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**RESEARCH ARTICLE**

# ADDIE Instructional Design Model Empowering International Chinese Language Learning: Mechanisms and Practical Strategies

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## ABSTRACT

With the rapid expansion of global Chinese language education, traditional instructional approaches have become insufficient to address the needs of diverse and cross-cultural learners. Systematic and learner-centered instructional design has therefore become an increasingly important topic in international Chinese language education. This study develops and validates an integrated model that incorporates the ADDIE instructional design framework, self-efficacy, and creative climate, aiming to examine how systematic instructional design influences international Chinese learners' learning outcomes and learning satisfaction, as well as the psychological mediating mechanism and contextual moderating effect underlying this process. Based on 466 valid questionnaire responses, structural equation modeling was employed for analysis. The results indicate that: (1) the implementation of the ADDIE model significantly enhances learning outcomes and learning satisfaction, demonstrating the effectiveness of systematic instructional design in international Chinese teaching; (2) self-efficacy plays a significant mediating role between ADDIE and learning outcomes, suggesting that systematic instructional design can improve learning performance by strengthening learners' confidence and sense of capability; and (3) creative climate positively moderates the relationship between self-efficacy and learning outcomes, indicating that an open, supportive, and exploratory learning environment amplifies the positive influence of self-efficacy. Theoretically, this study extends the applicability of the ADDIE model to the field of language education and reveals the interaction among instructional design, learning psychology, and learning context. Practically, the findings provide strategic implications for curriculum development, learner support, and classroom innovation in international Chinese language teaching. Finally, directions for future research are proposed to further deepen the understanding of systematic instructional design in cross-cultural learning settings.

***Keywords:*** ADDIE model; international Chinese language teaching; self-efficacy; creative climate; learning outcomes; learning satisfaction

## 1. Introduction

In recent years, China's growing national strength and cultural influence have reshaped the global linguistic landscape, gradually transforming Chinese from a regional language into one of the major world languages [1]. By 2023, more than 190 countries had launched Chinese language education, with over 30 million people learning Chinese and nearly 200 million individuals using or engaging with the language

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globally. Alongside the advancement of the Belt and Road Initiative, an increasing number of international students have come to China to pursue language training and academic degree programs. These learners must not only acquire linguistic competence but also adapt to academic conventions, disciplinary learning, and cross-cultural communication demands [2-4]. As a result, international Chinese language education faces diverse learning needs that span daily communication, academic Chinese, and Chinese for specific purposes [6].

However, traditional teacher-centered instructional approaches in Chinese language classrooms have become insufficient in the context of increasingly heterogeneous learner backgrounds, more complex learning goals, and rapid advances in educational technology. Previous studies have noted that many Chinese language programs lack systematic curriculum design, provide limited learner engagement opportunities, and employ inadequate assessment mechanisms, which together constrain improvements in learning outcomes and satisfaction [7]. At the same time, global language education is shifting toward more learner-centered approaches—such as task-based learning, situated learning, and technology-enhanced instruction [8]—underscoring the urgent need for a structured, adaptable, and evidence-based instructional design framework.

The ADDIE model—comprising analysis, design, development, implementation, and evaluation—offers a systematic and iterative instructional design method that has been widely applied in education, medical training, and digital learning [9]. Its learner-centered orientation and emphasis on continuous improvement make it highly aligned with the needs of international Chinese language education. The ADDIE model supports teachers in conducting accurate needs analysis, aligning learning objectives with instructional activities, integrating multimedia and digital tools, and optimizing teaching through formative and summative evaluation[7]. Nevertheless, empirical research on ADDIE in the context of Chinese language instruction remains limited, particularly regarding the psychological and contextual mechanisms that underlie its effectiveness.

Theoretically, research in international Chinese education has largely focused on linguistic features or classroom practices, with insufficient integration of instructional design, learner psychology, and classroom climate. Self-efficacy, for instance, is a key mechanism in social cognitive theory and is known to influence learning motivation, strategy use, and performance [10]. Creative climate has also been shown to affect learner engagement, emotional involvement, and willingness to communicate [11]. Yet, these factors have rarely been examined together with instructional design models in Chinese language education, leaving a gap in understanding how structured teaching design transforms into actual learning outcomes.

Practically, international Chinese learners often encounter problems such as unclear learning objectives, insufficient interactive activities, difficulty understanding specialized terminology, and limited feedback mechanisms [12]. These issues indicate that teaching design must not only adopt systematic processes but also account for the interaction between learner psychology and learning environment. Integrating the ADDIE model with constructs such as self-efficacy and creative climate may therefore provide a more explanatory and adaptable pathway for optimizing instruction, particularly in digital and blended Chinese language learning contexts.

Against this backdrop, the present study proposes an integrated research framework to examine how the ADDIE instructional design model influences learning outcomes and satisfaction among non-native Chinese learners in China. Using structural equation modeling (SEM), this study aims to accomplish three objectives: (1) test the direct effects of the ADDIE model on learning outcomes and learning satisfaction; (2) analyze the mediating role of learner self-efficacy in the relationship between ADDIE and learning results; and (3) explore whether creative climate moderates the effect of self-efficacy on learning outcomes and satisfaction. The contributions of this study are twofold: (a) it addresses the insufficient integration of instructional design theory

with second language learning mechanisms, and (b) it provides actionable teaching design strategies and empirical evidence to support teachers, curriculum designers, and policymakers in enhancing the quality and sustainability of global Chinese language education.

