

# A three-step management framework for computer-assisted English teaching: Evidence from program management, learning management and PRACTICAL integration

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## ABSTRACT

Computer-assisted English teaching (CAET) has been widely adopted in higher education; however, its effectiveness often varies due to fragmented management and inconsistent instructional implementation. Existing studies predominantly focus on technological tools or pedagogical strategies, while insufficient attention has been paid to the underlying management structures that sustain CAET programs. Drawing on program management and educational management perspectives, this study proposes and examines a three-step management framework for CAET, consisting of program management, learning management, and PRACTICAL integration. Using survey data collected from English education major students and teachers at a university in Hubei, China, confirmatory factor analysis (CFA) was employed to validate a four-factor program management model and a five-factor learning management model. The results indicate that both models demonstrate satisfactory construct validity and model fit, supporting the conceptualization of CAET as a multi-layered management system. Building on these validated structures, the PRACTICAL framework is introduced as an integrative management approach that aligns managerial processes with instructional practices. This study contributes to CAET research by reframing computer-assisted English teaching as a managed educational system rather than a collection of instructional technologies. The findings offer theoretical insights into the hierarchical organization of CAET management and provide practical implications for institutions seeking sustainable and coherent CAET implementation.

**Keywords:** Computer-assisted English teaching, program management, learning management, confirmatory factor analysis, PRACTICAL framework.

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## INTRODUCTION

### Challenges in the Implementation of computer-assisted English teaching

The proliferation of digital technologies has positioned computer-assisted English teaching (CAET) as a cornerstone of modern higher education. Learning management systems, online platforms, and interactive software are now prevalent in English programs, fundamentally reshaping instructional practices and

learning environments. However, despite significant investment and technological advancement, the effectiveness of CAET remains highly variable across different institutions and contexts. While some programs successfully enhance learner engagement and instructional efficiency, many others struggle to translate technological potential into sustainable improvements in teaching quality and learning outcomes.

A growing body of research indicates that these

persistent challenges cannot be attributed solely to technological limitations or inadequate pedagogical design. A more fundamental issue often lies in the institutional approach to implementation. In numerous cases, higher education institutions invest considerable resources in acquiring digital tools without simultaneously establishing coherent management structures to guide planning, coordination, and long-term integration (Bax, 2003). Consequently, CAET initiatives frequently devolve into fragmented instructional practices rather than functioning as systematically managed educational programs. This fragmentation is particularly acute in English education programs at local universities, where limited resources, diverse stakeholder expectations, and the rapid pace of technological change place additional, and often unmet, demands on institutional management. Without a structured management framework to bind these elements together, CAET risks remaining a collection of isolated activities, thereby undermining its potential to foster effective and sustainable English language teaching.

### **The need for a management-oriented perspective on CAET**

Addressing the systemic challenges of CAET requires a fundamental shift in perspective: understanding CAET not merely as a technological or pedagogical innovation, but fundamentally as a management issue. From the standpoint of educational management, the success of any teaching innovation is contingent upon a supportive organizational infrastructure. Clear planning, strategic resource allocation, effective communication, and strong leadership are not merely ancillary benefits but essential preconditions for meaningful educational impact (Bush, 2011). In their absence, even the most well-designed instructional technologies are unlikely to achieve their intended outcomes.

This view is reinforced by program management theory, which posits that complex, multi-stakeholder initiatives require coordinated processes across all organizational levels (Project Management Institute [PMI], 2017). A CAET initiative inherently involves a network of actors—administrators, teachers, technical staff, and students—each with distinct roles, expectations, and contributions. Managing the complex interactions between these groups requires more than individual instructional competence from teachers; it demands a system-level approach that purposefully aligns managerial decisions with the realities of instructional practice. In the context of English education programs, where teaching quality and the professional preparation of future teachers are under constant scrutiny, ineffective management of CAET can have far-reaching consequences. Poor coordination between management and instruction can lead to underutilized technologies, inconsistent teaching practices across courses, and

insufficient support for faculty, ultimately compromising both instructional effectiveness and institutional accountability. Therefore, a systematic examination of the management structures that underpin CAET is not just beneficial but essential.

