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Investigating How Inclusive Intercultural Strategies Influence Immigrant Children's Language Acquisition Efficiency

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Abstract. As the global immigrant population continues to grow, immigrant children face the challenges of language gap, acculturation, and communicative anxiety in the process of language acquisition. To cope with this problem, this study used a quasi-experimental design to assist the experimental group with a 12-week English language teaching intervention by introducing an AI multilingual story generation, semantic translation engine, and voice conversation simulation system. Data were collected using a mixed-methods approach with multi-layer validation. The results show that the experimental group significantly outperforms the control group in terms of language proficiency, cultural adaptation and classroom participation, and the feedback and behavioral data provided by the AI system provide critical support for teaching personalization, cultural empathy and output quality optimization. The study validates the potential of the AI-enabled inclusive education model in multilingual environments and provides empirical evidence for language teaching and education policy making.

Keywords: Immigrant children, Language acquisition efficiency, Intercultural strategies, AI-assisted instruction

1. Introduction

With the increase in global migration, more and more children are growing up in non-native language environments, where linguistic barriers, cultural adaptation difficulties, and lack of motivation for learning have become major obstacles to their language acquisition. Traditional language teaching often ignores the impact of cultural context on learning efficiency. In recent years, intercultural education and inclusive teaching strategies have been gradually emphasized, and the introduction of multicultural elements in the classroom, the creation of an atmosphere of respect and trust, and the encouragement of cross-cultural exchanges are believed to be helpful in enhancing immigrant children's language proficiency and cultural adaptability [1]. Taking immigrant children in elementary school as the target group, this study adopts a mixed-method approach combining standardized tests, classroom observation and interviews to comprehensively analyze the mechanism of the role of inclusive cross-cultural strategies in the efficiency of language acquisition, cultural adaptation, and teacher feedback, with the aim of providing empirical evidence and practical suggestions for language teaching in the context of multicultural education.

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2. Literature review

2.1. Intercultural education and language acquisition

In terms of language acquisition, research has shown that students are more likely to be emotionally engaged in language learning activities when their cultural identities are respected and given positive meaning in the classroom [2]. Language ceases to be a training of isolated skills and becomes a tool for cultural interaction. Especially in multilingual environments, intercultural competence constitutes a language strategy in its own right, enabling students to build frameworks of understanding more effectively through contextualized language input [3]. Based on this, intercultural education not only provides students with a context for language input, but also provides a real-life linguistic environment for language output, forming an effective cycle of input-interaction-output [4].

2.2. AI-supported pathways of inclusive education strategy

At the level of instructional design, teachers can utilize AI multilingual picture book platforms and AI story generation tools to automatically generate multilingual cultural stories that match students' cognitive levels according to their cultural backgrounds, enhancing students' empathy for the cultural content of the classroom [5]. AI-assisted translation tools and semantic guidance systems can help students with different language backgrounds communicate effectively and avoid interaction barriers due to language mismatch [6]. At the same time, the AI can also recommend subject-related native language materials or complementary cultural content in real time, supporting students to understand each other's cultural differences in a collaborative manner [7].

2.3. Measurement methods of language acquisition efficiency

Standardized language tests are generally used to assess changes in listening, speaking, reading and writing skills, such as the commonly used CELF and Peabody Diagramming Word Test, which can provide quantitative indicators of students' language level at different stages [8]. Meanwhile, the Classroom Participation Observation Scale (CPOS) can reflect students' language application skills and self-confidence performance in actual communication. In addition, fluency, error rate and grammatical complexity are also important parameters for assessing students' language output. Combining these measurement dimensions not only captures objective changes in language skill enhancement, but also helps to understand the potential impact of teaching strategies on students' motivation and frequency of language use.

3. Methodology

3.1. Experimental design

This 12-week quasi-experimental study examined the impact of inclusive intercultural strategies on the language acquisition of 60 immigrant children. The experimental group received instruction integrating cultural content and collaborative tasks, while the control group followed standard teaching without intercultural elements.

The experimental group introduces AI support mechanisms based on regular teaching, integrating cultural input and technology enhancement strategies. Teachers customize cultural texts through the AI multilingual story generation platform to improve students' cultural empathy and language

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understanding. Collaborative sessions use AI semantic translation tools to facilitate cross-language communication and task completion. In the oral training, the voice interaction AI system is introduced to simulate the cultural contexts and improve the naturalness of expression and pragmatics, and the AI platform records the students' language output and interactive behaviors to provide data support for teaching feedback and differentiated instruction. Al-Supported Inclusive Education Modfor Language Development is shown in Figure 1.