# 2. Theoretical background and literature review

## 2.1. Cross-Cultural challenges in language learning and the need for systematic instructional design

In a globalized context, foreign language learning is not merely the accumulation of linguistic knowledge but also an important pathway toward understanding other cultures. Wagner (2008) argues that language learning is inherently a cross-cultural process aimed at cultivating learners' ability to understand, communicate, and develop cultural sensitivity in diverse cultural contexts, thereby reducing stereotypes and promoting genuine cultural understanding [13]. Suprun and Kuligina (2010) similarly emphasize that foreign language curricula should incorporate intercultural orientations at the design stage to facilitate the integrated development of language and culture [14]. Empirical studies have shown that international learners commonly struggle with listening comprehension, oral fluency, and classroom interaction in academic environments [15]. Cultural distance theory [16] further posits that the greater the disparity between a learner's home culture and the target language culture, the more pronounced the challenges in language acquisition, classroom adaptation, and interpersonal communication. Collectively, these studies indicate that language learning difficulties arise from interacting linguistic, cognitive, and intercultural factors.

To address such complexities, contemporary pedagogy has shifted from content-centered approaches to learner-centered and systematically designed instruction. Branch (2009), and Dick, Carey and Carey (2005) conceptualize instruction as a dynamic system composed of learners, teachers, materials, methods, assessments, and learning environments, all of which jointly influence learning outcomes [17-18]. Instructional design, therefore, should not rely solely on teacher experience but instead integrate learning objectives, instructional strategies, and assessment methods within a coherent system. In this context, structured instructional design models—particularly the ADDIE model—have become essential tools for addressing complex and cross-cultural learning environments. For international Chinese language education, a systematic instructional design framework helps improve coherence and responsiveness amid diverse learning needs, multifaceted learning goals, and cultural differences.

## 2.2. The ADDIE instructional design model and its applications in education

The ADDIE model—analysis, design, development, implementation, and evaluation—is one of the most widely used systematic instructional design frameworks [17]. The analysis stage focuses on learner characteristics, prior knowledge, and contextual constraints; the design stage transforms needs into concrete learning objectives, instructional strategies, and media arrangements; the development stage produces instructional materials and assessment tools; the implementation stage concerns the actual delivery of instruction; and the evaluation stage involves formative and summative assessments, feeding into iterative instructional improvement [19]. Due to its clear logic and flexibility, ADDIE has been widely applied in higher education and professional training. For example, Reinbold (2013) redesigned a medical information literacy course using ADDIE [20]; Cheung (2016) applied it in radiology instruction and significantly improved learning outcomes [21]; and Campbell (2014) along with Nichols Hess and Greer (2016) confirmed its effectiveness in library education and digital literacy [22-23]. These studies collectively indicate that ADDIE helps instructors respond systematically to different instructional contexts, improving course quality and learner engagement.

However, ADDIE has also faced criticism in language education contexts. Originating in military and corporate training needs [24], the model emphasizes task orientation and predictable outcomes. Some scholars argue that its relatively linear structure may be overly rigid and may not fully accommodate the nonlinear, interactive, and culturally sensitive nature of language classrooms [19]. Additionally, a highly structured design may limit instructors' flexibility in responding to real-time classroom interactions and contextual changes [25] and may not sufficiently account for the complexities of pragmatics and cultural diversity [26]. Consequently, some researchers suggest modifying ADDIE or combining it with more iterative or agile design methods (e.g., SAM model) to better address complex learning processes [24]. These discussions highlight that ADDIE should not be applied mechanically in language education but should be adapted to specific instructional contexts. In international Chinese language education, ADDIE offers both potential and limitations: its structure supports differentiated teaching strategies aligned with learners' linguistic backgrounds, motivations, and cultural traits, yet its use must also account for the interactive and intercultural nature of Chinese language learning. This study therefore treats ADDIE as a flexible instructional design framework that can be enriched through psychological and contextual variables (e.g., self-efficacy and creative climate), forming a more comprehensive model of instructional effectiveness.

Based on prior findings that structured instructional design improves learning outcomes and satisfaction (Salas & Stagl, 2015), the following hypotheses are proposed:

H1a: Higher levels of ADDIE implementation in Chinese language courses are associated with better learning outcomes.

H1b: Higher levels of ADDIE implementation in Chinese language courses are associated with greater learning satisfaction.

### 2.3. The role of self-efficacy in learning and language education

Self-efficacy, a core concept in social cognitive theory, refers to an individual's belief in their capability to organize and execute actions required to achieve specific goals [27-29]. This belief shapes task choices, effort levels, persistence, and psychological resilience when encountering difficulties [30]. Meta-analyses have consistently identified academic self-efficacy as a key predictor of learning behavior and academic performance [31-33].

In academic settings, academic self-efficacy concerns learners' confidence in completing tasks and achieving course objectives [34]. It is formed through mastery experiences, vicarious experiences, verbal persuasion, and physiological or emotional states [30]. For example, Lin and Tsai (2013) developed a multidimensional self-efficacy scale for science learning based on Bandura's framework [35]. Self-efficacy is closely linked to strategy use, learning confidence, and self-regulation [36-37]. It is also context- and task-specific [38]. In unfamiliar learning environments or when feedback is insufficient, learners' self-efficacy may decline, reducing motivation and engagement [39-40]. In language learning contexts, learners with high self-efficacy tend to show stronger willingness to communicate, greater persistence, and more positive learning experiences, whereas those with low self-efficacy often exhibit anxiety and avoidance [41].Theoretically, self-efficacy may serve as a psychological mechanism linking instructional design to learning outcomes [28]. When instructional design—such as ADDIE-based instruction—adequately considers learner needs, provides appropriately challenging tasks, and offers timely feedback, learners are more likely to accumulate mastery experiences and build confidence, thereby developing higher self-efficacy and deeper engagement.

Based on these perspectives, this study conceptualizes self-efficacy as a mediator between ADDIE implementation and learning outcomes/satisfaction, leading to the following hypotheses:

H2a: Learners' self-efficacy mediates the relationship between ADDIE implementation and learning outcomes.

