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Unveiling secondary school ESL teachers' E-learning readiness in Malaysia: Retrospective insights and future directions

KE HU^a  

ASMAA ALSAQQAF^b  

^aSchool of International Business, Hunan University of Information Technology, China

^bCentre for the Promotion of Knowledge and Language Learning, Universiti Malaysia Sabah, Malaysia

Abstract

E-learning has significantly reshaped education, including English language teaching (ELT). Acknowledging this, the Malaysian Ministry of Education made e-learning a strategic priority for ELT in the Malaysia Education Blueprint 2013–2025. Sabah, however, remains cautious; as a developing state with limited infrastructure, it questions how effectively e-learning can be deployed. Because classroom teachers ultimately mediate e-learning initiative, the present study investigated the readiness of secondary school ESL teachers in Kota Kinabalu, Sabah. A 17-item questionnaire was developed following Chapnick's e-learning readiness framework. After checking content and face validity, the instrument was pilot tested with 64 teachers. Exploratory factor analysis (EFA) identified four underlying dimensions; confirmatory factor analysis (CFA) on a second sample ($n = 145$) verified the four-factor structure and showed satisfactory reliability and validity. Descriptive analysis of the final sample revealed the readiness profile for each dimension. Technological skills readiness was highest (mean = 4.22, "ready, go ahead"), psychological readiness was moderate (mean = 3.66, "ready, but needs a few improvements"), while human resource readiness (mean = 3.30) and equipment readiness (mean = 3.25) were "not ready, needs some work". The validated four-factor instrument provides Sabah's educational stakeholders with an empirically valid tool to assess ESL teachers' e-learning readiness, enabling targeted interventions (e.g., infrastructure upgrades, technical training) to support effective e-learning implementation in ELT. Strengths, limitations and implications are also presented.

Keywords: Chapnick's readiness model; e-learning readiness; Malaysian secondary ESL teachers; exploratory factor analysis; confirmatory factor analysis

Introduction

The aftermath of the COVID-19, which swept across Malaysia by the end of 2023, sparked heated discussions among educational stakeholders about relaunching e-learning. Many Malaysian universities temporarily switched from physical to virtual teaching. Meanwhile, the scheduled year-end school holidays provided a buffer for primary and secondary schools, mitigating the health impact of the crisis. However, the primary concern remains ensuring adequate preparation for e-learning to maintain quality education and handle uncertainties in daily school instruction. Reflecting the fourth goal of the United Nations' Sustainable Development Goals, quality education is emphasized as key to overcoming inequalities, with e-learning accelerating this progress (Rathinam et al., 2023). E-learning enhances education quality by expanding access to resources and offering personalized instruction. It is particularly beneficial for English language teaching (ELT) due to its resource availability, flexibility, and enhancement of global communication skills (Buragohain et al., 2023; Thu, 2022).

In Malaysia, English is a second language (ESL) subject at all educational levels within a bilingual system to meet national and international demands. In this transformative economic era, new generations are known as digital natives, and technology use has become a unique characteristic of the youth (Revilla Muñoz et al., 2017). Therefore, educational technology should be integrated into teaching practices, as it has gradually evolved and become mainstream across all schooling levels (Khan & Arabia, 2016). That said, in specific teaching contexts like real-time teacher-student interaction in language instruction, guidance remains most impactful when provided in a physical classroom setting, a mode that no other technologies can substitute (Chen, 2023). As the designated "global skill" in the education system, ESL proficiency determines tertiary access, employability and international mobility. Student-centered learning dominates current ELT practice, positioning teachers as facilitators who guide discovery rather than dispense rules. This shift amplifies the criticality of teacher readiness. Without prepared educators, the promise of student-centered learning cannot be fully realized, especially in online contexts (Lai et al., 2025; Taghizadeh & Basirat, 2024).

While Malaysia's national education policies (e.g., Education Blueprint 2013–2025, Education 4.0) prioritize e-learning integration, regional disparities in infrastructure, resources, and cultural-linguistic dynamics create context-specific challenges that prior research has failed to address. Kota Kinabalu, Sabah's capital and a mid-sized urban district (94% urbanization; OpenDOSM, 2020) stands out as a critical yet understudied setting for three key reasons. First, Sabah is classified as a "developing state" in Malaysia, with infrastructure limitations (e.g., unreliable internet connectivity, outdated hardware) that are more severe than in Peninsular Malaysia (Jafar et al., 2022; Rathinam et al., 2023). Even in urban Kota Kinabalu, ESL teachers face rural-like technological barriers (e.g., inconsistent internet access, limited school funding for digital tools) that differ from those in Peninsular cities like Kuala Lumpur or Johor Bahru, where e-learning infrastructure is more mature (Awang et al., 2018; Khan et al., 2024). Second, Kota Kinabalu's ethnolinguistic diversity, including Malays, Chinese, and indigenous groups (e.g., Kadazan-Dusun), creates unique ESL teaching demands, teachers must adapt digital tools to support learners with varying first-language backgrounds and proficiency levels, a challenge rarely explored in prior Malaysian studies focused on monolingual or less diverse classrooms (Sulong et al., 2024; Zainuddin et al., 2023). Third, Sabah's secondary school ESL workforce operates within a public education system that is under-resourced relative to Peninsular Malaysia, with fewer professional development opportunities for digital pedagogy (Jafar et al., 2022). This context differs sharply from prior research settings, which have centered on Peninsular Malaysian university students (Sharoni et al., 2022; Sarkam et al., 2022), IT administrators

(Khan et al., 2024), or primary school Malay teachers (Sulong et al., 2024), groups with distinct roles, resources, and needs.

Given these distinct contextual factors, Kota Kinabalu's ESL teachers face a "double bind": they are tasked with implementing national e-learning policies yet lack the infrastructure and support systems available in other Malaysian regions. Prior studies have not examined how ESL-specific pedagogical needs intersect with regional resource constraints in Sabah. This study therefore fills a critical gap by focusing on a population and context that has been marginalized in Malaysian e-learning research, ensuring findings are relevant to policymakers and practitioners working in underdeveloped, multilingual settings.

In a classroom where the ESL teacher's confidence and troubleshooting skills form the hidden curriculum, a moment's hesitation to launch an ed-tech app, adjust a device setting, or give feedback on a recorded presentation can stall learner autonomy in seconds. Consequently, accessing ESL teachers' e-learning readiness is not an administrative checkbox. It is a direct predictor of instructional quality and the decisive factor in whether "student-centered" translates into empowered, uninterrupted learning when classes move online (Bashir & Lapshun, 2024). Therefore, measuring readiness is no longer an academic exercise, it is a prerequisite for instructional insurance. Given that, a validated instrument now gives stakeholders a way to monitor quality, foreground gaps, and allocate resources before the next unforeseen event interrupts learning. In short, the post-COVID-19 era has reframed e-learning readiness as core infrastructure, placing ESL teachers on the line where national language policy and digital equity meet. Therefore, this study addresses two research questions (RQs).

RQ1: How valid is the e-learning readiness questionnaire for secondary school ESL teachers in Kota Kinabalu, Malaysia?

RQ2: What is the level of e-learning readiness among secondary school ESL teachers in Kota Kinabalu, Malaysia?

Literature Review

Building on the research background and questions outlined in the introduction, this section synthesizes the global and Malaysian e-learning landscape, highlights gaps in readiness research, and anchors on Chapnick's (2000) model to clarify the study's theoretical basis and dimension selection.

