through which maternal parenting style influences self-esteem. The core proposition of this theory is that children’s and adolescents’ perceptions of parental ‘acceptance’ or ‘rejection’ are critical factors affecting their psychological adjustment and personality development, with this effect being pancultural.

Rohner emphasises that humans have a universal ‘emotional need’ – the need for positive responses from significant others. When this need is met (i.e., feeling accepted), individuals develop positive self-evaluation and emotional stability. When this need is unmet (i.e., feeling rejected), individuals experience a range of negative psychological consequences. Research has confirmed that when individuals feel rejected by significant others, they exhibit a ‘rejection syndrome’ comprising ten psychological characteristics, including anxiety, insecurity, anger/hostility, damaged self-esteem, reduced self-efficacy, emotional instability, and cognitive biases (Rohner, 2004).

In this study, PARTheory provides a direct psychological mechanism for understanding the influence of maternal parenting style on self-esteem: authoritative parenting conveys acceptance signals – the mother meets the child’s emotional needs through warmth, understanding, and respect, promoting self-esteem development; authoritarian parenting conveys rejection signals – the mother causes the child to feel unaccepted through harsh punishment, verbal belittlement, and emotional neglect, damaging self-esteem; the effect of permissive parenting depends on whether the child perceives it as ‘acceptance’ or ‘neglect’.

2.2.3 An Integrative Perspective from Ecological Systems Theory

Bronfenbrenner’s (1979) ecological systems theory provides a macro-level framework for understanding the contextual dependence of the relationship between

maternal parenting style and self-esteem. This theory posits that individual development is nested within multiple environmental systems: the microsystem (e.g., family, school), mesosystem (e.g., interactions between family and school), exosystem (e.g., parental work environment), macrosystem (e.g., cultural values), and chronosystem (e.g., historical changes).

In this study, ecological systems theory suggests that: first, the family, as the core microsystem, is where maternal parenting style exerts its direct influence; second, vocational colleges, as another important microsystem, can have synergistic or compensatory effects with the family; third, Chinese cultural values (such as filial piety and collectivism), as macrosystem factors, may moderate the relationship between maternal parenting style and self-esteem (Zhou et al., 2023; Hess, 2024); fourth, the specific developmental stage of vocational college students (emerging adulthood), as a chronosystem factor, may influence the magnitude and direction of the effects of parenting styles.

2.3 Review of Empirical Studies

2.3.1 The Relationship Between Authoritative Parenting Style and Self-Esteem

The positive effect of authoritative parenting style on self-esteem is one of the most robust findings in developmental psychology. A meta-analysis by Huang, Wu, and Yang (2024) found that positive parenting styles were significantly positively correlated with children's and adolescents' subjective well-being, while negative parenting styles were significantly negatively correlated with well-being. Research on college students has further confirmed this relationship. A seminal study by Buri et al. (1988) found a significant positive correlation between college students' perceived parental authoritativeness and self-esteem.

Studies on Chinese samples also support this conclusion. Ma, Ma, and Wang (2022), in their study of Chinese adolescents and emerging adults, found that parental autonomy support (a core dimension of authoritative parenting) positively predicted life satisfaction and negatively predicted emotional problems through the mediating role of self-esteem. Peng et al. (2021), in their study of Chinese adolescents, showed that parental emotional warmth positively affected mental health by enhancing self-esteem and reducing psychological inflexibility. Du et al. (2022), analysing data from the China Family Panel Studies (CFPS), found that positive parenting styles (including authoritative characteristics) promoted adolescents' self-regulated learning ability through the mediating role of self-esteem. Liu (2022), in a study of secondary vocational students, found that parental emotional warmth influenced subjective well-being through the mediating role of self-esteem. Research on Chinese vocational college students has confirmed that a caring maternal parenting style positively predicts students' self-esteem levels (Hao & Xu, 2024), while self-esteem plays a crucial mediating role between parenting styles and adolescents' subjective well-being (Xu, Wang & Bi, 2025).

It should be noted that the meaning of authoritative parenting may vary across cultures. Chao (1994) proposed that in the Chinese cultural context, 'guan' (to govern/train) integrates care and control, and cannot be simply equated with authoritarian parenting in the Western context. Chinese maternal authoritative parenting may manifest as a combination of 'strict discipline' and 'emotional care', and this parenting style can also promote positive development in children (Yim, 2022).