H2b: Learners' self-efficacy mediates the relationship between ADDIE implementation and learning satisfaction.

## 2.4. Creative climate as a contextual factor in education and language learning

Beyond individual psychological factors, the learning environment plays a crucial role in shaping learning processes and outcomes. Creative climate, defined as individuals' perceptions of whether their environment supports creativity, exploration, and risk-taking [42], has been widely examined in organizational research. It includes dimensions such as clarity of vision, support, autonomy, resource availability, encouragement of new ideas, tolerance for risk and errors, and peer relationships [43-45]. Instruments such as CCQ and KEYS [46-47] indicate that environments with clear goals, adequate resources, higher autonomy, and positive feedback tend to stimulate intrinsic motivation and creative performance [48-49].

In educational contexts, creative climate reflects whether teachers and institutions provide space for exploration and experimentation, allow mistakes, and encourage collaborative knowledge construction. A supportive creative climate can enhance learning interest, autonomy, and engagement, thereby promoting deeper learning [50]. In language education, open and supportive environments that incorporate challenging tasks and interactive activities can help learners use language creatively and understand cultural meanings more effectively, improving both performance and satisfaction [47,49]. Theoretically, creative climate may interact with both self-efficacy and instructional design. According to [29], learning behavior arises from the interaction between personal factors and environmental support. In classrooms with high creative climate, learners with strong self-efficacy are more likely to experiment, take risks in language use, and transform confidence into performance and positive emotional experiences. Conversely, in low-creative environments, the positive influence of self-efficacy may be diminished.

Thus, this study conceptualizes creative climate as a key contextual moderator shaping the effects of ADDIE and self-efficacy on learning outcomes and proposes the following hypotheses:

H3a: Creative climate positively moderates the relationship between self-efficacy and learning outcomes.

H3b: Creative climate positively moderates the relationship between self-efficacy and learning satisfaction.

## 2.5. Learning outcomes and learning satisfaction

As this study adopts learning outcomes and learning satisfaction as its primary dependent variables, it is necessary to clearly define these constructs. Learning outcomes refer to changes in learners' knowledge, skills, or behavior after instructional engagement [51-52]. Learning satisfaction captures learners' emotional and cognitive evaluations of their overall learning experience. Kirkpatrick and Kirkpatrick's (2006) four-level training evaluation model remains one of the most influential frameworks in education and training [53]. It examines instructional effectiveness across four levels: reaction, learning, behavior, and results. Reaction relates to learners' feelings and satisfaction; learning concerns mastery of knowledge and skills; behavior examines whether learning transfers into practice; and results assess broader organizational or societal impacts. In educational research, the first three levels are most commonly adopted.

Aligned with this framework, the present study operationalizes three dimensions relevant to its context: Learning satisfaction (reaction level): learners' subjective evaluation of course design, instructional methods, materials, and overall learning experience. Knowledge acquisition (learning level): mastery of Chinese

linguistic knowledge and related cultural content. Skill improvement (behavior level): learners' ability to apply Chinese effectively in real or academic contexts.

By integrating ADDIE (instructional design), self-efficacy (psychological mechanism), and creative climate (contextual moderator), along with multidimensional learning outcome measures, this study aims to systematically examine how instructional design shapes learning effectiveness and satisfaction in digital international Chinese language environments, thereby offering a more explanatory and empirically supported theoretical model for international Chinese education.

Based on the hypothesized relationships above, the study constructs the theoretical model shown in Figure 1.

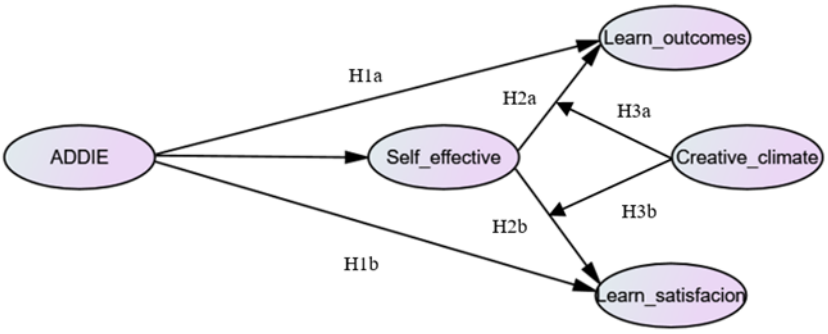


**Figure 1.** The theorical model

# 3. Research design

## 3.1. Questionnaire design

This study employed a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree) to measure participants' perceptions of their learning experiences in the Chinese language course. First, the items measuring the ADDIE instructional design model were developed with reference to Gagné et al. (2005)[54], Branch (2009)[55], Dick & Carey (2005)[18], and Khalil & Elkhider (2016)[19]. A total of 15 items were constructed across the five stages—analysis, design, development, implementation, and evaluation—to assess learners' subjective perceptions of the extent to which the instructional design was implemented. Second, the self-efficacy scale was developed based on Bandura's (1997)[27] theoretical framework and adapted from Wong et al. (2019)[36], Kim & Jeon (2020)[37], Tsai (2019)[40], and Honicke & Broadbent (2016)[31]. Eight items were included to capture psychological aspects such as learning confidence, perceived task challenge, emotional regulation, and strategy use, reflecting learners' confidence in completing Chinese language tasks. Third, the creative climate scale was adapted from Amabile et al. (1996)[47], Isaksen et al. (2001)[56], and Kelly & Littman (2001)[50]. It includes eight items covering autonomy, challenge, resource support, peer support, and teacher encouragement, designed to measure the extent to which the classroom environment supports creativity. Fourth, learning outcomes were measured with reference to the learning and behavior levels of Kirkpatrick & Kirkpatrick's (2006)[53] evaluation model, together with scales developed by Pike et al. (2012)[52] and Guay et al. (2008)[51]. Five items were constructed to assess students' knowledge acquisition and skill application. Finally, learning satisfaction was assessed based on the reaction level of the Kirkpatrick model and adapted from Pike et al. (2012)[52] and Guay et al. (2008)[51]. Five items were included to capture learners' overall satisfaction with their learning experience. All items were reviewed by subject experts and pilot tested to ensure clarity, relevance, and alignment with the context of international Chinese language education. This process

enhanced the content validity and construct validity of the measurement instruments, providing a solid basis for subsequent empirical analysis.