E-learning Status in Education

The emergence of e-learning as a practical substitute for long-established, classroom-based instruction has generated considerable attentions. As a form of distance education, e-learning delivers instructional content to learners through digital platforms and online resources (Bashir & Lapshun, 2024; Teng, 2024). The global e-learning landscape has expanded rapidly, fueled both by advances in digital technologies and by the urgent shift to remote learning during the COVID-19 pandemic (Maahs et al., 2025). Data from the 2018 Programme for International Student Assessment (PISA) indicated that in Organization for Economic Co-operation and Development (OECD) countries, 65% of 15-year-old learners attended schools where principals reported that teachers possessed the necessary technical and pedagogical competencies to integrate digital tools into instruction. Additionally, 54% of students were in schools that already had effective online learning platforms, and these systems likely expanded and improved further during the COVID-19 pandemic. Worldwide internet usage also increased substantially, rising from 16% of the global population in 2005 to 66% in 2022. By the same year, roughly

half of all lower secondary schools across the globe had internet connectivity for teaching and learning purposes (UNESCO, 2023).

According to Josephine (2025) that the e-learning in education sector is poised for substantial expansion, with its market size expected to surge from \$404 billion in 2025 to \$850 billion by 2030, reflecting a strong Compound Annual Growth Rate (CAGR) of 16.3%. Meanwhile, online learning adoption is also projected to grow significantly, rising from 5.5% to 12.0%. The Asia Pacific region stands out as a major driver of this growth, combining a large market size (\$2.56 trillion) with a rapid CAGR of 15.2%. In contrast, North America, though sizable at \$2.04 trillion, is projected to grow at a more moderate pace. The Middle East and Africa region, valued at \$511 billion, demonstrates strong growth potential (12.4% CAGR), despite ongoing infrastructure limitations. K-12 education continues to dominate the sector, representing over one-third of the global digital education market. However, a stark disparity in investment remains between developed and emerging economies, with OECD countries spending five to ten times more per student. This investment gap highlights both a challenge in achieving educational equity and an opportunity to leverage technology for greater cost-efficiency and accessibility.

Given that, integrating e-learning into educational curricula is a global trend, and Malaysia is no exception. The incorporation of e-learning into ELT is explicitly outlined in Malaysia's Education Blueprint (2015–2025) (Ministry of Education Malaysia, 2013). However, the impact of e-learning on education has been less than satisfactory. A notable example is the 1BestariNet project and its virtual learning platform, Frog VLE, intended to serve 10,000 public schools nationwide. Teachers' dissatisfaction with the system, primarily due to inadequate training, led to widespread disagreement (Awang et al., 2018), highlighting the gap between policy intent and on-the-ground implementation. In 2018, Malaysia's Ministry of Higher Education launched Education 4.0, focusing on integrating knowledge, industry, and humanities into higher education, and extended this initiative to secondary and primary schools in 2019. To support these changes, the National Fiberization and Connectivity Plan was introduced in 2019, aiming to improve internet access until 2023 (Rathinam et al., 2023). Additionally, the rollout of a 5G network began, enhancing online learning infrastructure across various states. During the COVID-19 outbreak, The Jafar et al.'s (2022) findings suggest location significantly shaped e-learning challenges for higher education students. Rural students classified as a disadvantaged group face more technical and internet connectivity issues, reduced learning focus, physical health problems, social isolation, and low digital literacy than urban peers. Geographical analysis highlights Sabah, Perlis, and Melaka students as highest-risk, while Kuala Lumpur students are an exception differing from other urban groups by confronting rural-like challenges. This ongoing struggle highlights the need for continuous improvements and support to fully realize the potential of e-learning in Malaysia.

In measuring e-learning, e-learning readiness can be effectively manipulated and assessed using various instruments. Several studies have been conducted for this purpose. Sharoni et al. (2022) found that Malaysian university students exhibited a high level of online learning readiness, particularly in computer/internet self-efficacy, while learner control was the lowest. Sarkam et al. (2022) examined e-learning readiness through factors like effort expectancy, attitudes, and facilitating conditions, finding that facilitating conditions most significantly impact learning acceptance and achievement among Malaysian university students. Hock and Ayub (2024) discovered that among 54 pre-service teachers from Malaysian universities, the majority had a solid understanding of e-learning and were prepared to adopt it with a positive perception. Nonetheless, a small subset of them was still unprepared for it. Khan et al. (2024) collected 262 responses from IT administrators in Malaysia's leading universities and reported that robust ICT adoption and social-IoT integration markedly improve e-learning system quality, whereas

AI contributes only partially. Digital literacy and pedagogical digital competence significantly mediate the positive influence of both ICT and AI on e-learning outcomes, yet technostress showed no moderating role. Sulong et al. (2024) interviewed six Malay-language teachers in Terengganu primary schools via semi-structured interviews analyzed in NVivo 12. Participants admitted they seldom use Google Tools, blaming limited technical skills and low awareness; nonetheless, they unanimously welcomed a dedicated Google-tools training module that could serve as an implementation guide and enduring reference.

E-learning has become a globally expanding force in education, driven by technology and the COVID-19 pandemic, yet its growth is hindered by investment disparities and infrastructure gaps between developed and emerging economies. For Malaysia, while national policies like the Education Blueprint and Education 4.0 prioritize e-learning integration in ELT, implementation challenges persist, including inadequate teacher training, regional inequities (notably in states like Sabah), and misalignment between policy and on-the-ground practice. Existing research on e-learning readiness in Malaysia covers diverse groups from university students to primary school teachers but highlights the need for context-specific assessments and targeted support to address unique barriers, ensuring e-learning fulfills its potential for equitable, quality education across the country.

Theoretical Framework

Chapnick's (2000) readiness model comprises eight constructs for assessing organizational e-learning readiness: psychological, sociological, environmental, human resource, financial, technological skills, equipment, and content readiness (Table 1). The model helps stakeholders examine organizational e-learning readiness, pinpoint areas for improvement and confirm strengths, and institutions worldwide have already adopted it for such assessments. Because organizations may weight these components differently, the model is intentionally flexible; consequently, only four dimensions, psychological readiness, human resource readiness, technological skills readiness, and equipment readiness were retained for the present study of secondary school ESL teachers in Kota Kinabalu, Sabah. Whereas Chapnick's framework addresses e-learning readiness broadly, this current study targets the narrower phenomenon of e-learning readiness among local ESL teachers. Effective e-learning for ESL instruction hinges on teachers' digital competence to deliver language-focused activities, available infrastructure tailored to interactive language learning, institutional support for integrating technology into ESL curricula, and willingness to innovate pedagogical practices; the four selected constructs map directly onto these context-specific prerequisites.