### **Management and instruction in CAET: A review of related studies**

Historically, research on CAET and computer-assisted language learning (CALL) has been predominantly occupied with classroom-level phenomena, such as instructional strategies, learner attitudes, and technology acceptance models. Studies have richly explored the pedagogical affordances of digital tools, the fostering of learner autonomy, and evolving interaction patterns in technology-enhanced environments (Chapelle, 2001; Levy, 1997). While these contributions provide invaluable insights into micro-level teaching and learning practices, they have typically treated management-related factors—such as leadership, institutional policy, and resource coordination—as mere contextual variables or external conditions, rather than as central objects of analysis in their own right.

A smaller, yet significant, body of literature has begun to acknowledge the critical role of institutional and organizational factors in the successful implementation of CALL. Bax (2003), in his influential work on the normalization of technology in language learning, argued that true integration depends not only on the technology itself but critically on institutional support and coherent management practices. Similarly, Hubbard and Levy (2006) emphasized that sustaining technology-enhanced language learning requires a dual focus on teacher training and broader organizational alignment. In the parallel field of educational management, researchers have long highlighted the pivotal importance of leadership, strategic planning, and resource management in driving and sustaining instructional innovation (Bush, 2011; Fullan, 2016). Despite the clear relevance of these perspectives, they have rarely been systematically integrated into mainstream CAET research. This disciplinary divide has resulted in a notable gap: a lack of empirically validated, theoretically grounded frameworks that conceptualize CAET as a managed educational system, one that encompasses both high-level program processes and ground-level learning activities. This gap underscores the pressing need for research that deliberately bridges the domains of CAET and educational management by placing the structural organization of management factors at the center of the inquiry.

### **Research hypotheses and analytical framework**

To directly address this research gap, the present study

proposes and examines a three-step management framework for CAET. This framework moves beyond a technology-centric view to conceptualize CAET as an integrated system consisting of three core components: program management, learning management, and an overarching integrative framework termed PRACTICAL. The current research focuses specifically on validating the structural organization of the first two foundational components. By treating management structures as the primary objects of analysis, this study aims to provide empirical evidence for a systemic understanding of CAET.

Accordingly, the following hypotheses were formulated to test the proposed multidimensional structure:

**H<sub>1</sub>:** Program management in CAET can be represented as a four-factor model, comprising the core managerial dimensions of planning, resource allocation, communication, and leadership.

**H<sub>2</sub>:** Learning management in CAET can be represented as a five-factor model, encompassing the instructional and operational dimensions of software and applications, interactive learning activities, online resources and tools, assessment and feedback, and teacher training and support.

**H<sub>3</sub>:** Both the four-factor program management model and the five-factor learning management model will demonstrate acceptable construct validity when empirically examined using confirmatory factor analysis.

To test these hypotheses, survey data were collected from students and teachers within an English education program. Confirmatory factor analysis was employed as the primary analytical method to rigorously examine the measurement structure and model fit of the proposed management models. Following the validation of these foundational components, the PRACTICAL framework will be introduced and discussed as an integrative management approach designed to strategically align program-level decisions with learning-level practices, thereby completing the proposed three-step system for sustainable CAET implementation.

## METHOD

### Research design and analytical strategy

This study adopted a quantitative, cross-sectional research design to examine the structural organization of management constructs underlying computer-assisted English teaching (CAET). Rather than exploring instructional outcomes or learner performance, the analytical focus was placed on validating the measurement structure of program management and learning management as foundational components of

CAET implementation.

Confirmatory factor analysis (CFA) was employed as the primary analytical technique. CFA is particularly suitable when the factor structure of a construct is theoretically grounded and specified a priori (Kline, 2016). In the present study, CFA was used to test whether the proposed four-factor program management model and five-factor learning management model adequately represented the observed data. This approach aligns with the study's objective of examining CAET as a managed system composed of distinct yet interrelated structural dimensions. The subsequent introduction of the PRACTICAL framework—a conceptual integration of program and learning management—will be informed by the validated factor structures, providing a qualitative interpretive layer that links empirical findings to actionable management practice.