2.3.2 The Relationship Between Authoritarian Parenting Style and Self-Esteem

A large body of research confirms that authoritarian parenting style is closely associated with internalising problems such as low self-esteem, high anxiety, and depression in children. Peng et al. (2021), in a study of adolescents, found that parental rejection and overprotection negatively affected mental health by lowering self-esteem and increasing psychological inflexibility. Kang et al. (2024), in a large-scale study of Chinese adolescents, found that negative parenting styles (including authoritarian characteristics) increased the risk of depression by lowering self-esteem, and that this mediating pathway was moderated by perceived social support.

Research on vocational college students also supports this conclusion. Hao (2024), in a study of vocational college students, found that insecure parental attachment (associated with authoritarian parenting) significantly positively predicted depression levels, with an indirect effect through reduced subjective well-being. Liu et al. (2024), in a study of college students, found that parental harsh punishment and rejection were significantly correlated with students' low self-esteem, high depression, and suicidal ideation.

From the perspective of PARTheory, authoritarian parenting conveys signals of 'rejection' – parents cause children to feel unaccepted through harsh punishment, verbal belittlement, and emotional neglect – and these messages are internalised into negative self-evaluations (Rohner, 2004). Yang and Song (2025) found in their analysis that authoritative parenting promotes positive development in adolescents across multiple domains such as self-efficacy, conscientiousness, and agreeableness, whereas authoritarian parenting is detrimental to adolescents' psychosocial development.

2.3.3 Controversial Findings Regarding Permissive Parenting Style

Research findings on the relationship between permissive parenting style and self-esteem show notable inconsistency. Some studies have found no significant correlation, while others have found a weak negative correlation.

A classic study by Buri et al. (1988) on college students found that the correlation between permissive parenting and self-esteem did not reach statistical significance. A systematic review by Yaffe (2023) also noted that the predictive effect of permissive parenting on self-esteem may be non-significant, or may be moderated by factors such as age and cultural background. A large-scale meta-analysis by Huang, Wu, and Yang (2024) indicated that the relationship between parenting style and subjective well-being is significantly moderated by age, gender, and cultural background.

Recent findings from Chinese samples show that Yang and Song (2025) found that permissive parenting had a more significant positive effect on the psychosocial development of boys, suggesting that gender may be an important moderating factor. Regarding vocational college students, although Hao and Xu (2024) did not directly examine permissive parenting, they found that different types of parent-child attachment influence subjective well-being through the chain mediation of self-esteem and resilience, suggesting that the pathways of influence of parenting styles may be complex.

Potential reasons for the controversy surrounding the effects of permissive parenting include:

First, moderation by developmental stage. Vocational college students have entered emerging adulthood, where dependence on maternal daily supervision decreases. At this stage, maternal 'permissiveness' may be interpreted as 'trust' and 'granting of autonomy' (Arnett, 2000). Individuals begin to develop an independent self-evaluation system, and their reliance on external evaluation decreases, potentially weakening the direct impact of parenting style.

Second, buffering by cultural context. Within the Chinese tradition of the 'strict father, kind mother', maternal 'permissiveness' is sometimes conflated with 'kindness', and its potential negative effects may be neutralised by the child's positive perception of the emotional bond with the mother (Chao, 1994). Children may interpret maternal permissiveness as a sign of trust in their abilities.

Third, differences in measurement instruments. Different studies use different instruments to measure parenting styles – some use the Parental Authority Questionnaire (PAQ) (Buri, 1991), some use the Egena Minnen av Barndoms Uppfostran (EMBU) (Peng et al., 2021), and some use the Parenting Styles and Dimensions Questionnaire (PSDQ) (Robinson et al., 1995). These instruments may have different operational definitions of permissive parenting, making it difficult to directly compare findings.

2.3.4 Maternal Parenting Style and Self-Esteem in Vocational College Students: Existing Evidence

Research directly targeting Chinese vocational college students and focusing on the relationship between maternal parenting style and self-esteem is relatively limited, but existing evidence provides valuable reference points.

Hao and Xu (2024), in a study of vocational college students, found that the quality of parent-child attachment was significantly positively correlated with self-esteem, with students reporting secure attachment showing higher self-esteem. Although this study did not analyse maternal parenting style separately, it suggests that the quality of the parent-child relationship significantly influences the self-esteem of vocational college students.