To address the gap in exploring related studies on secondary school ESL teachers' e-learning readiness, particularly those using frameworks like Chapnick's (2000). Previous research (e.g., Coopasami et al., 2017; Chatikobo & Pasipamire, 2024; Rao & Raturi, 2022; Zainuddin et al., 2023) has applied Chapnick's model to diverse educational stakeholders, but few have focused on secondary school ESL teachers, a group with unique pedagogical and contextual needs. For instance, Rao and Raturi (2022) surveyed 150 Fijian secondary school science teachers using Chapnick's model and the Technology Acceptance Model (TAM), finding that perception and subject-impact strongly predicted e-learning adoption motivation. However, science education differs from ESL instruction in its emphasis on communicative practice. This disciplinary difference means their findings might not be generalized to ESL teachers, who face distinct barriers such as aligning digital tools with language proficiency goals. Another limitation in existing literature is the lack of Chapnick's framework application to secondary school ESL teachers specifically. Zainuddin et al. (2023) applied Chapnick's model to ESL diploma students in engineering programs at Politeknik Kota Bharu, reporting high acceptance and readiness for

Table 1. Chapnick’s (2000) e-learning framework

E-Learning readiness dimensions	Descriptions
Psychological readiness	This refers to how an individual’s mental attitude, motivation, and cognitive state influence the potential success of the e-learning initiative.
Sociological readiness	This encompasses the interpersonal dynamics and social climate of the setting where the e-learning program is introduced.
Environmental readiness	The large-scale internal and external forces that influence everyone involved in the organization.
Human resource readiness	This concerns the availability and structure of the human support network, specifically regarding the preparedness of management and staff to facilitate the program.
Financial readiness	This relates to the fiscal capacity of the organization, specifically regarding the adequacy of the budget and the efficiency of the fund allocation process.
Technological readiness	This denotes the quantifiable technical skills of the users, specifically their proficiency in utilizing computers and internet-based technologies.
Equipment readiness	This addresses the infrastructural adequacy of the organization, ensuring the necessary hardware and software are both available and accessible.
Content readiness	This involves the quality and relevance of the subject matter, as well as the alignment of the instructional design goals.

learning systems, but their focus on higher education students overlooks secondary school ESL teachers’ roles as curriculum designers and adolescent mentors. These teachers require not just technical skills but also institutional support to adapt curricula and psychological motivation to blend technology with language teaching, needs unaddressed in student-focused or non-ESL studies. Additionally, studies in non-Western, multilingual contexts like Sabah are scarce. Chatikobo and Pasipamire (2024) used Chapnick’s framework to assess AI readiness among Zimbabwean university library staff, identifying barriers like outdated infrastructure and weak leadership support, but their focus on higher education administration does not reflect secondary school ESL teachers’ realities in Sabah, where limited access to language-specific digital tools and inadequate training in ESL-tech integration compound infrastructural challenges. Coopasami et al. (2017) similarly identified technological and equipment gaps among Durban nursing students using a modified Chapnick model, but their findings prioritize vocational training needs over ESL’s pedagogical and linguistic demands.

These studies directly informed the present research design. First, the retention of psychological, human resource, technological skills, and equipment readiness was justified by evidence from Rao and Raturi (2022) and Coopasami et al. (2017) that these dimensions are the predictors of e-learning adoption. For ESL teachers, psychological readiness reflects motivation to adapt language teaching, technological skills readiness ensures proficiency in ESL-specific

tools, equipment readiness addresses access to interactive language-learning infrastructure, and human resource readiness fills the institutional support gap highlighted by Chatikobo and Pasipamire (2024). Second, sociological, environmental, financial, and content readiness were excluded due to contextual irrelevance. Financial and environmental readiness are organizational-level constructs beyond secondary school ESL teachers' control, already explored in broader studies like Chapnick's (2000) original work. Sociological readiness (interpersonal dynamics) was deemed less critical for individual teacher readiness, while content readiness focuses on e-learning content design, an area addressed by Zainuddin et al. (2023) and unrelated to the present study's focus on teachers' preparedness to use e-learning.

Research Gaps and Applicability of the Current Study

A critical research gap persists in the literature, there is a dearth of empirical research assessing e-learning readiness among secondary school ESL teachers in Kota Kinabalu, Sabah, particularly work that employs a theoretically grounded framework like Chapnick's (2000) to account for their unique pedagogical, linguistic, and regional challenges. Existing e-learning readiness studies in Malaysia are mainly concentrated in Peninsular Malaysia, where e-learning infrastructure and institutional support are far more robust (Awang et al., 2018; Hock & Ayub, 2024) and focus on populations irrelevant to Sabah's secondary ESL context: Peninsular university students (Sharoni et al., 2022; Sarkam et al., 2022), IT administrators (Khan et al., 2024), or primary school Malay teachers (Sulong et al., 2024). For instance, Sharoni et al. (2022) documented high online learning readiness among Peninsular university students, attributed to widespread internet access and digital literacy programs, and these resources remain scarce in Sabah, while Khan et al. (2024) focused on ICT adoption in Peninsular universities and overlooked the on-the-ground realities of Sabah's secondary ESL teachers, who lack dedicated technical support (Jafar et al., 2022). Even studies that acknowledge Sabah as a "high-challenge" region for e-learning challenges (e.g., Jafar et al., 2022) fail to specifically examine ESL teachers' readiness to implement language-focused digital tools, leaving unanswered questions about how ESL-specific needs interact with readiness constructs.

Compounding this gap, Sabah's distinct context, characterized by underdeveloped infrastructure, a multilingual student population (including Malays, Chinese, indigenous groups like the Kadazan-Dusun), and an under-resourced public education system relative to Peninsular Malaysia has been largely unexamined. Unlike Peninsular Malaysia, where ESL instruction often aligns with urban learners' needs, Kota Kinabalu's ESL teachers face two unique, unaddressed challenges: adapting digital resources to multilingual classrooms and compensating for inadequate infrastructure. These context-specific barriers are absent from prior research, which either focuses on non-ESL disciplines (e.g., science, nursing; Coopasami et al., 2017; Rao & Raturi, 2022) or ignores regional resource disparities. Additionally, no validated instrument exists to capture the distinct constraints related to technological skills, equipment, psychological attitudes, and human resource support that Sabah's secondary ESL teachers face, nor to identify targeted support that could convert low readiness into confident online English delivery.

The present study addresses these gaps by applying and adapting Chapnick's (2000) model to this underrepresented group, focusing on four contextually relevant dimensions (technological skills, equipment, psychological, and human resource readiness) that directly target ESL-specific and regional barriers. By streamlining the instrument to Kota Kinabalu's secondary school context while preserving relevance to local challenges and ensuring methodological rigor, the study advances understanding of e-learning readiness in discipline-specific, multilingual educational settings. Furthermore, it provides empirical data to inform targeted interventions

(e.g., training in ESL-specific digital tools, infrastructure upgrades) and furnishes evidence-based guidance for equitable e-learning rollout across East Malaysia. In doing so, the research extends prior work by exploring how e-learning readiness operates in contexts where policy intent outpaces systemic capacity, a scenario common in developing regions globally but rarely studied in Malaysia's ESL context.

Methodology

To address the research questions and fill literature gaps, this section adopts a quantitative cross-sectional survey design, detailing sampling strategies, questionnaire development and validation, as well as data collection and analysis methods to ensure scientific rigor.