### Participants and research context

The research was conducted at a public university in Hubei Province, China, where computer-assisted English teaching has been systematically incorporated into the English education curriculum. Participants consisted of two groups: (a) undergraduate students majoring in English education, who had direct experience with CAET-related courses and digital learning environments, and (b) teachers and administrators involved in the delivery or coordination of CAET programs. The inclusion criterion for students was current enrollment in the English education program with at least one semester of exposure to CAET-supported instruction. For teachers and administrators, inclusion required active participation in CAET-related teaching or administrative duties during the data collection period. No participants were excluded based on gender, age, or years of experience, provided they met the above criteria.

A total of 245 valid student questionnaires and 61 valid teacher/administrator questionnaires were included in the analysis. The combined sample size of 306 met commonly accepted criteria for structural equation modeling, which recommends a minimum ratio of five to ten participants per estimated parameter (Hair et al., 2019). Confirmatory factor analysis was conducted on the pooled sample, as the study aimed to validate the management constructs from the perspective of all key stakeholders within the same institutional context. The institutional setting provided a relatively homogeneous administrative and technological environment, allowing for a focused examination of management structures without excessive contextual variation.

### Measurement instruments

Two self-administered questionnaires were used to collect

data for this study: a program management scale and a learning management scale. Both instruments were developed based on an extensive review of program management literature, educational management theory, and CAET-related studies. Prior to data collection, the instruments were refined through consultation with a panel of three external experts: one specialist in applied linguistics with expertise in CALL, one methodological expert in quantitative educational research, and one practitioner with experience in educational technology management. None of the experts was affiliated with the participating institution, ensuring an independent review. Their feedback informed adjustments to item wording, dimension coverage, and scale structure to enhance content validity.

### ***Program management scale***

The program management scale was designed to measure institutional-level management practices supporting CAET implementation. It comprised four latent dimensions: planning, resource allocation, communication, and leadership. These dimensions reflect core managerial processes frequently emphasized in program and educational management literature (Bush, 2011; Project Management Institute [PMI], 2017).

Each dimension was measured using multiple Likert-type items, with responses ranging from strongly disagree to strongly agree. Reliability and validity of the scale were examined using CFA, composite reliability, and average variance extracted, following established psychometric guidelines (Hair et al., 2019).

### ***Learning management scale***

The learning management scale captured the instructional and operational aspects of CAET at the teaching and learning level. This scale consisted of five dimensions: software and applications, interactive learning activities, online resources and tools, assessment and feedback, and teacher training and support. These dimensions were derived from CAET and CALL literature that emphasizes both technological affordances and instructional support mechanisms (Chapelle, 2001; Hubbard and Levy, 2006).

Similar to the program management scale, all items were measured using a Likert-type format. The learning management scale was subjected to CFA to confirm its factor structure and assess construct validity.

### **Data collection procedure**

Data were collected through structured questionnaires administered during the academic semester. Participants

were informed of the purpose of the study and assured of the confidentiality and anonymity of their responses. Participation was voluntary, and informed consent was obtained prior to data collection.

The questionnaires were distributed both electronically and in paper form to ensure accessibility and maximize response rates. Among student participants, approximately 60% completed the questionnaire online, while 40% used paper versions. For teachers and administrators, the distribution was roughly balanced, with slight variations based on preference and availability. Completed questionnaires were screened for missing data and response consistency before being included in the final dataset. Cases with more than 10% missing responses or clear patterns of straight-lining were excluded from analysis.

### **Data analysis**

Confirmatory factor analysis was conducted using structural equation modeling software to examine the measurement models of program management and learning management. Maximum likelihood estimation was applied, as it is widely recommended for CFA when sample size and data distribution assumptions are adequately met (Brown, 2015).

Model fit was evaluated using multiple indices, including the chi-square statistic divided by degrees of freedom ( $\chi^2/df$ ), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). Following established conventions, CFI and TLI values of .90 or above and RMSEA values below .08 were considered indicative of acceptable model fit (Hu and Bentler, 1999; Kline, 2016).

In addition to overall model fit, standardized factor loadings, composite reliability, and average variance extracted were examined to assess convergent and discriminant validity of the constructs. The validated factor structures serve as the empirical foundation for the subsequent conceptual discussion of the PRACTICAL framework, which integrates program-level and learning-level management processes into a coherent implementation strategy.