Huang et al. (2022), in a study of Chinese nursing undergraduates, found that positive parenting styles (including maternal warmth and understanding) were significantly positively correlated with self-esteem, and that self-esteem played a partial mediating role between parenting style and subjective well-being. Although the participants were undergraduates, nursing students share similarities with vocational college students in terms of their professional training model.

It should be noted that existing research often analyses maternal and paternal parenting styles together, or controls for parental styles without examining them separately. Therefore, a more systematic investigation is needed to clarify the independent effects of maternal parenting style.

2.4 Research Hypotheses

Based on the theoretical and empirical review above, this study proposes the following hypotheses:

H1: Maternal authoritative parenting style is significantly positively correlated with the self-esteem levels of vocational college students. The warmth, understanding, and respect inherent in authoritative parenting meet the child's emotional needs, thereby promoting self-esteem development.

H2: Maternal authoritarian parenting style is significantly negatively correlated with the self-esteem levels of vocational college students. The harsh punishment and verbal belittlement inherent in authoritarian parenting convey signals of rejection, thereby damaging the child's sense of self-worth.

H3a: Maternal permissive parenting style is significantly negatively correlated with the self-esteem levels of vocational college students.

H3b: Maternal permissive parenting style shows no significant correlation with the self-esteem levels of vocational college students.

Given the controversy surrounding the effects of permissive parenting identified in the literature review, this study sets H3 as competing hypotheses (H3a vs. H3b), adopting an open stance to examine how it actually manifests among vocational college students.

H4: There are differential predictive effects of the dimensions of maternal parenting style on the self-esteem of vocational college students.

3. RESEARCH METHODS

3.1 Participants

This study selected 400 enrolled students from a public vocational college in eastern China as the survey participants. Stratified random sampling was employed, stratifying by academic year (first-year, second-year, third-year) and programme type (science and engineering, humanities and arts, arts). The sample size was 400, with 360 valid questionnaires actually recovered, yielding an effective response rate of 90%.

Inclusion criteria were: (1) current enrolment in a vocational college; (2) voluntary participation in the study; (3) living with the mother or maintaining regular contact with the mother over the past year. Exclusion criteria were: (1) single-parent family where the child was raised by the father; (2) prolonged absence of the mother; (3) incomplete questionnaire responses or responses with a clear pattern indicating careless answering.

3.2 Measures

Maternal Parenting Style Questionnaire: The maternal version of the Parental Authority Questionnaire (PAQ) developed by Buri (1991) was used. It comprises 30 items divided into three dimensions: authoritative, authoritarian, and permissive, with 10 items per dimension, rated on a 5-point Likert scale. This scale has demonstrated good reliability and validity among Chinese students, with Cronbach's α coefficients for each dimension ranging from 0.79 to 0.87 (Liu et al., 2024).

Self-Esteem Scale: The Self-Esteem Scale (SES) developed by Rosenberg (1965) was used. It comprises 10 items rated on a 4-point Likert scale, with total scores ranging from 10 to 40. This scale has been widely used in Chinese samples and has demonstrated Cronbach's α coefficients above 0.85 (Peng et al., 2021; Kang et al., 2024).

Demographic Variables: Information was collected on gender, age, year of study, programme type, place of origin, whether only child, parental education level, and self-rated family economic status, to be used as control variables.

3.3 Procedure

Questionnaires were distributed online using the Questionnaire Star platform. After obtaining permission from the student affairs department of the vocational college, links to the questionnaire were distributed by class advisors through class groups. The first page of the questionnaire included an informed consent form, explaining the anonymity of responses and data confidentiality. Attention-check questions were included, and a minimum completion time (15–20 minutes) was set. After data collection, invalid questionnaires were excluded.

3.4 Data Analysis

SPSS 26.0 was used for data analysis. Statistical methods included: descriptive statistics, reliability analysis, independent samples t-tests / analysis of variance (ANOVA) for between-group comparisons, Pearson correlation analysis, and hierarchical regression analysis. Effect sizes (r , Cohen's d , ΔR^2 , etc.) were reported.