Research Design and Sampling

This study, grounded in the positivist paradigm, adopted a quantitative research approach with a cross-sectional survey design (Gay et al., 2012). It was conducted in Kota Kinabalu, the capital of Sabah, which had about 500,421 residents in 2020. The district is overwhelmingly urban, with roughly 470,000 urban and 30,000 rural inhabitants, giving an urbanization rate of approximately 94 percent according to OpenDOSM by the Department of Statistics Malaysia. Its population is ethnically and linguistically diverse, including Malays, Chinese, indigenous groups and others, and the public sector dominates education through 58 government primary and 24 government secondary schools (Jeffrey, 2019). In short, Kota Kinabalu is a mid-sized, half-million-resident urban district whose students are educated mainly in the public system. Therefore, the sampling process followed a two-stage stratified random sampling method to ensure representativeness. First, a sampling frame was constructed using the official list of secondary schools in Kota Kinabalu provided by Jabatan Pendidikan Negeri Sabah. From this frame, 18 secondary schools were randomly selected, stratified by school type and student enrolment size to reflect the demographic diversity of the region's educational institutions. Second, within each selected school, in-service ESL teachers were randomly sampled from the school's official teacher roster, yielding a final sample of 145 participants. This two-stage randomization ensured that both schools and teachers were selected without systematic bias, aligning with the definition of a probability sample. Investigating perceptions in Sabah's capital is justified because capital cities typically mirror broader regional trends, their diverse populations, relatively better infrastructure and access to experienced inputs shape understanding and inform the future direction of e-learning initiatives. For ethical considerations, permission to collect data was granted by Malaysia's Ministry of Education, Jabatan Pendidikan Negeri Sabah and Pejabat Pendidikan Daerah Kota Kinabalu. Data were collected over a four-month span (December 2019–April 2020) that bridged the onset of COVID-19, combining pre-pandemic responses with those gathered during the early outbreak period.

Instrument

This study followed a four-stage research design in accordance with Park et al. (2017) for instrument development and evaluation, ensuring methodological rigor and alignment with standards in research.

i) Instrument Development

In line with the research design outlined in the study, a survey questionnaire for measuring ESL teachers' e-learning readiness was adapted from prior scholarly works (Agarwal & Prasad, 1998; Mulwa & Kyalo, 2011; Mutiaradevi, 2009) to ensure the validity and

reliability of its measuring items. The questionnaire focused on four core dimensions of e-learning readiness, technological skills readiness (TSR, four items), equipment readiness (ER, four items), psychological readiness (PR, five items), and human resource readiness (HRR, four items), with these constructs modified to align with the specific context of secondary school ESL teachers in Kota Kinabalu before being labeled for sequential analysis. To facilitate administration and data analysis, all measuring items were designed as close-ended questions using a five-point Likert scale (ranging from “strongly disagree [SD]” to “strongly agree [SA]”) with single response options; the items were also revised to be simple, concise, and phrased in language familiar to the target respondents.

ii) Bilingual Translation and Validation Checks

Given the linguistic context of the study, a bilingual version of the questionnaire (English and Bahasa Malaysia) was adapted and developed to guarantee accuracy and prevent misunderstandings (Appendix A). The translation from the source language (English) to the target language (Malay) was conducted using the back-translation method (Dörnyei & Dewaele, 2023) with two bilingual experts (with doctoral degrees in TESL and native proficiency in both English and Malay) independently translating the English questionnaire into Malay and a third bilingual expert (a senior lecturer in applied linguistics with no prior exposure to the original instrument) back-translating the Malay version into English. Discrepancies between the original and back-translated English versions were resolved (Rezai, 2025) through a consensus meeting with all three experts.

After completing the questionnaire design, the study turned to validating and refining the instrument to ensure it reliably measured e-learning readiness among the target ESL teachers, consistent with the focus on psychometric rigor in the study. Validity (ensuring the instrument measures its intended construct) and reliability (ensuring consistent results) were prioritized, as noted by Gay et al. (2012). Content validity was assessed by four experts from a Malaysian public university, specializing in e-learning instruction, educational evaluation, and English language education. These experts reviewed the questionnaire for appropriateness, provided feedback for revisions, and evaluated criteria (e.g., grammar, font size, item clarity, spelling, sentence structure, instrument format) using a “Yes/No” content validation form. No major revisions were required following the expert review, confirming the instrument’s content validity. Face validity (assessing readability and understandability) was evaluated by three secondary school in-service ESL teachers in Malaysia (excluded from the final sample), who confirmed the items were generally comprehensible and only identified minor technical errors requiring correction.

iii) Pilot Study

A one-month pilot study was conducted to refine the instrument and detect potential issues (Gay et al., 2012). Data were collected via Google Forms from 64 in-service ESL teachers (excluded from the final sample), focusing on item clarity, response relevance, and scale functionality. Feedback from the pilot study confirmed the questionnaire’s feasibility (Rezai, 2025), with no substantive revisions required before full-scale data collection.

iv) Full-Scale Data Collection and Analysis

The finalized questionnaire was re-uploaded to Google Forms for automated data collection. Responses were scaled and scored via the platform, then exported to Excel for cleaning, before being imported into SPSS 29 (for EFA and descriptive statistics) and SmartPLS4 (for CFA and construct validity assessment) for rigorous statistical analysis.

Results and Discussion

Preliminary screening (Tabachnick & Fidell, 2013) identified no systematic missing data or extreme outliers. EFA was conducted in SPSS 29 to delineate the initial factor structure, followed by CFA in SmartPLS4 (via covariance-based structural equation modelling, CB-SEM) to assess discriminant validity. With the measurement model accepted, construct-specific readiness levels were analyzed.

Construct Validity

According to Pallant (2020), the EFA involves three main steps: 1) Checking data suitability (Kaiser-Meyer-Olkin, KMO) > 0.6, Bartlett's Test $p < 0.05$, 2) Factor extraction (eigenvalues > 1), and 3) Factor rotation and interpretation (Direct Oblimin method), CFA fit was evaluated using SmartPLS4 (Hair et al., 2025). Key findings, with necessary data retained in tables, are interpreted below.

Data Suitability for Factor Analysis

Table 2. Results of KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.736
Bartlett's Test of Sphericity	Approx. Chi-Square	659.236
	df	136
	Sig.	<.001

Prior to EFA, factorability screening confirmed the dataset's suitability. As shown in Table 2, the KMO index met the critical threshold of 0.6 for acceptable sampling adequacy (Pallant, 2020), while Bartlett's test of sphericity reached statistical significance ($\chi^2 = 659.236$, $df = 136$, $p < 0.001$), confirming the correlation matrix deviated sufficiently from an identity matrix to justify factor analysis. Together, these results validate that the sample of 145 secondary school ESL teachers and corresponding dataset meet the basic requirements for subsequent EFA and CFA, laying a reliable foundation for psychometric analyses.

EFA: Factor Extraction, Rotation, and Structure

Table 3. Total variance explained (EFA)

Component	Initial eigenvalues		
	Total	% of variance	Cumulative %
1	4.415	25.972	25.972
2	3.930	23.117	49.089
3	2.231	13.122	62.212
4	1.659	9.758	71.969
		...	
17	.097	.569	100.000

Note: Extraction method: Principal component analysis.
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

As presented in Tables 3 and 4, EFA explored the latent factor structure of the e-learning readiness scale, with Principal Component Analysis (PCA) for extraction and Oblimin rotation (Kaiser normalization) for interpretation. Using the eigenvalue criterion (eigenvalue > 1.0; Pallant, 2020), four components were retained, collectively explaining 71.969% of total variance, far exceeding the commonly accepted 60% threshold (Hair et al., 2019) indicating strong explanatory power for the original 17 scale items. Factor rotation yielded four distinct, conceptually clear factors, with all item loadings exceeding the critical 0.6 threshold for item-factor alignment (no cross-loading or weak items retained). The four factors are defined as follows.

