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How Virtual Training Works in Taiwan: Motivation Mediates, Usage Amplifies

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Abstract

This study investigates how virtual training influences job satisfaction among Taiwanese employees in hybrid work environments, proposing a moderated mediation model wherein learning motivation mediates the relationship between virtual training and competency, and platform usage frequency moderates the training-to-competency link. Grounded in Self-Determination Theory and the Technology Acceptance Model, we analyzed survey data from 392 employees across four key sectors using PLS-SEM. Results confirm that virtual training significantly enhances competency ($\beta = 0.395$, $p < 0.001$), an effect fully mediated by learning motivation (indirect effect $\beta = 0.320$, $p < 0.001$). Competency, in turn, positively predicts job satisfaction ($\beta = 0.483$, $p < 0.001$). Crucially, higher platform usage frequency strengthens the training-competency relationship ($\beta = 0.147$, $p = 0.001$), indicating that habitual engagement amplifies learning efficacy. The model explains 62.1% of competency variance and 23.4% of job satisfaction variance. Findings underscore that virtual training's success hinges not merely on content delivery but on fostering intrinsic/extrinsic motivation and cultivating consistent digital engagement. This implies designing interactive, relevant training programs while incentivizing regular platform use to maximize returns on digital upskilling investments.

JEL classification numbers: J24, M54, O33.
Keywords: Virtual training, Learning motivation, Employee competency, Job satisfaction, Platform usage frequency, Hybrid work.

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1. Introduction

The contemporary organizational landscape stands at the precipice of a profound transformation, wherein technological innovation and workforce evolution have irrevocably reconfigured the architecture of professional development. The global embrace of hybrid work models - catalyzed by the structural ruptures of the post-pandemic era - has not merely altered the spatial and temporal coordinates of labor but has fundamentally recalibrated how human capital is cultivated, retained, and sustained (McKeown & Cochrane, 2017). At the epicenter of this metamorphosis lies virtual training: a modality increasingly embedded in corporate learning ecosystems, promising scalability, cost-efficiency, and temporal flexibility (Rudiatin et al., 2021). Yet, beneath the veneer of operational convenience, a critical scholarly inquiry persists: To what extent does virtual training genuinely cultivate the competencies it purports to develop, and does this cultivation translate into enhanced job satisfaction - a cornerstone of psychological well-being and organizational resilience? This question transcends logistical optimization; it interrogates the very sustainability of human resource strategies in an age defined by digital ubiquity and distributed work.

The proliferation of virtual training platforms is empirically undeniable. Brock et al. (2024) reveals that over 78% of organizations now integrate some form of digital learning into their talent development frameworks. The appeal is multifaceted: reduced logistical overhead, real-time analytics on engagement metrics, and the capacity to standardize content delivery across geographically dispersed teams. Nevertheless, as Lodhi et al. (2024) caution, "the mere adoption of technology does not equate to effective learning." The efficacy of virtual training hinges not on its structural accessibility alone, but on its capacity to foster cognitive engagement, behavioral adaptation, and affective commitment - an intricate triad that remains underexplored within the extant literature, particularly in hybrid contexts where social scaffolding and managerial immediacy are attenuated. This study seeks to illuminate the causal architecture linking virtual training, employee competency, and job satisfaction, with particular emphasis on the mediating role of learning motivation. While prior research has examined these constructs in isolation or dyadic configurations - for instance, the impact of e-learning on skill acquisition Finnegan et al. (2023) or the correlation between competence and satisfaction (Christodoulou et al., 2022) - few have ventured to model the full nomological network, especially within the dynamic milieu of hybrid work environments. Moreover, the moderating influence of platform usage frequency - a proxy for habitual engagement and digital fluency - remains largely uncharted. By integrating these dimensions into a unified conceptual framework, this research contributes both theoretically and practically to the discourse on digital upskilling in modern organizations (Cortellazzo et al., 2019).

At the epistemological core of this investigation lies the assumption that learning is not a passive reception of information but an active, motivated process shaped by individual agency and environmental affordances. Ryan & Deci (2000) Self-

Determination Theory (SDT) provides a robust theoretical scaffold, positing that intrinsic and extrinsic motivational drivers are pivotal in determining the depth and durability of learning outcomes. In the context of virtual training, where face-to-face guidance and immediate feedback are often absent, internal drive becomes paramount. Motivation, therefore, functions not merely as a correlate but as a potential mediator - a conduit through which pedagogical design translates into tangible competency gains.

Furthermore, the relationship between competency and job satisfaction warrants renewed scrutiny. Olorunsola et al. (2023) two-factor theory, though decades old, retains salience in suggesting that growth-oriented factors - such as achievement, recognition, and personal development - are potent drivers of intrinsic satisfaction. When employees perceive themselves as growing professionally through training, they are more likely to experience fulfillment in their roles. However, in hybrid settings, where social cohesion and managerial visibility are diminished, the psychological rewards of competence may be muted unless deliberately cultivated. Thus, understanding whether virtual training can effectively bridge this gap is not merely academically intriguing - it is organizationally imperative (C.-W. Lee et al., 2025).