## **RESULTS**

This section reports the results of the confirmatory factor analyses conducted to examine the measurement structure of program management and learning management in computer-assisted English teaching. The focus is placed on model fit and construct validity rather than on comparative or outcome-based analyses. Table 1 summarizes the demographic characteristics of the participants included in the study.

**Table 1.** Demographic characteristics of survey respondents.

Group	Category	Frequency	Percentage
Students (n = 245)	Male	121	49.39
	Female	124	50.61
	Freshman	83	33.88
	Sophomore	85	34.69
	Junior	56	22.86
	Senior	21	8.57
Teachers & Administrators (n = 61)	Male	34	55.74
	Female	27	44.26
	Age 23–35	24	39.34
	Age 36–50	26	42.63
	Age 51 or above	11	18.03
	Years teaching 1–10	30	49.18
	Years teaching 11–20	14	22.95
Years teaching 21 or above	17	27.87	

### Data screening and preliminary analysis

Prior to conducting confirmatory factor analysis, the dataset was examined for completeness and suitability for multivariate analysis. All questionnaires included in the final dataset contained complete responses for the measurement items, and no cases with excessive missing values were identified. Descriptive inspection indicated that item distributions were within acceptable ranges for CFA, and no extreme outliers were detected.

Given the relatively homogeneous institutional context and the use of parallel Likert-scale items, inter-item correlations were expected to be moderate to high. This pattern is consistent with prior studies examining management constructs within a single organizational setting (Kline, 2016). The data were therefore deemed appropriate for confirmatory factor analysis using maximum likelihood estimation.

All subsequent confirmatory factor analyses were conducted on the combined sample of 306 respondents (students, teachers, and administrators). This approach reflects the study's aim to validate the management constructs from the perspective of the full range of stakeholders involved in CAET implementation within the same institutional context. To examine whether perceptions of the management structures differed systematically between the two respondent groups, a multi-group confirmatory factor analysis was also performed. The results indicated configural invariance, suggesting that the basic factor structure was consistent across students and teachers/administrators. However, given the disproportionate group sizes (245 vs. 61) and the primary focus on validating the overall measurement model, the results presented below are based on the full pooled sample to maximize statistical power and

stability of parameter estimates.

### Measurement model of program management

A confirmatory factor analysis was conducted to examine the four-factor program management model, consisting of planning, resource allocation, communication, and leadership. Each observed item was specified to load on its hypothesized latent factor, and no cross-loadings were permitted.

The model demonstrated a satisfactory overall fit to the data. Commonly reported fit indices met recommended thresholds, indicating that the proposed structure adequately represented the relationships among observed variables (Hu and Bentler, 1999). All standardized factor loadings were statistically significant and exceeded the minimum acceptable level, suggesting that the indicators were appropriate measures of their respective constructs.

Taken together, these results support the structural validity of the four-factor program management model and provide empirical evidence that institutional-level CAET management can be represented as a multidimensional construct encompassing planning, resource allocation, communication, and leadership. (Figure 1)

### Measurement model of learning management

To examine the instructional and operational dimensions of CAET, a separate confirmatory factor analysis was performed on the five-factor learning management model. This model comprised software and applications, interactive learning activities, online resources and tools, assessment and feedback, and teacher training and support.

The CFA results indicated that the learning management model achieved acceptable model fit according to established criteria. All observed items loaded significantly on their hypothesized factors, and standardized factor loadings were generally strong, providing evidence of convergent validity. Composite reliability values for the five dimensions exceeded recommended benchmarks, further

supporting internal consistency of the measurement model (Hair et al., 2019).

These findings suggest that learning management in CAET encompasses multiple interrelated yet distinguishable instructional components, reflecting the complexity of technology-enhanced English teaching practices.

