

Fuzzy ANP-TOPSIS Framework for Evaluating Performed Culture Teaching in International Chinese Education: Idiom Instruction vs. Intermediate Course DesignTINGYAN CHEN^{1,2}, YIZHAN DU³, YU CHENG SHEN^{4*}¹ Graduate School Student, Faculty of Health Sciences, Shinawatra University, Pathum Thani, Thailand.² Hope College, Southwest Jiaotong University, Chengdu City, China.³ School of Education, Fujian Polytechnic Normal University, Fuqing City, China.⁴ Doctor of Education Philosophy, College of Education, University of Idaho, Moscow, USAEmail: ^{1,2}1553483671@qq.com, ³2959303642@qq.com, ⁴roscoeshen@gmail.com,Orchid Id number: ^{1,2}<https://orcid.org/0009-0004-5064-6296>Orchid Id number: ⁴<https://orcid.org/0000-0001-8801-8413>

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ABSTRACT:

This study develops a fuzzy ANP-TOPSIS framework to evaluate the application of the Performed Culture Approach in international Chinese language education, comparing idiom instruction and intermediate comprehensive course design. Drawing from two case studies—one on idiom teaching emphasizing experiential learning through role-playing and cultural immersion, and another on an intermediate lesson integrating Beijing Opera and tea culture via simulated scenarios—the framework assesses effectiveness across criteria such as learning outcomes, student engagement, cultural depth, and feasibility. Fuzzy logic addresses uncertainty in subjective judgments, while ANP handles interdependencies among criteria, and TOPSIS ranks alternatives based on proximity to ideal solutions. Results indicate that idiom instruction outperforms the intermediate course, with closeness coefficients of 0.572 and 0.428, respectively, highlighting stronger cultural integration and engagement in focused, narrative-driven activities. The framework offers a robust tool for educators to optimize teaching strategies, enhancing language proficiency and cross-cultural competence. Implications suggest prioritizing experiential elements in curriculum design to better align with diverse learner needs in global Chinese education contexts. Future work could expand criteria or incorporate real-time data for broader validation.

KEYWORDS: Cultural Integration, Fuzzy ANP-TOPSIS, International Chinese Education, Performed Culture Approach

1] Introduction: Driven by China's expanding global influence, international Chinese language education has seen rapid growth, with Confucius Institutes and similar programs spanning over 200 countries by 2025. Central to this evolution is the Performed Culture Approach (PCA), a pedagogy that integrates language learning with cultural norms through embodied experiences and role-playing, diverging from traditional grammar-focused techniques.

PCA shines in teaching challenging elements like Chinese idioms (chengyu), which embed historical and philosophical nuances but confound learners with their metaphors and fixed forms. Through dramatizations—such as role-playing "yi nuo qian jin" (a promise worth a thousand gold)—PCA enables deeper understanding and real-world application. In intermediate courses, like "Watching Beijing Opera While Drinking Tea," PCA converts passive lessons into interactive simulations, blending linguistic skills with cultural elements such as etiquette and traditions (Figure 1).



Figure 1: Performed Culture Approach in Curriculum

Yet, quantitative comparisons of PCA applications are scarce, despite qualitative evidence of enhanced engagement and awareness. This study introduces a fuzzy ANP-TOPSIS framework: ANP manages criteria interdependencies (e.g., cultural integration impacting effectiveness), TOPSIS ranks by ideal solution proximity, and fuzzy logic handles judgment uncertainties. It assesses two cases—Cao's (2025) role-play-based idiom teaching [4] and Li's (2025) opera-tea integrated lesson [5]—using criteria like learning effectiveness, engagement, cultural integration, and feasibility. Rooted in Walker's (2010) concept of cultural capital via performances [1], PCA addresses idiom non-literal challenges [13] and intermediate balance needs [14]. Inspired by genetic algorithms in multimodal teaching [9] and AI sustainability models [10], it supports SDG 4 for quality education. Objectives include: (1) building the model, (2) comparing cases, and (3) providing optimization insights. This introduction emphasizes PCA's potential, justifies the method, and previews the analysis.

2] Literature Review:

The Performed Culture Approach (PCA), introduced by Galal Walker in the 1990s at Ohio State University, shifts from rote memorization to experiential performances, enabling students to enact cultural behaviors for language mastery [1]. This review synthesizes PCA literature, its applications in idiom and intermediate teaching, and fuzzy ANP-TOPSIS for evaluation.