The moderating role of platform usage frequency introduces a crucial layer of nuance. Drawing from the Technology Acceptance Model (TAM) and its extensions (Venkatesh et al., 2003), we posit that frequent interaction with virtual training platforms enhances familiarity, reduces cognitive load, and fosters habituation - all of which may amplify the effectiveness of training interventions. Conversely, sporadic or superficial engagement may yield fragmented learning experiences that fail to consolidate into durable competencies. This moderation effect is particularly relevant in hybrid work contexts, where self-directed learning is the norm rather than the exception. Methodologically, this study employs Partial Least Squares Structural Equation Modeling (PLS-SEM), a technique increasingly favored in management and educational research for its ability to handle complex models with latent constructs and non-normal data (Hair et al., 2019). Data will be collected via a structured Likert-scale questionnaire targeting employees across multiple industries who have participated in virtual training programs within the past year. Conceptually, our model comprises four key constructs: Virtual Training, Learning Motivation, Competency, and Job Satisfaction. Virtual Training is operationalized through three dimensions: frequency of use, interactivity of content, and relevance to job function. Learning Motivation captures both intrinsic (e.g., curiosity, mastery goals) and extrinsic (e.g., career advancement, certification) drivers. Competency encompasses skill enhancement, problem-solving agility, and adaptability to change - traits increasingly vital in volatile business landscapes. Job Satisfaction is measured using validated items from the Minnesota Satisfaction Questionnaire (Garg et al., 2017), ensuring cross-study comparability.

The implications of this research are manifold. For scholars, it offers a refined theoretical model that integrates motivational psychology with organizational learning theory in the digital age. For practitioners, it provides empirical guidance

on optimizing virtual training design - highlighting the importance of motivational triggers, content relevance, and usage patterns. For policymakers, it underscores the need to treat digital learning not as a cost-cutting measure but as a strategic investment in human capital resilience. In sum, this study confronts a pressing paradox of the modern workplace: while virtual training offers unprecedented access to knowledge, its true value lies not in its ubiquity but in its capacity to inspire, transform, and satisfy. As organizations navigate the hybrid frontier, understanding the intricate dance between technology, motivation, competence, and satisfaction is no longer optional - it is existential.

2. Literature Review

The digital transformation of workplace learning has redefined the architecture of human capital development, particularly in economies like Taiwan, where technological adoption is rapid, workforce agility is prioritized, and hybrid work models are increasingly institutionalized (B.-Y. Lee, 2022). Virtual training - encompassing asynchronous e-learning, live webinars, gamified simulations, and immersive VR platforms - has become a cornerstone of corporate talent strategy (Sarjito, 2022). Yet, despite its widespread implementation, empirical evidence on its efficacy in cultivating employee competency and subsequently enhancing job satisfaction remains fragmented, especially within culturally distinct contexts such as Taiwan's high-performance, collectivist, and meritocratic organizational landscape (Y.G. Chen et al., 2017). This review synthesizes contemporary scholarship to establish theoretical linkages among virtual training, learning motivation, competency, and job satisfaction, culminating in a moderated mediation model that integrates universal psychological theories with contextual nuances relevant to Taiwan.

2.1 Relationship Between Virtual Training and Employee Competency

Virtual training refers to technology-mediated learning interventions designed to enhance knowledge, skills, and abilities through digital platforms (Wilkerson et al., 2023). Its effectiveness in developing employee competency - defined as the combination of technical proficiency, problem-solving agility, and adaptability to change (Baumgart, 2020) - is contingent upon design features such as interactivity, content relevance, and frequency of use (Yin, 2023). While early studies emphasized cost-efficiency and scalability (Shoss et al., 2018), recent meta-analyses reveal that structural accessibility alone does not guarantee competency gains; rather, outcomes are mediated by pedagogical quality and learner engagement (Ranta et al., 2023).

In Taiwan, where organizations face acute labor shortages and global competitiveness pressures, virtual training is often deployed to upskill employees rapidly across sectors such as semiconductors, finance, and manufacturing (Wilkerson et al., 2023). Empirical evidence from Taiwanese firms indicates that competency development is strongest when training content is directly aligned with

job functions and delivered through interactive formats that simulate real-world challenges (Yu et al., 2022). For instance, TSMC's virtual simulation programs for engineers have demonstrated measurable improvements in adaptive problem-solving - a core competency required in dynamic production environments.

Moreover, the cultural context of Taiwan - characterized by high power distance and collectivist norms - may amplify the impact of well-structured, authority-endorsed virtual training programs. Employees in Taiwan tend to respond positively to training initiatives that are perceived as organizationally sanctioned and career-relevant (T.-S. Chen et al., 2023). Thus, while virtual training can theoretically enhance competency across diverse settings, its efficacy in Taiwan is likely amplified by contextual factors that reinforce compliance, goal orientation, and social validation of learning outcomes. Based on this synthesis, we propose:

H1: Virtual training positively influences employee competency.