Table 4. Factor loadings of each construct (EFA)

E-learning readiness	Component			
	1	2	3	4
Technological skills readiness (TSR)				
TSR1. I have the basic skills to operate a computer (e.g. keyboarding, etc).	.898			
TSR2. I know how to install any software on my computer to support my teaching of English.	.869			
TSR3. I have the basic skills to use the search engines (e.g. Google, etc) to find the needed materials, and information on English lessons.	.867			
TSR4. I am good at using Microsoft programs (e.g. Word, etc) in teaching English.	.804			
Human Resource Readiness (HRR)				
HRR1. My school has experienced human resource to organize and evaluate training and to help other teachers with career development.		.932		
HRR2. My school has a vision on the use of e-learning.		.840		
HRR3. My school principal encourages me to use the e-learning facilities at my school or after office hours.		.833		
HRR4. My school human resource department is able to design Web pages for e-learning.		.753		
Equipment Readiness (ER)				
ER1. I have access to a fairly new computer at my school (e.g. enough RAM, good speakers, fast processor) for preparing my English lessons.			.921	
ER2. I have access to a computer at my school with adequate software (e.g. Microsoft Programs).			.916	
ER3. I have access to a computer at my school.			.916	
ER4. The Internet connectivity at my school is adequate to support my teaching of English via the use of e-learning.			.732	

(Continued)

(Continued)

E-learning readiness	Component			
	1	2	3	4
Psychological Readiness (PR)				
PR1. I like to experiment with new information technologies in teaching English.				.914
PR2. If I hear about a new ICT tool that could improve my English lesson, I would look for ways to experiment with it.				.868
PR3. Compared to my colleagues, I am usually the first to try out new information technologies in teaching English.				.692
PR4. I would be more comfortable using use e-learning in teaching English if I were familiar with e-learning.				.638
PR5. Knowing how to use e-learning technologies will increase my job prospects.				.636

Note: Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 8 iterations.

Four readiness dimensions were identified. The first factor, labelled technological skills readiness (TSR), encompasses four items (TSR1 to TSR4) measuring proficiency in basic computer operations, software installation, search engine utilization for English teaching materials, and Microsoft program application in ESL instruction. The second factor, human resource readiness (HRR), includes four items (HRR1 to HRR4) reflecting institutional support, such as experienced staff for training/career development, a clear e-learning vision, principal encouragement for e-learning facility use, and the HR department’s ability to design e-learning webpages. The third factor, equipment readiness (ER), comprises four items (ER1 to ER4) assessing access to functional resources (e.g., newer computers with sufficient specifications, adequate software, and reliable Internet connectivity) to support e-learning in English teaching. The fourth factor, psychological readiness (PR), contains five items (PR1 to PR5) capturing attitudes toward e-learning, including willingness to experiment with new ICT tools, motivation to adopt lesson-enhancing technologies, early adopter tendencies relative to colleagues, comfort with familiar e-learning tools, and perceived career value of e-learning skills.

CFA: Model Fit and Construct Validity

CFA was conducted using SmartPLS4 with CB-SEM to verify the fit of the four-factor model and assess the construct validity of the scale, with results reported in Tables 5 (Model Fit), 6 (Construct Reliability and Validity), and 7 (Discriminant Validity).
Regarding model fit (Table 5), the study evaluated the four-factor model using multiple standard fit indices. The chi-square/degrees of freedom (ChiSqr/df) ratio was 2.154, which is less than the threshold of 3.0, indicating acceptable model fit. The Comparative Fit Index (CFI) was 0.908, exceeding the 0.90 threshold for good fit, while the Tucker-Lewis Index (TLI) was 0.889, a value close to the 0.90 threshold and considered marginally acceptable. The Root Mean Square Error of Approximation (RMSEA) was 0.089, and the Standardized Root Mean Square Residual (SRMR) was 0.073, less than the 0.08 threshold for good fit, confirming that the four-factor model provides an acceptable fit to the data (Chua, 2024; Hair et al., 2025).

Table 5. Model fit

Estimated model	
Chi-square	243.415
P value	0.000
ChiSqr/df	2.154
RMSEA	0.089
GFI	0.842
SRMR	0.073
NFI	0.843
TLI	0.889
CFI	0.908

Table 6. Construct reliability and validity

	Cronbach's alpha (standardized) ≥ 0.7	Composite reliability (rho_c) ≥ 0.7	Average variance extracted (AVE) ≥ 0.5
ER	0.860	0.867	0.626
HRR	0.851	0.856	0.592
PR	0.863	0.863	0.561
TSR	0.884	0.879	0.665

Note: ER = equipment readiness, HRR = human resource readiness, PR = psychological readiness, TSR = technological skills readiness

For construct reliability and convergent validity (Table 6), the study reported three key indicators. Cronbach's alpha (standardized) for all four factors exceeded the 0.7 threshold recommended by Chua (2024), indicating excellent internal consistency for each factor. Composite Reliability (CR), a more robust measure than Cronbach's alpha, was also above 0.85 for all factors, confirming that each latent factor is measured reliably. The AVE for each factor exceeded 0.5, surpassing the 0.5 threshold proposed by Chua (2024).

Table 7. Discriminant validity (Fornell-Larcker Criterion)

	ER	HRR	PR	TSR
ER	0.791			
HRR	0.454	0.770		
PR	0.336	0.379	0.749	
TSR	0.200	0.209	0.539	0.815

Note: ER = equipment readiness, HRR = human resource readiness, PR = psychological readiness, TSR = technological skills readiness

Discriminant validity was confirmed in Table 7 through the Fornell-Larcker criterion, as the square root of each factor's AVE exceeded its highest correlation with any other factor (Chua, 2024; Hair et al., 2025), demonstrating that the four factors are conceptually distinct and capture unique aspects of e-learning readiness without redundancy.

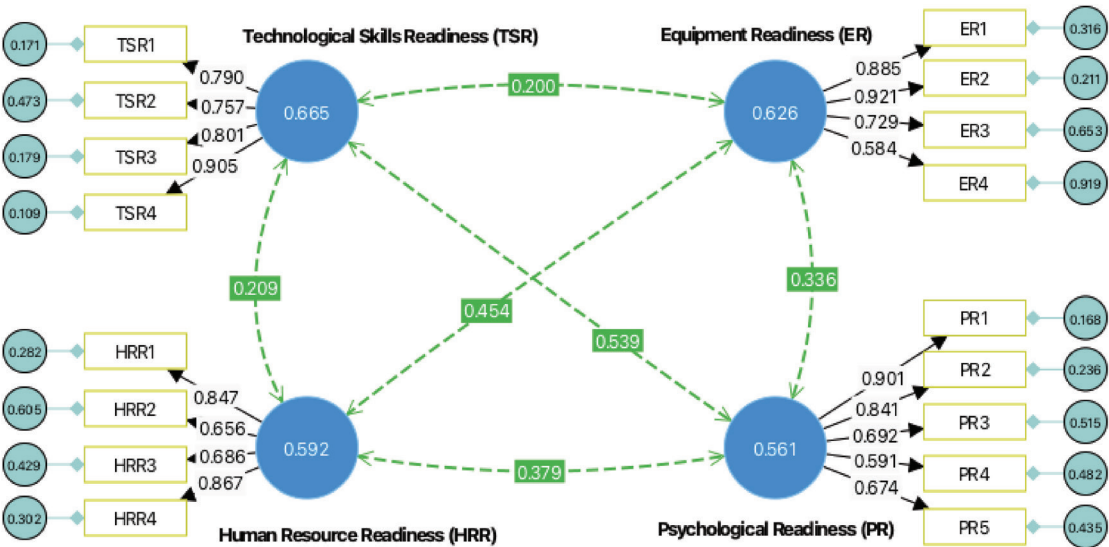


Figure 1. CFA results in SmartPLS4 on e-learning readiness

Overall, Figure 1 serves as a visual summary of the CFA results, illustrating the structural relationships within the e-learning readiness scale and providing intuitive evidence for the validity of the four-factor model proposed in the study.

