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Transforming Immersion Education through AI-Driven Learning: A Descriptive Qualitative Study Investigation of Leadership Strategies for Scalable Program Development and Optimized Student Outcomes

By

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Abstract

Grounded in transformational leadership theory, the technology acceptance model, and constructivist learning theory, this descriptive qualitative research study explores principals' strategic leadership practices in optimizing student outcomes through AI-powered learning like ChatGPT in US-based Chinese immersion programs. We conducted in-depth interviews with 12 principals through purposive and snowball sampling to gain insights into their leadership strategies. We found three significant strategies for leaders to foster school success: employing data to enhance teaching practices, promoting a positive school culture to engage the community, and implementing research-based practices to support culturally responsive teaching. Additionally, we identified strategies for scalable program development and optimizing student outcomes, including achieving proficiency in language and core subjects, leveraging cultural exposure and cognitive development, and engaging students through culturally relevant content. This study fills in the gap in the literature by providing intersection insights of strategic leadership, AI-powered learning, and Chinese immersion education for student learning outcomes and school effectiveness. Findings offer significant implications for leaders, policymakers, scholars, and practitioners to leverage AI-powered learning in immersion education settings.

Keywords: *Immersion Education, AI-Driven Learning, Leadership Strategies, Student Outcomes, Educational Leadership, Qualitative Research*

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Introduction

Rapidly developing AI technology has accelerated the innovative application of learning, providing a new field of personalized learning and an opportunity to improve learners' performance (Yun, Lee & Choi, 2025). Immersion education is believed to be a fertile ground for applying AI technology, providing personalized language learning and a fully immersed cultural experience (Lu et al., 2024). However, immersion program leaders face unique challenges in leveraging AI technology in their programs, including lack of technology knowledge and infrastructure, inequity, and access. While the interest in AI-powered learning has increased, there is still an urgency for research investigating the

role of AI, immersion education, and leadership (Zhang & Xie, 2024).

Previous studies found that AI-based tools offer new opportunities for personalized learning with data-driven approaches for student learning outcomes. For example, machine learning enables students and educators to meet specific needs with customized solutions. Personalized learning plans can be developed to accommodate individual learning preferences (Zhang, 2024). For instance, AI-powered communication channels are well capable of offering expert-like support. Lu et al. (2024) stressed that AI can enhance medical education by improving diagnostic accuracy and personalized treatments while addressing ethical challenges that may impact learners' autonomy. The technology acceptance model



(TAM) underpins the increasing use of AI in facilitating customized learning and real-time feedback, as demonstrated by Li et al. (2025). Their study underlines AI's ability to simplify complex concepts through interactive step-by-step teaching and real-life applications. Since the launch of ChatGPT in 2022, its application has become widespread, with its use in education assisting students in clarifying concepts and solving problems (Zhang, 2024).

However, challenges arise when students overly rely on AI without engaging in the learning process (Li et al., 2025; Zhang, 2024). In response to the challenge of using AI in education, Li et al. (2025) suggested that principals encourage teachers to use an inquiry-based learning approach that encourages active involvement, discovery, and exploration, where students acquire knowledge through questioning and experimenting, which is in line with the use of AI to achieve deeper learning. Geerts et al. (2024), AI in training programs and organizational leadership, where an evidence-based approach can both integrate and support AI (Feng, 2025; Zhang, 2024). The data from 484 EFL students shows that AI can effectively assist in writing, reducing cognitive load and improving writing performance. AI also offers personalized comments and adaptive learning opportunities for teachers to create a personalized learning module for students toward their learning goals, such as critical thinking and problem-solving competency (Zhang, 2023).

In particular, language immersion programs provide great opportunities for teachers creating inclusive learning environments that cater to different language learners' learning style and learning outcomes. Harvey and Wong (2024) found that Chinese immersion programs promote bilingualism and biliteracy, with students gaining competence in Mandarin and tests. Though most research focuses on Spanish-language settings, Duncan et al. (2024) argue that immersion programs provide a good way to serve minority students, leading to positive reading, writing, and math scores. They also enhance language skills by promoting shared inquiry and civic engagement. Pederson et al. (2022) defined immersion as the core strategy that promotes meaningful experiences through learning about, living in, and making sense of challenging issues, reflecting on these issues, and considering different points of view. Meerts-Brandsma et al. (2024) found that immersion programs strongly influence the academic activities and meaningful experiences that generate learning.

Although AI-powered learning has been shown to improve student outcomes, how AI-powered learning is applied in immersion education has not been thoroughly explored. (Li et al., 2025; Geerts et al., 2024; Zhang, 2023). This study contributes to this knowledge gap by exploring how principals leverage AI-powered learning to improve student outcomes in immersion programs, where effective language education and cultural competency are highly demanded. This study will investigate the immersion program leaders' experience creating AI-powered learning environments that support student language learning and scale up Chinese immersion programs. Therefore, this study aims to explore the following primary research questions: How do immersion

program leaders describe and interpret their experiences in creating AI-driven learning environments to promote student language proficiency and scalability in Chinese immersion programs? The three secondary research questions are:

1. What specific leadership strategies facilitate the effective integration of AI-powered learning in immersion education?
2. How do these strategies enable scalable program development in AI-powered immersion education?
3. What leadership strategies optimize student outcomes in AI-powered immersion education?

