

International Journal of Learning, Teaching and Educational Research
Vol. 24, No. 11, pp. 540-560, November 2025
<https://doi.org/10.26803/ijlter.24.11.26>
Received Aug 15, 2025; Revised Oct 8, 2025; Accepted Oct 9, 2025

Factors Influencing Work Readiness in Computer-Assisted Foreign Language Testing

Muhammad Sobri^{ID}, Tubagus Zam Zam Al Arif^{ID}, Anwar Sanusi^{ID} and
Ady Muh. Zainul Mustofa^{ID}
Universitas Jambi, Indonesia

Abstract. The rapid growth of digital technology has made Computer-Assisted Foreign Language Testing (CAFLT) an indispensable component of modern language education and assessment. However, a significant gap persists in ensuring that pre-service teachers possess the necessary work readiness to integrate and manage CAFLT in professional settings effectively. While previous research has primarily addressed fragmented issues related to CAFLT, this study offers a unique integrative analysis of how linguistic, pedagogical, and environmental factors collectively influence the work readiness of future educators. This holistic approach addresses the inadequacy of isolated studies by proposing a robust, multidimensional framework that integrates multiple perspectives. Employing a quantitative research design, the study collected survey data from 515 pre-service teachers across three universities in Jambi, Indonesia. The data were analyzed using partial least squares structural equation modeling (PLS-SEM) to test the hypothesized relationships within the proposed integrative model. The results indicate that all three factors – linguistic, pedagogical, and environmental – were perceived positively by the respondents. However, the structural model analysis revealed that linguistic factors ($\beta = 0.389$, $t = 3.082$, $p = 0.002$) and environmental and technical factors ($\beta = 0.446$, $t = 4.898$, $p = 0.000$) have a significant, direct positive influence on work readiness. Conversely, the impact of pedagogical factors on work readiness was found to be statistically insignificant ($\beta = 0.063$; $t = 0.608$; $p = 0.543$). This finding suggests that work readiness in CAFLT is more directly determined by a student's linguistic abilities and the technological environment, rather than by pedagogical methods alone, providing new insights into the factors influencing work readiness in Computer-Assisted Foreign Language Testing. These findings have significant implications for educators, policymakers, and test designers, underscoring the need for a comprehensive approach that integrates linguistic competency development and technological support to enhance student work readiness in the digital era.

*Corresponding author: Muhammad Sobri; muhammadsobri@unja.ac.id

Keywords: CAFLT; Environmental factors; Linguistic factors; Pedagogical factors

1. Introduction

The development of digital technology over the past decade has driven significant transformations in education, particularly evaluation methods for learning foreign languages. One form of evaluation innovation that is now widely adopted is Computer-Assisted Tests (CAT), a computer-based testing system that offers efficiency, speed, and objectivity in the assessment process (Fraidan & Aldawsri, 2025; Huang et al., 2025).

Amidst the demands of the Society 5.0 era, this system is considered crucial for producing graduates with the essential work readiness to meet modern professional demands, thus positioning CAFLT proficiency as a core employability skill. The successful implementation of CAFLT and the resulting student work readiness are not solely determined by biology alone, but by a complex interplay of human and systemic factors. From a linguistic perspective, difficulties often stem from gaps in students' Communicative Competence (e.g., poor mastery of vocabulary or discourse structure), which is further complicated when assessment is mediated by a computer interface (Chapelle & Douglas, 2006).

Pedagogically, the success of CAFLT is framed by theories like the Technology Acceptance Model, where user perception and instructional design significantly influence acceptance and performance (Mahmud, 2014). Finally, the environmental factor is crucial, relating to the institutional context and resource availability, often analyzed through the lens of Ecological Sy. This theory emphasizes the impact of access to technology, institutional support, and examination conditions on student outcomes (Collins et al., 2019). These three dimensions, linguistic, pedagogical, and environmental, are inherently interrelated and collectively shape student success in computer-based foreign language exams

Several previous studies have highlighted various aspects of computer-based language testing. Research by Chapelle and Douglas (2006) demonstrated that the effectiveness of the CAFLT is highly dependent on the integration of technology and valid linguistic evaluation principles. Meanwhile, Suherdi (2021) emphasized the importance of students' digital literacy in supporting their success in online exams. Furthermore, research by Collins et al. (2019) also highlighted the disparity in technology access that impacts the performance of students from low-income backgrounds. However, research that holistically examines student difficulties across these three key dimensions simultaneously is rare.

However, a critical review reveals that the existing literature remains fragmented. Recent studies indicate that the majority of research focuses on technical dimensions such as the user interface and question format in the CAFLT (Arslanyilmaz, 2013; Suvorov & Hegelheimer, 2013). Scholarly work,

such as that by Kim and Baylor (2006), treats the problem as primarily technological. Conversely, literary work that holistically and simultaneously examines the difficulties students face across all three key dimensions—linguistic competence, pedagogical readiness, and environmental support—and maps their impact onto work readiness is rare, particularly within the context of developing countries like Indonesia.

This literature gap highlights the need for studies that can more thoroughly explore the complex difficulties students encounter in the CAFLT, particularly in relation to linguistic, pedagogical, and environmental factors. Given that many educational institutions in Indonesia have begun adopting online examination systems following the COVID-19 pandemic (Cahaya et al., 2022; Utomo et al., 2020). Understanding these three factors is crucial for ensuring the fairness and effectiveness of assessments.

This study aims to identify and analyze the difficulties experienced by students in taking CAFLTs, focusing on three main aspects: linguistic factors, pedagogical factors, and environmental factors on students' work readiness in the context of CAFLTs. The novelty of this study lies in the integrative analytical framework used to evaluate student difficulties from three interrelated perspectives simultaneously. Unlike previous research, which tends to be fragmented, this study combines linguistic, pedagogical, and environmental analysis into a single, coherent conceptual model. This condition enables more targeted policymaking to improve the design of computer-assisted learning and assessments in the future.

To the best of our knowledge, no prior studies have simultaneously examined these three dimensions in the context of CAFLT, particularly within the Indonesian higher education setting. Thus, this article not only broadens the scope of research on CAFLT in the context of foreign language education but also contributes to the development of more inclusive technology-based education policies. This research is expected to serve as a reference for educators, assessment designers, and policymakers in developing testing models that are adaptive to the actual needs and conditions of students.