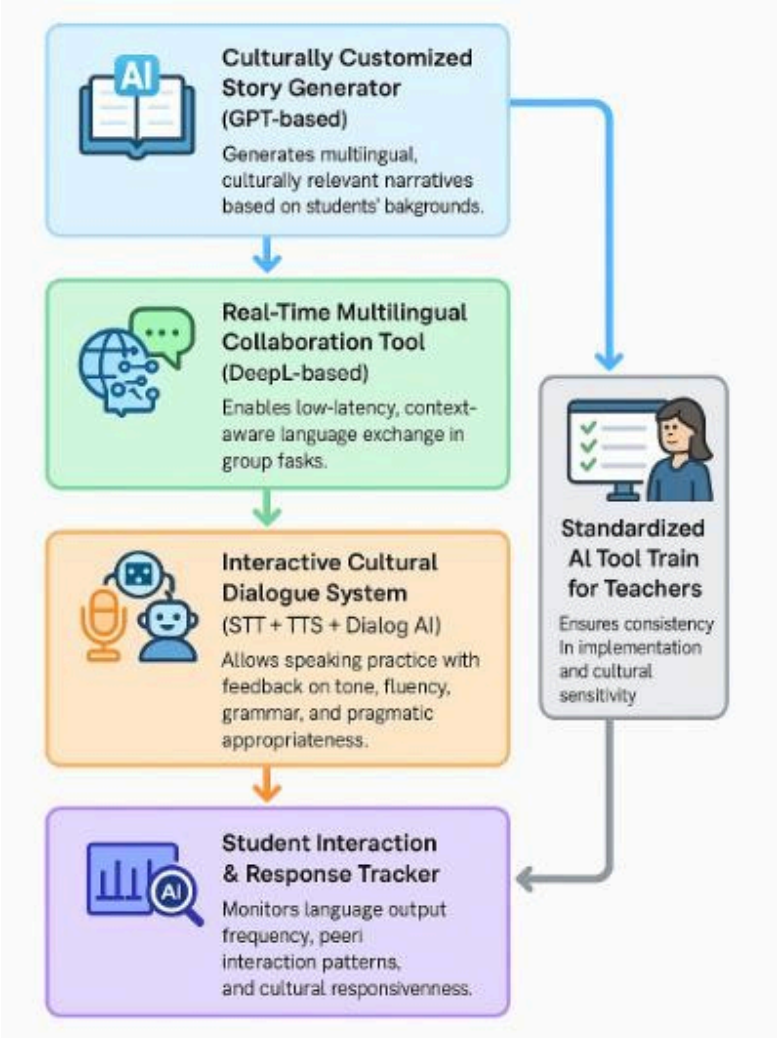

Figure 1. Al-supported inclusive education modfor language development

3.2. Quantitative method

3.2.1. Instruments and measures

The language test was administered in Week 1 and Week 12. Classroom participation was rated biweekly by two independent observers. Weekly writing tasks were scored across three dimensions, grammatical accuracy, lexical diversity, and task completion. The measurement questionnaire is shown in Table 1.

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Table 1. Measurement tools

Measure	Tool	Frequency	Description
Language Proficiency Score	CELF-5 Standardized Test	Week1 & Week 12	Assessment of listening, speaking, reading, and writing
Classroom Participation	Five-Level Participation Rubric	Biweekly	Observation of voluntary speech, questioning, and engagement
Writing Performance	Teacher Rubric	Weekly	Scoringbasedonaccuracyand linguistic complexity

3.2.2. Data analysis techniques

Data were analyzed using SPSS 28.0. Paired-sample t-tests assessed pre- and post-test language proficiency within each group, while independent-sample t-tests examined between-group differences in post-test results. The paired t-test was computed as:

$$t = \frac{\bar{D}}{S_D / \sqrt{n}} \tag{1}$$

Where $\bar{D}$ is the mean of score differences, sD is the standard deviation of differences, and nnn is the sample size. The experimental group's mean score increased significantly from 61.4 to 82.7 ($t = 11.24$, $p < 0.001$), while the control group rose from 62.0 to 70.2 ($t = 4.31$, $p = 0.029$), demonstrating a strong treatment effect.

To control for individual differences and reinforce robustness, a multiple linear regression model was employed:

$$Y_i = \beta_0 + \beta_1 \cdot T_i + \beta_2 \cdot X_{i1} + \beta_3 \cdot X_{i2} + \varepsilon_i \tag{2}$$

Where Yi represents language score gains, Ti indicates group assignment, and Xi1,Xi2 are control variables (e.g., cultural background, pre-test score). The model showed that the treatment variable was significantly associated with score gains ($\beta_1 = 0.52$, $p < 0.001$), with R2=0.41R^2 = 0.41R2=0.41, confirming the explanatory power of inclusive strategies in improving language acquisition.