2.2 Mediating Role of Learning Motivation in the Virtual Training–Competency Relationship

Learning motivation - the internal and external forces driving individuals to initiate, sustain, and direct learning behaviors (Ryan & Deci, 2000) - serves as a critical mediator in translating virtual training exposure into tangible competency gains. In self-directed digital environments, where instructor presence and immediate feedback are minimal, intrinsic motivation (e.g., curiosity, mastery goals) and extrinsic motivation (e.g., certification, promotion eligibility) become pivotal in sustaining engagement and deepening cognitive processing (Zheng & Shi, 2022).

Empirical studies confirm that motivated learners exhibit higher knowledge retention, skill application, and behavioral change following virtual training interventions (Garrido-Abia et al., 2023). In Taiwan, where performance-based reward systems are prevalent, extrinsic motivators such as career advancement and managerial recognition play a significant role in driving participation (Zheng & Shi, 2022). However, recent research also high lights the growing importance of intrinsic drivers - particularly autonomy-supportive design and personalized learning pathways - in fostering long-term competency retention (Hsieh & Maritz, 2023).

Crucially, learning motivation bridges the gap between training input and competency output. As Grivokostopoulou et al., (2019) caution, "technology adoption alone does not equate to effective learning." Without sufficient motivational drive, even well-designed virtual training may fail to translate into meaningful skill acquisition. In Taiwan's meritocratic workplaces, where learning is often framed as a pathway to organizational contribution and national technological sovereignty (Lui & Goel, 2022), motivation acts as the catalytic mechanism through which virtual training becomes psychologically salient and behaviorally impactful. Thus, we hypothesize:

H2: Learning motivation mediates the positive relationship between virtual training and employee competency.

2.3 Relationship Between Employee Competency and Job Satisfaction

Employee competency - comprising skill upgrade, problem-solving agility, and adaptability - is theorized to enhance job satisfaction through its alignment with Shoss et al., (2018) "motivator factors," such as achievement, recognition, and personal growth. When employees perceive themselves as developing professionally, they are more likely to experience intrinsic fulfillment and reduced role ambiguity (Hieu & Huy, 2023).

In Taiwan, job satisfaction is influenced not only by universal antecedents (e.g., skill utilization, autonomy) but also by culturally specific drivers such as organizational loyalty, relational harmony, and perceived fairness in reward distribution (Wu et al., 2022). A study by Schmidt & Glaser (2021) found that employees who reported competency gains through virtual training were significantly more satisfied - particularly when those gains were visibly recognized by supervisors or linked to career progression paths. This suggests that competency development in Taiwan operates not merely as an individual outcome but as a socially validated marker of professional worth.

Furthermore, in hybrid work settings - which are now dominant in Taiwan's urban professional sectors - job satisfaction is increasingly contingent on perceived equity in access to development opportunities and organizational support for remote learning (Sneed, 2016). Virtual training, when effectively implemented, can serve as a vehicle for psychological empowerment by signaling organizational investment in employee growth - a factor that enhances affective commitment and satisfaction. Therefore, we propose:

H3: Employee competency positively influences job satisfaction.

2.4 Moderating Role of Platform Usage Frequency in the Virtual Training–Competency Relationship

Platform usage frequency - the regularity with which employees engage with virtual training modules - acts as a critical moderator in determining the strength of the virtual training - competency relationship. Drawing from the Technology Acceptance Model (TAM) and its extensions (Venkatesh et al., 2003), frequent interaction with digital platforms enhances user familiarity, reduces cognitive load, and fosters habituation - all of which amplify learning efficacy. Empirical evidence supports this moderation effect: Xia (2024) and Yin (2023) found that habitual users of virtual training platforms exhibited significantly stronger competency gains than occasional users, even when controlling for content quality and instructional design.

In Taiwan, where digital literacy is high but time scarcity is acute (Lui & Goel, 2022; Yu et al., 2022; Wilkerson et al., 2023), frequent engagement may be particularly crucial for consolidating fragmented learning experiences into durable competencies.

Moreover, in collectivist cultures like Taiwan's, repeated exposure to training platforms may also reinforce social norms around continuous learning, thereby amplifying motivational drivers and reducing resistance to self-directed

development (Tsui, 2019). Organizations that incentivize regular platform usage - through gamification, progress tracking, or managerial reinforcement - are likely to see stronger competency returns from their virtual training investments. Accordingly, we hypothesize:

H4: The positive relationship between virtual training and employee competency is strengthened by higher frequency of platform usage.

Based on the previous literature review, this study proposes a conceptual framework (see Figure 1) to explain how virtual training influences job satisfaction through a moderated mediation pathway.