2. Literature Review

2.1 Measuring Job Readiness through Computer-Assisted Language Testing (CALT)

CALT is an increasingly used evaluation tool to measure work readiness, particularly in the context of globalization, which demands linguistic competence and pedagogical adaptation. CALT combines technology with psychometric measurement principles to objectively assess language abilities, including aspects such as fluency, technical vocabulary, and comprehension of work instructions (Pathan, 2012). Recent studies have shown that CALT not only measures language skills but also predicts work readiness through simulations of workplace-based tasks, such as cross-cultural communication and collaborative problem-solving (Liu et al., 2025). The integration of test design with industry needs makes CALT a valid tool for assessing work readiness,

particularly in professions that require intensive interaction, such as healthcare or international business.

Linguistic factors, such as grammatical accuracy, fluency, and mastery of field-specific vocabulary, are critical components of CALT for assessing work readiness. Research by Janssens and Steyaert (2017) has found that test takers with high scores on the linguistic dimension of the CALT tend to be more successful in work environments that require complex communication, such as negotiations or presentations (Clark & Clifford, 1988). This correlation establishes the predictive validity of CALT; that is, its ability to accurately forecast future performance based on test results.

Furthermore, the CALT can identify linguistic competency gaps that can hinder new employee integration, such as understanding technical manuals or safety instructions (Douglas & Hegelheimer, 2007). This high predictive validity and reliability, driven by standardized, computer-administered scoring that minimizes human rater variability, makes the CALT superior to conventional paper-based tests, especially when combined with big data analysis to map trends in language needs across industries.

Pedagogical approaches within the CALT, such as competency-based training and adaptive feedback, play a crucial role in increasing the test's relevance to the workplace. A study by García-Peñalvo (2022) showed that integrating scenario-based learning into the CALT, such as virtual meeting simulations or technical report writing, improves skill transfer from the exam room to the real-world environment (Zhang et al., 2019). Furthermore, curricula designed to support CALT, such as industry vocabulary training or listening comprehension exercises related to work contexts, have been shown to strengthen the relationship between test scores and actual performance (Tong et al., 2017).

CALT serves not only as a measurement tool but also as part of a learning ecosystem that supports the education-to-work transition (Kolzow et al., 2021). The descriptions and relevance of each factor – linguistic, pedagogical, and environmental – are summarized in Table 1 and primarily synthesized from the reviewed literature, with further formulation by the authors to develop an integrative framework tailored to the context of CAFLT. This approach enables a comprehensive understanding of how these dimensions collectively impact students' work readiness.

The summary of the three main factors influencing job readiness in foreign language testing is presented in Table 1 below.

Table 1: Three main factors in foreign language tests for job readiness

Factors	Descriptions	Relevance
Linguistics	Students' language abilities and competencies in the fundamental aspects of the foreign language being tested, such as vocabulary, grammar, reading comprehension, listening skills, and writing skills.	In computer-based exams, material is often presented in digital text, audio, or interactive multiple-choice formats. If students lack adequate linguistic skills, they will struggle to understand question prompts, reading context, or instructions in a foreign language.
Pedagogical	Pedagogical factors encompass teaching methods, teacher approaches, and the materials and techniques used to prepare students for computer-based assessments. This statement addresses whether teachers develop students' digital skills, provide CAT-like exercises, and integrate technological literacy into language learning.	Suppose teaching does not prepare students for digital exams in terms of content or technique. In that case, they are likely to experience anxiety, confusion in navigating the system, or a lack of strategies for answering digital questions.
Environment	Environmental factors refer to external conditions that influence student readiness and performance, such as access to technological devices, internet connection, support from family/school, and the physical environment during the exam (e.g., noise, space, or quietness).	Computer-based tests are highly dependent on technological infrastructure. Students from underserved or economically disadvantaged areas often lack personal devices or stable internet connections. This condition creates significant gaps in their preparedness and performance.

2.2 The Role of CALT in Measuring Work Readiness: Linguistic and Pedagogical Dimensions

CALT is an increasingly used evaluation tool to measure job readiness, particularly in the context of globalization, which demands linguistic competence and pedagogical adaptation. CALT combines technology with psychometric measurement principles to objectively assess language ability, including aspects such as fluency, technical vocabulary, and comprehension of work instructions. (Yang, 2010).

Recent studies have shown that the CALT not only measures language skills but also predicts job readiness through simulations of workplace-based tasks, such as cross-cultural communication and collaborative problem-solving (Bachman, 2000). The integration of test design and industry needs makes the CALT a valid tool for assessing work readiness, especially in professions that require intensive interaction, such as healthcare or international business.

Linguistic factors, such as grammatical accuracy, fluency, and mastery of field-specific vocabulary, are critical components of the CALT for assessing job readiness. Research by Zondi (2025) found that test takers with high scores on the linguistic dimension of the CALT tend to be more successful in work environments that require complex communication, such as negotiations or presentations (Antontseva et al., 2025). Furthermore, the CALT can identify linguistic competency gaps that can hinder new employee integration, such as understanding technical manuals or safety instructions. This predictive validity makes the CALT superior to conventional tests, especially when combined with big data analysis to map trends in language needs across industries.

Pedagogical approaches within the CALT, such as competency-based training and adaptive feedback, play a crucial role in increasing the test's relevance to the workplace (Van Doremalen et al., 2016). A study by García-Peñalvo (2022) showed that integrating scenario-based learning into CALT, such as virtual meeting simulations or technical report writing, improves skill transfer from the exam room to the real-world workplace (Mendoza & Wu, 2022). Furthermore, curricula designed to support CALT, such as industry vocabulary training or listening comprehension exercises related to work contexts, have been shown to strengthen the relationship between test scores and actual performance (Bacalja et al., 2022; Yang, 2010). Thus, CALT serves not only as a measurement tool but also as part of a learning ecosystem that supports the transition from education to employment.

2.3 Impact of Environmental and Interdisciplinary Factors on CALT Validity

In addition to linguistic and pedagogical factors, the validity of CALT in measuring work readiness is significantly influenced by environmental factors (Bacalja et al., 2022). This environment encompasses external conditions that can impact test takers' performance, such as access to technology, the reliability of internet connections, and the availability of infrastructure support from educational institutions or homes.

For example, students in areas with limited internet access or inadequate devices face significant barriers to completing computer-based tests, regardless of their proficiency in the language. This digital divide can result in scores that do not reflect true language competency, thus compromising the validity of CALT as a fair and accurate measure of work readiness. Research by Okoye et al. (2023) highlights the significant impact of the digital infrastructure on student performance on online tests, particularly in developing countries, which can bias the measurement of work readiness.

Furthermore, the physical and psychological context during CALT administration also plays a crucial role (He & Min, 2024; Shalash, 2024). Noise, uncomfortable room temperature, or even test takers' stress levels due to unfamiliar surroundings can affect their concentration and performance. Support from family or school is also an external factor that cannot be ignored. When the environment is not supportive, CALT results can be less representative, obscuring an individual's actual ability to adapt to the demands of real-world jobs that may require language skills under diverse conditions.