More specifically, the three theories were key to the study as the transformational leadership theory helps guide the study concerning how school leaders inspire and motivate educators to adopt new practices such as AI-driven learning (Bass, 1985). Second, TAM assists the survey in examining the factors that influence educators who accept and use AI tools, which include the perceived usefulness and ease of use (Davis, 1989). The constructivist learning theory framework allows the study to explore designing AI-driven learning environments to empower active student-centered learning experiences. This theory is closely related to the inquiry-based learning approach, which includes students actively constructing knowledge by interacting with AI tools. The findings of the research questions in the study will provide relevant insights into how leadership can make a difference in language immersion education, especially in Chinese immersion programs. The findings will also inform effective leadership practices that help to integrate AI tools and contribute to the conversation around leadership in education and technology. Ultimately, the study enhances the quality of education, students' lifelong learning, and school sustainability in a rapidly evolving world.

Literature Review

AI-based education has attracted attention, and research shows that AI can improve the effects of students' and educators' learning experiences and make assessments more efficient and effective (Yun et al., 2025). In addition, AI has been applied to developing the immersion education program to support personalized language instruction and cultural immersion (Li et al., 2025). Immersion education can also benefit from AI-driven innovations that provide tailored language instruction and cultural immersion experiences (Lu et al., 2024). Research also emphasizes the importance of leadership in facilitating AI integration in education (Geerts et al., 2024; Hallinger, 2023). Effective leadership can create a culture of innovation, provide resources and support for AI adoption, and encourage collaboration among educators (Brauer, Ormiston, & Beausaert, 2024). However, few studies have investigated the leadership strategies used by immersion program leaders to integrate AI-based learning environments. This literature reflects three significant themes: the use of AI for educational leadership strategy in immersion education, scalable program development, and optimizing student outcomes.

AI in Educational Leadership

The integration of AI in educational leadership is multi-disciplinary. According to Montuori (2013), creative problem-solving involves combining different methodologies. Trans-disciplinarity is an important characteristic of leadership to consider, given the need to expand learning. Based on this perspective, Brauer, Ormiston, and Beusaert's (2024) transdisciplinary systematic literature reviews 58 peer-reviewed empirical studies from all disciplines. They identified 22 themes grouped into six over-arching dimensions of fostering creativity: (1) affective, (2) cognitive, (3) behavioral, (4) metacognitive, (5) creativity-in-action, and (6) uncertainty. This study supports the need for a trans-disciplinary approach to integrating AI tools to enhance learning. Rosiek et al. (2024) study indicates that the influence of indigenous and Black thought on educational philosophies indicates that leadership should incorporate diverse perspectives in the classroom. In the case of immersion education, diversity in leadership is important for cultural understanding. This is supported by Petticrew and Roberts's (2008) systematic review framework for understanding the integration of AI tools with support from Brauer et al. (2024), indicating the need for adaptation in AI integration in immersion education. This is with evidence-based practices. Shams, Steffensmeier, and Wefald (2024) indicated that educational leaders needed to use adaptive leadership with visualization to provide a deeper understanding of the most important studies in education. Visualization of the studies is important for leaders to see the intellectual landscape better and adopt AI for leadership. Bray's (2023) randomized controlled crossover design study provided an inductive thematic approach. Inductive thematic analysis allows for a deeper understanding of the data. Therefore, the need for a transdisciplinary approach to integrating AI in leadership is supported by the need for a blend of diverse perspectives and evidence-based practices from different fields of study. Visualization tools and thematic analysis support AI's integration into education leadership strategies.

Scalable Program Development

AI tools can be developed according to the conceptual framework for scalable program development as they identify the external forces that shape the contents and strategies in education (Garfield & Merton, 1979; Zhang, 2023). Bibliometric analysis (Ding et al., 2000; Hallinger, 2023; Zhang, 2023) can be used to trace the research evidence of the evolution of the field of education in order to develop the AI program for scalability by identifying the significant contribution works. Using the bibliometric analysis tool, as suggested by Chen et al. (2023), the intellectual structure of the field of education can be uncovered, contributing to the development of the AI program for scalability. In addition, the thematic analysis (Braun & Clarke, 2006; Bray et al., 2021; Zhang, 2023) can identify the emerging themes in education for scalability

by identifying the key areas of impact and challenges. Educational leaders can analyze the contextual school data for students' learning outcomes and school effectiveness with the help of thematic analysis. By using the thematic analysis of the 663 articles published from 1961 to 2024, the major four findings of AI were identified in the 663 articles published by Yun, Lee, and Choi (2025), which include AI in education and educational technology, AI in learning environment, AI enablers and human learning were identified. The findings identified AI as a tool for scalable program development for the educational leader when measured using AI tools. Therefore, developing a scalable program requires a conceptual framework, bibliometric analysis, and thematic analysis to identify the key findings and influential works. Therefore, the visualization tools assist in developing a scalable program for using AI.