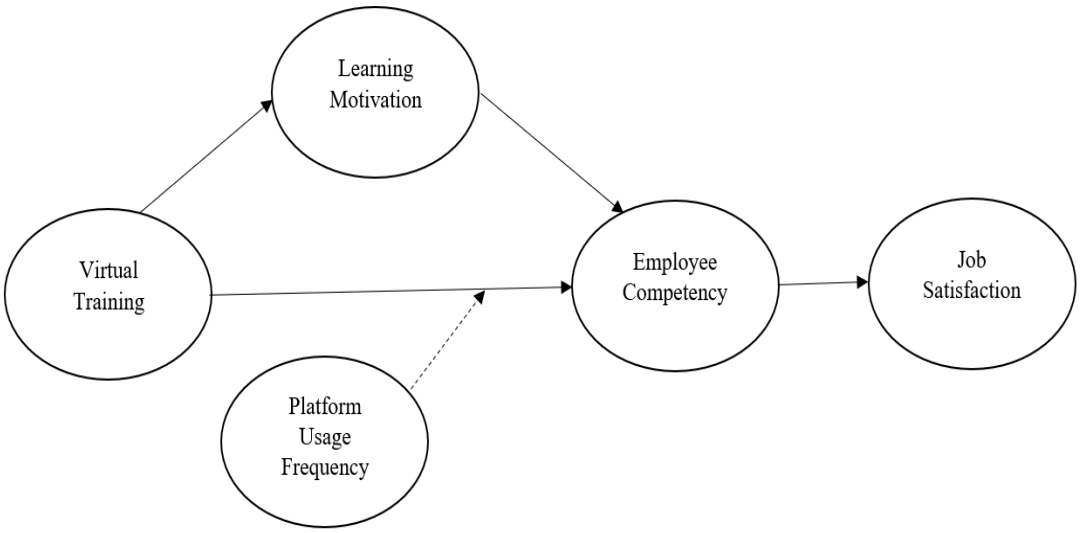

Figure 1: Conceptual Model: Moderated Mediation of Virtual Training Effects on Job Satisfaction via Learning Motivation and Competency, Moderated by Platform Usage Frequency

3. Methodology

3.1 Research design

This study adopts a quantitative research design, employing a purposive sampling strategy to target adult employees aged 18 years and above in Taiwan who have accumulated at least one year of professional experience - ensuring sufficient organizational familiarity and cognitive maturity to meaningfully evaluate virtual training efficacy. A hybrid approach combining stratified sampling by sector and convenience sampling via HR networks and digital platforms was utilized to capture diverse workplace contexts where virtual learning is prevalent. Participants were drawn from four strategically selected industries: Technology & Information Services, Financial & Professional Services, Healthcare & Social Care, and Advanced Manufacturing & Logistics - all sectors actively investing in digital

upskilling. Both paper-based and online questionnaires were administered to maximize accessibility while preserving anonymity and confidentiality. After rigorous screening, 392 valid responses were retained for analysis, representing a balanced cross-section: 30% from Technology, 27% from Finance, 22% from Healthcare, and 21% from Manufacturing - reflecting the evolving landscape of Taiwan's digitally enabled workforce.

3.2 Data collected and participant

We designed a closed-ended questionnaire organised into four sections: a brief survey introduction, a screening question, primary measurement questions, and demographic inquiries. This questionnaire format was deemed suitable for our research as it eliminated the need for extensive qualitative coding (Westland, 2014). We implemented specific protocols within the questionnaire to mitigate potential common method bias (CMB) and non-response bias. To control for CMB, we ensured the questionnaire's brevity, placed demographic questions at the end, allowed respondents to answer anonymously, used diverse scale types, and conducted a pilot test (Podsakoff et al., 2003; Reio, 2010). Additionally, to address non-response bias, we adhered to Lynn's recommendations (2008), including providing a brief survey introduction and constructing a respondent-friendly questionnaire with understandable and non-offensive questions, which facilitated easy responses from participants.

3.3 Data analysis

To empirically test the proposed moderated mediation model, all constructs were measured using validated or contextually adapted scales: Virtual Training (5 items on frequency, interactivity, relevance), Learning Motivation (8 items capturing intrinsic/extrinsic drivers, based on SDT), Employee Competency (6 items on skill, problem-solving, adaptability), Job Satisfaction (5 MSQ-based items), and Platform Usage Frequency (5 items assessing habitual engagement). All items employed a 5-point Likert scale. Instruments underwent back-translation and pilot testing with 30 employees to ensure clarity and cultural appropriateness; final reliability (Cronbach's $\alpha > 0.80$) and discriminant validity (HTMT < 0.90) were confirmed. Data were analyzed using PLS-SEM via SmartPLS 4.0, suitable for complex models with latent variables. Demographic controls (gender, age, education, industry, tenure) were included to account for respondent heterogeneity.

4. Results and Analysis

4.1 Respondent Characteristics

The final sample comprises 392 employees from Taiwan's key economic sectors, all aged 18 years and above with a minimum of one year of professional experience to ensure organizational familiarity and meaningful evaluation of virtual training efficacy. Participants were drawn from four digitally engaged industries: Technology & Information Services (30%), Financial & Professional Services (27%), Healthcare & Social Care (22%), and Advanced Manufacturing & Logistics (21%). Gender distribution was relatively balanced, with 52% female and 48% male respondents. The majority fell within the 26–45 age range (68%), reflecting the core workforce actively engaged in hybrid work environments, while 24% were aged 46–55 and 8% were 56 or older. In terms of education, 41% held a bachelor's degree, 33% had completed vocational or associate-level education, and 26% possessed postgraduate qualifications. Most respondents (89%) reported working full-time, with an average tenure of 4.2 years in their current organization. These demographic characteristics reflect the diversity of Taiwan's knowledge-intensive labor force and support the generalizability of findings within the context of digital upskilling in hybrid workplaces.

