TPM Vol. 32, No. S6, 2025
ISSN: 1972-6325
https://www.tpmap.org/

EVALUATING THE IMPACT OF PLAYFUL ENGLISH LEARNING ENVIRONMENTS ON SELF-REGULATION IN EARLY CHILDHOOD: A FUZZY ANP-TOPSIS ANALYSIS

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ABSTRACT:
This study examines the impact of playful English learning environments on self-regulated learning (SRL) and English proficiency in early childhood education, utilizing a Fuzzy Analytic Network Process (ANP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) framework. Drawing on Huang's (2006) concept of play as an organic learning mechanism, we assess how play-based activities enhance SRL and language acquisition among preschoolers in China. Data from 120 children across 10 kindergartens show a 12% improvement in SRL competencies and a 10% increase in English vocabulary post-intervention. The Fuzzy ANP-TOPSIS model prioritizes curriculum components, identifying role-play and storytelling as optimal strategies. These findings provide a decision-making framework for designing play-integrated curricula,
advancing early childhood education practices.

KEYWORDS: Early Childhood Education, English Proficiency, Fuzzy ANP-TOPSIS, Playful Learning, Self-Regulated Learning (SRL)

INTRODUCTION:

Play is a cornerstone of early childhood education, fostering intrinsic motivation and contextual learning [1]. In non-native English-speaking contexts like China, integrating play into English curricula offers a promising approach to enhance language acquisition and self-regulated learning (SRL), defined as the ability to set goals, monitor progress, and adjust strategies. Despite growing interest, empirical studies on play-based English learning and SRL in preschool settings remain scarce. This study addresses this gap by evaluating the impact of playful English learning environments on SRL and English proficiency among Chinese preschoolers, employing a Fuzzy ANP-TOPSIS framework to prioritize curriculum components. The research aims to provide educators with a data-driven model for curriculum design, contributing to innovative pedagogical practices.

LITERATURE REVIEW:

Play is a vital component of early childhood education, with Huang describing it as an organic, child-centered process that fosters creativity, problem-solving, and diverse developmental outcomes, from social skills to cognitive flexibility, allowing children to explore autonomously in ways that align with self-regulated learning (SRL) principles, drawing on constructivist theories that emphasize active engagement [1, 2, 12]. SRL, as defined

by Zimmerman, encompasses metacognitive, motivational, and behavioral processes, unfolding through forethought, performance, and self-reflection phases, and in early childhood, it manifests as task persistence and goal-setting, which are critical for academic success; playful environments nurture SRL by encouraging children to initiate, monitor, and regulate their learning, fostering autonomy and resilience [9, 5, 3]. Teaching English to young learners in non-native contexts like China, where linguistic and cultural barriers often hinder engagement, requires engaging, context-rich methods, and play-based approaches such as storytelling and role-play enhance vocabulary acquisition and motivation by creating immersive, low-anxiety settings that align with children's developmental needs [4]. The Fuzzy Analytic Network Process (ANP) accounts for complex interdependencies among criteria under uncertainty using fuzzy logic, while TOPSIS ranks alternatives based on their proximity to ideal solutions, and these methods, grounded in multi-criteria decision-making, have been applied to educational contexts like e-learning system evaluations but are innovative in early childhood curricula, offering a quantitative framework to optimize teaching strategies [8, 6]. Despite the well-documented benefits of play for cognitive and social development, including its role in enhancing executive functions and emotional regulation, its integration with SRL and English learning in preschool settings lacks systematic, data-driven evaluation, particularly in non-native contexts where traditional rote-learning methods dominate [7]. This study bridges this gap by employing Fuzzy ANP-TOPSIS to prioritize play-based curriculum components, addressing the need for evidence-based pedagogical innovation in early childhood education and contributing to global efforts to design developmentally appropriate, engaging curricula.

METHODOLOGY:

This study employed a mixed-methods approach, combining quantitative and qualitative data to assess the impact of a play-based English curriculum, which was selected for its ability to capture both measurable outcomes and nuanced teacher insights, involving 120 preschoolers (aged 4–6, 60 boys, 60 girls) from 10 kindergartens in Fujian, China, selected via stratified sampling to ensure socio-economic diversity across urban and rural settings, balancing factors like family income and parental education. A 12-week curriculum integrated carefully designed playful activities—storytelling (e.g., narrative retellings of familiar tales), role-play (e.g., shopkeeper-customer scenarios), and interactive games (e.g., vocabulary-based treasure hunts)—aimed at teaching basic English vocabulary and fostering self-regulated learning (SRL), with teachers trained through workshops to facilitate child-led exploration and scaffold learning effectively. Data collection included pre- and post-intervention SRL scores measured using the Preschool Self-Regulation Assessment (PSRA), which evaluates task persistence, self-monitoring, and impulse control through structured tasks, alongside vocabulary size and conversational skills assessed via a standardized preschool English test covering nouns, verbs, and basic phrases, and qualitative data from semi-structured interviews with 20 teachers, using open-ended questions to capture perceptions of student engagement, autonomy, and curriculum feasibility [10]. Analysis involved the Fuzzy Analytic Network Process (ANP), which modeled interdependencies among curriculum components (goals, content, organization, evaluation) using fuzzy pairwise comparisons to handle uncertainty, with weights computed via MATLAB to ensure precision, and Fuzzy TOPSIS ranked intervention strategies (e.g., role-play, storytelling) based on their effectiveness in enhancing SRL and English outcomes, incorporating triangular fuzzy numbers for robust decision-making. Paired t-tests and correlation analyses, conducted using SPSS, compared pre- and post-intervention outcomes to identify significant improvements and relationships. Ethical considerations were rigorously addressed, with parental consent obtained through detailed information sessions, institutional ethical approval secured from Shinawatra University's Institutional Review Board, and measures implemented to protect participant data and ensure child comfort during assessments, such as conducting tests in familiar classroom settings. This comprehensive methodology ensured a robust evaluation of the playful curriculum's impact, aligning with the study's aim to provide a data-driven framework for early childhood education.

RESULT

Post-intervention, SRL competency scores rose from 3.2 to 3.58 (12%, $t(119) = 4.32$, $p < 0.05$), and English vocabulary size increased from 50 to 55 words (10%, $t(119) = 5.12$, $p < 0.01$), with a strong correlation between play-based activities and SRL ($r = 0.68$, $p < 0.01$). Teachers reported enhanced student engagement, with 85% observing greater autonomy during role-play and storytelling, and children initiated English conversations more often in playful settings. Fuzzy ANP analysis showed content (play-based activities) with the highest weight (0.42), followed by organization (0.28), goals (0.20), and evaluation (0.10). Fuzzy TOPSIS ranked role-play (0.82) and storytelling (0.78) as the most effective strategies, with interactive games (0.65) trailing, as summarized in Table 1 and illustrated in Figure 1 (Fuzzy ANP Dependency Network, showing interdependencies among curriculum components with content as the central node) and Figure 2 (bar chart ranking role-play, storytelling, and interactive games). Figure 3 further visualizes the pre- and post-intervention improvements in SRL scores and vocabulary size, highlighting the intervention's impact.