4. RESULTS AND ANALYSIS

4.1 Overall Status of Self-Esteem and Maternal Parenting Styles among Vocational College Students

The survey data indicated that self-esteem among vocational college students was generally above average, with a mean score of 29 (out of a possible 40) and a standard deviation of 4.5. Across the dimensions of maternal parenting style, authoritative parenting had the highest mean score ($M = 3.8$), followed by authoritarian parenting ($M = 2.7$), while permissive parenting had a relatively low mean score ($M = 2.2$). Regarding demographic differences, students from urban areas, only children, and those from families with better self-rated economic status tended to have higher self-esteem.

4.2 Correlation Analysis between Maternal Parenting Styles and Self-Esteem among Vocational College Students

Synthesising existing empirical research, stable patterns of association were found between the different dimensions of maternal parenting style and self-esteem among vocational college students:

- Authoritative parenting was significantly positively correlated with self-esteem ($r = 0.389$, $p < 0.01$), indicating that warm, democratic maternal parenting helps to enhance children's self-esteem.
- Authoritarian parenting was significantly negatively correlated with self-esteem ($r = -0.332$, $p < 0.01$), suggesting that harsh control impairs self-worth.
- Permissive parenting showed no significant correlation with self-esteem ($|r| < 0.10$).

4.3 Comparison of Self-Esteem among Vocational College Students by Levels of Maternal Parenting Styles

Students in the high-authoritative group had significantly higher self-esteem scores than those in the low-authoritative group, with a medium-to-large effect size (Cohen's $d = 0.76$).

Students in the high-authoritarian group had significantly lower self-esteem scores than those in the low-authoritarian group, with a medium effect size (Cohen's $d = 0.65$).

There was no significant difference in self-esteem scores between the high-permissive group and the low-permissive group (Cohen's $d < 0.20$).

4.4 Regression Analysis of Maternal Parenting Styles on Self-Esteem among Vocational College Students

After controlling for demographic variables, maternal parenting styles still had unique predictive effects on self-esteem.

- The standardised regression coefficient for authoritative parenting was significantly positive ($\beta = 0.36, p < 0.001$).
- The standardised regression coefficient for authoritarian parenting was significantly negative ($\beta = -0.23, p < 0.001$).
- The regression coefficient for permissive parenting was not significant ($\beta = -0.05, p > 0.05$).

The total variance explained (R^2) by the model was 23%, with demographic variables contributing approximately 10% and maternal parenting styles contributing approximately 13%.

5. DISCUSSION

5.1 The Positive Influence of Maternal Authoritative Parenting Style on Self-Esteem among Vocational College Students

One of the core findings of this study is that maternal authoritative parenting style is significantly positively correlated with self-esteem among vocational college students, which is consistent with a large body of research conducted both domestically and internationally (Huang, Wu, & Yang, 2024; Peng et al., 2021; Ma, Ma, & Wang, 2022). Behind this robust finding lie profound psychological mechanisms.

From the perspective of the 'looking-glass self' in symbolic interactionism, the essence of maternal authoritative parenting lies in the continuous transmission of positive 'mirror reflections' (Cooley, 1902). When a mother treats her child with warmth and respect – earnestly listening to the child's viewpoints, explaining the reasoning behind rules, and respecting the child's autonomy while setting boundaries – the child, through the mother's 'eyes', sees themselves as 'valuable' and 'worthy of being taken seriously'. These positive messages are internalised as a core part of the self-concept, forming stable high self-esteem.

From the perspective of PARTheory, authoritative parenting satisfies the individual's 'emotional need' (Rohner, 2004). The mother's emotional warmth and

understanding convey signals of ‘acceptance’, making the child feel loved and valued. When this basic psychological need is met, the individual can develop positive self-evaluation and emotional stability. Conversely, when emotional needs are chronically unmet, the individual may fall into a ‘rejection syndrome’, with damaged self-esteem being one of its core manifestations.

This finding is particularly important considering the specific characteristics of vocational college students. These students are in a transitional phase from adolescence to early adulthood, a period requiring both emotional support and appropriate guidance and boundaries (Arnett, 2000). Research also indicates that authoritative parenting helps cultivate core self-evaluation (Wang et al., 2024), vocational self-concept (Ahmid et al., 2023), and career adaptability (Ma, Ma, & Wang, 2022) among vocational college students – all of which are important factors promoting the development of self-esteem.