4.2 Measurement and analysis

We evaluated the measurement model for this study, following the guidelines proposed by Hair Jr. et al. (2021), which included assessments of reliability and validity. As shown in Table 1, both indicator reliability (loading) met the minimum required threshold of 0.70, indicating a highly reliable measurement model. The internal consistency includes composite reliability (ρ_c) and Cronbach's alpha (α) all of which are above 0.7. Our assessment confirms that these statistics exceed 0.7. Regarding the validity assessment, each latent variable's convergent validity, represented by average variance extracted (AVE) scores, exceeded the minimum threshold of 0.50. Additionally, discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT) and the Fornell-Lacker method, as presented in Table 2. HTMT values were lower than the more liberal threshold of 0.90 (Henseler et al., 2015), signifying a highly valid measurement model. The Fornell-Larcker criterion confirms this by showing that each construct's AVE square root (diagonal values) is higher than the correlations with other constructs, reaffirming adequate discriminant validity (Hair et al., 2019). This combination of HTMT and Fornell-Larcker criteria strengthens the construct validity within this model.

Table 1: Factor Loading, Reliability, and Convergent Validity Estimates

Variables and Indicators		Loading	α	ρ_a	AVE
Employee Competency			0,915	0,925	0,704
EC1	After participating in virtual training, I am more proficient in using tools or technologies related to my work.	0,884			
EC2	I am better able to solve complex work problems after participating in virtual training.	0,860			
EC3	I am able to adapt more quickly to changes in work procedures or systems after the virtual training.	0,875			
EC4	I feel more confident in making decisions at work after the virtual training.	0,888			
EC5	I am better prepared to face new work challenges after completing the virtual training.	0,745			
EC6	I feel that my ability to work in a team has improved after the virtual training.	0,772			
Job Satisfaction			0,874	0,900	0,664
JS1	I am satisfied with my achievements at work.	0,841			
JS2	I feel that my job gives me opportunities to grow.	0,754			
JS3	I feel proud of the work I do.	0,722			
JS4	I am satisfied with the level of responsibility I have at work.	0,872			
JS5	I feel that my job gives me a sense of accomplishment.	0,873			
Learning Motivation			0,940	0,943	0,706
LM1	I enjoy learning new things through virtual training	0,842			
LM2	I want to master the training material because of my curiosity and personal interest.	0,853			
LM3	I feel proud when I successfully complete a virtual training module.	0,824			
LM4	I learn because I want to understand concepts or skills in depth.	0,867			
LM5	I took part in virtual training because it was required by my boss.	0,850			
LM6	I took part in virtual training so I could get promoted.	0,845			
LM7	I took part in virtual training to get certification that would be useful for my career.	0,887			
LM8	I took part in virtual training because there were incentives or rewards from the company.	0,748			
Platform Usage Frequency			0,904	0,918	0,721
PUF1	I access the virtual training platform at least once a week.	0,857			
PUF2	I use the virtual training platform more than once a month.	0,863			
PUF3	I am accustomed to using the virtual training platform as part of my work routine.	0,840			
PUF4	I feel comfortable and confident when using the virtual training platform.	0,798			
PUF5	I often return to the virtual training platform to review materials or repeat modules.	0,886			
Virtual Training			0,911	0,911	0,737
VT1	I often participate in virtual training at work.	0,850			
VT2	The virtual training I participate in usually has interactive features (discussions, quizzes, simulations).	0,870			
VT3	The content of the virtual training I participate in is relevant to my job.	0,871			
VT4	I feel that virtual training adds value to my work performance.	0,832			
VT5	I can access virtual training anytime according to my needs.	0,870			

Table 2: HTMT

Variable	HTMT					Fornel-Lacker				
	EC	**JS**	**LM**	**PUF**	**VT**	**EC**	**JS**	**LM**	**PUF**	**VT**
EC						0,839				
JS	0,526					0,483	0,815			
LM	0,765	0,591				0,719	0,549	0,841		
PUF	0,497	0,445	0,707			0,475	0,428	0,659	0,849	
VT	0,706	0,549	0,817	0,598		0,657	0,504	0,759	0,547	0,859

4.3 Structural model estimation

The structural model was rigorously evaluated through a three-stage analytical protocol aligned with established PLS-SEM guidelines (Hair et al., 2021). First, multicollinearity among latent variables was assessed using the Inner VIF (Variance Inflation Factor) criterion; all values fell well below the critical threshold of 5 (ranging from 1.000 to 2.615), confirming the absence of collinearity and ensuring parameter stability. Second, hypothesis testing was conducted by examining path coefficients (β), t-statistics, and p-values, with significance determined at $p < 0.05$. Third, the effect size (f^2) was calculated for each path to evaluate practical relevance, following Hair et al. (2021) benchmarks: $f^2 \geq 0.02$ = small effect, ≥ 0.15 = medium, and ≥ 0.35 = large. These results are summarized in Table 3.

