

GAME-BASED LEARNING WITH AI TO MAINTAIN THE RIGHT BALANCE

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Abstract:

The integration of artificial intelligence (AI) into game-based learning (GBL) offers adaptive, personalized, and engaging experiences for early language education. AI-powered games can enhance vocabulary, listening comprehension, and speaking confidence through real-time feedback and adaptive difficulty, but raise questions about balancing AI guidance, parental involvement, and child autonomy. Drawing on GBL theory, flow theory, and the input hypothesis, this paper identifies four dimensions of balance—pedagogical, parental involvement, engagement, and child autonomy—and proposes research questions and a conceptual framework for AI-supported game-based microlearning systems for English acquisition among children aged 5–8.

Keywords: Artificial intelligence, game-based learning, early language acquisition, adaptive learning, parental involvement, child autonomy, microlearning, English as a foreign language.

Annotatsiya

Sun'iy intellektning (AI) o'yin asosidagi ta'limga (GBL) integratsiyasi erta til ta'limi uchun moslashuvchan, individuallashtirilgan va qiziqarli imkoniyatlar yaratadi. AI asosidagi o'yinlar real vaqtdagi fikr-mulohaza va moslashuvchan qiyinlik orqali lug'at boyligi, tinglab tushunish va gapirish ishonchini oshiradi, ammo AI yordami, ota-onalar ishtiroki va bolaning mustaqilligi o'rtasidagi muvozanat masalasini keltirib chiqaradi. O'yin asosidagi ta'lim nazariyasi, oqim nazariyasi va kirish gipotezasiga tayangan holda, maqolada to'rtta muvozanat o'lchovi — pedagogik, ota-onalar ishtiroki, jalb qilish va bolaning mustaqilligi — aniqlanadi hamda 5–8 yoshli bolalar uchun AI qo'llab-quvvatlaydigan o'yin asosidagi mikro-ta'lim tizimlariga oid tadqiqot savollari va kontseptual asos taklif etiladi.

Kalit so'zlar: sun'iy intellekt, o'yin asosidagi ta'lim, erta til o'zlashtirish, moslashuvchan ta'lim, ota-onalar ishtiroki, bolaning mustaqilligi, mikro-ta'lim, chet tili sifatida ingliz tili.

Аннотация

Интеграция искусственного интеллекта (ИИ) в игровое обучение (GBL) открывает адаптивные, персонализированные и увлекательные возможности для раннего языкового образования. Игры на основе ИИ улучшают усвоение словарного запаса, восприятие речи на слух и уверенность в говорении благодаря обратной связи в реальном времени и адаптивной сложности, однако поднимают вопросы баланса между руководством ИИ, участием родителей и самостоятельностью ребёнка. Опираясь на теорию игрового обучения, теорию потока и гипотезу входного материала, статья выделяет четыре измерения баланса — педагогическое, участие родителей, вовлечённость и самостоятельность ребёнка — и предлагает исследовательские вопросы и концептуальную основу для систем микрообучения на базе ИИ для детей 5–8 лет.

Ключевые слова: искусственный интеллект, игровое обучение, раннее овладение языком, адаптивное обучение, участие родителей, самостоятельность ребёнка, микрообучение, английский язык как иностранный.

Introduction

Advances in artificial intelligence (AI) have transformed how children learn, particularly through game-based learning (GBL), which embeds educational content within game mechanics—points, levels, challenges, rewards—to sustain attention and is linked to stronger knowledge retention and positive attitudes toward learning (Plass et al., 2015).¹ AI adds adaptive pathways, real-time feedback, and personalized recommendations; in language learning, speech recognition, natural language processing, and generative models enable interactive speaking practice previously unavailable in traditional settings (Pokrivčáková, 2019).²

The Integration of AI Tools into Game-Based Learning

AI contributes to GBL across three domains. For knowledge and skills, AI-integrated games continuously assess performance and adjust difficulty in real time, speech recognition gives immediate, non-judgmental feedback that reduces speaking anxiety, and generative models produce age-appropriate stories and dialogues that supply comprehensible input.

For engagement, gamification elements provide reinforcement, narrative immersion gives meaningful context for language use, and adaptive difficulty maintains the challenge–skill balance central to Csikszentmihalyi's (1990)³ Flow Theory, keeping learners within their Zone of Proximal Development (Vygotsky, 1978).⁴

¹ Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. *Educational Psychologist*, 50(4), 258–283.