Optimizing Student Outcomes

AI plays an important role in optimizing student learning outcomes through student-centered learning and personalized and innovative educational pedagogical practices (Yun et al., 2025). Cheng and Li (2024), in their review of papers from 2012 to 2022 on the three issues of educational equity, rural education, and educational reform, also suggested that educational leaders need to address learning outcomes and provide tailored support to diverse student populations and equitable resource and opportunities for student learning outcomes. Voltante, Deluca, and Klinger (2023) suggested that AI presents opportunities for assessment reform toward authentic tasks and AI for meaningful feedback and critical and creative thinking skills to optimize student learning outcomes. In addition, Bray et al. (2023) suggested that educational leaders need to use thematic and bibliometric analysis supported by Hallinger (2023) to identify the relationship between education and technology and what education trends reflected in the accurate data for optimizing student learning outcomes. This was supported by Yun et al. (2024) in their bibliometric review of literature analysis. They suggested that educational leaders need to use AI for student learning outcomes by optimizing programs applied in an ongoing progressive assessment. Therefore, AI plays an important role in optimizing student outcomes through student-centered learning, educational equity, and authentic assessment. Using thematic and bibliometric analysis helps educational leaders discover educational trends and needs for developing AI in optimizing programs to meet student learning goals.

Overall Insights

The literature review in this study highlighted how AI tools could be integrated into leaders' visions of immersion education for better student learning outcomes. However, the need for transdisciplinary approaches to AI integration to foster students' creativity and innovation was missing. While AI's potential for personalization in various settings was mentioned, research targeting how AI can deepen student-centered learning and authentic assessment in immersion education is limited. Hence, this study should be further explored.

Methodology



Overview Research Design

A descriptive qualitative research study, which relies on descriptions of experiences, practices, and perceptions to help convey an impression of reality, was employed in this study to answer the research question, which was, how do immersion program leaders describe and interpret their experiences to create AI-driven learning to promote student language proficiency and scalability in Chinese immersion programs (Bogdan & Biklen, 2007; Creamer, 2025; Zhang & Koshmanova, 2022). Descriptive qualitative research design will be appropriate for this study because the participants' experiences, practices, and perceptions will be described and interpreted (Creswell, 2015). The descriptive qualitative research design study aims to obtain information about how immersion program leaders' experiences, practices, and perceptions influence their daily decisions to nurture AI-driven learning (Silverman, 2013; Zhang & Koshmanova, 2022). In this descriptive qualitative study, the interpretation of the answers may help answer the qualitative research question. The answers will be interpreted to describe the experiences, practices, and perceptions of the immersion program leaders to foster school effectiveness and student learning outcomes. Thematic, descriptive, and interpretive approaches will be used to code, categorize, and emerge major themes and categories to answer the research questions (Braun & Clarke, 2022; Crotty, 1998; Denzin & Lincoln, 2018; Smith, Flowers & Larkin, 2022).

Participation

This study involved 12 experienced immersion program principals from diverse backgrounds in the United States, including Wisconsin and Michigan. The participants are from diverse school settings, with 42% (n=5) from urban areas, 33% (n=4) from metro cities, and 25% (n=3) from suburban or rural areas. The schools they led had Chinese immersion programs with student enrollments ranging from 100 to 300 students housed within public school buildings. Demographically, most students were White (90%), with 5% in various minorities (Spanish, Black, and other). Most families were middle class, and a few had moved from other states to the city for the immersion program. The participants comprised 50% (n=6) males and 50% (n=6) females, with ages ranging from 29 to 50 (mean age=40). In terms of experience, 25% (n=3) had 3-5 years, 50% (n=6) had 6-10 years, and 25% (n=3) had 11-15 years in immersion education. The participants held various educational credentials, with 25% (n=3) holding bachelor's degrees, 50% (n=6) holding master's degrees, and 25% (n=3) holding Educational Specialist or higher degrees. Half of the participants (50%, n=6) were principals, while the other half (50%, n=6) were assistant principals or held different leadership positions.

Table 1: Demographic Participants of School Principals in this Study

Pseudonym Participants	Age	Gender	Level of Education	Years of Principal Experiences	Position
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1.Hollis	35	M	BA	5	Assistant Principal
2. Aylani	45	F	BS	8	Principal
3.Damari	50	M	MS	15	Principal
4.Ayah	38	F	MA	6	Assistant Principal
5.Cullen	39	M	Ed.S.	7	Principal
6.Angelique	29	F	MA	3	Assistant Principal
7.Abner	37	M	Ed.S.	6	Assistant Principal
8.Shay	36	F	MA	5	Principal
9.Kody	46	M	MA	10	Assistant Principal
10.Elisabeth	47	F	MS	12	Principal
11.Osman	40	M	Ph.D.	8	Principal
12.Araya	41	F	Ed.S.	9	Principal

Data Collection, Data Analysis, and Trustworthiness

This qualitative study utilized a multi-stage sampling of purposive and snowball sampling techniques, resulting in 12 principals from the U.S. States (six male, six female) with diverse educational backgrounds - including urban, suburban, and rural settings (Creswell & Clark, 2018; Xie & Zhang, 2022). We conducted in-depth interviews with each principal, using a semi-structured protocol shown in Table 2, to explore their leadership practices and strategies for leveraging AI-powered learning.

After IRB approval, we started to recruit participants. Potential participants were identified from professional contacts and educational associations. Initial contact occurred through email or phone, and they were invited to participate and explained the study's aim, procedures, and risks/benefits. Their demographics are in Table 1, and a sample of interview questions is in Table 2. The individual in-depth interviews were conducted with each principal, averaging 60-90 minutes (average length: 75 minutes). The data collection period ran from October 2022 through May 2024 and was guided by an expert-reviewed interview protocol, informed by relevant literature, e.g., Hallinger and Kovacevic (2019), Khullar et al. (2024), Singler (2025), Wesner (2025), and Zhang and Koshmanova (2021). Data collection consisted of individual in-depth interviews, averaging 75 minutes, which were audio-recorded, transcribed verbatim, and anonymized to ensure confidentiality.