### 3.2. Data collection

Data collection was conducted using a snowball sampling approach. The target participants were non-native Chinese learners studying in China, including international students of various academic levels, language proficiencies, and cultural backgrounds. The survey was administered through both in-class paper questionnaires and online forms to ensure diversity of sample sources and convenience of participation. A total of 500 questionnaires were distributed, and 478 were returned, yielding a response rate of 95.6%. After removing incomplete responses and those exhibiting excessive response consistency, 466 valid questionnaires were retained, resulting in a valid response rate of 92.3%. The sample size meets the minimum requirements for structural equation modeling (SEM) and ensures statistical stability for multivariate analysis [57]. All data collection procedures complied with research ethics guidelines. Participants were informed of the study purpose, data usage, and confidentiality measures prior to completing the survey and participated voluntarily.

## 4. Results

### 4.1. Demographic characteristics

Among the 466 valid responses, the gender distribution was relatively balanced, with 42.7% male (n = 199) and 57.3% female (n = 267), indicating good representativeness in terms of gender composition. Regarding academic level, the sample covered ten stages of study ranging from first-year undergraduate to the third year of doctoral programs. Specifically, 33.7% of participants were first- and second-year undergraduates, 49.8% were third- and fourth-year undergraduates, and 16.5% were graduate students (including both master's and doctoral programs). Overall, the sample was primarily composed of senior undergraduates, supplemented by a meaningful proportion of postgraduate learners.

In terms of academic disciplines, the participants were categorized into natural sciences and humanities/social sciences, accounting for 42.1% and 57.9% of the sample, respectively. With regard to monthly living expenses, respondents fell into six expenditure ranges: 1000 RMB or below, 1001–2000 RMB, 2001–3000 RMB, 3001–4000 RMB, 4001–5000 RMB, and above 5000 RMB. The majority were concentrated in the 2001–3000 RMB and 3001–4000 RMB ranges, followed by the 1001–2000 RMB and 4001–5000 RMB ranges. Only a small proportion reported monthly expenses below 1000 RMB or above 5000 RMB. Overall, the distribution reflects a predominantly moderate level of living expenses.

### 4.2. Common method variance

To ensure that the dataset was not substantially affected by common method variance (CMV), Harman's single-factor test was conducted. All measurement items were subjected to an unrotated exploratory factor analysis to examine whether a single factor accounted for the majority of the variance. The results showed that several factors had eigenvalues greater than 1, and the first factor explained 31.2% of the total variance, which is well below the 40% threshold suggested by [58]. This indicates that no single factor dominated the variance structure. Therefore, the risk of CMV in this study is low and does not pose a threat to the validity of the subsequent model analyses. The results can thus be considered reliable and robust.

### 4.3. Reliability and validity

Internal consistency reliability was first assessed using SPSS 26.0, followed by confirmatory factor analysis (CFA) conducted in Amos 26.0 to evaluate the reliability and validity of the measurement model. As shown in Table 1, Cronbach's α values for all latent constructs ranged from 0.862 to 0.923, exceeding the

recommended threshold of 0.70 and indicating strong internal consistency. Composite reliability values ranged from 0.864 to 0.922, also surpassing the 0.70 criterion, further confirming the stability of the measurement scales. At the CFA stage, the overall model demonstrated good fit, with fit indices as follows: $\chi^2/df = 2.755$, CFI = 0.965, TLI = 0.956, IFI = 0.965, RMSEA = 0.048, and SRMR = 0.039. These values indicate an acceptable and satisfactory model fit, supporting the adequacy of the measurement model for subsequent structural analysis. Regarding validity, all latent constructs exhibited average variance extracted (AVE) values above 0.50, ranging from 0.580 to 0.747, demonstrating good convergent validity. Additionally, standardized factor loadings for all items fell between 0.747 and 0.896 on their respective constructs, meeting the criteria for construct validity as suggested by [59].

**Table 1.** The results of CFA

| Constructs/Items | Estimate | Alpha | CR | AVE |
|---|---|---|---|---|
| Analysis | | 0.872 | 0.871 | 0.692 |
| Ana1 | 0.855 | | | |
| Ana2 | 0.791 | | | |
| Ana3 | 0.848 | | | |
| Design | | 0.878 | **0.877** | 0.705 |
| Des1 | 0.875 | | | |
| Des2 | 0.888 | | | |
| Des3 | 0.814 | | | |
| Development | | 0.862 | 0.864 | 0.68 |
| Dev1 | 0.857 | | | |
| Dev2 | 0.816 | | | |
| Dev3 | 0.799 | | | |
| Implementation | | 0.874 | 0.876 | 0.702 |
| Imp1 | 0.871 | | | |
| Imp2 | 0.832 | | | |
| Imp3 | 0.809 | | | |
| Evaluation | | 0.898 | 0.898 | 0.747 |
| Eva1 | 0.867 | | | |
| Eva2 | 0.852 | | | |
| Eva3 | 0.873 | | | |
| Self-efficacy | | 0.918 | 0.917 | 0.58 |
| SE1 | 0.747 | | | |
| SE2 | 0.754 | | | |
| SE3 | 0.737 | | | |
| SE4 | 0.728 | | | |
| SE5 | 0.811 | | | |
| SE6 | 0.806 | | | |
| SE7 | 0.749 | | | |
| SE8 | 0.857 | | | |