Studies have found that test anxiety levels caused by less-than-ideal environmental conditions are negatively correlated with computer-based language test results, underscoring the importance of a controlled testing environment (Akhtar et al., 2023; Sari & Han, 2024). Therefore, to ensure the validity of the CALT, systematic efforts are needed to create an equitable and optimal testing environment for all participants.

The integration of interdisciplinary factors is also essential in enhancing the predictive validity of the CALT. Work readiness encompasses not only language competence but also crucial soft skills, including collaborative problem-solving, critical thinking, and adapting to new technologies. The CALT can be enhanced by incorporating simulations that require a combination of language skills with these interdisciplinary skills, such as scenarios involving data analysis, project presentations, or interaction with artificial intelligence.

Thus, the CALT assesses not only language fluency but also an individual's capacity to apply their linguistic abilities in a variety of complex, multidisciplinary work situations. One study advocates the development of a multidimensional CALT framework that integrates language assessment with 21st-century skills to enhance its predictive validity in a global work context (Aghazadeh, 2019). This holistic approach would make the CALT a more comprehensive and relevant tool for predicting success in the modern workplace.

3. Method

3.1 Research Design

This study employed a quantitative approach to explore the linguistic, pedagogical, and environmental factors affecting work readiness in the context of CAFLT. Utilizing a survey design, the research gathered numerical data to analyze trends, attitudes, and opinions among a selected sample, allowing the researcher to make inferences about the broader population (Creswell, 2014).

The investigation was guided by theories from linguistics, pedagogy, and CALT to assess the proposed hypotheses, which were aligned with the study's objectives. The data collection instrument, a structured questionnaire, was meticulously developed based on established theoretical frameworks and underwent rigorous testing to ensure its **construct validity** and **internal consistency (reliability)**, aligning with the psychometric requirements for assessing complex constructs in educational technology.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), which examined the determinants influencing work readiness in CAFLT and addressed the research hypotheses. PLS-SEM, a causal-predictive approach, focuses on generating structural predictions through statistical models. This method is advantageous over traditional covariance-based SEM (CBSEM) as it effectively handles issues such as multivariate normality, varying measurement levels, sample size constraints, model complexity, and uncertain variables (Hair et al., 2020).

It is important to note that the scope of this model was deliberately limited to three foundational factors (linguistic, pedagogical, and environmental) to establish a baseline integrative framework. While acknowledging that other variables might influence work readiness, this focused selection was a methodological choice aimed at synthesizing these three core pillars, thus defining the specific boundary condition of this study

3.2 Participants

This study involved 515 pre-service teachers from the English, Arabic, and Indonesian language education departments at three universities in Jambi, Indonesia. The participants, ranging from first- to fourth-year students enrolled in the 2024 academic year, were selected using a purposive sampling method to ensure representation across different study programs and educational levels. Ethical considerations were strictly observed throughout the research process. Participation was voluntary, and all participants provided informed consent before data collection. Data confidentiality and anonymity were also maintained to protect participants' privacy and uphold research integrity.

Each of these prospective educators had formally studied a foreign language for three years during their secondary education, followed by an additional three years in high school. They continue to engage in language courses and receive instruction through the medium of the language based on their major. Additionally, they have also been exposed to English, Arabic, and Indonesian language education, enriching their linguistic backgrounds. A detailed analysis of the participants' demographics is presented in the following table.

Table 2: Demographic information of respondents

	Number	Percentage
Gender		
Male	117	22.7%
Female	398	77.3%
Class Enrollment		
1 st Year Students	112	21.75%
2 nd Year Students	156	30.29%
3 rd Year Students	128	24.85%
4 th Year Students	119	23.11%
Study Program		
English Language Education	171	33.20%
Arabic Language Education	185	35.93%
Indonesian Language Education	159	30.87%
Language Tests Taken		
TOEFL/IELTS	515	100%
TOAFL	256	49.71%
Other	13	2.52%

3.3 Research Instruments

To investigate the linguistic, pedagogical, and environmental factors influencing work readiness in CAFLT, we employed a multiple-item questionnaire. The questionnaires' first part comprised questions on demographic information (i.e.,

gender, years of students' enrollment, study program, and language tests taken). The second part consisted of four variables: linguistic difficulties (ten items), pedagogical difficulties (five items), environmental factors (five items), and work readiness (ten items). The model deliberately focuses on these three foundational factors: linguistic, pedagogical, and environmental, as they represent the core pillars of subject competency, instructional strategy, and contextual support, which are most often fragmented in existing CAFLT literature. This focused scope, however, constitutes a limitation, as other relevant psychological variables (such as self-efficacy or test anxiety) were not included in the model. This methodological choice was made to establish a clear, initial integrative framework, thus defining the specific boundary conditions of this study for future model expansion.

Table 3 below displays the detailed variables and items of the questionnaire. For measuring each item, a four-point Likert scale was used, ranging from 1 (strongly disagree) to 4 (strongly agree). Researchers coded the data collected through the online questionnaire (using Google Form). We examined the factor loadings for each item in the constructs to ensure they were greater than 0.70. The value of Cronbach's alpha varies based on the research type; for exploratory analysis, the author considers 0.7 to be the minimum acceptable value. The structural model in SmartPLS4 software was used to test the hypotheses at a significance level of 0.05.

Table 3: Items of the questionnaire

Variables	Items
Linguistic Difficulties	I struggled to understand the written instructions in the test because of the complex technical vocabulary
	I often feel insecure when responding to oral questions (speaking) in an online communication
	I find it challenging to express my ideas in writing in a foreign language during computer-based exams
	I have difficulty catching the keywords in computer-assisted listening tests
	The vocabulary used in the listening test is too fast or unclear in pronunciation for me
	I feel that my grammar skills hinder my performance in digital tests
	I have difficulty understanding the questions due to my limited mastery of academic/professional vocabulary
	I often forget the meanings of specific vocabulary that appears in digital reading tests
	I feel anxious when faced with sudden (improvised) questions in computer-assisted speaking tests
	I have difficulty distinguishing the accents or pronunciation of native speakers in listening tests
	Pedagogical Difficulties
I am not accustomed to the interactive question types (e.g., drag-and-drop, dialogue simulations) in this test	
I struggled to manage my time during the exam due to	

	insufficient practice with the computer system
	The lack of instant feedback from the system made it difficult for me to correct my mistakes
	The learning materials were not entirely relevant to the computer-assisted test content
Environmental Difficulties	Technical issues (e.g., audio interruptions, lag) distracted my concentration during the test
	I felt uncomfortable with the test platform's interface, which was not intuitive
	The test environment (e.g., noisy surroundings, an uncomfortable chair) reduced my focus
	I was concerned about the stability of the internet connection during the exam
	The provided devices (e.g., headphones, mouse) did not support optimal performance
Work Readiness	My experience with digital foreign language testing has enhanced my technology skills for work
	I am better prepared to communicate in a foreign language in a professional environment, thanks to this practice
	Technical difficulties during the test have trained me to handle digital challenges in the workplace
	I am confident in collaborating within a multilingual team after becoming accustomed to computer-based testing
	My adaptability in high-pressure situations (e.g., deadlines) has improved due to this testing experience
	I can apply technical vocabulary from the test to a professional context
	Digital speaking test practice has helped me improve my presentations at work
	I have become accustomed to using digital tools for foreign language tasks thanks to this exam
	I feel competent working in a technology-dependent environment
	My experience overcoming challenges during the test has made me more resilient in the workplace