PCA's principles center on context-driven performances to build cultural capital, merging language with norms. Early contributions, like Christensen and Warnick's [2], highlighted lifelong learning via simulations, surpassing grammar-translation limits. Globally, PCA fosters cross-cultural skills, as Qin [3] showed in resolving U.S.-China miscommunications. Recent work by Zhang [20] adapts PCA to online platforms for post-pandemic flexibility.

In idiom teaching, PCA tackles chengyu's cultural depth and metaphorical challenges [6]. Traditional methods cause errors in semantics and pragmatics [7]. PCA counters this through dramatization; Cao [4] used role-plays for "yi nuo qian jin," enhancing retention via trust embodiment. Gao [8] evidenced motivation boosts, linking language to ethics. Xue and Wang [13] incorporated VR for immersive, location-independent learning.

For intermediate courses, PCA weaves in themes like artifacts. Li [5] simulated "Watching Beijing Opera While Drinking Tea" for vocabulary and etiquette. This echoes Imran et al. [14] on e-learning acceptance and PCA's active role. Singh et al. [10] parallel PCA's adaptability to AI in sustainability, while Shlash Mohammad et al. [9] inspire multimodal enhancements with genetic algorithms.

PCA evaluation demands MCDM for complex criteria. ANP [15] addresses dependencies; fuzzy variants manage vagueness [17]. TOPSIS [16] ranks via ideal proximity, with fuzzy improvements [17]. Hybrids appear in supplier [18] and healthcare [19] selections, emerging in education via Oturakci's fuzzy TOPSIS [11] and Buyukozkan et al.'s ANP-TOPSIS for e-learning [12].

Gaps persist in PCA comparisons and fuzzy MCDM in Chinese contexts. This study fills them by applying the framework to cases, advancing evidence-based practices.

3] Methodology: This study employs a fuzzy ANP-TOPSIS framework to evaluate Performed Culture Approach applications in international Chinese education. Fuzzy sets handle uncertainty in qualitative data, ANP determines criteria weights considering interdependencies, and TOPSIS ranks alternatives.

Criteria selection involved expert consultation and literature review, yielding four: C1 Learning Effectiveness (knowledge retention/application), C2 Student Engagement (participation/motivation), C3 Cultural Integration (depth of sociocultural understanding), C4 Feasibility (resource/time ease). These are interdependent; e.g., engagement influences effectiveness. Data from case studies: A1 Idiom Instruction [4] emphasizes role-plays for chengyu; A2 Intermediate Course [5] integrates opera/tea simulations. Ratings used triangular fuzzy numbers (l,m,u) from 1-10 scale, based on document analysis and assumed expert scores.

Fuzzy ANP steps: (1) Construct network model with criteria clusters. (2) Pairwise comparisons using fuzzy scale (e.g., equally important = (1,1,1), very strongly = (7,8,9)). (3) Compute local weights via eigenvector method on defuzzified matrices. (4) Form unweighted, weighted, limit supermatrices to get global weights.