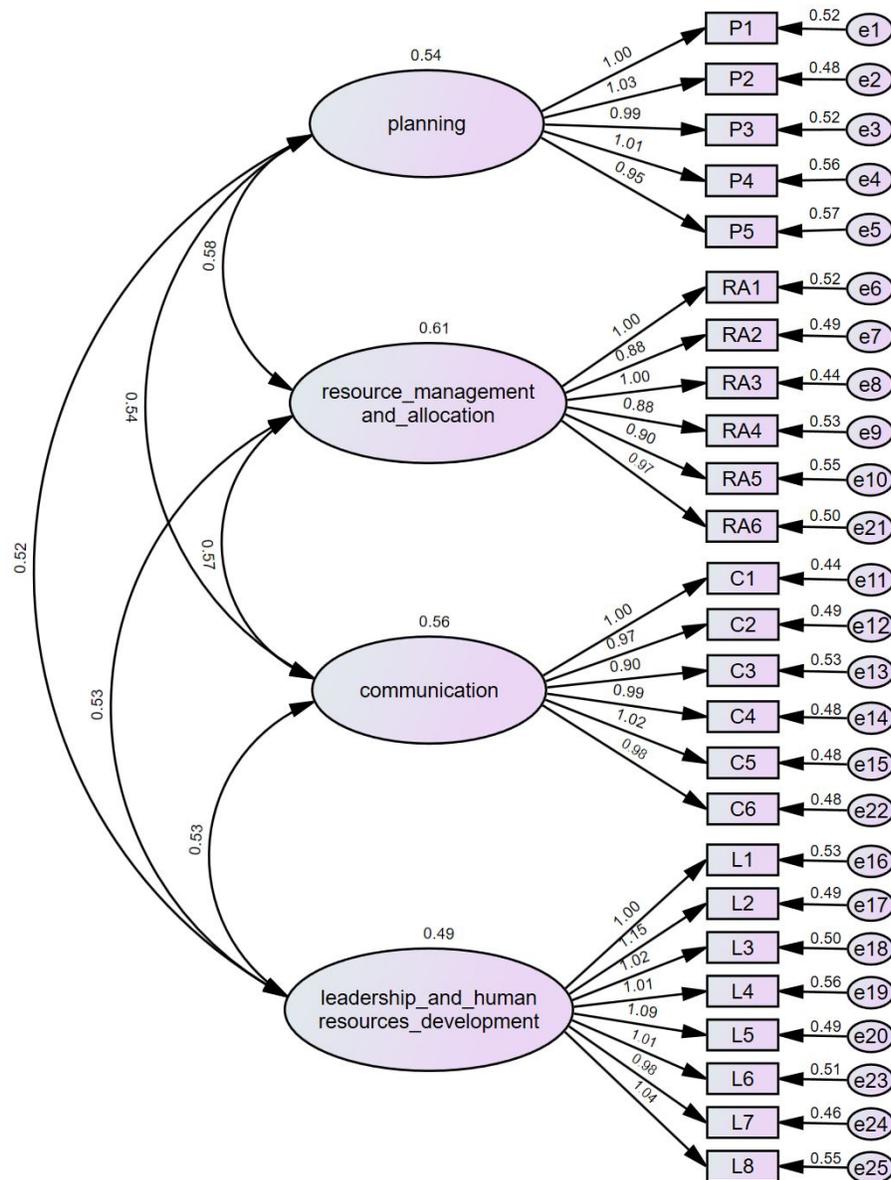


Figure 1. Four-factor program management measurement model.