| Constructs/Items | Estimate | Alpha | CR | AVE |
|---|---|---|---|---|
| Creative Climate | | 0.923 | 0.922 | 0.596 |
| Cc1 | 0.763 | | | |
| Cc2 | 0.751 | | | |
| Cc3 | 0.736 | | | |
| Cc4 | 0.794 | | | |
| Cc5 | 0.723 | | | |
| Cc6 | 0.819 | | | |
| Cc7 | 0.787 | | | |
| Cc8 | 0.799 | | | |
| Learning Outcomes | | 0.913 | 0.914 | 0.682 |
| LE1 | 0.847 | | | |
| LE2 | 0.856 | | | |
| LE3 | 0.848 | | | |
| LE4 | 0.798 | | | |
| LE5 | 0.776 | | | |
| Learning Satisfaction | | 0.918 | 0.92 | 0.698 |
| LS1 | 0.853 | | | |
| LS2 | 0.778 | | | |
| LS3 | 0.821 | | | |
| LS4 | 0.825 | | | |
| LS5 | 0.896 | | | |

**Table 1.** (*Continued*)

Using the Fornell–Larcker (1982) criterion, this study examined the discriminant validity among the latent constructs [60]. The results indicate that the square root of the AVE for each construct was greater than its correlations with other constructs (see Table 2). Overall, all constructs met the Fornell–Larcker criterion, demonstrating adequate discriminant validity and confirming that the latent variables were statistically distinct from one another.

**Table 2.** The discrimination effect

| No | Constructs | CR | AVE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Analysis | 0.871 | 0.692 | 0.832 | | | | | | | | |
| 2 | Design | 0.877 | 0.705 | 0.623 | 0.84 | | | | | | | |
| 3 | Development | 0.864 | 0.68 | 0.512 | 0.701 | 0.825 | | | | | | |
| 4 | Implementation | 0.876 | 0.702 | 0.522 | 0.722 | 0.727 | 0.838 | | | | | |
| 5 | Evaluation | 0.898 | 0.747 | 0.481 | 0.609 | 0.684 | 0.741 | 0.864 | | | | |
| 6 | Self-efficacy | 0.917 | 0.58 | 0.589 | 0.643 | 0.592 | 0.505 | 0.574 | 0.762 | | | |
| 7 | Creative Climate | 0.922 | 0.596 | 0.505 | 0.629 | 0.572 | 0.542 | 0.507 | 0.546 | 0.772 | | |
| 8 | Learning Outcomes | 0.914 | 0.682 | 0.618 | 0.598 | 0.657 | 0.526 | 0.641 | 0.657 | 0.549 | 0.826 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | Learning Satisfaction | 0.92 | 0.698 | 0.627 | 0.555 | 0.666 | 0.614 | 0.627 | 0.632 | 0.608 | 0.577 | 0.835 |

## 4.4. Structural equation modeling (SEM)

In the structural equation modeling (SEM) analysis, the overall structural model demonstrated a satisfactory fit, with all indices meeting commonly recommended thresholds ($\chi^2/df = 3.016$, CFI = 9.421, TLI = 9.398, IFI = 9.421, RMSEA = 0.056, SRMR = 0.049), indicating a robust level of model adequacy. The path analysis results showed that the ADDIE instructional design exerted a significant positive effect on self-efficacy ($\beta = 0.521$, T = 11.578, $p < 0.001$). ADDIE also significantly predicted learning outcomes ($\beta = 0.323$, T = 6.592, $p < 0.001$) and learning satisfaction ($\beta = 0.379$, T = 7.151, $p < 0.001$). In addition, self-efficacy exhibited a significant positive effect on learning outcomes ($\beta = 0.282$, T = 4.947, $p < 0.001$) and a significant predictive effect on learning satisfaction ($\beta = 0.265$, T = 6.310, $p < 0.001$). Overall, all path coefficients reached high levels of statistical significance, supporting the main hypotheses of this study. These findings indicate that the ADDIE instructional design not only directly enhances learning outcomes and learning satisfaction but also indirectly improves learning performance by strengthening learners' self-efficacy.

**Table 3.** The Results of SEM

| Path | | | Estimate | S.E. | T-Value | P |
|---|---|---|---|---|---|---|
| ADDIE | → | Self-efficacy | 0.521 | 0.045 | 11.578 | *** |
| ADDIE | → | Learning Outcomes | 0.323 | 0.049 | 6.592 | *** |
| ADDIE | → | Learning Satisfaction | 0.379 | 0.053 | 7.151 | *** |
| Self-efficacy | → | Learning Outcomes | 0.282 | 0.057 | 4.947 | *** |
| Self-efficacy | → | Learning Satisfaction | 0.265 | 0.042 | 6.31 | *** |