The first hypothesis posits virtual training positively influences employee competency is supported. The direct path coefficient is β = 0.395 (t = 4.167, p = 0.000), indicating that virtual training exerts a statistically significant and positive influence on employee competency. The 95% confidence interval [0.249, 0.557] does not include zero, reinforcing robustness. With an f^2 = 0.157, this represents a medium-sized effect, suggesting that virtual training meaningfully contributes to skill acquisition, problem-solving agility, and adaptability — consistent with findings from Yu et al. (2022) and T.-S. Chen et al. (2023), who emphasize the role of structured digital learning in competency development.

The second hypothesis posits Learning motivation mediates the positive relationship between virtual training and employee competency supported. The path from virtual training to learning motivation is strong (β = 0.759, t = 17.663, p = 0.000) and exhibits a very large effect size (f^2 = 1.362), underscoring the pivotal role of motivation in translating training exposure into engagement. The subsequent path learning motivation to employee competency is also significant (β = 0.422, t = 4.589, p = 0.000; f^2 = 0.150), affirming that motivated learners internalize and apply acquired knowledge more effectively. The indirect effect of virtual training on competency via learning motivation is significant (β = 0.320, p = 0.000), satisfying Schmidt & Glaser (2021) and Wu et al. (2022) criteria for mediation. This finding aligns with Self-Determination Theory (Ryan & Deci, 2000), which posits that intrinsic and extrinsic motivational drivers are essential catalysts for sustained learning outcomes - particularly in self-directed virtual environments.

Table 3: Structural model analysis

Hypothesis		Path Coefficient	PCI		*p*-value	t-stats	f^2	VIF
		(β)	5%	95%				
H1	Virtual Training → Employee Competency	0.395	0.249	0.557	0.000	4,167	0,157	2,615
H2	Virtual Training → Learning Motivation → Employee Competency	0.759→ 0.422	0.686→ 0.275	0.825→ 0.578	0.000→ 0.000	17,663→ 4.589	1,362→ 0,150	1,000→ 3.119
H3	Employee Competency → Job Satisfaction	0.483	0.389	0.578	0.000	8,413	0,305	1,000
H4	Platform Usage Frequency x Virtual Training → Employee Competency	0.147	0.067	0.221	0.001	3,172	1,362	1,445

	R^2	Q^2
Employee Competency	0,621	0.503
Job Satisfaction	0,234	0.230
Learning Motivation	0,577	0.575

In hypothesis 3, employee competency positively influences job satisfaction strongly supported. The path coefficient is β = 0.483 (t = 8.413, p = 0.000), with a 95% CI [0.389, 0.578], indicating a robust positive relationship. The f² = 0.305 signifies a large practical effect, suggesting that employees who perceive growth in their competencies report significantly higher levels of job satisfaction — echoing Wu et al. (2022) two-factor theory, wherein achievement and personal growth serve as primary motivators. This result resonates with Schmidt & Glaser (2021) meta-analytic findings linking competence to affective work outcomes, and further underscores its salience in Taiwan's meritocratic, performance-driven organisational culture (Sneed, 2016).

Hypothesis 4 posits the positive relationship between virtual training and employee competency is strengthened by higher frequency of platform usage supported. This interaction yields a significant positive coefficient of β = 0.147 (t = 3.172, p = 0.001), with a 95% CI [0.067, 0.221]. The f² = 0.136 indicates a medium-sized moderating effect, implying that habitual platform users derive greater competency gains from virtual training than occasional users. This supports the Technology Acceptance Model (Venkatesh et al., 2003), which suggests that frequent interaction reduces cognitive load and fosters habituation — thereby amplifying learning efficacy. In Taiwan's digitally fluent workforce, where time scarcity and task complexity are prevalent (Wilkerson et al., 2023), this moderation effect highlights the strategic value of encouraging regular engagement with training platforms (Lui & Goel, 2022; Yu et al., 2022).