Descriptive Analysis of E-Learning Readiness Levels

The study used a 5-point Likert scale to measure e-learning readiness and adopted Aydin and Tasci's (2005) classification benchmark to interpret the results: scores of 1.0–2.59 indicate “not ready, needs much work”; 2.6–3.39 indicate “not ready, needs some work”; 3.4–4.19 indicate “ready, but needs a few improvements”; and 4.2–5.0 indicate “ready, go ahead.” Descriptive statistics for each dimension of e-learning readiness are presented in Tables 8–11.

Table 8. Level of technological skills readiness (TSR)

Items	Mean	Standard deviation	Skewness/Kurtosis
TSR1	4.46	.677	–1.017/.402
TSR2	3.81	1.056	–.645/-/208
TSR3	4.34	.709	–.830/.321
TSR4	4.26	.780	.780/- .133
Overall TSR	4.22	.693	–.590/- .444

Table 8 presents the overall mean fell into the “ready, go ahead” category. Within the dimension, basic computer operation skills scored highest, while software installation proficiency scored lowest, suggesting strong foundational digital skills but room for growth in specialized software use.

Table 9. Human resource readiness (HRR)

Items	Mean	Standard deviation	Skewness/Kurtosis
HRR1	3.20	1.004	-.120/-.174
HRR2	3.45	1.034	-.414/-.171
HRR3	3.57	.903	-.133/-.210
HRR4	2.97	1.105	-.070/-.590
Overall HRR	3.30	.842	-.136/-.140

Table 9 details the overall mean was categorized as “not ready, needs some work.” Principal encouragement for e-learning facility use scored highest, while the HR department’s webpage design ability scored lowest, indicating uneven institutional support, with leadership buy-in outpacing technical support capacity.

Table 10. Level of equipment readiness (ER)

Items	Mean	Standard deviation	Skewness/Kurtosis
ER1	3.05	1.210	.237/-.697
ER2	3.21	1.185	-.373/-.642
ER3	3.81	1.184	-.828/-.210
ER4	2.92	1.185	-.080/-.910
Overall ER	3.25	1.000	-.327/-.493

Table 10 reports the lowest overall mean among the four dimensions, falling into “not ready, needs some work.” Access to new computers for English teaching preparation scored highest, while Internet connectivity adequacy was the lowest across all items in all dimensions, highlighting connectivity as a critical bottleneck for e-learning implementation.

Table 11. Psychological readiness (PR)

Items	Mean	Standard deviation	Skewness/Kurtosis
PR1	3.58	.948	-.157/-.432
PR2	3.65	.902	-.338/.184
PR3	3.10	.998	.087/-.272
PR4	3.94	.864	-.285/-.828
PR5	4.04	.897	-.492/-.742
Overall PR	3.66	.741	-.214/-.398

Table 11 includes the overall mean was classified as “ready, but needs a few improvements.” Perceived career value of e-learning skills and comfort with familiar e-learning tools scored highest, while early adopter tendencies relative to colleagues scored lowest, reflecting positive attitudes toward e-learning’s utility but less willingness to be first movers.

Discussion of Findings

Drawing on the empirical results in Section 4, this section interprets the questionnaire’s validity and teachers’ e-learning readiness profiles, links findings to relevant literature and local educational contexts, and analyzes their theoretical and practical implications.

Discussion of RQ1

The results stemming from EFA and CFA revealed a satisfactory pattern, findings directly supported by the psychometric. Items were selected and later adapted based on their theoretical relevance in prior work. This process yielded a clear four-factor structure (TSR, HRR, ER, PR) with all retained items exhibiting factor loadings >0.6 . The original scale demonstrated acceptable reliability and validity in prior research, which increases the likelihood that the new scale will also exhibit strong reliability and validity, provided contextual adaptations are sound (Wongpakaran & Wongpakaran, 2012). This aligns with the adapted scale’s performance in the study with Cronbach’s $\alpha > 0.85$ for all four and $CR > 0.85$, alongside $AVE > 0.56$, all exceeding standard thresholds for reliability and convergent validity.

This study also advances e-learning readiness theory by adapting and refining Chapnick’s readiness model to the specific needs of secondary school ESL teachers in Sabah. The decision to narrow Chapnick’s original eight-factor model to four factors was theoretically justified, as it prioritizes the dimensions most directly relevant to e-learning delivery at the teacher level. ESL teachers’ ability to implement e-learning depends on their own technical skills (TSR), access to tools (ER), institutional support (HRR), and willingness to adopt new practices (PR). The strong psychometric performance of model explaining nearly 71.969% of total variance, confirming it is a theoretically sound tool for measuring teacher e-learning readiness in contexts like Sabah, where resources and support systems differ from university settings. This contextualization fills a gap in existing theory, failing to account for the unique barriers faced by in-service teachers in developing regions.

Besides that, if items are translated or culturally adapted, their meaning and interpretability are preserved across languages and cultures, leading to misinterpretation of items and accuracy of the results (Benlidayi & Gupta, 2024; Gjersing et al., 2010). Consistent with this, even though the target respondents were ESL teachers in Kota Kinabalu, a bilingual version of the questionnaire (Bahasa Malay and English) was used to ensure linguistic clarity for participants and mitigating translation-related bias. The current adapted scale was also validated through content and face validity, where experts checked its theoretical aspects while non-experts examined its surface validity before it was administered to the actual study participants (Boateng et al., 2018). This step reinforces the scale’s alignment with the study’s focus on ESL teacher e-learning readiness, as reflected in the study’s EFA and CFA results (e.g., no cross-loading items, discriminant validity).

Discussion of RQ2

The results of the study reveal a critical gap between teacher capabilities and systemic support for e-learning, ESL teachers in Kota Kinabalu have strong technological skills and moderate psychological readiness to use e-learning, but schools relatively fail to provide adequate equipment and human resource support. This aligns with literature emphasizing that readiness involves

mindset, the right tools, and a support system (Almusawi & Durugbo, 2024; Yang & Xu, 2023, Teng, 2024). This “supply-demand mismatch” is particularly notable because even skilled and willing teachers cannot effectively implement e-learning without functional resources (e.g., reliable Internet) or institutional backing (e.g., training, technical support), meaning that the full potential of e-learning in ESL classrooms is likely being undermined by systemic deficits. Francom et al. (2021) document the same fracture elsewhere, noting that instructors leveraged familiar apps to keep classes running, but still buckled under weak institutional guidance, disengaged homes, and uneven connectivity, underscoring that systemic deficits, not teacher deficits, now limit e-learning success.