² Pokrivčáková, S. (2019). Preparing teachers for the application of AI-powered technologies in foreign language education. *Journal of Language and Cultural Education*, 7(3), 135–153.

³ Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. Harper & Row.

⁴ Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

For personalization, AI sequences content based on accuracy, response time, and error patterns, ensuring tasks match each child's level (Cheng & Wang, 2022);⁵ this matters because children aged 5–8 vary widely in language exposure.

The Balance Challenge: AI, Parent, and Child

Integrating AI into GBL raises questions about balance across four dimensions.

Pedagogical balance: AI scaffolding must support learning without creating dependency; systems should be “semi-proactive,” helping when needed while stepping back to allow independent exploration (Puntambekar & Hübscher, 2005).⁶

Parental involvement balance: parental involvement supports language development (Sénéchal & LeFevre, 2002),⁷ but excessive intervention can undermine autonomy (Grolnick & Pomerantz, 2009);⁸ AI should position parents as facilitators, not instructors.

Engagement balance: gamified rewards must be calibrated so that extrinsic motivators do not crowd out intrinsic interest (Deci et al., 1999).⁹

Child autonomy balance: AI should gradually release responsibility as skills develop, supporting self-regulated learning.

Research Gap and Questions

Limited empirical research addresses the developmental appropriateness of AI features for children aged 5–8, the optimal balance between AI guidance, parental involvement, and child autonomy, and design principles that sustain engagement. These gaps motivate the following research questions:

1. RQ1: How can game-based microlearning address the developmental characteristics of learners aged 5–8?
2. RQ2: What AI features best balance scaffolding and autonomy in game-based language learning?
3. RQ3: How does AI integration affect vocabulary acquisition, listening comprehension, and speaking confidence?
4. RQ4: How can AI systems support parental involvement without replacing it?
5. RQ5: What design principles support appropriate balance across pedagogical, relational, and developmental dimensions?

The aim of this study is to design, implement, and evaluate an AI-supported game-based microlearning system for early English acquisition, delivered in short, home-based, parent-assisted sessions for children aged 5–8, and to derive design guidelines for future systems.

⁵ Cheng, Y., & Wang, S. (2022). Adaptive learning technologies for young language learners. *Journal of Educational Computing Research*, 60(3), 601–625.

⁶ Puntambekar, S., & Hübscher, R. (2005). Tools for scaffolding students in a complex learning environment: What have we gained and what have we missed? *Educational Psychologist*, 40(1), 1–12.

⁷ Sénéchal, M., & LeFevre, J. A. (2002). Parental involvement in the development of children's reading skill: A five-year longitudinal study. *Child Development*, 73(2), 445–460.

⁸ Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives*, 3(3), 165–170.

⁹ Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627–668.

Methodology

This study will use a mixed-methods, quasi-experimental pre-test/post-test design, with parent interviews and usage logs to examine engagement and the AI–parent–child balance.

Participants will be approximately 40–60 children aged 5–8 and their parents, divided into an experimental group (adaptive AI-supported system) and a comparison group (non-adaptive version of the same content).

Data will come from vocabulary, listening comprehension, and speaking confidence measures, usage logs, and a parent questionnaire with follow-up interviews, over a six-week intervention. Quantitative data will be analyzed with t-tests (or ANCOVA) and qualitative data thematically; ethical approval and informed parental consent will be obtained.

Expected Outcomes

The experimental group is expected to show greater gains in vocabulary, listening comprehension, and speaking confidence, and higher engagement, than the comparison group, consistent with prior findings on adaptive AI-supported learning (Tsai et al., 2021; Cheng & Wang, 2022).¹⁰ Qualitative data are expected to reveal both reduced instructional burden and concerns about reduced parental involvement. These outcomes remain hypotheses to be tested empirically.

Conclusion

This paper has examined how AI can enhance knowledge and skills, foster engagement, and personalize game-based learning for early English acquisition, while raising the challenge of balancing AI guidance, parental involvement, and child autonomy. The framework and research questions are intended to guide future empirical work with children aged 5–8; although no empirical findings are reported yet, the paper lays the groundwork for a study implementing and evaluating an AI-supported game-based microlearning system.

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