3.3. Qualitative method

3.3.1. Interview design and procedure

To examine the psychological and interactional mechanisms of inclusive intercultural strategies, semi-structured interviews were conducted with 26 participants, including students, teachers, and parents. Topics covered emotional classroom experience, language confidence, cultural identity, and perceptions of the strategy. Interviews were mainly in English with mother tongue support, lasting 15–30 minutes.

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3.3.2. Observation protocol

Classroom observations took place twice weekly over 12 weeks, with each session lasting 45 minutes. The classroom observations are shown in Table 2.

Table 2. Classroom observation rubric

Dimension	Rating Scale	Frequency	Method
Verbal Participation	0 = None, 1 = 1–2, 2 = 3–4, 3 = ≥5 times	Twice weekly	Counted per lesson
Peer Interaction	0 = None, 1 = Passive, 2 = Responsive, 3 = Initiating	Twice weekly	Group interaction recorded
Target Language Use	0 = <30%, 1 = 30–59%, 2 = 60–79%, 3 = ≥80%	Twice weekly	Ratio of English use to total verbal behavior
Cultural Responsiveness	0 = Avoid, 1 = Neutral, 2 = Engaged, 3 = Proactive	Twice weekly	Response to multicultural content
Task Engagement	0 = Off-task, 1 = Minimal, 2 = Adequate, 3 = Fully	Twice weekly	Rated based on participation in assigned tasks

3.3.3. Thematic analysis and coding

Qualitative coding was conducted using NVivo 14, with open coding followed by axial coding to summarize six core themes, “Decreased language anxiety,” “Increased cultural identity,” “Diversification of interaction patterns,” “Increased teacher cultural sensitivity,” “Changes in home language practices,” and "Positive feedback mechanisms for classroom participation. “, ”Increased cultural sensitivity of teachers“, ”Changes in home language practices“ and ”Positive feedback mechanisms for classroom participation". These themes are closely related to the changes in the learning environment after the implementation of inclusive strategies, reflecting the multilevel impact of the strategies.

4. Results

4.1. Changes in language proficiency

The total language score of the experimental group improved by nearly 20 points, grammatical accuracy increased by 28%, TTR increased from 0.42 to 0.61, and the usage rate of compound sentences went up from 13% to 31%. the AI composition analysis showed a significant increase in syntactic complexity and frequency of connective use, and the feedback from the speech system showed a smoother speed of speech and an increase in intonation naturalness by 1.6 points, which verified the facilitating effect of the AI training on the quality of language output.

4.2. Improvement in cultural adaptation

According to the interview data, 83% of the students in the experimental group indicated that they were more willing to speak in the classroom, and that the teacher's reference to their mother's cultural elements enhanced the sense of classroom identity. The AI behavioral data tracking system further reveals that after the introduction of culturally generated texts, the frequency of students' language output on cultural topics such as “family,” “festivals,” and “traditional food” has increased

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significantly, with the average number of active expressions per lesson increasing from 3.2 to 7.8. This reflects that AI technology not only enhances the accessibility of language communication, but also promotes the confidence and mobility of cultural expression.

4.3. Feedback from teacher observations

Teachers believe that AI technology has improved student engagement and emotional stability. the AI voice system records show a significant increase in the number of active speeches by otherwise anxious students. Automatically generated culturally annotated materials and behavioral logs assisted teachers in adjusting grouping strategies, accurately intervening with low-engagement students, and optimizing the instructional feedback mechanism.

5. Discussion

AI-supported inclusive cross-cultural teaching strategies significantly improve immigrant children's language output complexity, cultural adaptability, and classroom participation.The AI system builds a closed loop of “input-interaction-feedback” teaching, and speech and text analysis assists in the development of pragmatic skills. The AI system constructs the closed loop of teaching “input-interaction-feedback”, speech and text analysis assists in the development of language proficiency, and the customized cultural text enhances students' cultural belonging and willingness to express themselves.

6. Conclusion

This study systematically examined the positive impact of inclusive cross-cultural strategies on immigrant children's language acquisition efficiency, and the results showed that the strategies significantly enhanced language skill levels, cultural competence and classroom participation. This study not only provides educators with actionable pedagogical recommendations, but also provides empirical support for future language education policy development.

Contribution

Ye Li and Weihang Zhang contributed equally to this paper.

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