The ER data reveals two interrelated core issues that undermine e-learning for ESL teachers. First, unreliable internet connectivity (ER4) is an existential pain point. Teachers depend on the internet to access digital English materials, deliver hybrid lessons, and facilitate real-time student engagement. Poor connectivity can disrupt these activities. Second, while ER3's relatively high score suggests progress in providing computers, ER1's low score indicates a lack of essential software that would allow teachers to fully leverage the hardware. Similarly, ER2's moderate score implies that computers may be scarce relative to the number of teachers, forcing educators to share devices or wait for access, reducing the time and flexibility needed to prepare e-learning lessons. This is supported by Bećirović (2023) and Taghizadeh and Basirat (2024) that the effective integration of modern technologies into teaching hinges on reliable access to the requisite tools via stable connectivity.

The moderate level of PR also offers important insights. While teachers generally hold a positive attitude toward ICT tools in ESL teaching, they are hesitant to be early adopters, as reflected by PR3. This caution may stem from insufficient training or fear of technical failures, both of which are linked to the weak HRR observed in the study. For example, if schools fail to provide structured training on new tools or prompt technical assistance when issues arise, teachers may be reluctant to take risks with untested technologies in their ESL lessons. Consistent with Abedi (2024), Maahs et al. (2025), and Taghizadeh and Basirat (2024), teachers frequently cite inadequate training as a barrier to effective technology use. Lacking systematic professional development, they hesitate to adopt unfamiliar tools, fearing classroom failure. Successful integration therefore hinges on sustained programmes that couple technical know-how with clear pedagogical guidance, ensuring teachers acquire practical skills aligned with their everyday instructional needs.

Additionally, the low scores in HRR highlight two key institutional weaknesses. First, schools lack a clear, actionable vision for e-learning. HRR2 is the second highest score in the HRR dimension, it only barely falls into the “ready, but needs a few improvements” category and remains weak enough to limit cohesive e-learning planning. Second, school HR departments lack the technical expertise to support e-learning, HRR4 places it in the “not ready, needs some work” range and signaling a critical gap in technical support capacity. Without a shared, actionable e-learning vision, efforts to integrate digital tools into ESL classrooms may become fragmented and inconsistent across teachers. Meanwhile, the absence of technical HR support means teachers cannot rely on school resources to resolve practical issues such as designing e-learning webpages or troubleshooting software problems, creating additional barriers that further discourage their adoption of e-learning. Echoing Bećirović (2023) and Thu (2022), technology integration is not a solo endeavor but an institutional commitment. Schools must supply robust resources, targeted training, and reliable administrative backing. Readily available technical assistance is critical; without on-site help, teachers often shelve new tools to avoid disruptive classroom breakdowns. Theodorio (2024) reinforces this, stressing that continuous, proactive support is essential for cultivating teachers' technical competence and their capacity for innovative pedagogical strategies.

Implications and Limitations of the Findings

Moreover, the study's findings yield actionable practical implications, both tailored to Kota Kinabalu's secondary school ESL teachers and broadly applicable to global contexts facing similar systemic challenges. For local school administrators, the priority lies in addressing human resource and equipment readiness gaps while building on existing strengths: upskilling HR staff in e-learning technical support or partnering with external tech organizations, designing ESL-focused training that avoids redundant basic technical skills (given the already strong TSR, prioritizing reliable internet connectivity, and pre-installing ESL-specific software on school computers to enhance ER. Local education authorities can further leverage teachers' robust TSR by developing a centralized repository of ESL e-learning resources such as digital lesson plans, while mitigating PR caution through an "e-learning teacher champion" program that empowers high-PR teachers to share best practices and mentor peers. Meanwhile, teacher professional development providers should shift their focus from basic tech training to advanced ESL-focused digital pedagogy, including the integration of AI tools for language teaching, offer "safe experiment" sessions for new ICT tools with on-site support to ease PR hesitancy, and add post-training support to address HRR gaps, ensuring teachers receive sustained assistance beyond initial workshops.

Beyond Kota Kinabalu, the study's findings hold three key implications for global ESL/EFL contexts. First, the validated four-factor model, which encompasses technological skills, human resource, equipment, and psychological readiness, extends Chapnick's (2000) original framework by demonstrating its utility in settings with limited infrastructure and discipline-specific (ESL) needs. This adaptation is particularly relevant to other developing regions, such as ASEAN neighbors (Indonesia, Thailand, the Philippines) and African countries, where e-learning policies are mandated but infrastructure is constrained, teachers work with multilingual student populations, and institutional support for digital pedagogy is fragmented. In Indonesia or Kenya, for example, where secondary school ESL/EFL teachers face similar resource gaps (Mulwa & Kyalo, 2011; Mutiaradevi, 2009), the scale can identify readiness gaps without major modifications, as the core dimensions are universal to teacher e-learning readiness. This finding also challenges one-size-fits-all readiness frameworks by highlighting that psychological readiness (attitude toward innovation) and technological skills alone are insufficient without systemic support, emphasizing the need to contextualize assessments to a region's unique systemic capacity.

Second, the study's key insight, a "supply-demand mismatch" where strong teacher skills and attitudes are paired with weak equipment and human resource support, is transferable to any context where e-learning implementation is hindered by systemic deficits rather than individual teacher competence. For practitioners in infrastructure-poor settings, targeted investments in connectivity and language-specific tools should take precedence over generic tech training, aligning with the finding that Kota Kinabalu's teachers already possessed strong technological skills. In multilingual contexts worldwide, developing centralized repositories of adaptable digital ESL resources, such as multilingual lesson plans and audio-visual materials, can reduce teacher workload and address diverse learner needs, a solution directly derived from Kota Kinabalu's ethnolinguistic diversity.

Third, while the core dimensions of readiness are transferable across contexts, the magnitude of gaps such as severe equipment shortages may not generalize to fully developed regions with well-established infrastructure. Even so, the study's focus on aligning interventions with existing teacher capacities, for example leveraging strong technological skills to offset equipment gaps, is universally applicable. For instance, in contexts with adequate infrastructure but low psychological readiness, such as some developed regions where teachers hold concerns about

digital pedagogy, the study's emphasis on institutional vision and peer support (key components of human resource readiness) can inform targeted professional development initiatives that address teacher hesitancy and build confidence in digital teaching practices.

Despite its strengths and implications, the study has some limitations that should guide future work. First, the sample of 145 teachers is restricted to Kota Kinabalu, meaning results may not generalize to rural areas of Sabah or other Malaysian states, where resource constraints or educational policies could differ. Expanding the sample to include multi-site data (e.g., rural Sabah, Peninsular Malaysia) would enhance the model's generalizability. Second, the cross-sectional design captures e-learning readiness at a single time point, preventing the study from tracking how readiness changes over time or establishing causal relationships (e.g., whether improved Internet connectivity boosts PR). A longitudinal design, with annual assessments using the validated scale, would allow researchers to evaluate the impact of interventions (e.g., equipment upgrades, HR training) and test causal claims. Finally, the scale focuses on traditional e-learning tools (e.g., Microsoft programs, search engines) and does not include emerging technologies like artificial intelligence (AI) or virtual reality (VR) tools increasingly relevant to ELT under Malaysia's digital education agenda. Updating the scale to include AI/VR readiness items would ensure it remains relevant in ELT as e-learning evolves (Hao et al., 2024).