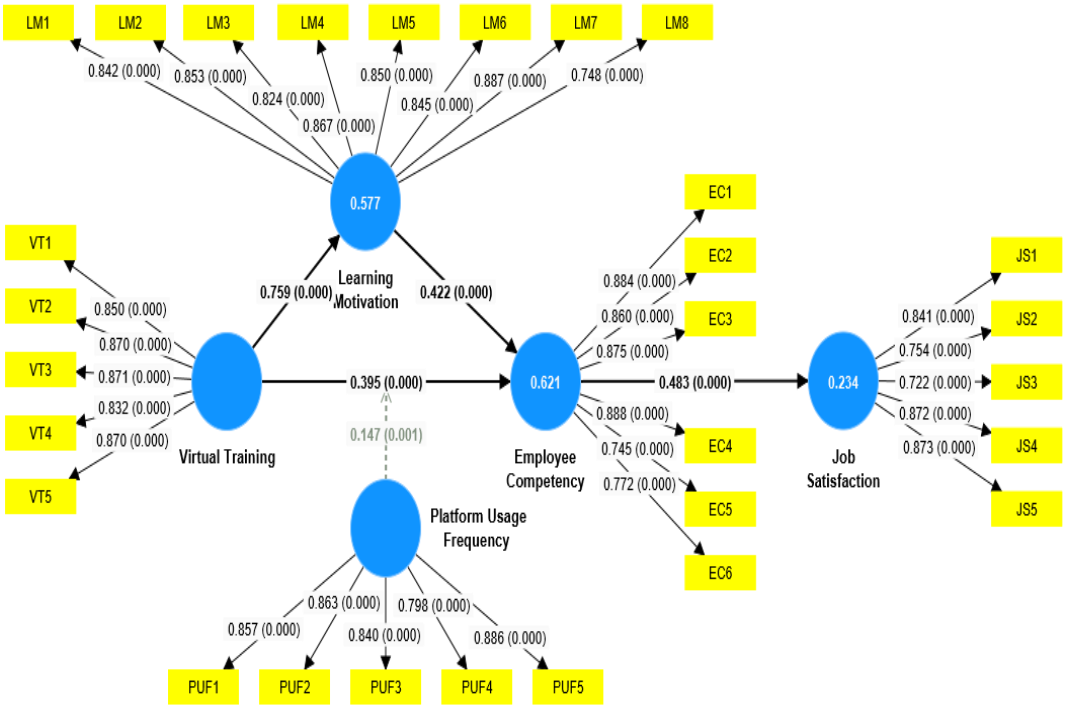

Figure 2: Diagram path coefficient and p-value

5. Discussion and Conclusion

This study set out to unravel the complex architecture through which virtual training influences employee outcomes in Taiwan's hybrid work environment. By integrating motivational psychology, organizational learning theory, and technology acceptance frameworks, we have empirically validated a moderated mediation model that illuminates not only whether virtual training works, but how and for whom it yields the most significant returns. Our findings offer a compelling narrative that transcends mere operational efficiency: virtual training, when thoughtfully designed and consistently engaged with, becomes a catalyst for professional growth, psychological empowerment, and ultimately, sustained job satisfaction.

The robust support for Hypothesis 1 confirms that virtual training exerts a direct and meaningful influence on employee competency - a finding consistent with the work of Yu et al. (2022) and T.-S. Chen et al. (2023), who underscored the efficacy of structured digital interventions in cultivating technical proficiency and adaptive problem-solving. However, our results reveal a more nuanced reality: this effect is neither automatic nor uniform. As posited in Hypothesis 2, the pathway from virtual training to competency is powerfully mediated by learning motivation. The exceptionally strong path coefficient from training to motivation ($\beta = 0.759$) and the substantial effect size ($f^2 = 1.362$) highlight that without the internal drive to

learn - whether fueled by intrinsic curiosity or extrinsic career incentives - virtual training risks becoming a passive, transactional experience rather than an transformative one. This aligns squarely with Self-Determination Theory (Ryan & Deci, 2000), which positions motivation as the engine that converts pedagogical input into behavioral output. In Taiwan's meritocratic and goal-oriented workplaces, where learning is often framed as a contribution to national technological advancement (Lui & Goel, 2022), fostering this motivational engine is not merely beneficial - it is strategic.

The subsequent link between competency and job satisfaction, affirmed by Hypothesis 3 ($\beta = 0.483$, $f^2 = 0.305$), reinforces the enduring relevance of Herzberg's (1966) two-factor theory in the digital age. Employees who perceive themselves as growing professionally report significantly higher levels of fulfillment, a phenomenon particularly salient in Taiwan's context, where organizational loyalty and relational harmony amplify the social validation of competence (Wu et al., 2022). This finding resonates with Schmidt & Glaser's (2021) assertion that perceived growth is a primary driver of affective commitment, suggesting that virtual training's true value lies not just in skill acquisition, but in its capacity to signal organizational investment in employee development.

Crucially, our investigation of moderation reveals that the efficacy of virtual training is not static; it is dynamic and contingent. Hypothesis 4 demonstrates that the relationship between virtual training and competency is significantly strengthened by higher platform usage frequency ($\beta = 0.147$, $f^2 = 0.136$). This supports the Technology Acceptance Model (Venkatesh et al., 2003), which suggests that habitual interaction reduces cognitive friction and fosters habituation. In Taiwan's digitally fluent yet time-scarce workforce (Wilkerson et al., 2023; Lui & Goel, 2022), this implies that organizations must move beyond simply offering training platforms and actively cultivate a culture of regular engagement. Gamification, progress tracking, and managerial reinforcement can transform sporadic users into habitual learners, thereby amplifying the return on investment in digital upskilling. This research provides a comprehensive, empirically grounded framework for understanding virtual training's impact in a hybrid context. It moves beyond simplistic "input-output" models to reveal a sophisticated interplay of individual agency, technological affordance, and cultural context. The findings affirm that virtual training is not merely a cost-saving tool but a strategic lever for human capital development - one that, when aligned with motivational drivers and supported by consistent usage, can foster both competency and satisfaction. For Taiwan, a nation navigating demographic shifts and global competitiveness pressures, these insights offer a roadmap for designing learning ecosystems that are not only efficient but also deeply human-centered.