## 4.5. Mediation effects

To examine the mediating role of self-efficacy between the ADDIE instructional design and learning outcomes, the present study employed a bootstrap approach with 5,000 resamples to estimate indirect effects. The results indicate that the direct effect of ADDIE on learning outcomes was significant ($\beta = 0.323$, Z = 6.592, $p < 0.001$), and the indirect effect through self-efficacy was also significant ($\beta = 0.147$, Z = 4.594, $p < 0.001$). The 95% percentile bootstrap confidence interval (CI = [0.119, 0.316]) did not include zero, demonstrating a significant mediating effect of self-efficacy between ADDIE and learning outcomes. Because both the direct and indirect effects were significant, this relationship represents partial mediation. Similarly, ADDIE exerted a significant direct effect on learning satisfaction ($\beta = 0.379$, Z = 7.151, $p < 0.001$), and its indirect effect through self-efficacy was also significant ($\beta = 0.138$, Z = 5.520, $p < 0.001$). The corresponding 95% percentile bootstrap confidence interval (CI = [0.109, 0.279]) did not cross zero, further supporting the significant mediating role of self-efficacy between ADDIE and learning satisfaction. This pattern likewise corresponds to partial mediation. Overall, the findings confirm that self-efficacy serves as a key psychological mechanism through which the ADDIE instructional design influences learning outcomes. The ADDIE model not only directly enhances learning performance and satisfaction but also improves learning results indirectly by strengthening learners' self-efficacy. Both H2a and H2b were supported.

**Table 4.** The results of mediation

| path | | Point estimate | product of coefficients | | Percentile 95%CI | | Mediation |
|---|---|---|---|---|---|---|---|
| | | | se | Z-value | Lower | Upper | |
| ADDIE→Learning Outcomes | total effects | 0.470 | 0.058 | 8.103 | 0.111 | 0.374 | |
| | direct effects | 0.323 | 0.049 | 6.592 | 0.103 | 0.341 | |
| ADDIE→Self-efficacy→Learning Outcomes | indirect effects | 0.147 | 0.032 | 4.594 | 0.119 | 0.316 | yes |
| ADDIE→Learning Satisfaction | total effects | 0.517 | 0.058 | 8.763 | 0.131 | 0.423 | |
| | direct effects | 0.379 | 0.053 | 7.151 | 0.098 | 0.229 | |
| ADDIE→Self-efficacy→Learning Satisfaction | indirect effects | 0.138 | 0.025 | 5.520 | 0.109 | 0.279 | yes |

## 4.6. Moderation effects

To examine the moderating role of creative climate in the relationships between self-efficacy, learning outcomes, and learning satisfaction, the present study employed PROCESS 3.4 for analysis. As shown in Table 5, in learning environments characterized by higher levels of creativity and exploration, learners' self-efficacy exerted a stronger positive effect on learning outcomes (self-efficacy × creative climate: $\beta = 0.067$, $t = 3.245$) and a more pronounced positive effect on learning satisfaction (self-efficacy × creative climate: $\beta = 0.058$, $t = 2.998$). These results indicate that creative climate serves as an important contextual factor that enhances the practical influence of the psychological mechanism embedded in the instructional design.

**Table 5.** The results of moderation

| Dependent Variables | Learning Outcomes | | | | Learning Satisfaction | | | |
|---|---|---|---|---|---|---|---|---|
| | model 1 | | model 2 | | model 3 | | model 4 | |
| | coef. | t | coef. | t | coef. | t | coef. | t |
| Interrupt | 2.937 | 4.378 | 4.351 | 5.372 | 1.634 | 3.298 | 2.332 | 4.608 |
| Control variables | | | | | | | | |
| Sex | 0.095 | 1.393 | 0.035 | 0.479 | 0.063 | 1.008 | 0.054 | 0.841 |
| Grade | -0.009 | -0.097 | -0.015 | -0.164 | -0.09 | -0.392 | -0.028 | -0.752 |
| Subject | -0.046 | -0.456 | 0.008 | 0.096 | -0.008 | -0.241 | -0.012 | -0.297 |
| Income | 0.054 | 0.967 | 0.044 | 0.625 | 0.029 | 0.547 | 0.021 | 0.643 |
| Creative Climate | 0.113 | 2.526 | 0.108 | 2.279 | 0.126 | 2.731 | 0.111 | 2.321 |
| Independent Variable | | | | | | | | |
| Self-efficacy | 0.271 | 4.354 | 0.256 | 4.373 | 0.282 | 4.576 | 0.273 | 4.768 |
| Moderator | | | | | | | | |
| Self-efficacy * Creative Climate | | | 0.067 | 3.245 | | | 0.058 | 2.998 |
| Model statistics | | | | | | | | |
| $R^2$ | 0.457 | | 0.512 | | 0.568 | | 0.624 | |
| $R^2$ adj. | 0.448 | | 0.504 | | 0.557 | | 0.621 | |
| F | 55.603 | | 54.788 | | 66.222 | | 62.127 | |

# 5. Discussion and conclusion

## 5.1. Summary of key findings

This study developed and validated an integrated model incorporating the ADDIE instructional design framework, self-efficacy, and creative climate to explain learning outcomes and learning satisfaction among international Chinese language learners. Based on structural equation modeling and regression analyses, three major findings emerged.

First, the implementation of the ADDIE instructional design model significantly enhanced both learning outcomes and learning satisfaction. The structural model showed that ADDIE exerted significant positive effects on learning outcomes ($\beta = 0.323$, $p < 0.001$) and learning satisfaction ($\beta = 0.379$, $p < 0.001$). These results indicate that systematic instructional processes—including analysis, design, development, implementation, and evaluation—play a crucial role in improving the effectiveness of international Chinese language teaching, addressing long-standing issues of weak structure and low adaptability in traditional Chinese classrooms. Second, self-efficacy served as a significant mediator linking ADDIE to learning outcomes. ADDIE demonstrated a substantial positive effect on self-efficacy ($\beta = 0.521$, $p < 0.001$), which in turn significantly predicted both learning outcomes ($\beta = 0.282$, $p < 0.001$) and learning satisfaction ($\beta = 0.265$, $p < 0.001$). The indirect effects were significant for both learning outcomes ($\beta = 0.147$, $Z = 4.594$) and learning satisfaction ($\beta = 0.138$, $Z = 5.520$). These results suggest that systematic, learner-centered instructional design enhances learners' confidence and perceived competence, thereby improving both their performance and subjective satisfaction. Third, the study confirmed a significant moderating role of creative climate. The interaction between self-efficacy and creative climate significantly predicted both learning outcomes ($\beta = 0.067$, $t = 3.245$) and learning satisfaction ($\beta = 0.058$, $t = 2.998$). Simple slope analyses showed that the positive effects of self-efficacy were stronger under conditions of high creative climate. This suggests that learning environments that encourage experimentation, expression, and creativity make it easier for learners to translate their self-efficacy into active learning behaviors and positive emotional experiences.