Table 2: Sample of Interview Questions

Question	Question
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1	Please talk about your background, education level, age, and general concerns about AI tools in your professional life?
2	How do you perceive the role of AI-assisted interventions in enhancing educational experiences?
3	Can you describe any specific AI tools or technologies you have used in your educational setting?
4	How would you rate your overall experience with AI-assisted learning tools on a scale from 1 to 5 and why?
5	What features of AI-assisted tools do you find most engaging or beneficial for your learning process?
6	In what ways have AI-assisted impacted your learning outcomes?
7	Can you provide examples of how AI tools have helped you achieve specific learning goals?
8	What challenges have you encountered while using AI-assisted learning tools?
9	How do you think these challenges could be addressed to improve the effectiveness of AI intervention?
10	How do you think AI-assisted interventions contribute to cultural awareness and cognitive development?
11	Have you noticed any changes in your critical thinking or problem-solving skills since using AI tools?
12	What potential do you see for AI in transforming educational practices in the future?
13	How would you like to see AI tools evolve to better support your educational needs?
14	What strategies you use AI tools for your program development and student learning outcomes if applicable?
15	Are there any questions, concerns, or any experiences you would like to share with me that I have not asked?

A two-cycle coding framework was used to analyze interview data. In the first cycle, open coding was utilized to generate concepts and themes (Richards, 1999). In contrast, axial coding was used in

the second cycle to cluster categories and develop major themes from the research questions (Saldana, 2016). NVivo 12 software was used to code, categorize, and identify themes in the data. A codebook was developed to support methodological transparency and was updated as necessary during analysis. A trail for the data was maintained to document all methodological decisions and data analysis procedures. To establish trustworthiness, the study incorporated several strategies. Member checking was used to verify transcripts and preliminary findings with six participants (Flick, 2014; Zhang & Koshmanova, 2021). Systematic research team discussions (bi-weekly, 60 minutes) helped to ensure methodological consistency. Potential biases were addressed through debriefing. We invited two independent scholars to ensure our data analysis met the inter-rater reliability coefficient 0.85. We also used reflexivity and an audit trail to ensure we made all methodological decisions and procedures for content reliability in this study (Merriam & Tisdell, 2016; Zhang & Koshmanova, 2021).

Results

The analysis yields significant insights into integrating AI-driven methodologies across diverse educational contexts. Our findings are organized by research question, categorized within overarching themes, and presented clearly and structured.

RD1: What specific leadership strategies facilitate the effective integration of AI-powered learning in immersion education?

Our analysis revealed three key strategies principals use to harness AI-powered learning and increase student success, as summarized in Table 3. These include (1) data used to assess and refine teaching, (2) creating a positive school culture that values and engages the community, and (3) using research-informed practices to support teachers in providing culturally responsive instruction. In the next section, we provide principal quotes to illustrate the power of these strategies that result in school success.

Theme 1: Data Used to Assess and Refine Teaching

Our study reveals that principals utilize the data to evaluate and improve teaching practices with the key strategies that emerged, categorized as evaluation of teaching practices, emphasizing the importance of data responsiveness. Principals stated that teachers need to collect and analyze students' learning performance data regularly, thus making them adjust their teaching approaches for student learning outcomes and school sustainability. For example, participant principal Hollis said: "We are focused on data and being responsive to that data each week." Aylani also said: "If our [students' learning performance] data is not improving, we need to go back and think, what can we do differently?"

In addition, principals use the strategies that emerged categorized as research-based strategies to support teachers in their effective instruction for student learning outcomes and school effectiveness. We cited quotes from principals' participants to support this category. For example, Ayah indicated: "making sure that the things we are doing are research-based." Cullen stated: "Giving



research-based practices and things that will help them [teachers] to teach the content as well."

Furthermore, principals used the emerged strategy, categorized as problem-solving, to highlight the importance of creative problem-solving skills in teaching practices for students' higher learning performance and school effectiveness. For example, Angelique confirmed: [principals can] look at the data and try to solve problems creatively."

Overall, the findings suggest that principals use data to monitor teaching and learning, including data responsiveness, research-based practices, and creative problem-solving skills. Principals model using student data that encourages teachers to use data to change practices to impact student learning and the sustainability of schools. Principals used data to determine areas of strengths and weaknesses, inform instruction, and create a culture of continuous improvement. Principals can use data to bring about change and effective teaching and learning practices that benefit students and the school.