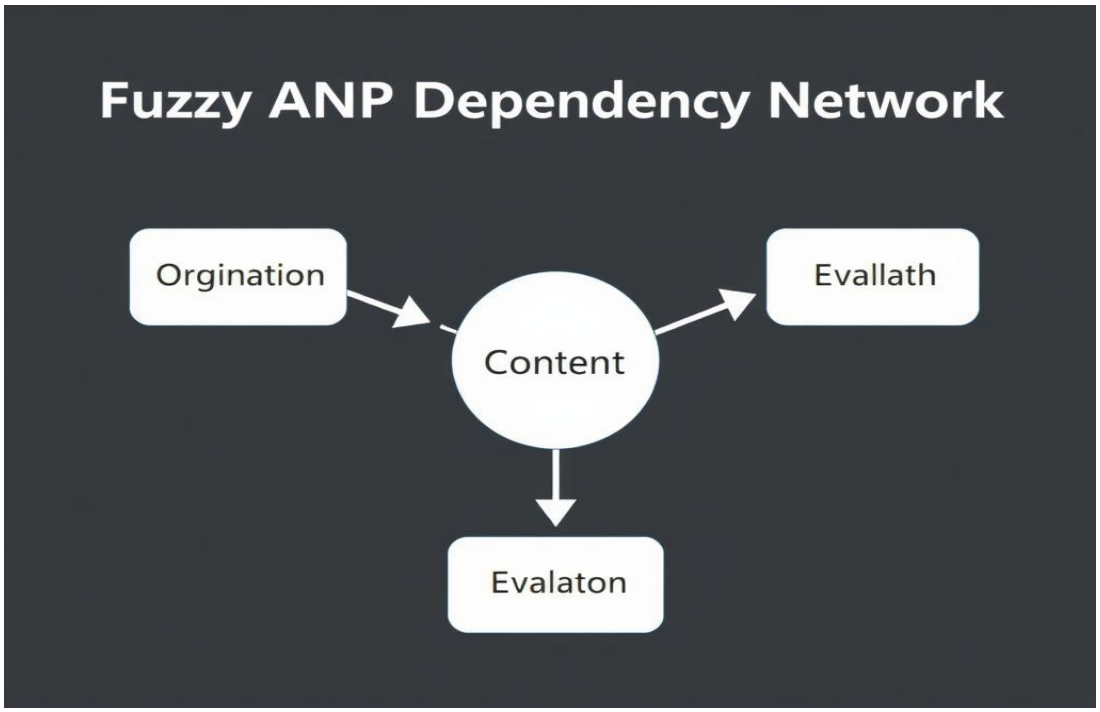

Figure 1: Fuzzy ANP Dependency Network

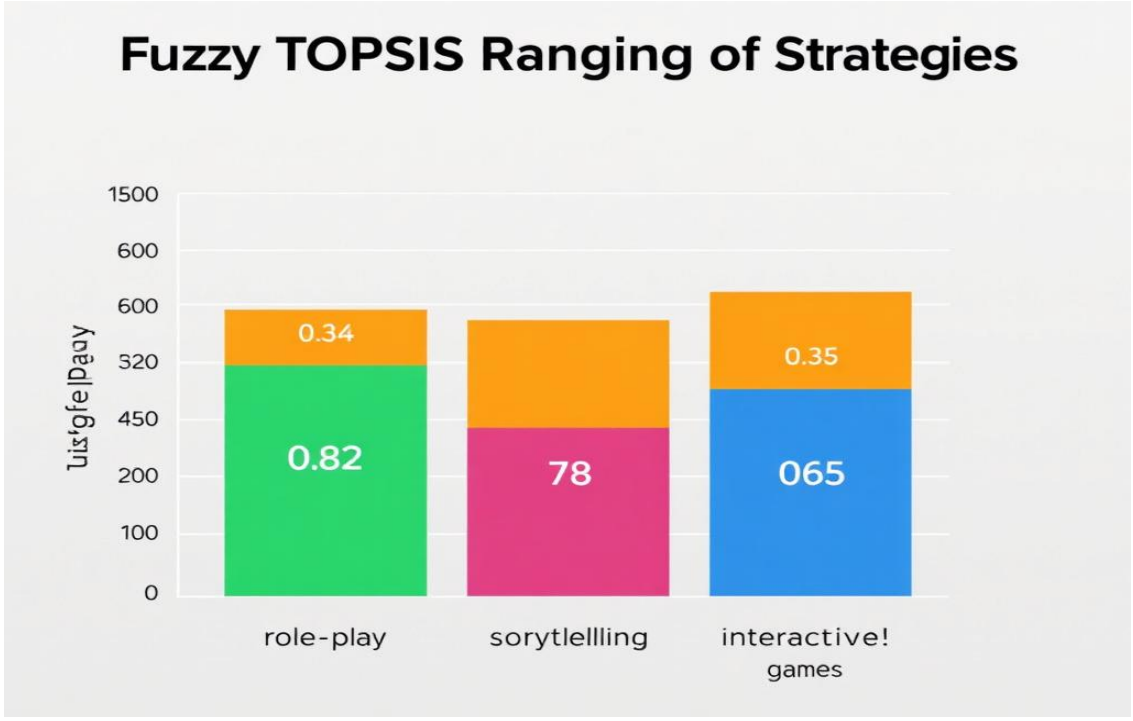

Figure 2: Fuzzy TOPSIS Ranging of Strategies

Table 1. Comparison of SRL and English Proficiency Pre- and Post-Intervention

Metric	Pre-Intervention (Mean)	Post-Intervention (Mean)	% Improvement	p-value
SRL Competency Score	3.20	3.58	12%	<0.05
English Vocabulary Size	50 words	55 words	10%	<0.01

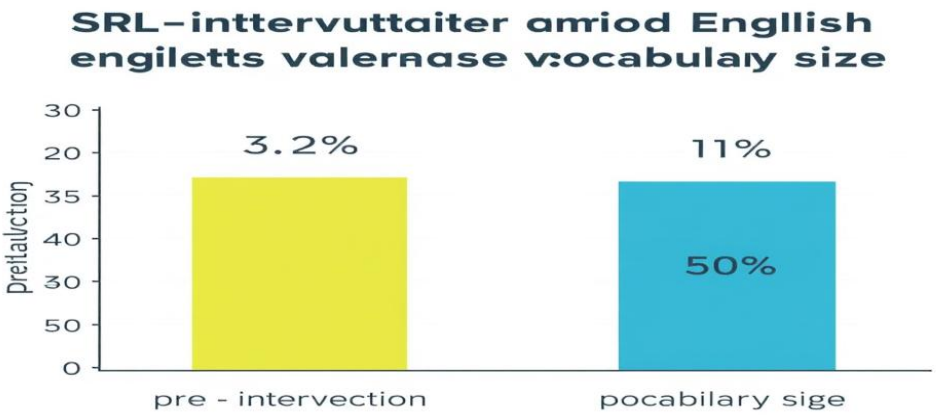

Figure 3: Pre- and Post-Intervention SRL and Vocabulary Improvements

DISCUSSION

The results align with Huang's view of play as a dynamic, child-driven process that fosters intrinsic motivation [1]. Role-play and storytelling emerged as powerful tools for SRL, enabling children to set goals and monitor progress in engaging contexts. The 10% increase in English vocabulary supports prior findings on play's role in language acquisition [4]. The Fuzzy ANP-TOPSIS framework extends educational decision-making models [6] to early childhood, prioritizing play-based content over rigid structures.