3.4 Procedures

The data collection procedure involved using an online questionnaire created with Google Forms. This questionnaire was specifically designed and coded by the researchers to gather relevant information from pre-service teachers at three universities in Jambi, Indonesia. The respondents consisted of 515 pre-service teachers, who were invited to participate in the survey. By utilizing an online platform, the researchers aimed to facilitate easy access and encourage higher participation rates among the respondents.

The distribution of the questionnaire yielded 515 completed responses, resulting in an impressive response rate of 71.8%. This high rate of participation indicates a strong interest among the pre-service teachers in sharing their insights and experiences. After the data collection phase, the researchers systematically reviewed and coded the responses to ensure the accuracy of the analysis and

interpretation of the findings. This structured approach not only enhanced the validity and reliability of the data but also provided a comprehensive understanding of the perspectives of the targeted population.

3.5 Data Analysis

To analyze the data, the partial least squares structural equation modeling (PLS-SEM) approach was employed, involving two main stages: testing the measurement model and the structural model. This method enables the estimation of complex models comprising multiple constructs and indicator variables without requiring strict distributional assumptions (Hair et al., 2019). All statistical analyses were conducted using SmartPLS 4 with the minimum likelihood method for parameter estimation (Hair et al., 2020).

To strengthen the foundation of the model and address potential concerns regarding indicator reliability and validity, a rigorous measurement model assessment was conducted. PLS-SEM was utilized to investigate the factors influencing work readiness in the context of CAFLT. The first step in evaluating the results from PLS-SEM involves assessing the measurement models, where each construct is evaluated against essential criteria. If the measurement models satisfy all requirements, the next step is to analyze the structural model. PLS-SEM was conducted to test the hypotheses with a significance level of 0.05.

Before hypothesis testing, the research assessed and validated the construct (Average Variance Extracted (AVE) > 0.50) and reliability (Cronbach's alpha > 0.5), meeting the prerequisites for PLS-SEM analysis. Additionally, the researchers verified that the factor loadings for each item in the constructs were greater than 0.70 (Hair et al., 2019). To further evaluate the model's explanatory and predictive power, the coefficient of determination (R^2) and predictive relevance (Q^2) values were also examined. This systematic validation ensures that the observed indicators accurately and reliably measure the latent constructs (Hair et al., 2020), thereby providing robust support for the proposed structural model.

4. Results

4.1 Descriptive Statistics

Based on the descriptive statistical analysis of each item, the average score was above the midpoint of 2.00, indicating a positive response to each item measured. The mean and standard deviation determine the shape of a normal distribution. Standard deviation is a statistic that indicates how closely all samples in a data set cluster around the mean. It measures the dispersion of scores within a dataset. The standard deviation of the data is within one standard deviation of the mean (from -1 to +1), indicating a normal distribution.

Furthermore, the skewness analysis showed that all items fell within the range of -1 to 1. This negative value indicates that the data distribution tends to be negatively skewed, meaning that most respondents gave answers in the high category. Meanwhile, the excess kurtosis value also fell within the range of -1 to 1, with most still in the mesokurtic to mild leptokurtic category. This indicates

that the data distribution tends to be normal, with values slightly centered around the mean, as presented in Table 1 below.

Table 4: Descriptive statistics

	Mean	Median	Observed min	Observed max	Standard deviation	Excess kurtosis	Skewness
LD1	3.304	4.000	1.000	4.000	0.863	0.272	-1.066
LD10	3.193	3.000	1.000	4.000	0.851	0.415	-0.969
LD2	3.228	3.000	1.000	4.000	0.880	0.384	-1.044
LD3	3.126	3.000	1.000	4.000	0.863	0.300	-0.903
LD4	3.212	3.000	1.000	4.000	0.851	-0.019	-0.858
LD5	3.181	3.000	1.000	4.000	0.882	0.389	-1.009
LD6	3.204	3.000	1.000	4.000	0.855	0.287	-0.948
LD7	3.206	3.000	1.000	4.000	0.873	0.320	-0.993
LD8	3.171	3.000	1.000	4.000	0.836	0.323	-0.893
LD9	3.214	3.000	1.000	4.000	0.865	0.513	-1.043
PD1	3.095	3.000	1.000	4.000	0.849	0.300	-0.853
PD2	3.235	3.000	1.000	4.000	0.900	0.144	-1.011
PD3	3.117	3.000	1.000	4.000	0.854	0.315	-0.883
PD4	3.202	3.000	1.000	4.000	0.812	0.368	-0.889
PD5	3.142	3.000	1.000	4.000	0.863	0.252	-0.898
TD1	3.286	3.000	1.000	4.000	0.773	0.632	-0.974
TD2	3.183	3.000	1.000	4.000	0.838	0.406	-0.933
TD3	3.251	3.000	1.000	4.000	0.861	0.602	-1.095
TD4	3.272	3.000	1.000	4.000	0.813	0.712	-1.060
TD5	3.128	3.000	1.000	4.000	0.852	0.324	-0.891
WR1	3.259	3.000	1.000	4.000	0.767	0.905	-0.997
WR10	3.237	3.000	1.000	4.000	0.810	1.094	-1.120
WR2	3.305	4.000	1.000	4.000	0.838	0.630	-1.122
WR3	3.243	3.000	1.000	4.000	0.835	0.973	-1.145
WR4	3.274	3.000	1.000	4.000	0.728	0.299	-0.778
WR5	3.319	3.000	1.000	4.000	0.766	1.080	-1.109
WR6	3.226	3.000	1.000	4.000	0.839	0.838	-1.100
WR7	3.307	3.000	1.000	4.000	0.771	0.744	-1.025
WR8	3.226	3.000	1.000	4.000	0.796	0.912	-1.030
WR9	3.270	3.000	1.000	4.000	0.803	1.188	-1.161

4.2 Factor Analysis

The results of the measurement model analysis in Figure 1 show that all indicators have outer loading values above 0.70, except for indicator LD8 (0.237) in the Linguistic Factors (LD) construct, which is well below the recommended threshold (≥ 0.70) and therefore potentially eliminated. The LD construct has good internal consistency, with outer loadings for other indicators ranging from 0.727 to 0.826. The Pedagogical Factors (PD) construct also demonstrates high reliability with outer loadings in the range of 0.784 to 0.838. The Environmental and Technical Factors (TD) construct has strong outer loadings for all indicators (0.788 to 0.809), indicating good convergent validity. The Work Readiness (WR) construct also demonstrates good indicator strength, with outer loadings ranging from 0.753 to 0.810.