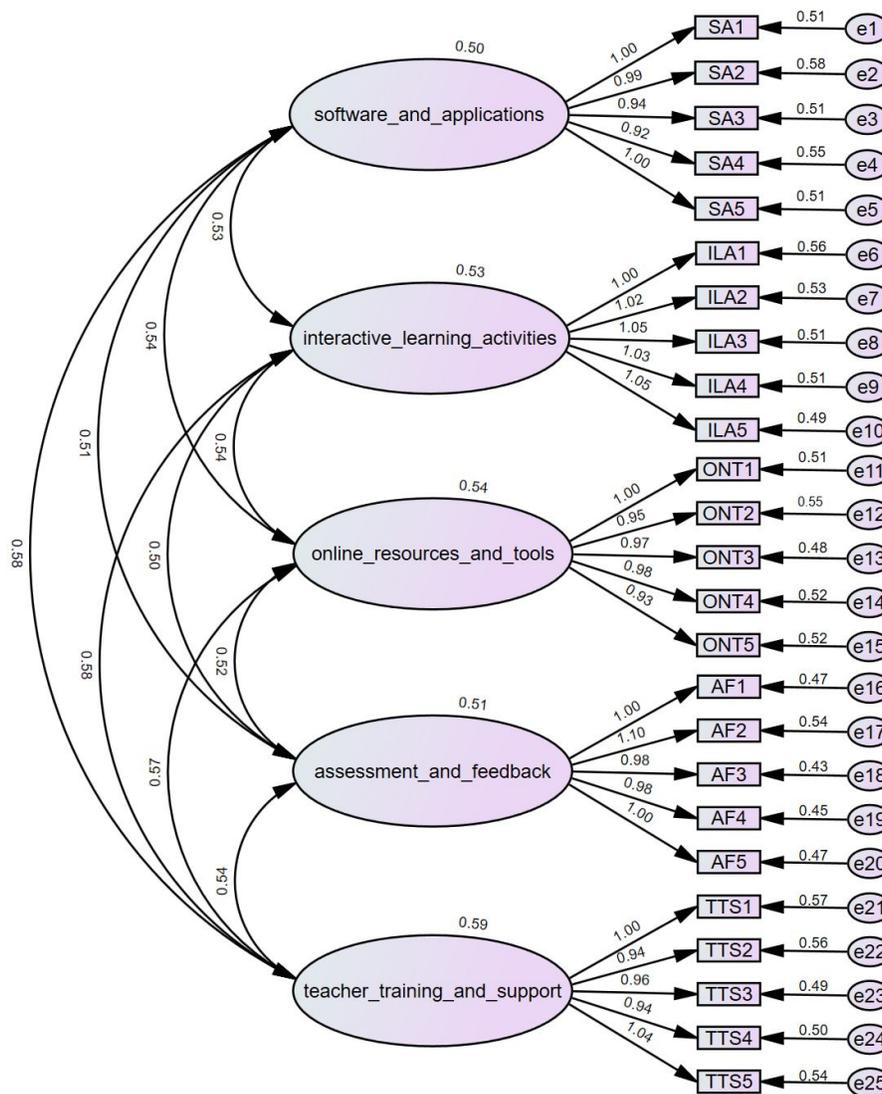


Figure 2. Five-factor learning management measurement model.

Table 2 reports the model fit indices for the confirmatory factor analyses conducted in this study, including the

program management model, the learning management model, and the second-order CAET management model.

Table 2. Personal status of students, teachers and administrators.

Model	$\chi^2/df$	CFI	TLI	RMSEA
Program Management Model	1.098	0.993	0.992	0.020
Learning Management Model	1.117	0.991	0.990	0.022
Second-Order CAET Management Model	1.327	0.916	0.912	0.037

### A higher-order structure of CAET management

To examine whether program management and learning management can be empirically organized within a higher-

level management structure, a second-order confirmatory factor analysis was conducted. In this hierarchical model, the four first-order program management factors and the five first-order learning management factors were

specified to load onto two second-order latent constructs, namely program management and learning management, which together formed an overarching CAET management structure.

As reported in Table 2, the second-order model demonstrated an acceptable fit to the data according to commonly used goodness-of-fit criteria. The chi-square to degrees of freedom ratio ( $\chi^2/df$ ) was 1.327, which is below the recommended threshold of 3.0, indicating satisfactory model parsimony. Incremental fit indices also met established standards, with a Comparative Fit Index (CFI) of 0.916 and a Tucker–Lewis Index (TLI) of 0.912, both exceeding the recommended cutoff value of 0.90. In addition, the Root Mean Square Error of Approximation (RMSEA) was 0.037, suggesting a close fit between the hypothesized model and the observed data.

The fit indices of the second-order model were

comparable to those of the first-order program management and learning management models shown in Table 2, indicating that the introduction of a higher-order structure did not result in a substantial loss of model fit. This finding suggests that program management and learning management, while empirically distinct at the first-order level, can be meaningfully integrated within a unified CAET management framework.