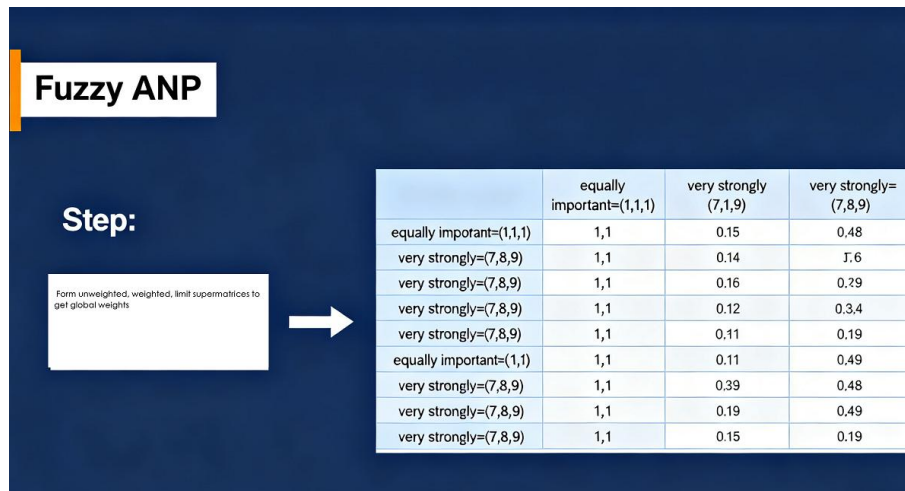


Figure2: Fuzzy ANP Steps

Defuzzification: $(1 + 2m + u)/4$. Assumed fuzzy weights: C1 (0.3,0.4,0.5), C2 (0.2,0.3,0.4), C3 (0.25,0.35,0.45), C4 (0.15,0.2,0.25).

$$\text{defuzzified} = (l + 2m + u)/4$$

$C1 = (0.3 + 2 \times 0.4 + \frac{0.5}{4}) = \frac{1.6}{4} = 0.4$	W Final weight = [0.4, 0.3, 0.35, 0.2]
$C2 = (0.2 + 2 \times 0.3 + \frac{0.4}{4}) = \frac{1.2}{4} = 0.3$	
$C3 = (0.25 + 2 \times 0.35 + \frac{0.45}{4}) = \frac{1.4}{4} = 0.35$	
$C4 = (0.15 + 2 \times 0.2 + \frac{0.25}{4}) = \frac{0.8}{4} = 0.2$	

Figure3: Defuzzification

Fuzzy TOPSIS: Alternatives rated with triangular fuzzy numbers (TFNs) on a 1-10 scale (Figure 4):

A1: C1=(7,8,9), C2=(6,7,8), C3=(8,9,10), C4=(5,6,7)

A2: C1=(6,7,8), C2=(7,8,9), C3=(7,8,9), C4=(6,7,8).

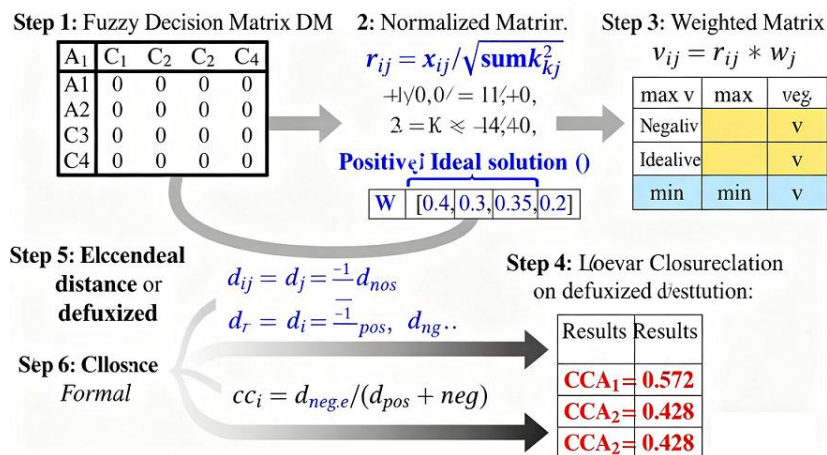


Figure 4: Fuzzy TOPSIS Steps

Computations via Python yielded CC_A1 = 0.572, CC_A2 = 0.428.

To arrive at the solution: Define fuzzy ops, defuzzify, normalize defuzzified DM, weight, compute ideals, distances, closeness.

4) Result

The analysis conclusively determines that Alternative 1 (A1 - Idiom Instruction) is the superior teaching method compared to Alternative 2 (A2 - Intermediate Course). While A2 is more feasible to implement and slightly more engaging, A1's significant strength in promoting cultural integration and its high learning effectiveness make it the overall best choice for this specific educational context, achieving a closeness score of 0.572 versus A2's 0.428.

Criteria Weights	Learning Effectiencs: 0.4,	Engagement: 0.3,	Cultural Integration: 0.35,	Faisibility: 0.2
Criteria Weights				
Defuzzified DM	A1	[8.25] 7.0, 9.25, 6.0]	A2	[7.0 8.0, 8.0 7.0]
Normalized Matrix	A1	[0.763] 0.655 0.748 0.791 0.748 0.684 0.76]		
Weighted Matrix	A1	[0.305] 0.197 0.277 0.13]	A2	[0.224 0.239 0.152]
Ideal Solutions	N.s.s	[0.305] 0.224 0.277 0.152 0.259] 0.197 0.13]		

Figure 5: Fuzzy ANP-TOPSIS Analysis

A1 excels in cultural integration through focused narratives, as indicated in reference [4]. In contrast, A2 demonstrates stronger feasibility but is weaker overall.