In the structural model, the path from LD to PD has a coefficient of 0.389, indicating a moderate positive influence. The path from TD to PD has a higher coefficient (0.446), suggesting a more substantial positive impact. Meanwhile, the path from PD to WR has a very low coefficient (0.063), so its influence on WR can be considered insignificant. Overall, the model indicates that TD, as well as LD, contribute positively to PD; however, the influence of PD on WR is relatively weak. Reliability and validity are adequate; however, the indicator (LDLD8) should be considered for deletion due to its low factor loading value.

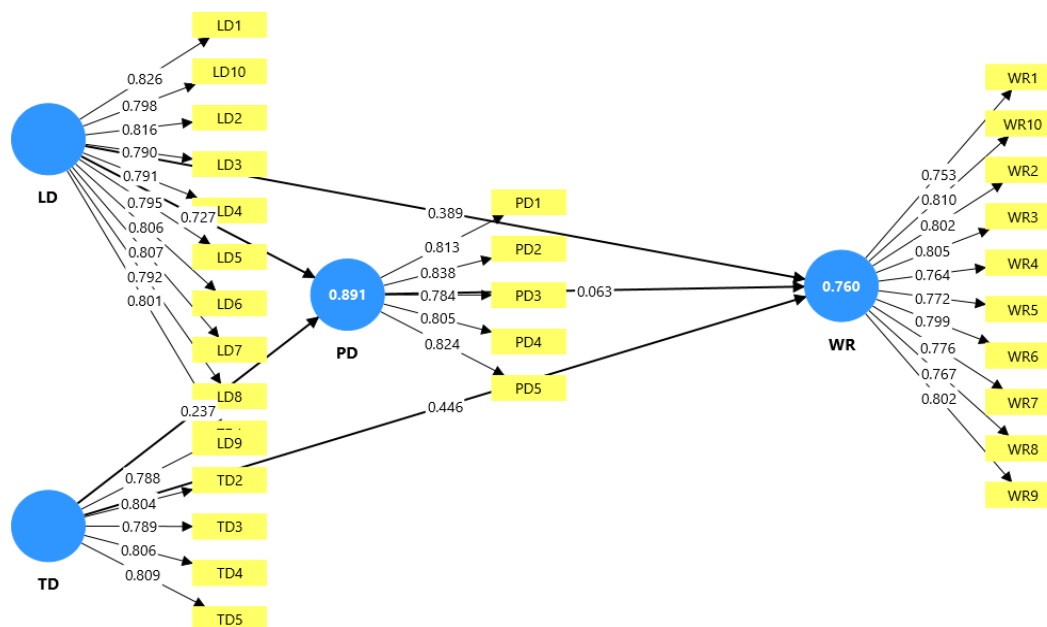


Figure 1: Factor Analysis Result

4.3 Evaluation of The Measurement Model

Confirmatory Factor Analysis was used to evaluate measurement models with uncorrelated errors. Higher values generally indicate better reliability and validity. Data reliability was assessed using Cronbach's alpha (meeting the criteria if ≥ 0.70), rho_A (> 0.70), Composite Reliability (CR) (> 0.70), and AVE to assess convergent validity. An AVE value ≥ 0.50 is considered acceptable; it indicates that the construct can explain at least 50% of the variance in its indicators (Hair et al., 2019).

The test results showed that all constructs met the required criteria. Cronbach's alpha values ranged from 0.859 to 0.938, rho_A between 0.860 and 0.939, and Composite Reliability (rho_c) between 0.898 and 0.948. All these values exceeded the threshold of 0.70, indicating excellent internal consistency. Furthermore, the AVE values for all constructs ranged from 0.617 to 0.661, exceeding the minimum threshold of 0, thus meeting the criterion of exceeding convergent validity. Therefore, it can be concluded that all constructs (linguistic factors, pedagogical factors, environmental and technical factors, and WR) had excellent reliability and adequate convergent validity, making them suitable for use in further structural model analysis.

Table 5: Construct validity and reliability

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
LD	0.938	0.939	0.948	0.644
PD	0.872	0.872	0.907	0.661
TD	0.859	0.860	0.898	0.639
WR	0.931	0.931	0.941	0.617

The next step is to assess discriminant validity, which refers to the extent to which a construct empirically differs from other constructs in the structural model. Discriminant validity is evaluated using the Fornell-Larcker Criterion, where the square root of the AVE of each construct is compared with the correlations between the corresponding constructs. Discriminant validity is met if the square root of the AVE for each construct is greater than the correlations between the other constructs (Fornell & Larcker, 1981).

Table 6 shows that the square root of the AVE for LD (0.802), PD (0.813), TD (0.799), and WR (0.785) are all higher than the correlations between constructs in their respective rows and columns. Thus, each construct can be said to have good discriminant validity because it can be empirically distinguished from the other constructs in the model. Fornell-Larcker discriminant validity - Fornell-Larcker Criterion

Table 6: Fornell-Larcker Discriminant Validity Criterion

	LD	PD	TD	WR
LD	0.802			
PD	0.938	0.813		
TD	0.891	0.885	0.799	
WR	0.846	0.823	0.849	0.785

Table 7 shows the goodness-of-fit results of the model. Several goodness-of-fit indices were used to assess the suitability of the measurement model, including the Standardized Root Mean Squared Error (SRMR), d_{ULS} , d_G , the Chi-square statistic, and the Normed Fit Index (NFI). According to Hu and Bentler (1999), an SRMR value of less than 0.08 is considered indicative of a good fit. The SRMR value for both the saturated and estimated models is 0.048, which is well below the 0.08 threshold, indicating a good fit to the data.

The d_{ULS} value of 1.088 and d_G of 0.852 are within the acceptable range, indicating that the difference between the observed and estimated covariance matrixes is relatively small. The Chi-square value of 2,323.640, although high, is still consistent with a PLS-SEM model that is sensitive to large sample sizes. Meanwhile, the NFI value of 0.823 is close to 1, indicating a good model fit. Overall, these results suggest that the measurement model has adequate goodness-of-fit and can be used for further structural model analysis.