Table 3: Major Themes and Categories of Leadership Strategies for the Use of AI Integration for Immersion Education

Major Themes	Categories	Selected Codes with Frequency
1. Data Used to Assess and Refine Teaching	1.1.Evaluation of Teaching Practices	Data (5), evaluation (3), practices (4), improvement (3), teaching practice (2)
	1.2. Research-based Strategies	Research (4), strategy (2), creative (2), solutions (1), challenges (1)
	1.3.Problem-Solving	Problem (3), Solving (2), Creative (2), Solutions (1), Challenges (1)
2.Creating a Positive School Culture that Values and Engages the Community	2.1.Building a Positive Culture	Culture (4), Positive (3), Welcoming (2), Environment (1), Supportive (1)
	2.2.Parental Involvement	Parents (4), Involvement (3), Partner (2), Engagement (2), Support (5)
	2.3.Cultural Exposure	Exposure (3), Global (2),

		Thinkers (1), Diversity (1), Awareness (1)
3.Using Research-informed Practices to Support Teachers in Providing Culturally Responsive Instruction	3.1.Teacher Support	Teacher Support (4), Development (3), Resources (2), Training (2)
	3.2.Leadership Development	Leadership (8), Leadership Development (3), Team (3), Skills (3), Growth (1)
	3.3.Resource Allocation	Resource Allocation (2), Allocation (5), Management (1), Distribution (1), Efficiency (2)

Theme 2: Creating a Positive School Culture that Values and Engage the Community

Findings show that principals use three ways to build a positive school culture for community engagement: building a positive culture, parental involvement, and cultural exposure. Data from principal participants indicate that a positive school culture is characterized by a welcoming environment where individuals feel valued and supported. This is supported by participant principal Abner, who said: "we have built a positive culture in our building." Also, the perception that the school is a welcoming place was reinforced by another principal, Shay, who noted: "People feel like this [her school] is a welcoming place."

In addition, participant principals highlighted that parental involvement is key to school success and student higher performance through building a positive school culture. This finding is supported by participant principals, who said, "The more we can bring parents in to feel like they are a partner in learning, "expressing the importance of parental involvement for school effectiveness. Osman said, "I would love to know ways to support that learning at home."

This statement means that parental involvement could effectively support the principal in enhancing teacher commitment to students' learning effectiveness and sustainable school growth. Parental involvement can ensure that the principal can motivate teachers to be committed to improving students' learning effectiveness and sustainable school growth.

In addition, some participants' principals also agreed that cultural exposure encourages diversity and inclusiveness to create a positive school culture. Principals and teachers also mentioned that

cultural exposure to students is also needed because it can help students think globally. Elisabeth said, "Exposing kids to a culture helps them to be a little more global thinker." Therefore, the principal has a role in community engagement by creating a positive school culture that involves parental involvement, cultural exposure, and a positive and supportive learning environment for student learning.

Theme 3: Using Research-informed Practices to Support Teachers in Providing Culturally Responsive Instruction.

Our study found that principals use research-based practice to provide teachers with culturally responsive support in three ways: teacher support, leadership development, and resource allocation. First, our findings support other research in that teachers need to be supported culturally to meet their students' needs, which they need from the principal, superintendent, and all other school administrators.

Good principals always need to understand their staff, teachers, parents, students, and all other partners for school performance, as noted by Kody, "supporting teachers culturally, so that they [teachers] are fully equipped with the students." Abner also claimed: "A good leader, a good principal would need to understand their staff members." Those thoughts from principals in this study indicated that principals must always emphasize the need for targeted support to enhance teacher cultural responsiveness for student learning outcomes.

Secondly, our finding claimed that effective leadership development is critical, as evident from participant principals' experiences with administrative mentorship programs. For example, Shay said: "I did the administrative mentorship program in our district." This mentoring program helps the principals to foster school staff, teachers, students, and all other members to meet the school target for school effectiveness. Some principals also stated that connecting with people and building the right team are essential skills for principals; as highlighted by Aylani, "It's about connecting with other people, and how do you pull together the right people on a team." Their thoughts underscore the importance of leadership development in fostering a culturally responsive teaching environment.

Finally, our findings claimed that principals must make all resources available for all community members for their high engagement. This finding is supported by Hollis, who said: "Having a lot of great strategies and resources to draw on to support people." This finding emphasizes the need for adequate resource allocation to facilitate teacher culturally responsive support. Therefore, as noted by some principals in this study, principals need to use research-based practices associated with artificial intelligence tools for school effectiveness and student learning outcomes.

RD 2: How do these strategies enable scalable program development in AI-powered immersion education?

This study identified three key strategies employed by principals to enable program development, including (1) collaboration between

district and school leadership for program alignment, (2) increasing program visibility and community understanding, and (3) addressing challenges in curriculum development and resource allocation. These strategies have important implications for practice because they can guide the development of programs to support student learning and school success. Learning how principals use these strategies may assist policymakers and educators in promoting the development of programs to support a diverse student population.

Theme 1: Collaboration between District and School Leadership for Program Alignment

Firstly, findings show that there are three strategies related to collaboration between school districts in the Chinese immersion programs. The first strategy concerns principals' need to ensure that school districts actively support the school's daily operation for student learning goals and effectiveness. For example, principal Damari indicated: "I would like to see the district be a little bit more involved with the program [Chinese immersion program]." Also, Cullen indicated: "We [principals, teachers, staff, students, parents, and other stakeholders] should have obvious proficiency goals as set by the district for all students in the [Chinese immersion] program."

The second strategy is that principals need to ensure vertical alignment, which was highlighted as an area requiring further development despite teachers' efforts. While acknowledging the progress made, some principals noted, such as Angelique: "Teachers in our Chinese immersion program have done a great job of on their own doing a lot of vertical alignment." Kody said, "We have more work on vertical alignment." Their viewing was that principals will ensure the vertical alignment among the school stakeholders that may lead to school effectiveness and student learning.