Conclusion

The current study advances e-learning readiness literature by refining a globally recognized framework to fit the unique realities of ESL teachers in developing, multilingual regions. By distilling Chapnick's (2000) eight-factor model into a focused four-dimensional scale, the research identifies the core pillars of teacher-level e-learning readiness: individual capabilities, institutional support, and material resources, which are most relevant in contexts where systemic constraints (e.g., limited infrastructure) shape educational practice. This adaptation addresses a limitation in existing theory, the tendency to apply one-size-fits-all frameworks without accounting for discipline-specific needs (e.g., language-focused digital tool integration) or regional barriers (e.g., resource scarcity). The scale's psychometric performance confirms its utility as a sound tool for researchers and practitioners working with ESL teachers in similar such as developing regions with multilingual student populations, limited educational infrastructure, and mandatory ESL instruction, thereby fostering more nuanced and context-sensitive readiness assessments.

The research also highlights that effective e-learning implementation in ELT is a systemic endeavor, not merely a function of individual teacher competence. By providing Sabah's educational stakeholders with a validated instrument, the study enables evidence-based interventions that address root causes of implementation challenges rather than surface-level fixes. This aligns with Malaysia's Education Blueprint (2013–2025) and Education 4.0, by bridging the gap between policy intent and on-the-ground practice. The findings emphasize the need for collaborative action across schools, local education authorities, and professional development providers to ensure that structural supports (e.g., infrastructure, technical assistance) align with teachers' existing capacities, creating an enabling environment for digital innovation in ESL classrooms.

Moreover, this study advances the United Nations' Sustainable Development Goal 4 by centering the experiences of a marginalized group, ESL teachers in East Malaysia, and offering a model for inclusive digital education that resonates far beyond Sabah. By prioritizing local adaptation, it challenges the uncritical transfer of technological and pedagogical models, underscoring that successful digital transformation must be grounded in regional contexts, cultures, and resource realities. Notably, its focus on traditional e-learning practices provides

a retrospective foundation for understanding teacher readiness while also illuminating future directions aligned with evolving digital education landscapes. Future research can build on this transferability by testing the scale in other multilingual, resource-constrained settings to further refine the model and identify cross-cultural commonalities in readiness gaps. In doing so, the study contributes to a more equitable global e-learning discourse, one that acknowledges regional differences while distilling universal principles for supporting teachers in diverse contexts, reinforcing its commitment to inclusive quality education for all.

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Author Bios

Ke Hu, Ph.D., currently teaches business English at Hunan University of Information Technology, China. He earned his doctoral, master's, and bachelor's degrees in TESL from Universiti Malaysia Sabah (UMS), Malaysia. His research interests include English for Specific Purposes (ESP), curriculum and instruction, and e-learning in language teaching.

Asmaa AlSaqqaf, Ph.D., is an Associate Professor of English at the Centre for the Promotion of Knowledge and Language Learning (PPIB), Universiti Malaysia Sabah (UMS), Malaysia. She teaches undergraduate and postgraduate courses and supervises master's and Ph.D. students, both local and international. Currently, she publishes her work under the Knowledge, Attitude and Practice (KAP) Research Group, PPIB, UMS.

Appendix A

E-learning readiness scale for ESL teachers

English version	Malay version
Technological Skills Readiness	Kesediaan Kemahiran Teknologi
TSR1. I have the basic skills to operate a computer (e.g. keyboarding, etc).	TSR1. Saya mempunyai kemahiran asas untuk mengendalikan komputer (misalnya, kemahiran menaip, dll.)
TSR2. I know how to install any software on my computer to support my teaching of English.	TSR2. Saya tahu bagaimana untuk memasang sebarang perisian pada komputer untuk menyokong pengajaran Bahasa Inggeris saya.
TSR3. I have the basic skills to use the search engines (e.g. Google, etc) to find the needed materials, and information on English lessons.	TSR3. Saya mempunyai kemahiran asas untuk menggunakan enjin carian (misalnya, Google,dll.) untuk mencari bahan yang diperlukan, dan maklumat mengenai pelajaran Bahasa Inggeris.
TSR4. I am good at using Microsoft programs (e.g. Word, etc) in teaching English.	TSR4. Saya mahir menggunakan program Microsoft (misalnya, Word, dll.) dalam pengajaran Bahasa Inggeris.
Human Resource Readiness	Kesediaan Sumber Manusia
HRR1. My school has experienced human resource to organize and evaluate training and to help other teachers with career development.	HRR1. Sekolah saya mempunyai pengalaman sumber manusia dalam menganjurkan latihan pentaksiran dan untuk membantu guru dengan perkembangan kerjaya.
HRR2. My school has a vision on the use of e-learning.	HRR2. Sekolah saya mempunyai visi mengenai penggunaan e-pembelajaran.
HRR3. My school principal encourages me to use the e-learning facilities at my school or after office hours.	HRR3. Pengetua sekolah menggalakkan saya menggunakan kemudahan e-pembelajaran di sekolah atau selepas waktu pejabat.
HRR4. My school human resource department is able to design Web pages for e-learning.	HRR4. Jabatan sumber manusia sekolah saya dapat merancang laman web untuk e-pembelajaran.
Equipment Readiness	Kesediaan Peralatan
ER1. I have access to a fairly new computer at my school (e.g. enough RAM, good speakers, fast processor) for preparing my English lessons.	ER1. Saya mempunyai akses kepada komputer baru di sekolah (misalnya, RAM yang cukup, alat pembesar suara yang baik, pemprosesan yang pantas) untuk menyediakan pelajaran Bahasa Inggeris saya.

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English version	Malay version
ER2. I have access to a computer at my school with adequate software (e.g. Microsoft Programs).	ER2. Saya mempunyai akses kepada komputer di sekolah saya dengan perisian yang mencukupi (misalnya, Microsoft Program).
ER3. I have access to a computer at my school.	ER3. Saya mempunyai akses komputer di sekolah saya.
ER4. The Internet connectivity at my school is adequate to support my teaching of English via the use of e-learning.	ER4. Sambungan Internet di sekolah saya cukup untuk menyokong pengajaran Bahasa Inggeris melalui penggunaan e-pembelajaran.
Psychological Readiness	Kesediaan Psikologi
PR1. I like to experiment with new information technologies in teaching English.	PR1. Saya suka membuat eksperimen dengan teknologi maklumat baru dalam mengajar Bahasa Inggeris.
PR2. If I hear about a new ICT tool that could improve my English lesson, I would look for ways to experiment with it.	PR2. Jika saya mendengar tentang alat ICT baru yang dapat mempertingkatkan pengajaran Bahasa Inggeris saya, saya akan mencari jalan untuk membuat eksperimen dengannya.
PR3. Compared to my colleagues, I am usually the first to try out new information technologies in teaching English.	PR3. Berbanding dengan rakan-rakan sekerja, saya biasanya yang pertama mencuba teknologi maklumat baru dalam mengajar Bahasa Inggeris.
PR4. I would be more comfortable using use e-learning in teaching English if I were familiar with e-learning.	PR4. Saya akan lebih selesa untuk menggunakan e-pembelajaran dalam mengajar Bahasa Inggeris jika saya lebih mengetahui tentang e-pembelajaran.
PR5. Knowing how to use e-learning technologies will increase my job prospects.	PR5. Mengetahui cara menggunakan teknologi e-pembelajaran akan meningkatkan peluang pekerjaan saya.