Table 7: Model fit

	Saturated model	Estimated model
SRMR	0.048	0.048
d_ ULS	1.088	1.088
d_ G	0.852	0.852
Chi-square	2.323.640	2.323.640
NFI	0.823	0.823

4.4 Evaluation of the Structural Model (Hypotheses Testing)

Table 8 shows the results of the hypothesis testing. The test was conducted using the t-statistic and p-value to determine whether the hypothesis was accepted or rejected. The criteria used were a t-statistic > 1.96 and a p-value < 0.05 , indicating that H_0 is rejected and H_a is accepted.

Table 8: Hypothesis Testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
LD -> PD	0.727	0.727	0.059	12.415	0.000
LD -> WR	0.389	0.388	0.126	3.082	0.002
PD -> WR	0.063	0.065	0.104	0.608	0.543
TD -> PD	0.237	0.236	0.061	3.916	0.000
TD -> WR	0.446	0.445	0.091	4.898	0.000

The test results showed that the path from Linguistic Factors (LD) to Pedagogical Factors (PD) was statistically significant ($p = 0.001$, 12.415). The path from LD to WR was also substantial ($\beta = 0.389$; $t = 3.082$; $p = 0.002$). Meanwhile, the path from Pedagogical Factors (PD) to WR was not significant ($\beta = 0.063$; $t = 0.608$; $p = 0.543$), so this hypothesis was rejected. The path from TD to PD was significant ($\beta = 0.237$; $t = 3.916$; $p = 0.000$), as was the path from TD to WR, which was also substantial ($\beta = 0.446$; $t = 4.898$; $p = 0.000$).

There is an interesting phenomenon: the insignificance of the path from PD to WR suggests that, in this context, pedagogical approaches may not be the primary drivers of students' readiness for the workforce. This statement could be because WR often emphasizes practical skills and competencies that are directly applicable in professional settings. If pedagogical methods are not effectively aligned with these skills—such as communication, teamwork, and problem-solving—then their impact on WR may be diminished. Overall, four of the five paths in the structural model showed significant effects, while one path (PD \rightarrow WR) was insignificant. These findings suggest that WR is more directly influenced by LD and TD, rather than through the mediation of PD.

5. Discussions

The results of the descriptive statistical analysis showed that the three main factors – linguistics, pedagogy, and environment – received positive responses from respondents. A mean score > 2.00 and a standard deviation < 1.00 indicate perceptions that tend to be positive and homogeneous.

According to Bandura (1997), positive perceptions of the learning environment strengthen self-efficacy, which in turn increases readiness for assignments or exams, including in the context of CAFLT. Skewness and kurtosis within normal limits enhance the validity of the data distribution. This confirms that respondents not only have positive but also relatively consistent perceptions. Podsakoff et al. (2003) suggest that this condition may reflect leniency bias in educational contexts, where respondents tend to give positive assessments of their perceived learning experiences.

Specifically, linguistic factors demonstrated the highest mean scores, for example, in LD1 ($M = 3.304$), confirming the importance of language skills in mastering and implementing the CAFLT. This aligns with Chalhoub-Deville and Deville's (2005) observation that computer-based language tests place a high demand on strong linguistic readiness. Similarly, pedagogical factors and the technological environment also received high responses, demonstrating the relevance of all three to WR.

These findings support Vygotsky's (1978) theory, which posits that technology serves as a mediating tool that accelerates cognitive development. In the context of the CAFLT, digital devices, online learning environments, and technology-based interactions contribute to respondents' readiness to face the challenges of digital communication and work. This is also evident in the high scores on Work Readiness indicators such as WR2 and WR5.

In factor analysis, most indicators had outer loadings above 0.70, indicating good convergent validity (Hair et al., 2019). However, one indicator (LD8) had a very low value (0.237). This finding highlights the importance of selecting items relevant to the CAFLT context to accurately measure linguistic constructs. The model structure shows that LD have a positive influence on PD ($\beta = 0.389$), reinforcing the Communicative Language Teaching theory (Richards, 2006), which emphasizes that language proficiency supports interactive learning processes. In the CAFLT, respondents who are more linguistically proficient are more likely to follow the teacher's pedagogical strategies.

Furthermore, TD have a greater influence on PD ($\beta = 0.446$), in line with the TPACK framework that supports technology-enriched pedagogical practices and broadens instructional approaches (Mishra & Koehler, 2006). In the CAFLT, user interface, network stability, and device access are essential elements that enhance learning effectiveness. However, the influence of PD on WR is very weak ($\beta = 0.063$; $p > 0.05$), indicating that although the teaching process is considered adequate, it is unable to directly improve work readiness. Bridgstock (2009) emphasized that WR requires the integration of practical skills, technology, and real-world work contexts, rather than relying solely on conventional teaching approaches.

Conversely, LD ($\beta = 0.389$) and TD ($\beta = 0.446$) were found to influence WR significantly. This data aligns with Canale and Swain's (1980) communicative

competence theory and research by Voogt et al. (2015), which underscores the importance of technological literacy and communication in shaping WR, especially in the digital and globalized era. Furthermore, the model's reliability and validity evaluation showed satisfactory results, with Cronbach's alpha and Composite Reliability above 0.70, and AVE above 0.50. The model also passed the discriminant validity test and demonstrated a good fit (SRMR = 0.048). This statement confirms that the model structure, which links linguistic, pedagogical, and technological factors to WR, is feasible and relevant for the CAFLT context.

When discussing the generalizability of our study's findings, it is essential to consider the specific context in which the research was conducted – specifically, the context of pre-service teachers in Jambi, Indonesia. While the results provide valuable insights into the experiences and perceptions of this particular group, their transferability to other educational contexts may be limited. Local technological infrastructure, cultural norms, and institutional factors in Jambi significantly shape the experiences of these pre-service teachers, potentially influencing their attitudes and behaviors in ways that may not be replicated elsewhere.

Therefore, while some aspects of the findings may resonate with pre-service teacher populations in different regions, future research must explore these dynamics in varied educational settings to ascertain the broader applicability of our results. This nuanced understanding can contribute to a more comprehensive framework for teacher education that is sensitive to both local and global contexts.

In exploring the impact of linguistic, pedagogical, and environmental factors on WR in CAFLT, several key recommendations emerge for educators, policymakers, and test designers. Educators should strive to strike a balance between technology integration and effective pedagogy. This condition can be achieved by adopting a blended learning approach that combines traditional teaching methods with technology-enhanced practices. Educators should incorporate collaborative learning by utilizing CAFLT platforms to facilitate peer collaboration, allowing students to engage in group projects and discussions that enhance language skills through social interaction.