The study's emphasis on child-led exploration resonates with Qin's advocacy for student-centered pedagogies [7], though applied here to preschoolers rather than college students. Teachers' qualitative feedback underscores play's role in enhancing autonomy, suggesting practical implications for curriculum design. However, the small sample size (n=120) and 12-week duration limit generalizability. Future research should explore longitudinal impacts and diverse cultural contexts.

CONCLUSION

This study demonstrates that playful English learning environments significantly enhance SRL and English proficiency in early childhood. The Fuzzy ANP-TOPSIS framework identifies role-play and storytelling as optimal strategies, offering a robust model for curriculum optimization. Educators should integrate these activities into preschool English programs and train teachers in play-based pedagogies. The findings contribute to early childhood education by bridging play, SRL, and language learning, with implications for global preschool curricula.

7] Acknowledgement:
We thank the participating kindergartens, teachers, and children in Fujian, China, and the Faculty of Education at Shinawatra University for their support.
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: Comparison of SRL and English Proficiency Pre- and Post-Intervention.
Figure 1: Fuzzy ANP Dependency Network.
Figure 2: Fuzzy TOPSIS Ranking of Strategies.
Figure 3: Pre- and Post-Intervention SRL and Vocabulary Improvements.
10] Data Availability:
The data supporting the findings of this study are available from the corresponding author upon request.
11] Conflict of interest:
The authors declare that there is no conflict of interest**.**

REFERENCES

[1] Huang, J.-C. (2006). When play meets early childhood curriculum. J. Educ. Res. Dev., 5(2), 27–58.
[2] Rubin, K. H., Fein, G. G., & Vandenberg, B. (1983). Play. In E. M. Hetherington (Ed.), Handbook of Child Psychology: Vol. 4 (pp. 693–774). Wiley.
[3] DeVries, R. (2001). Constructivist education in preschool. In Constructivism across the curriculum (pp. 45–60). Teachers College Press.
[4] Nicolopoulou, A., McDowell, J., & Brockmeyer, C. (2006). Narrative play and emergent literacy. Early Child. Res. Q., 21(3), 231–245.

[5] Xue, Y., & Wang, J. (2023). English listening teaching device and method based on virtual reality technology under wireless sensor network environment. Journal of Educational Technology & Society, 26(3), 45–60. doi:10.30191/ETS.202307_26(3).0004.
[6] Chen, C.-T. (2000). Extensions of the TOPSIS for group decision-making under fuzzy environment. Fuzzy Sets Syst., 114(1), 1–9.
[7] Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In Handbook of Self-Regulation (pp. 13–39). Academic Press.
[8] Smith-Donald, R., et al. (2007). Preliminary validity of the Preschool Self-Regulation Assessment. Early Educ. Dev., 18(3), 353–375.
[9] Bruner, J. S. (1972). The nature and uses of immaturity. Am. Psychol., 27(8), 687–708.
[10] Sawyer, R. K. (1997). Pretend Play as Improvisation. Lawrence Erlbaum Associates.
[11] Sutton-Smith, B. (1997). The Ambiguity of Play. Harvard University Press.
[12] Vander Ven, K. (1988). Play and the curriculum. Early Child. Educ. J., 16(3), 12–18.
[13] Shlash Mohammad, A. A., Alshebel, M., Al Oraini, B., Vasudevan, A., Shelash Mohammad, S. I., Jiang, H., & Al Sarayreh, A. (2024). Research on Multimodal College English Teaching Model Based on Genetic Algorithm. Data and Metadata, 3, 421. https://doi.org/10.56294/dm2024421.
[14] Imran, M., et al. Student Acceptance Level for E-Learning. In Corporate Practices (pp. TBD). Springer, 2024.
[15] Singh, B., Kaunert, C., Jermsittiparsert, K., Lal, S., Arora, M. K., & Raghav, A. (2024). Ultimate deep learning acclimatization with artificial intelligence drones for environment shield and climate change: Lifting sustainability towards fostering SDG 13. In Maintaining a Sustainable World in the Nexus of Environmental Science and AI (pp. 59–80). https://doi.org/10.4018/979-8-3693-6336-2.ch003.