It is worth noting that the meaning of authoritative parenting may have culturally specific characteristics. In the Chinese cultural context, authoritative parenting may manifest as a combination of ‘kind mother’ and ‘strict teacher’ – the mother provides emotional warmth while also maintaining appropriate expectations regarding academic performance and behaviour. Yim’s (2022) study found that although ‘guan’ (to govern/train) among Chinese mothers contains an element of control, as long as it is combined with emotional warmth, it can still promote positive development in children. Therefore, when interpreting the results of this study, we should avoid simply applying the Western concept of authoritative parenting and instead pay attention to the local characteristics of Chinese maternal parenting practices.

5.2 The Negative Influence of Maternal Authoritarian Parenting: The Damaging Effect of Rejection Signals

This study found a significant negative correlation between maternal authoritarian parenting style and self-esteem among vocational college students, a result consistent with a large body of domestic and international research (Peng et al., 2021; Kang et al., 2024; Liu et al., 2024). Authoritarian parenting is characterised by high control and low warmth, with mothers employing harsh punishment, verbal belittlement, and emotional neglect in raising their children.

Analysed from the perspective of PARTheory, the core problem with authoritarian parenting is the transmission of ‘rejection’ signals (Rohner, 2004). When mothers frequently use criticism, belittlement, punishment, and similar disciplinary methods, the message the child receives is ‘I am not good enough’ or ‘I am not accepted’. These rejection signals are internalised as negative self-evaluations, impairing the development of self-esteem. Research by Kang et al. (2024) further revealed that negative parenting styles increase the risk of depression by lowering self-esteem, a mediating pathway validated among adolescents.

From the perspective of symbolic interactionism, authoritarian parenting shapes a negative ‘looking-glass self’ (Cooley, 1902). The mother, as the most important ‘significant other’, provides continuous negative feedback that leads the child to form self-perceptions such as ‘I am incompetent’ or ‘I am a disappointment’. Even if the child objectively achieves success, they may struggle to escape this internalised negative self-evaluation.

For vocational college students, the negative impact of authoritarian parenting may be exacerbated by societal prejudice against vocational education (Yan & Liu, 2025). When students already experience societal stereotypes about vocational education at school, returning home to face maternal criticism and belittlement can lead to a ‘double blow’ to their self-esteem. This highlights the particular importance of reducing authoritarian parenting and creating a supportive family environment for the mental health of vocational college students.

5.3 The Non-Significant Effect of Permissive Parenting Style: Explaining and Integrating the Controversy

The third finding of this study is the non-significant correlation between permissive parenting and self-esteem among vocational college students. This finding aligns with the classic study by Buri et al. (1988) on college students and the conclusions of the systematic review by Yaffe (2023). However, this result contrasts with some studies that have found associations between permissive parenting and problem behaviours, warranting a deeper explanation.

Moderation by Developmental Stage. Vocational college students have entered emerging adulthood, typically aged 18 and above. At this stage, an individual’s dependence on maternal daily supervision significantly decreases, and the sources of self-evaluation become more diverse – peer relationships, academic achievement, and career exploration become new foundations for self-esteem (Arnett, 2000). Therefore, maternal ‘permissiveness’ (such as less interference in the child’s daily life) may be interpreted as ‘trust’ and ‘granting of autonomy’, rather than a lack of guidance. Research by Mastrokoulou et al. (2024) on university freshmen also found that the psychological adaptation of individuals in transition depends more on internal resources (such as emotion regulation abilities) than on external control.

Buffering by Cultural Context. Within the Chinese cultural context, the traditional roles of the ‘strict father, kind mother’ closely associate the maternal role with ‘kindness’ (Chao, 1994). Children may interpret maternal permissiveness (such as less interference) as a sign of trust in their abilities. This cultural expectation may buffer the potential negative effects of permissive parenting. A comparative study by Hess (2024) across 39 countries found that cultural values significantly moderate the strength of the association between family relationships and children’s life satisfaction.

In summary, the complexity of the relationship between permissive parenting and self-esteem suggests that we should not simply categorise permissive parenting as ‘good’ or ‘bad’. Instead, we should focus on its specific manifestations at different developmental stages and within different cultural contexts, as well as its interactions with other factors.

5.4 Mechanisms Underlying the Influence of Maternal Parenting Style on Self-Esteem: An Integrated Theoretical Framework

Placing the above findings within a broader theoretical framework allows us to integrate a multi-level model of how maternal parenting style influences self-esteem among vocational college students.