Moreover, policymakers play a crucial role in creating an environment that fosters the effective implementation of CAFLT. To support this, they should consider investing in infrastructure and allocating funding for robust technological infrastructure, including high-speed internet access in educational institutions, to ensure that all students have equal opportunities to engage with CAFLT tools. Providing comprehensive training through training programs for educators that focus not only on the technical aspects of using CAFLT platforms but also on pedagogical strategies that enhance language learning outcomes. Furthermore, test designers must ensure that CAFLT platforms address existing pedagogical gaps while facilitating practical language assessment through incorporating adaptive learning algorithms that customize assessments based on

individual learner performance, allowing for a more personalized and practical testing experience.

Overall, the results of this study confirm that the quality of instruction alone does not determine WR in the context of CAFLT. Instead, WR is more strongly influenced by students' linguistic abilities and the availability of technological support that facilitates effective learning and assessment processes. This statement implies that pedagogical quality, while important, must be supported by language proficiency and a robust technological environment to produce graduates who are ready to face the demands of technology-integrated workplaces. Therefore, enhancing WR requires a stronger integration between technology-based learning, language competency development, and the creation of adaptive learning environments aligned with real-world professional needs.

Consequently, we recommend that educational institutions adopt a curriculum centered on experiential learning to make training more practical and grounded in real-world experiences. This statement requires shifting from theoretical lectures to simulated assessment management projects where pre-service teachers are tasked with designing and deploying CAFLT platforms under realistic constraints. Crucially, the training must be oriented toward strengthening the soft skills essential for the modern workplace, such as technical problem-solving (e.g., troubleshooting assessment issues), data interpretation, and effective communication (e.g., conveying assessment results to stakeholders). By embedding these practical, soft-skill-focused experiences, universities can bridge the gap between academic preparation and the high demands of the job market.

6. Conclusion

The study systematically confirms the validity of the integrative model, revealing that linguistic factors and technological environmental factors are the dominant and significant predictors of WR in CAFLT, while pedagogical factors only contributed weakly. This crucial finding necessitates a clear policy priority: educational efforts must focus on strengthening students' language competence and upgrading technological infrastructure, as these two aspects primarily determine readiness, rather than teaching quality alone. To address this, future efforts must prioritize developing a practical, experiential learning model centered on simulated assessment management and the cultivation of essential soft skills, such as technical problem-solving, alongside refining existing instruments and expanding the model's scope in future research.

7. Acknowledgment

The authors would like to express their sincere gratitude to the Ministry of Higher Education, Science, and Technology (Kemdiktisaintek) for their support of this research. We also extend our appreciation to the Institute for Research and Community Service (LPPM) at Universitas Jambi for facilitating and funding this study.

8. References

- Aghazadeh, S. (2019). *Assessment of 21st-century skills*. In H. Jeanne, N. Betsy, H. K. Kiat, & D. R. Roberto (Eds.), Singapore: National Institute of Education.
- Akhtar, H., Silfiasari, Vekety, B., & Kovacs, K. (2023). The effect of computerized adaptive testing on motivation and anxiety: A systematic review and meta-analysis. *Assessment*, 30(5), 1379–1390. <https://doi.org/10.1177/10731911221100995>
- Antontseva, D., Kudysheva, A., Fominykh, N., Rakhimgaliyeva, Z., & Seidualiyeva, Z. (2025). Developing foreign language communicative competence in future natural science teachers with online speech simulators: The Kazakhstan experience. *International Journal of Learning, Teaching and Educational Research*, 24(6), 273–301. <https://doi.org/10.26803/ijlter.24.6.13>
- Arslanyilmaz, A. (2013). Computer-assisted foreign language instruction: task-based vs. form focused. *Journal of Computer Assisted Learning*, 29(4), 303–318. <https://doi.org/10.1111/jcal.12003>
- Bacalja, A., Beavis, C., & O'Brien, A. (2022). Shifting landscapes of digital literacy. *Australian Journal of Language and Literacy*, 45(2). <https://doi.org/10.1007/s44020-022-00019-x>
- Bachman, L. F. (2000). Modern language testing at the turn of the century: Assuring that what we count counts. *Language Testing*, 17(1). <https://doi.org/10.1177/026553220001700101>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. Freeman.
- Bridgstock, R. (2009). Graduate attributes we've overlooked: enhancing graduate employability through career management skills. *Higher Education Research & Development*, 28(1), 31–44. <https://doi.org/10.1080/07294360802444347>
- Cahaya, A., Yusriadi, Y., & Gheisari, A. (2022). Transformation of the education sector during the COVID-19 pandemic in Indonesia. *Education Research International*, 2022, 1–8. <https://doi.org/10.1155/2022/8561759>
- Canale, M., & Swain, M. (1980). Theoretical bases of communicative approaches to second language teaching and testing. *Applied Linguistics*, 1(1), 1–47. <https://doi.org/10.1093/applin/I.1.1>
- Chalhoub-Deville, M., & Deville, C. (2005). A look at the TOEFL and the GRE: Directions and research. In E. Hinkel (Ed.), *Handbook of Research in Second Language Teaching and Learning* (pp. 491–508). Lawrence Erlbaum Associates.
- Chapelle, C. A., & Douglas, D. (2006). *Assessing language through computer technology*. Cambridge University Press.
- Clark, J. L., & Clifford, R. T. (1988). The FSI/ILR/ACTFL proficiency scales and testing techniques: development, current status, and needed research. *Studies in Second Language Acquisition*, 10(2), 129–147. <https://doi.org/10.1017/S0272263100007296>
- Collins, P., Tate, T. P., & Warschauer, M. (2019). Technology as a lever for adolescent writing. *Policy Insights from the Behavioral and Brain Sciences*, 6(2), 194–201. <https://doi.org/10.1177/2372732219862574>
- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approach*. (4th ed). SAGE.
- Douglas, D., & Hegelheimer, V. (2007). Assessing language using computer technology. In *Annual Review of Applied Linguistics* (Vol. 27). <https://doi.org/10.1017/S0267190508070062>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.1177/002224378101800104>
- Fraidan, A. Al, & Aldawsri, M. S. (2025). Navigating the lexical labyrinth: Vocabulary test anxiety, teacher strictness, and strategic mastery in ESL assessment.