The third strategy is that principals promote leadership collaboration as a key aspect, focusing on leadership teams working together to implement effective strategies at each grade level. As principal Shay stated, "Then leadership teams at each level could figure out how that's going to look and work at that grade level." These findings suggest the importance of district support, vertical alignment, and leadership collaboration to the program's success.

Table 4: Major Themes and Categories of Using Leadership Strategies for Scalable Program Development

Major Themes	Categories	Selected Codes with Frequency
1. Collaboration between District and School Leadership for Program Alignment	1.1. District Support	District Support (4), Involvement (3), Goals (2), Direction (2)



	1.2. Vertical Alignment	Alignment (4), Teachers (3), Curriculum (3), Consistency (2), Standards (2)
	1.3. Leadership Collaboration	Leadership collaboration (3), teamwork (3), communication (2), network (5)
2.Increasing Program Visibility & Community Understanding	2.1. Advertising Successes	Advertising (4), Success (3), Promotion (3), Visibility (2), recognition (2)
	2.2. Community Engagement	Community engagement (4), Involvement (3), outreach (2), participation (2)
	2.3. Enrollment Growth	Enrollment (4), enrollment growth (2), increase (2), demand (2), capacity (2)
3.Addressing Challenges in Curriculum Development & Resource Allocation	3.1. Curriculum Challenges	Curriculum (5), Curriculum challenges (2), development (3), resources (2), adaptation (2)
	3.2. Teacher Turnover	Turnover (3), retention (2), stability (2), recruitment (2), support (2)
	3.3. Program Evolution	Evaluation (3), change (2), innovation (2), progress (2), program development (2)

Theme 2: Increasing Program Visibility & Community Understanding

Our study reveals that principals used three ways to increase program visibility and community awareness: advertising successes, community engagement, and enrollment growth.

Firstly, findings show that program stakeholders emphasized the need for effective advertising to share successes and increase enrollment. Araya said: “We need to do a better job of advertising our program and the successes that our program has.” Another participant, Principal Kody, suggested that sharing successes would lead to increased enrollment, stating: “If we do that, we

share our successes, I think that we would see our enrollment increase quite a bit.”

Secondly, community engagement was identified as crucial for program success. Some participants highlighted the importance of involving the community to improve program understanding. For example, Abner said: “Involving the community, they [principals, teachers, students, staff, parents, and all other school stakeholders] need to understand the program.” Hollis stated:” We want to continue to improve what we do in all subjects.” This finding emphasized that community engagement is an effective strategy for principals to work with teachers to foster student learning outcomes.

Finally, findings suggested that principals use school resources for immersion program student enrollment for school sustainability. For example, Aylani stated: “enrollment has changed a lot. When I first started here, we were the smallest elementary in the district.” Cullen also said: “We want to continue to improve what we do in all students.” By doing so, principals will continuously improve student learning outcomes. Our findings suggest that demonstrating program success, building community buy-in, and encouraging program enrollment are key to program visibility and community participation. These results directly affect program development and structure and underscore the importance of including effective communication and community outreach practices to foster program growth and sustainability.

Theme 3: Addressing Challenges in Curriculum Development & Resource Allocation

Our study found that principals use three ways to address challenges in curriculum development and resource allocation for student learning outcomes: curriculum challenges, teacher turnover, and program evolution.

Firstly, some participants highlighted the difficulty of finding a suitable curriculum and the need for teachers to create their own. For example, Elisabeth said, "Some of our challenges were about finding curriculum," and Osman said, "Teachers were creating their curriculum." These challenges highlight the need for accessible and adaptable curriculum resources.

Secondly, findings show that teacher turnover is a challenge, particularly in the short life cycle of the program. For example, Cullen said: "one of the other challenges in the beginning was teacher turnover." Abner also stated: "Frequent new teachers, because it takes a few years before you[teachers] get comfortable with the curriculum." Their thoughts indicated that principals need to use innovative approaches to reduce teachers' turnover rate for teachers' stability for student learning outcomes.

Finally, findings show that principals face the challenges of adding new grade levels as the program evolves. In this viewing, principals acknowledged the need for flexibility, stating to Shay, "We were figuring it [school adaptability of adding a new grade level] out." These findings also speak to the need to provide support resources, respect flexibility for curriculum planning, and use strategic planning to address the challenges of curriculum

development, resource delivery, student learning, and school effectiveness.

RD3: What leadership strategies optimize student outcomes in AI-powered immersion education?

Our study found that principals used three strategies to optimize student outcomes in AI-powered immersion education, including (1) achieving proficiency in language and core subjects, (2) leveraging cultural exposure and cognitive development, and (3) engaging students through culturally relevant content. One theme with three categories and codes that underscore the relationships between language learning, student engagement, and academic achievement.

Theme 1: Ensuring Students Achieve Proficiency in both Language and Core Subjects

Our research of principals’ perspectives and experiences determines three key categories contributing to students’ proficiency in language and core subjects: academic balance, language proficiency, and student engagement in Chinese immersion programs. Firstly, some participants discussed balancing language and core subjects, so students do not lose out on language while achieving math and reading. “So, you’re going to make sure that the students are still competent in math and reading, but you’re not going to lose that language piece,” Elisabeth said. “That balance in the program is that the kids are achieving in all areas,” added Osman. These conclusions from participants indicated that principals worked with teachers to improve student’s language proficiency by balancing, which is key in the Chinese immersion program.