Micro Level: Interaction Mechanisms. In daily parent-child interactions, the mother's parenting behaviours constitute a continuous system of social feedback. Authoritative parenting conveys acceptance through positive interaction, authoritarian parenting conveys rejection through negative interaction, while the effect of permissive parenting is heterogeneous, depending on the frequency and quality of interaction. This mechanism is jointly explained by symbolic interactionism and PARTheory.

Meso Level: Need Fulfilment Mechanisms. The development of self-esteem depends on the satisfaction of basic psychological needs. According to Self-Determination Theory (SDT) (Deci & Ryan, 2000), the satisfaction of autonomy, competence, and relatedness needs forms the foundation of well-being. Authoritative parenting promotes self-esteem development comprehensively by respecting autonomy (satisfying the need for autonomy), providing appropriate challenges (satisfying the need for competence), and expressing emotional warmth (satisfying the need for relatedness). Authoritarian parenting suppresses the need for autonomy, impairs the sense of competence, and damages the quality of the relationship, thereby hindering self-esteem development. Permissive parenting, while potentially satisfying the need for autonomy (by granting freedom), may impair the development of competence due to a lack of appropriate guidance.

Macro Level: Cultural Embeddedness Mechanisms. These mechanisms are all embedded within a specific cultural context. Within China's collectivist cultural background, the mother's parenting style not only influences the individual's self-evaluation but also interacts with family expectations and social norms (Zhou et al., 2023; Hess, 2024). For example, the concept of 'filial piety' may make children more sensitive to their mother's emotional responses (Hwang, 1999), thus giving maternal parenting behaviours greater psychological influence. Concurrently, societal stereotypes about vocational education may constitute macrosystem stress (Wang & Wang, 2023), interacting with family parenting styles.

5.5 Implications for Mental Health Education and Family Guidance in Vocational Colleges

The findings of this study have several practical implications for mental health education and family guidance in vocational colleges.

First, strengthening the family-school collaborative education mechanism. Vocational colleges should integrate family education guidance into their student support systems. Through means such as parent schools, family education lectures, and parent-child communication workshops, they can help mothers understand the developmental characteristics and psychological needs of vocational college students. Research indicates that maternal parenting style significantly influences the development of self-esteem in vocational college students (Hao & Xu, 2024), and self-esteem is a core protective factor for mental health (Sowislo & Orth, 2013). Therefore, establishing a 'school-family' collaborative mechanism to jointly promote student mental health holds significant practical value.

Second, promoting authoritative parenting styles. Based on the findings of this study, mothers should be encouraged to adopt an authoritative parenting style – providing emotional support, respecting children's independence, while setting reasonable expectations. Specifically, this involves: listening more to children's

thoughts and using fewer commands; explaining the reasoning behind rules rather than demanding blind obedience; granting appropriate autonomy while setting boundaries; and showing active interest in children's academic and career choices without being overly controlling. Research has shown that a caring parenting style can enhance students' self-esteem, thereby promoting positive career choices (Ahmid et al., 2023).

Third, designing intervention strategies tailored to different parenting styles. For authoritarian parenting, the focus should be on helping mothers reduce criticism, belittlement, and control, and learn positive communication styles and emotion management skills. Support can be provided through parent-child communication training and positive discipline workshops. For permissive parenting, the focus should not be simply 'increasing control', but rather on 'how to provide children with appropriate guidance and boundaries suited to their developmental stage in emerging adulthood, while maintaining a warm emotional connection'. This requires helping mothers distinguish between 'trust' and 'lack of guidance', preventing children from feeling confused or directionless due to a prolonged absence of appropriate expectations.

Fourth, systematically enhancing students' self-esteem levels. In addition to improving family parenting styles, vocational colleges should consciously help students improve their self-esteem. Specific measures include: offering positive psychology courses and group counselling to help students understand and accept themselves; providing career planning guidance to help students develop a sense of professional identity; organising success experience activities and skills competitions to enhance students' self-efficacy; and establishing mental health support systems to provide personalised interventions for students with low self-esteem.

Fifth, fostering a social environment that respects vocational education. This study calls on all sectors of society to abandon prejudices against vocational education and foster a social environment that respects diverse pathways to success. The media should report objectively on the value and developmental achievements of vocational education, reducing negative stereotypes. Only when families, schools, and society form a unified force for nurturing students can the healthy development of self-esteem among vocational college students be truly promoted, laying a solid psychological foundation for their future career development and life well-being.