## 5.2. Empirical evidence on the ADDIE instructional design model

This study provides important empirical support for the application of the ADDIE instructional design model in the context of international Chinese language education. While previous research has predominantly examined ADDIE in corporate training, medical education, engineering, and information literacy [55,18,20], its systematic benefits have been insufficiently validated in language education—particularly in Chinese as a second language.

First, the findings demonstrate that the five phases of the ADDIE model—analysis, design, development, implementation, and evaluation—can systematically enhance learning outcomes. The model significantly predicted both learning outcomes ($\beta = 0.323$) and learning satisfaction ($\beta = 0.379$), indicating its capacity to address learners' linguistic, cultural, and academic adaptation needs. Clear learner profiling in the analysis stage, along with multimedia integration, task-based learning, and contextualized instruction during the design and development stages, helps alleviate linguistic and cultural barriers commonly encountered by Chinese language learners. Second, this study shows that ADDIE can compensate for structural weaknesses in traditional Chinese language classrooms, which often suffer from fragmented activities, unclear assessment standards, and low learner engagement. The emphasis on alignment between objectives, activities, and assessment provides teachers with clearer instructional pathways and enhances curriculum coherence. Learners expressed positive perceptions of the improved course structure, diverse learning resources, and transparent evaluation mechanisms under ADDIE, confirming its suitability for language teaching settings. Third, the study identifies the unique value of ADDIE in the international Chinese language context: its effectiveness

increases when complemented by psychological and contextual factors. Although ADDIE is inherently a systematic framework, its instructional benefits depend on alignment with learners' psychological needs and the learning environment. This study shows that ADDIE not only directly enhances learning outcomes but also indirectly improves them via self-efficacy—and that these effects are amplified in classrooms with a strong creative climate. This highlights the integrated value of "systematic design—psychological empowerment—contextual support" in language learning.

### 5.3. The mediating role of self-efficacy

The study verifies the critical role of self-efficacy in mediating the relationship between ADDIE instructional design and learning outcomes, extending the application of social cognitive theory in international Chinese language education. The results show that ADDIE significantly increased learners' self-efficacy ($\beta = 0.521$, $p < 0.001$), which subsequently predicted learning outcomes ($\beta = 0.282$) and learning satisfaction ($\beta = 0.265$), with significant indirect effects ($\beta = 0.147$ and $\beta = 0.138$, respectively). This evidence indicates that the effectiveness of systematic instructional design depends not only on the instructional activities themselves but also on their capacity to strengthen learners' confidence in their abilities. In international Chinese learning environments—characterized by linguistic challenges, cultural differences, and academic pressure—self-efficacy plays a particularly crucial role. When instructional processes offer clear goals, diverse resources, and timely feedback, learners are able to accumulate mastery experiences, develop a sense of competence, and engage more proactively in language learning. Thus, self-efficacy constitutes a core psychological mechanism translating instructional design into behavioral and emotional learning outcomes.

### 5.4. The moderating role of creative climate

The study further confirms that creative climate significantly moderates the effects of self-efficacy on learning outcomes and learning satisfaction. The interaction term of self-efficacy × creative climate significantly predicted learning outcomes ($\beta = 0.067$, $t = 3.245$) and learning satisfaction ($\beta = 0.058$, $t = 2.998$), and simple slope plots showed that high creative climate strengthened these effects. These findings highlight that the psychological characteristics of the learning environment are key conditions shaping learning performance. Creative climate provides learners with freedom to explore, opportunities for expression, and a tolerant atmosphere—enabling them to convert self-efficacy into observable engagement and motivation. In international Chinese language learning, where learners face pronunciation challenges, cultural barriers, and anxiety in classroom participation, such a supportive environment enhances their willingness to take risks and engage actively in language use. Conversely, under low creative climate, learners—even those with high self-efficacy—may find it difficult to translate confidence into learning behavior or sustained motivation. Overall, the results demonstrate that creative climate not only influences learning outcomes directly but also acts as an important boundary condition that shapes how instructional design and psychological mechanisms interact. ADDIE yields stronger impacts in high creative climate environments, underscoring the synergistic relationship between systematic instructional design and a positive learning atmosphere.

### 5.5. Theoretical contributions

From the integrated perspective of instructional design, learning psychology, and learning context, this study proposes and validates a systematic model that offers several theoretical contributions to international Chinese language education and the broader field of language education.

First, this study expands the theoretical applicability of the ADDIE instructional design model in language education.

Existing research has predominantly applied ADDIE in corporate training, medical education, engineering programs, and information literacy courses [20,55], whereas systematic investigations of its relevance to language instruction remain limited. The findings of this study demonstrate that the five phases of ADDIE effectively enhance learning outcomes and learning satisfaction among international Chinese learners. Through clearer goal structuring, diversified resource design, and continuous evaluation mechanisms, ADDIE improves the overall learning experience. This extends the model from technical training contexts to language learning environments and confirms its explanatory power in culturally diverse and heterogeneous learner groups, thereby opening new theoretical directions for future language education research.