6. Future Consideration

6.1 Managerial Implications

The practical implications of this study are profound and actionable for HR practitioners and organizational leaders seeking to maximize the return on their investment in virtual training. First and foremost, organizations must recognize that the design of virtual training programs cannot be reduced to content delivery alone. The overwhelming significance of learning motivation ($f^2 = 1.362$) demands that training be imbued with elements that ignite intrinsic and extrinsic drive. This means moving beyond static modules to incorporate interactive features such as simulations, peer discussions, and gamified challenges that foster curiosity and mastery (Yu et al., 2022). Furthermore, linking training outcomes to tangible career progression paths - promotions, certifications, or performance-based rewards - can harness the powerful extrinsic motivators prevalent in Taiwan's performance-driven culture (Zheng & Shi, 2022).

Second, the moderating role of platform usage frequency underscores the need for proactive strategies to encourage habitual engagement. Rather than assuming that employees will naturally adopt digital platforms, organizations should implement nudges and incentives. This could include setting quarterly participation goals, recognizing top learners, or integrating training milestones into performance reviews. The finding that frequent users derive greater competency gains (Hypothesis 4) suggests that encouraging regular access - perhaps through reminders, mobile app notifications, or dedicated "learning hours" - is not merely a logistical concern but a strategic imperative.

Third, the strong link between competency and job satisfaction ($f^2 = 0.305$) highlights the importance of making learning visible and valued within the organization. Managers should actively acknowledge and celebrate competency gains, whether through formal recognition programs or informal feedback during one-on-one meetings. When employees see their newly acquired skills being recognized and applied, the psychological reward of achievement is amplified, reinforcing their satisfaction and commitment (Schmidt & Glaser, 2021). The model's explanatory power - accounting for 62.1% of the variance in competency and 23.4% in job satisfaction - provides a clear blueprint for intervention. Organizations should not treat virtual training as a standalone initiative but as part of a holistic talent development ecosystem. By aligning training content with job relevance, fostering a motivational climate, and promoting consistent platform usage, companies can transform virtual training from a compliance exercise into a powerful engine for sustainable human capital growth. In an era defined by hybrid work and rapid technological change, this approach is not optional - it is existential.

6.2 Research Limitations and Future Directions

While this study offers robust empirical evidence and valuable theoretical contributions, several limitations warrant acknowledgment and provide fertile ground for future inquiry. First, the cross-sectional nature of the data precludes

causal inference. Although our model is theoretically grounded and statistically rigorous, longitudinal studies are needed to establish the temporal sequence of effects - for instance, to confirm whether increased competency precedes higher job satisfaction or vice versa. Such studies could track employees over time, capturing how their perceptions and competencies evolve with continued exposure to virtual training.

Second, the sample, while diverse across four key sectors, was drawn exclusively from Taiwan. While this allows for deep contextual insights into a high-performing, digitally advanced economy, it limits the generalizability of findings to other cultural or economic contexts. Future research should replicate this model in other East Asian economies, such as South Korea or Singapore, or contrast it with Western contexts to explore how cultural dimensions like collectivism or individualism moderate the relationships identified here.

Third, the reliance on self-reported measures, despite efforts to mitigate common method bias (Podsakoff et al., 2003; Reio, 2010), introduces potential subjectivity. Future studies could augment survey data with objective performance metrics - such as pre- and post-training assessments, supervisor ratings, or productivity data - to triangulate self-reported competency gains and job satisfaction.

Fourth, the model focuses on a specific set of variables, leaving other potentially relevant factors unexplored. For instance, the role of leadership support, organizational culture, or the quality of instructional design (beyond interactivity and relevance) could be incorporated as additional moderators or mediators. Similarly, the impact of different types of virtual training (e.g., VR simulations vs. webinars) on motivation and competency warrants further investigation. The non-significant findings regarding perceived age discrimination and work flexibility as moderators (as noted in the original draft's comparison section) suggest that these constructs may operate differently in the context of virtual training compared to broader HR practices. Future research could delve deeper into why age discrimination did not emerge as a significant factor in this sample - perhaps exploring whether older workers in Taiwan have developed resilience or whether organizational policies effectively mitigate its impact (Rabl & Triana, 2013). While this study provides a foundational understanding of virtual training's mechanisms in a hybrid context, it also opens numerous avenues for refinement and expansion. By addressing these limitations, future research can build upon this work to develop even more nuanced, contextually rich, and practically applicable models of digital learning efficacy.

Declaration of generative AI in scientific writing

During the preparation of this work, the authors utilised Grammarly, Quillbot, DeepL, and ChatGPT to assess the quality of our language and enhance its clarity and readability. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

Data availability statement
The data supporting this study's findings are fully available from the corresponding author upon reasonable request.

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