Taken together, the results of the second-order CFA provide structural support for conceptualizing CAET management as a multi-layered system rather than a collection of isolated dimensions. This hierarchical organization offers an empirical foundation for the subsequent discussion of integrated management approaches, including the PRACTICAL perspective proposed in this study.

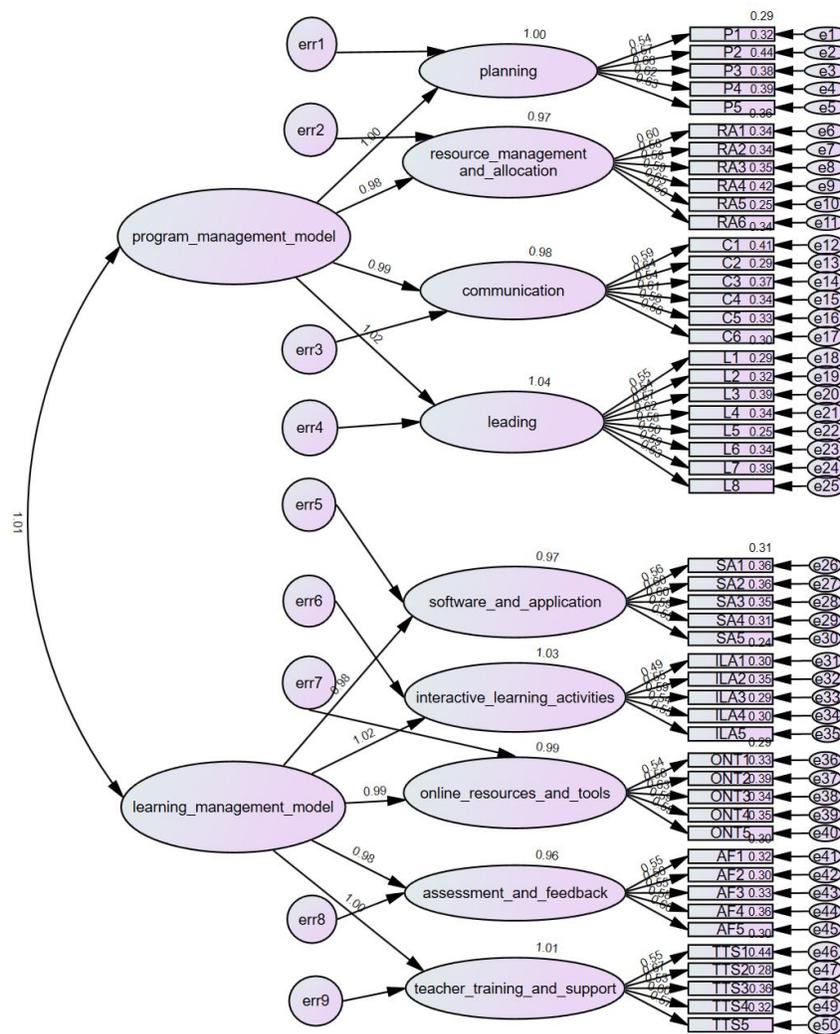


Figure 3. Second-order structure of CAET management.

## DISCUSSION

This section discusses the implications of the empirical findings in relation to the proposed three-step management framework for computer-assisted English teaching. The discussion focuses on interpreting the structural results, explaining the role of PRACTICAL integration, and outlining theoretical and practical implications.

### Interpreting the three-step management structure

This study provides empirical support for conceptualizing computer-assisted English teaching (CAET) as a multi-layered management system rather than a collection of instructional technologies. The validated four-factor program management model indicates that institutional planning, resource allocation, communication, and leadership form a coherent managerial foundation for CAET implementation. This aligns with broader evidence that technology-supported educational change depends on both external conditions (e.g., access, resources, organizational structures) and internal mechanisms (e.g., beliefs, leadership priorities, shared vision) that shape how innovations are adopted and sustained (Ertmer, 1999).

The five-factor learning management model further highlights that CAET implementation is not simply a matter of selecting digital tools; rather, it involves coordinated instructional processes, including interaction design, resource use, assessment practices, and professional support. Prior research on teacher preparation and technology integration similarly emphasizes that effective implementation requires institutional conditions (e.g., support structures, curriculum-level infusion) and teacher development that are embedded across practice contexts rather than delivered as isolated training events (Tondeur et al., 2012).