Second, this study identifies self-efficacy as a key psychological mechanism linking systematic instructional design and learning outcomes. Although self-efficacy has long been a central construct in educational psychology [10,31], few studies have examined its role as a mediator of structured instructional design. The present findings show that ADDIE indirectly enhances learning outcomes and satisfaction by improving learners' sense of competence, mastery experiences, and learning confidence, providing a sequential explanatory model of "instructional design → psychological empowerment → learning outcomes." This clarification of the psychological mechanism supplements previous instructional design research, which tended to emphasize procedural and structural aspects while overlooking learners' internal cognitive and emotional processes.

Third, this study highlights the critical moderating role of creative climate in language learning, thereby extending the significance of contextual factors in learning theories. Most prior research on creative climate originates from organizational psychology [44,47], with limited attention in educational contexts. This study provides empirical evidence that a high creative climate amplifies the positive effects of self-efficacy on learning outcomes and enhances the overall effectiveness of instructional design. This finding not only enriches the environmental-person interaction perspective within social cognitive theory but also aligns with learning sciences literature emphasizing "contextual support" and "psychological safety," underscoring that the learning climate is a vital condition for successful instructional interventions.

Fourth, this study proposes an integrative theoretical framework combining instructional design, psychological mechanisms, and contextual factors, offering cross-disciplinary theoretical value for language learning research.

Previous studies in international Chinese education have largely focused on linguistic structures, learning strategies, or cross-cultural adaptation. This study is the first to jointly examine ADDIE instructional design, self-efficacy, and creative climate within a single comprehensive model, revealing their interactive mechanisms. The integrated framework not only explains multiple sources of learning outcomes but also provides a conceptual foundation for future extensions, such as incorporating learning engagement, learning burnout, classroom interaction quality, or cultural distance as additional variables.

Fifth, this study reveals the synergistic effects of systematic instructional design and psychological empowerment in international Chinese language education, emphasizing the importance of a multi-level interaction of "structure × psychology × context" in theoretical development. This finding calls for language education research to move beyond viewing instructional design as a static procedure. Instead, theoretical models should integrate learners' perceptions, emotions, motivation, and learning climate into dynamic analyses. Such a perspective offers a more comprehensive basis for advancing theory in international Chinese language education.

### 5.6. Practical implications

The findings of this study offer several important practical implications for curriculum development, instructional practice, and learning environment design in international Chinese language education.

First, the results demonstrate that the implementation of the ADDIE instructional design model significantly enhances both learning outcomes and learning satisfaction. Therefore, teachers and curriculum developers should promote greater systematization in instructional design. This includes conducting a comprehensive needs analysis of learners' linguistic backgrounds, cultural contexts, and learning goals; optimizing course structure and integrating multimedia resources, task-based activities, and contextualized materials during the design and development stages; ensuring operational feasibility and adaptive use of instructional strategies during implementation; and establishing both formative and summative assessment mechanisms to improve course coherence and learning experience.

Second, the study confirms that self-efficacy is a crucial psychological mechanism linking instructional design to learning outcomes. Accordingly, teachers should adopt strategies to strengthen learners' self-efficacy, such as: providing achievable, staged learning tasks to accumulate mastery experiences; offering positive feedback and verbal encouragement to reinforce learning beliefs; modeling effective learning strategies and sharing successful peer examples to support vicarious learning; and enhancing learners' self-regulation through guidance in time management and emotional support. These practices help learners maintain persistence and engagement when encountering learning challenges.

Third, the results show that creative climate significantly amplifies the positive effects of self-efficacy on learning outcomes and satisfaction, underscoring the importance of the learning environment in ensuring the success of instructional interventions. Teachers should therefore foster an open, safe, and expressive classroom climate by offering diverse exploratory resources and creative tasks, encouraging cross-cultural communication and collaborative learning, and adopting supportive teaching behaviors that enhance learners' psychological safety. Such an environment serves as a key condition that elevates the motivational benefits of self-efficacy.

Fourth, the study suggests that international Chinese language teaching should further accelerate the integration of digital and innovative technologies. Tools such as smart classrooms, multimedia courseware, mobile learning applications, VR/AR immersive experiences, and AI-assisted speech evaluation can enhance interaction, provide more immediate feedback, and promote learners' autonomous learning.

Finally, from an institutional perspective, the results highlight the need to establish a systematic curriculum development process grounded in the ADDIE model. Institutions should also strengthen professional development programs that enhance teachers' intercultural competence and instructional design skills, and develop comprehensive teaching quality evaluation systems to ensure continual improvement.

### 5.7. Limitations and future research

First, this study employed a cross-sectional survey design, which allowed us to identify associations among the key variables but could not fully capture the dynamic processes underlying changes in learning outcomes, the development of self-efficacy, or shifts in creative climate. Future research may adopt longitudinal designs, experimental approaches, or learning analytics techniques to more precisely reveal how systematic instructional design produces cumulative effects across different stages of the learning process. Second, the sample was drawn primarily from non-native Chinese learners studying at universities in mainland China. Although this group is contextually representative, it may limit the generalizability of the findings. Future studies could expand the research scope to include learners from overseas Confucius Institutes,

international Chinese language programs, or online and blended learning environments, thereby enabling comparisons across different cultural contexts and instructional models regarding the applicability and effectiveness of the ADDIE framework. Finally, although the ADDIE model demonstrated strong effectiveness in this study, language learning is intrinsically interactive and context-dependent. Future research could integrate emerging instructional approaches—such as agile instructional design, project-based learning, or AI-generated content (AIGC)–supported teaching—to explore more flexible and innovative design frameworks. Such developments may further enhance the adaptability and sustainability of international Chinese language education in an increasingly globalized environment.

## Conflict of interest

The authors declare no conflict of interest

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