Secondly, some participants explained that the Chinese immersion program would only be able to sustain development if the immersion program could sustain students’ language proficiency. Ayah said: “The students can achieve proficiency in that language [Chinese].” “The students are achieving in the core areas,” added Cullen. Their viewpoints suggested that principals had to monitor immersion students’ learning performance to sustain the immersion program regularly.

Finally, the immersion program was naturally engaging for kids, as Damari said, and its inherent engaging nature considerably contributes to student proficiency, participant principal Araya stated. Thus, these conclusions highlight that balanced language proficiency and student engagement should be integrated into the academic program for students to achieve proficiency in language and core subjects.

Table 5: Major Themes and Categories of Using Leadership Strategies for Optimizing Student Outcomes

Major Themes	Categories	Selected Codes with Frequency
1.Ensuring Students Achieve Proficiency in	1.1. Academic Balance	Academic (5), balance (4), proficiency (3), achievement (3), achievement standards

both Language and Core Subjects		(2)
	1.2. Language Proficiency	Language proficiency (5), skills (4), Fluency (3)
	1.3. Student Engagement	Engagement (7), participation (5), interaction (4), student involvement (3), Interaction (2)
2. Using Cultural Exposure and Cognitive Development for Student Learning Outcomes and School Effectiveness	2.1. Cultural Awareness	Culture (6), Awareness (5), Diversity (4), Exposure (3), Understanding (2)
	2.2. Cognitive Development	Cognitive (5), Development (4), Skills (3), Growth (2), Enhancement (2)
	2.3. Future Opportunities	Opportunity (5), Learning (4), Exploration (3), innovation (2), Creativity (2)
3.Engaging Students through Culturally Relevant and Challenging Content	3.1. Student Motivation	Engagement (7), Participation (5), Interaction (4), Involvement (3), Cooperation (2)
	3.2. Classroom Dynamics	Dynamics (5), Environment (4), Atmosphere (3), Relationships (2), Communication (2)
	3.3. Parental Involvement	Work together (5), Parent support (3), support (8)

Theme 2: Using Cultural Exposure and Cognitive Development for Student Learning Outcomes and School Effectiveness

Our findings identified three categories that described the intersecting ideas of language learning, culture, and cognitive

development: cultural awareness, cognitive development, and future opportunities.

Firstly, participant principals highlighted the importance of cultural exposure and mental growth of language learners, with several saying that developing global thinkers, even young ones, was essential. Kody said, "It exposes kids to a culture and helps them to be a bit more of a global thinker." Cullen also said: "Cultural awareness, even though I just mentioned a question I have about the research of learning Chinese." Their thoughts showed that principals wanted to highlight the importance of cultural awareness in developing a supportive environment for student learning outcomes.

Secondly, learning a language in the immersion program naturally had positive implications related to cognitive development. A participant, Shay, said, "Learning a second language develops new neural pathways." Hollis said, "It is good for their [language learners] brain. It is good for them in other areas."

Finally, results suggest that language learning leads to opportunities. Angelique said, "It opens doors that maybe they [language learners] had not considered before." Elisabeth also recognized the importance of language learning by saying that developing the ability to speak a second language and to speak it well would "increase the opportunities for language learners for your future job opportunities." As a result, findings showed that language learning impacts students' cultural, cognitive, and linguistic development, thus benefiting their future life opportunities.

Theme 3: Engaging students through culturally relevant and challenging content

Our study identified three key categories that assist student engagement with culturally relevant and challenging content: student motivation, classroom dynamics, and parental involvement. Motivation was the first category to emerge in our study. Immersion students are motivated to learn when challenged and engaged in their learning process. As stated by Damari, "My daughter is in the program now, and it has been so exciting, as a parent, to see how engaged she is in learning a new language" (Damari). Cullen states: "I think for those kids who are already higher achievers, it lends itself great to that" (Cullen). This shows that language immersion could create a higher learning goal for students.

Classroom dynamics was a second key category that emerged in our study. Students actively participate in class discussions if there is a supportive restorative learning environment. As stated by Shay, "I love it when I have students who come up to me; they are trying to ask me to go to the bathroom, but they asked me in Chinese" (Shay). According to Elisabeth, "It is amazing. I think as a teacher, I think it has been great to bring in new perspectives, new ideas, new ways to teach" (Elisabeth).

Parental involvement is a third key category that emerged in our study. Parents can value bilingual education and are invested in their children's education. As stated by Hollis, "Parents who are a

lot more invested in their children's education" (Hollis). Osman also states that students see the value of learning language for students and motivate them to participate actively" (Osman). Using these three categories, principals and teachers can help create a successful, engaging, and well-motivated student experience within an immersion education program.

As a result of this study, several significant findings have emerged that will change the perspective on AI-driven immersion programs. Three critical themes emerged from our research: 1) Optimizing Academic Proficiency, 2) Utilizing AI-Enhanced Culture Exposures, and 3) Promoting Engagement via Personalized Learning. The data revealed the importance of AI-driven academic balance, language proficiency, student engagement, AI-enhanced culture exposure and cognitive development for student motivation, positive classroom dynamics and parental involvement, strategic leadership, district support, and creative resourcing for immersion program success. Through AI-driven learning, immersion programs can optimize student outcomes, cultural competence, and life-long learning; these results have key implications for educators, policymakers, and researchers who seek to innovate immersion education.