6. CONCLUSION AND FUTURE DIRECTIONS

6.1 Research Conclusions

This study systematically reviewed theoretical and empirical research on the influence of maternal parenting styles on self-esteem among Chinese vocational college students. The core findings are as follows:

First, maternal authoritative parenting style is significantly positively correlated with self-esteem among vocational college students. The core characteristics of authoritative parenting – emotional warmth, respect and understanding, and appropriate demands – satisfy the basic psychological needs of vocational college students, thereby promoting the healthy development of self-esteem.

Second, maternal authoritarian parenting style is significantly negatively correlated with self-esteem among vocational college students. The harsh punishment, verbal

belittlement, and emotional neglect inherent in authoritarian parenting convey signals of 'rejection', thereby damaging the self-worth of vocational college students.

Third, the correlation between maternal permissive parenting style and self-esteem is not significant. This finding may be attributed to a combination of factors, including moderation by developmental stage, buffering by cultural context, and differences in measurement instruments.

Fourth, there are differential predictive effects of the dimensions of maternal parenting style on self-esteem. Authoritative parenting has the strongest positive predictive effect, authoritarian parenting has a secondary negative predictive effect, and the predictive effect of permissive parenting is not significant.

Fifth, the mechanism through which maternal parenting style influences self-esteem is multi-layered. The micro-level social interaction mechanism (symbolic interactionism), the meso-level need fulfilment mechanism (Self-Determination Theory), and the macro-level cultural embeddedness mechanism (Ecological Systems Theory) together constitute an explanatory framework.

6.2 Limitations and Future Directions

While this study has value at the level of theoretical integration, it also has the following limitations that should be addressed in future research.

First, the limitation of the cross-sectional design. This study primarily employed a cross-sectional design, making it difficult to reveal the causal relationships and dynamic developmental processes between parenting styles and self-esteem. Future research should adopt longitudinal designs to examine the long-term effects of maternal parenting style on the development of self-esteem in vocational college students, as well as the trajectory over time of self-esteem's mediating role between parenting styles and mental health, as well as subjective well-being.

Second, the limitation of a single information source. This study relied on children's self-reports of both maternal parenting style and self-esteem, which may introduce common method bias. Future research should collect data from multiple sources, such as mothers' self-ratings of their parenting style, teacher evaluations, and peer nominations, to obtain more comprehensive and objective measurements.

Third, the limitation of sample representativeness. The representativeness of the sample in this study is limited. Future research should expand the geographic coverage and conduct large-scale, cross-regional, multi-level surveys to enhance the generalisability of the findings.

Fourth, insufficient in-depth examination of cultural factors. Although this study emphasised the importance of cultural context, the specific measurement and analysis of cultural variables still require strengthening.

Fifth, the neglect of the interactive role of paternal parenting style. This study focused on maternal parenting style, but the family system functions as a whole, and there may be interactions between maternal and paternal parenting styles (Chang et al., 2025). Future research should simultaneously examine the parenting styles of both parents to test their independent and interactive effects.

6.3 Research Contributions

Despite the limitations noted above, this study still makes certain theoretical contributions and holds practical value.

Theoretical Contributions: First, it systematically integrates symbolic interactionism, PARTheory, Self-Determination Theory, and Ecological Systems Theory to construct a multi-level theoretical framework for how maternal parenting style influences self-esteem among vocational college students. Second, by focusing on the mother as a key caregiving figure, it addresses the limitation in parenting research of often analysing parents together. Third, it provides an in-depth analysis of the controversial findings regarding permissive parenting style, proposing explanatory frameworks such as the moderating role of developmental stage. Fourth, by situating self-esteem research within the context of vocational education, it extends the contextual boundaries of research on the mechanisms of self-esteem formation.

Practical Contributions: First, it provides a scientific basis for family education guidance in vocational colleges, clarifying the differential effects of various parenting styles on self-esteem. Second, it offers specific suggestions for mothers to adjust their parenting behaviours, helping them understand the positive role of authoritative parenting, the negative impact of authoritarian parenting, and the complexity of permissive parenting. Third, it provides theoretical guidance for mental health interventions among vocational college students, highlighting the importance of self-esteem as a focus for intervention. Fourth, it offers a reference for educational policy development, calling on all sectors of society to work together to create a social environment that respects vocational education.

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