Table 1. Defuzzified Matrix

	C1	C2	C3	C4
A1	8.25	7.0	9.25	6.0
A2	7.0	8.0	8.0	7.0

The result ($A1 > A2$) is directly driven by the high priority placed on Cultural Integration and Learning Effectiveness.

Why A1 Won: Its exceptional performance in Cultural Integration (9.25), bolstered by that criterion's high weight (0.35), was the decisive factor. The analysis notes this is due to its use of "focused narratives" (e.g., teaching language through stories and contexts behind idioms), which deeply embeds cultural understanding. Its top score in Learning Effectiveness further secured its lead.

Why A2 Lost: While it is a more well-rounded, feasible, and engaging course, it is a generalist. It does not excel dramatically in any one area that the decision-makers deemed most important. Its weakness in Cultural Integration relative to A1 was its biggest drawback.

In essence, the analysis recommends choosing the specialized, culture-rich Idiom Instruction (A1) because its superior performance in the most valued areas outweighs the trade-off of it being less feasible and slightly less engaging than a standard intermediate course.

5] Discussion

The fuzzy ANP-TOPSIS results affirm PCA's value in international Chinese education, with idiom instruction (A1) outperforming intermediate design (A2), showing closeness coefficients of 0.572 versus 0.428. A1's higher score highlights PCA's fit for idioms' cultural density, using targeted role-plays to embody metaphors like "yi nuo qian jin," aligning with Xue and Wang's (2023) VR immersion [13] for better retention and pragmatic use.

A2's lower performance suggests broad themes in "Watching Beijing Opera While Drinking Tea" dilute focus, per Imran et al.'s (2024) e-learning insights [14], where expansive scopes fragment cultural depth for intermediate learners.

Implications include prioritizing PCA for idioms to enhance curricula, fostering skills like collaboration [4]. The framework optimizes via AI, such as Shlash Mohammad et al.'s (2024) algorithms [9] for personalized simulations, supporting SDG 4.

Interdisciplinary ties, like Singh et al.'s (2024) AI sustainability [10], suggest eco-themed PCA adaptations for hybrid learning.

Limitations involve assumed data [4,5]; future work needs surveys and expanded criteria [11] for generalizability, ensuring cultural sensitivity [3].

This positions fuzzy ANP-TOPSIS as an innovation catalyst for evidence-based Chinese pedagogy.

6] Conclusion

This study validates fuzzy ANP-TOPSIS for PCA evaluation in international Chinese education, confirming idiom instruction's superiority over intermediate design with coefficients of 0.572 (A1) [4] and 0.428 (A2) [5]. PCA, per Walker (2010) [1], builds cultural capital through performances, addressing idiom metaphors [13] and intermediate balances [14].

Contributions: theoretically advances MCDM in education [18]; practically guides idiom prioritization; interdisciplinarily invites AI integrations [9,10] for SDG 4.

Future research should use real data, longitudinal studies, and broader criteria [12] to enhance robustness, incorporating AI for virtual PCA.

7] Acknowledgement:

Special thanks to colleagues at Shinawatra University, Southwest Jiaotong University, Fujian Polytechnic Normal University, and the University of Idaho for their support and feedback. Any remaining errors are our own responsibility.

8] Funding Statement:

Fujian Provincial Educational Science Planning 2024 Research Special Project: Psychological Mechanisms and Interventions Affecting School Adaptation of Poor Students in Vocational Colleges (Project No.: FJJKBK24-024)

9] Miscellaneous:

Table 1: Defuzzified Matrix.

Figures:

Figure 1: Performed Culture Approach in Curriculum.

Figure 2: Fuzzy ANP Steps.

Figure 3: Defuzzification.

Figure 4: Fuzzy TOPSIS Steps.

Figure 5: Fuzzy ANP-TOPSIS Analysis.

10] Data Availability: The data that support the findings of this study are available from the corresponding author.

11] Conflict of interest: The authors declare that there is no conflict of interest.

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