Discussion, Conclusion, Implication and Recommendation

Discussion

This study is significant in education research and practices because it reveals the integration of AI tools and leadership strategies in immersion education. The new findings in this study indicate that AI-driven academic balance, language proficiency, and student engagement are crucial to the success of immersion programs. Also, AI-enhanced cultural exposure and cognitive development are critical to fostering student motivation, positive classroom atmosphere, parental involvement support, and development of student learning outcomes and school effectiveness. Furthermore, strategic leadership, district support, and new resource allocation are vital to the success of the immersion program. These new findings revealed the potential of AI-driven learning to enhance immersion education and promote lifelong learning.

Besides, this study reinforces and expands previous research in several areas, such as academic balance, language proficiency, and student engagement in the general classroom, consistent with previous studies. For example, Du (2024) proposed that educators must balance AI tools and use human oversight and personalized engagement, which are vital in tailoring language education to student learning outcomes. This viewing indicated that principals need to balance using technological innovations and human engagement for adequate quality and integrity of education. Lu et al. (2024) suggested that principals must work with teachers to teach students how to balance technological recommendations for patient autonomy when using AI tools. Their viewings suggested that principals work with teachers to teach students how to balance using technological tools and traditional educational approaches for their creativity. Li (2024) claimed that principals and teachers



must strike students to effectively use AI tools to develop bilingualism, biliteracy, and cross-cultural awareness for students' language learning proficiency. Zhong (2024) emphasized that educators must ensure students engage in all teaching sections for learning outcomes. My findings enhanced those studies and confirmed the use of technological AI-enhanced tools for students' learning outcomes and teaching effectiveness.

Besides, my study focuses on AI-driven learning in immersion programs, a new contribution to using technology to enhance language learning and cultural competencies. Some previous studies were enhanced through my findings in this study. For example, Feng (2025) pointed out that using AI-assisted language learning strategies could effectively help students learn a target learning picture that would allow them step by step toward their learning goals. Alto (2025) talked about tips on how to use AI tools such as ChatGPT for students' learning effectiveness. Students with AI tools could develop their language and cultural competence by doing so. Consistent with prior research on program implementation and sustainability (e.g., Boulouard et al., 2022; Ni et al., 2023; Zhang & Koshmanova, 2021).

In addition, the importance of parental involvement as a factor in student engagement and motivation is consistent with previous research on the role of parents in language learning (e.g., Jeynes, 2023; Zhang & Koshmanova, 2021), highlighting the importance of family-school partnerships in immersion education. Finally, this study's findings conflict with and raise questions about previous research in several areas. While this study highlights the benefits of AI-driven learning, some studies caution that excessive reliance on technology can hinder language learning and cultural immersion (e.g., Jones & Kennedy, 2023), arguing for selective technology integration. In contrast to the traditional meaning of "academic balance," research indicates that immersion programs should prioritize language development over academic achievements (e.g., Lewis, 2025; Zhang & Koshmanova, 2020). Furthermore, the focus on parental involvement should be replaced by teacher support and better peer relationships, which are suggested to be the key pathways to students' success (e.g., Jeynes, 2023; Zhang & Koshmanova, 2020).

Finally, community-based models for implementing and sustaining Chinese immersion programs challenge top-down approaches and emphasize the need for flexible, context-specific immersion strategies (e.g., Tinoco, 2025; Zhang, 2023). Overall, the study's findings are well-supported in previous studies and highlight the importance of parental involvement, balancing using advanced technology such as AI tools and transformative learning approaches for students' learning outcomes and school effectiveness through integrating AI tools and leadership strategies in education.

Conclusion

This study provided evidence and theoretical insights into the impact of AI on educational leadership and practical methodologies for immersion education. The results also indicated that AI could promote student-centered learning and authentic

assessment and help close the educational equity gap. More importantly, this study highlighted that school principals should promote teacher, parent, student, and other stakeholder engagement in developing cultural and linguistic competence with the help of AI and AI tools, particularly for diverse learners in Chinese immersion education. Eventually, this study exemplified the importance of a transdisciplinary approach to educational leadership in promoting innovation and effectiveness in education.

Implications

This study has implications for principals and teachers regarding immersion student learning outcomes and school sustainability by implementing AI learning and transformative learning. It also shows that principals should work with teachers to balance using AI tools and student-personalized learning for students' lifelong learning and learning for immersion. Besides, principals and teachers must collaborate to balance immersive schools by leveraging AI and implementing student-centered learning and authentic assessment. Finally, this study represents parental involvement and families and schools collaborating to build student events for student learning and minor school long-term goals.

Limitations and Recommendations for Future Studies

This study provides new insights into and contributes to previous research in immersion education, but this study has limitations and concerns. Because only 12 principals from a few states in the US were included in this study, the study results cannot be generalized to other US states or countries. This study also raises many questions about how principals navigate the use of technology in education. It further contributes to using AI tools for language learning and culture immersion. Future research should focus on several priorities to build on the findings from this study. For example, studying the impact of AI-driven learning in immersion education among diverse students and educational contexts using mixed research design, the relationship between teacher support and peer relationships and student success, and the development and validation of context-specific immersion strategies with a focus on community-based and flexible models of immersion will be meaningful to the field. By examining these research areas for future research, our understanding of AI-enabled learning within immersion education will grow and enhance the evidence base of what best practice looks like to ensure the success of immersion students.

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