- International Journal of Learning, Teaching and Educational Research*, 24(2), 280–301. <https://doi.org/10.26803/ijlter.24.2.15>
- García-Peñalvo, F. J. (2022). Desarrollo de estados de la cuestión robustos : Revisiones Sistemáticas de Literatura. (Developing robust literature reviews: Systematic literature reviews). *Education in the Knowledge Society (EKS)*, 23, e28600. <https://doi.org/10.14201/eks.28600>
- Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 109, 101–110. <https://doi.org/10.1016/j.jbusres.2019.11.069>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2019). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). SAGE.
- He, L., & Min, S. (2024). *Validation of CALT* (pp. 97–128). https://doi.org/10.1007/978-981-99-9987-3_6
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55.
- Huang, Y., Bailey, R. P., & Samsudin, N. (2025). Test anxiety research (2014–2024) A keyword co-occurrence analysis with implications for educational practice. *International Journal of Learning, Teaching and Educational Research*, 24(6), 21–49. <https://doi.org/10.26803/ijlter.24.6.2>
- Janssens, M., & Steyaert, C. (2017). Re-considering language within a cosmopolitan understanding: toward a multilingual franca approach in international business studies. In M. Y. Brannen, & T. Mughan (Eds.), *Language in international business*. (pp. 163–193). Springer. https://doi.org/10.1007/978-3-319-42745-4_7
- Kim, Y., & Baylor, A. L. (2006). A social-cognitive framework for pedagogical agents as learning companions. *Educational Technology Research and Development*, 54(6), 569–596. <https://doi.org/10.1007/s11423-006-0637-3>
- Kolzow, D. R., Smith, C. C. C., Serrat, O., Dilie, H. M., Zeeshan, S., Ng, S. I., Ho, J. A., Jantan, A. H., Massey, J., Sulak, T., Sriram, R., Dennis, R. S., Bocarnea, M., Hai, T. N., Van, Q. N., Herbert, S. L., So-Jung Kim, K., Kyoung-Seok Kim, Y.-G. C., Guillaume, O., Honeycutt, A., & Ingram, O. C., Jr. (2021). Unit 5: Theories of leadership. *International Journal of Organizational Leadership*, 10(1), 66–95. <https://doi.org/10.33844/ijol.2021.60553>
- Liu, X., Xu, Z., & Wang, H. (2025). Examining the association between cultural intelligence and linguistic confidence: The mediating roles of cross-cultural adaptation and interpersonal communication competence in international students in China. *SAGE Open*, 15(2), Article 21582440251336508. <https://doi.org/10.1177/21582440251336508>
- Mahmud, M. (2014). The EFL students' problems in answering the test of English as a foreign language (TOEFL): A study in Indonesian context. *Theory and Practice in Language Studies*, 4(12). <https://doi.org/10.4304/tpls.4.12.2581-2587>
- Mendoza, C., & Wu, P.-Y. (2022). Targeted English language development professional development matters: The impact of English language development-content based teaching and learning (ELD-CBTL) on teachers' self-efficacy in teaching secondary-level English learners. *Journal of Social and Political Sciences*, 5(4), 39–50. <https://doi.org/10.31014/aior.1991.05.04.383>
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Okoye, K., Hussein, H., Arrona-Palacios, A., Quintero, H. N., Ortega, L. O. P., Sanchez, A. L., Ortiz, E. A., Escamilla, J., & Hosseini, S. (2023). Impact of digital technologies upon teaching and learning in higher education in Latin America:

- an outlook on the reach, barriers, and bottlenecks. *Education and Information Technologies*, 28(2), 2291–2360. <https://doi.org/10.1007/s10639-022-11214-1>
- Pathan, M. M. (2012). Computer assisted language testing [CALT]: Advantages, implications and limitations. *Research Vistas*, 1(4), 30–45
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Richards, J. C. (2006). *Communicative language teaching today*. Cambridge University Press.
- Sari, E., & Han, T. (2024). The impact of automated writing evaluation on the writing self-efficacy, self-regulation, anxiety, and performance of English as a foreign language learner. *Journal of Computer Assisted Learning*, 40(5), 2065–2080. <https://doi.org/10.1111/jcal.13004>
- Shalash, M. J. (2024). Advancing language assessment and evaluation: innovative strategies for specialized English teaching. *Interdisciplinary Journal Papier Human Review*, 5(1), 1–12. <https://doi.org/10.47667/ijphr.v5i1.297>
- Suherdi, D. (2021). *Peran literasi digital di masa pandemik*. Cattleya Darmaya Fortuna.
- Suvorov, R., & Hegelheimer, V. (2013). Computer-assisted language testing. In A. J. Kunnan (Ed.), *The companion to language assessment* (pp. 594–613). Wiley. <https://doi.org/10.1002/9781118411360.wbcla083>
- Tong, F., Luo, W., Irby, B. J., Lara-Alecio, R., & Rivera, H. (2017). Investigating the impact of professional development on teachers' instructional time and English learners' language development: A multilevel cross-classified approach. *International Journal of Bilingual Education and Bilingualism*, 20(3), 292–309. <https://doi.org/10.1080/13670050.2015.1051509>
- Utomo, M., Sudaryanto, M., & Saddhono, K. (2020). Tools and strategy for distance learning to respond COVID-19 pandemic in Indonesia. *Ingénierie Des Systèmes d'Information*, 25(3), 383–390. <https://doi.org/10.18280/isi.250314>
- Van Doremalen, J., Boves, L., Colpaert, J., Cuccharini, C., & Strik, H. (2016). Evaluating automatic speech recognition-based language learning systems: a case study. *Computer Assisted Language Learning*, 29(4), 833–851. <https://doi.org/10.1080/09588221.2016.1167090>
- Voogt, J., Fisser, P., Roblin, N. P., Tondeur, J., & Braak, J. (2015). Technological pedagogical content knowledge—a review of the literature. *Journal of Computer Assisted Learning*, 31(3), 257–272. <https://doi.org/10.1111/jcal.12094>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Yang, Y. (2010). Computer-assisted foreign language teaching: Theory and practice. *Journal of Language Teaching and Research*, 1(6), 909–912. <https://doi.org/10.4304/jltr.1.6.909-912>
- Zhang, P., Shi, X., Khan, S. U., Ferreira, B., Portela, B., Oliveira, T., Borges, G., Domingos, H., Leitão, J., Mohottige, I. P., Gharakheili, H. H., Moors, T., Sivaraman, V., Najari, N., Berlemont, S., Lefebvre, G., Duffner, S., Garcia, C., Parmentier, A., ... Shan, H. (2019). IEEE draft standard for spectrum characterization and occupancy sensing. *IEEE Access*, 9(2), 1–6. <https://doi.org/10.1109/ACCESS>
- Zondi, S. P. (2025). The integrated approach to teaching literature in English second language classrooms: A constructivist lens. *International Journal of Learning, Teaching and Educational Research*, 24(6), 1–20. <https://doi.org/10.26803/ijlter.24.6.1>