The second-order CFA results strengthen the argument that program management and learning management can be meaningfully integrated within a broader CAET management structure. From an innovation diffusion perspective, technology adoption is more likely to become routinized when organizational systems support consistent decision-making, communication channels, and reinforcement mechanisms (Rogers, 2003). In this study, the hierarchical organization suggests that CAET implementation can be understood as two interdependent layers—program-level management and learning-level management—providing an empirical basis for a “three-step” framework.

### Why PRACTICAL integration matters

An important implication of the second-order structure is that program management and learning management

should not operate in parallel. Instead, they require an integrative mechanism that connects institutional decisions with classroom-level implementation. The PRACTICAL integration step is proposed in this study as a practical alignment approach: it translates program-level intentions (e.g., planning, leadership priorities) into learning-level enactment (e.g., interactive activities, assessment and feedback) through structured coordination and support.

This integrative emphasis is consistent with scholarship on technology leadership, which suggests that leadership impacts technology initiatives not only through resource decisions but through how leaders shape organizational routines, expectations, and coherent implementation pathways (Anderson and Dexter, 2005; Dexter, 2011). In the CAET context, PRACTICAL integration provides a structured way to ensure that management actions (planning, resource allocation, and communication) are reflected in teachers’ day-to-day instructional practice and support systems.

In addition, the prominence of teacher training and support within the learning management structure underscores that instructional implementation depends on teachers’ professional knowledge for teaching with technology. This aligns with the technological pedagogical content knowledge (TPACK) framework, which highlights the need for integrated teacher knowledge that connects technology, pedagogy, and content rather than treating technology skills as separate competencies (Mishra and Koehler, 2006). In practice, this means that CAET management should prioritize professional support systems that enable teachers to continuously adapt digital tools to instructional goals.

### Practical implications for English education programs

The three-step framework offers actionable implications for English education programs, especially in local university contexts where constraints and implementation variability are common:

**1. Strengthen program-level coherence:** Program management should be treated as a system of coordinated practices (planning, resources, communication, leadership) rather than as administrative tasks. Research on technology leadership suggests that coherent leadership practices are associated with more successful technology-related program implementation across schools (Anderson and Dexter, 2005).

**2. Embed learning management as an operational layer:** Learning management should include not only platforms and resources but also structured interaction design, assessment routines, and ongoing teacher support. Evidence syntheses indicate that technology integration succeeds when institutional conditions and

preparation strategies are implemented holistically rather than as isolated workshops (Tondeur et al., 2012).

**3. Use PRACTICAL as an alignment mechanism:** The integration step can be operationalized through cross-role communication routines, shared implementation standards, and feedback loops that connect program decisions to classroom practice—an approach consistent with leadership-as-systems perspectives in educational technology initiatives (Dexter, 2011).

### Limitations and future research

Several limitations should be noted. First, the data were collected from a single institutional context, which may limit generalizability to other regions or program types. Second, the study focused on measurement structure; future work could examine structural relations (e.g., whether program management predicts learning management outcomes) using full structural models. Third, the research relied on self-reported perceptions, which may differ from observed implementation behaviors.

Future studies could extend this work in three directions:

1. Cross-institution validation to test whether the same hierarchical structure holds across different universities and program contexts.
2. Longitudinal investigation to examine how management structures evolve as CAET becomes more routinized, consistent with diffusion perspectives on innovation adoption over time (Rogers, 2003).
3. Implementation-focused mixed methods, combining CFA/SEM with qualitative inquiry to examine how leadership practices and teacher support mechanisms translate program intentions into classroom realities (Ertmer, 1999).

### Conclusion

This study contributes to CAET research by validating a three-step management framework consisting of (1) a four-factor program management structure, (2) a five-factor learning management structure, and (3) an integrative PRACTICAL alignment approach. The results support the view that CAET implementation requires coherent management systems that connect institutional decision-making with instructional practice. By reframing CAET as a managed educational system, the framework offers both a structural evidence base and a practical pathway for improving sustainable CAET implementation in English education programs.

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