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# Integrating ChatGPT into Science Lesson Planning in Malaysian Primary Schools: A Mixed-Methods Study

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## Abstract

*This mixed-methods study examined the integration of ChatGPT into Science lesson planning among teachers in National-Type Chinese Primary Schools (SJKC) in Selangor, Malaysia. Drawing on Constructivist Learning Theory, Differentiated Instruction, and the Technology Acceptance Model (TAM), the study employed a convergent parallel mixed-methods design. Quantitative data were collected from 100 Science teachers through structured surveys, while qualitative data were gathered through semi-structured interviews with 30 teachers. Findings reveal that ChatGPT significantly enhances lesson planning efficiency (78% agreement), creativity ( $M=4.12$ ), and student engagement ( $M=4.20$ ). However, challenges persist, including lack of professional development ( $M=4.05$ ), curriculum alignment difficulties, and infrastructure limitations. Regression analysis identified professional training ( $\beta=-0.37$ ,  $p<.001$ ) and infrastructure availability ( $\beta=-0.29$ ,  $p<.01$ ) as significant predictors of adoption willingness. The study proposes strategies including structured professional development, curriculum-aligned guidelines, and Professional Learning Communities to optimize ChatGPT integration. Implications for teachers, school leaders, and policymakers are discussed.*

**Keywords:** ChatGPT; artificial intelligence in education; Science lesson planning; differentiated instruction; Malaysian primary schools; mixed-methods

## 1. Introduction

### 1.1 The Broader Context

The world today is witnessing a significant transformation in the educational landscape, driven by the continuous advancement of technology. Artificial intelligence's (AI) rapid spread throughout global education systems has sparked new discussions about the role of teachers, the future of education, and how students' expectations are changing in a technology-prioritizing society (Ayeni et al., 2024). AI can customize learning experiences and process infinite amounts of data, enabling teachers to create individualized learning environments tailored to each student's unique preferences, speeds, and styles (Jones, 2021; Lee, 2019).

In Malaysia, AI is no longer seen as optional enrichment but as a strategic priority aligned with national digital transformation objectives. The MyDigital blueprint aims to incorporate digital tools and resources into classrooms, promoting 21st-century learning skills (Nur Zarina Othman, 2021). The Malaysia Education Blueprint 2013-2025 emphasizes the integration of technology to enhance teaching and learning outcomes (Ministry of Education, 2013).

In subjects like Science, the need for adaptive learning is urgent. Science requires conceptual understanding, procedural knowledge, and inquiry-based learning. Many students in Malaysian primary schools, including SJKC schools, struggle to grasp abstract scientific concepts. These difficulties are compounded by language diversity, varying proficiency levels in Mandarin, English, and Malay, and resource constraints. The emergence of AI tools helps close this gap by providing teachers with instant lesson plans, differentiated materials, and multilingual explanations to support diverse learners.

ChatGPT, driven by the advanced GPT architecture, offers immense opportunities for teachers seeking to maximize their efforts in lesson planning (Alshater, 2022). Its capacity to produce logical and contextually appropriate text in response to prompts presents opportunities for educators looking to enhance the effectiveness and quality of lesson planning (Costello, 2023).

## **1.2 Identifying the Research Gap**

Despite Malaysia's progress in digital education with programs like MyDigital and the Digital Education Policy, little is known about how AI is actually used in lesson planning. Teachers in SJKC schools frequently balance the demands of the syllabus, high parental expectations, and multilingual instruction. While AI offers a chance to reduce workload pressure, there has been no systematic research on how much teachers trust, understand, and use these tools meaningfully.

Existing literature often generalizes findings across educational settings without considering the unique linguistic, cultural, and pedagogical characteristics of schools like SJKC, where bilingual instruction and differentiated learning needs are common. Most studies focus on the technological capabilities of AI tools without adequately addressing their contextual application in diverse educational environments (Rosli et al., 2022). Furthermore, little research has been conducted into how AI platforms like ChatGPT can be tailored or optimized for lesson planning in multilingual and multicultural environments.

## **1.3 The Need for the Present Study**

This study addresses these gaps by examining how ChatGPT is integrated into Science lesson planning in SJKC schools in Selangor. The multicultural and multilingual environment of Malaysia makes AI adoption more complicated. Although ChatGPT can produce bilingual or multilingual content, teacher judgment is still needed to determine the outputs' quality, accuracy, and cultural relevance. Understanding how teachers perceive the challenges they face is essential for creating responsible and successful AI integration frameworks for Malaysia's primary school ecosystem.

## 1.4 Research Purpose and Questions

The purpose of this study is to investigate the effectiveness of Science lesson planning, specifically how ChatGPT improves lesson customization, student engagement, and learning outcomes. The study is guided by three research questions:

- How does ChatGPT influence the effectiveness of Science lesson planning in Selangor national-type Chinese schools?
- What challenges do teachers face when integrating AI tools into Science lesson planning, and how can these be addressed?
- What strategies can be developed to optimize the integration of ChatGPT in Science education?

## 1.5 Significance of the Study

This study is significant because it provides practical insights into how AI tools can be effectively implemented in lesson planning within the Malaysian SJKC context. For educators and school administrators, the findings offer resources and best practices to improve learning outcomes and student engagement. For educational leaders and policymakers, the findings can serve as a crucial guide to support ChatGPT in Science education, influencing decision-making and resource allocation. The study also addresses ethical considerations, ensuring responsible AI integration.

## 2. Literature Review

### 2.1 The Evolution of AI in Education

The evolution of AI in education has progressed through three distinct waves. The first wave included administrative automation tools like automatic attendance, grading, and plagiarism detection (Vieriu & Petrea, 2025). The second wave introduced adaptive learning systems like ALEKS, Knewton, and DreamBox Learning that could change task difficulty and provide specific feedback (Wang et al., 2024). The third wave, which started with ChatGPT in 2022, brought generative AI capable of creating original pedagogical content such as lesson plans, explanations, assessment items, and multimodal prompts (Kasneci et al., 2023).

In Southeast Asia, Singapore leads in AI-driven education with national programs like "AI for Everyone" and Smart Nation Schools, where AI tutors and adaptive assessment platforms are being widely tested (Frana, 2024). Indonesia and Thailand have started experimenting with AI-based learning analytics for early detection of learning challenges (Theerawut Tantiathimongkhon & Kriangkrai Satjahiruthai, 2025).



## 2.2 AI in Lesson Planning

AI's role in lesson planning has emerged as one of its most transformative applications in education. With AI-powered platforms, teachers can now automate significant portions of the lesson planning process (Halaweh, 2023). Research highlights three main advantages: efficiency, creativity, and differentiation. Studies show that teachers save 30-50% of planning time when using AI to create lesson plans, learning objectives, and assessments (Roumeliotis & Tselikas, 2023).

AI tools expose teachers to new pedagogical opportunities by generating inquiry questions, real-world comparisons, activity ideas, and alternate explanations (Alshater, 2022). The ability of AI to rapidly adapt instructional materials to diverse student demands aligns with Universal Design for Learning principles, promoting inclusive approaches in multilingual settings (Wang et al., 2023).

## 2.3 Personalization Learning through AI

Personalized learning through AI is one of the most revolutionary advancements in modern education. Holmes, Bialik, and Fadel (2023) define personalization in AI-enabled environments as customization of instructional content, pedagogy, and assessment based on each student's unique characteristics. In science education, where students develop reasoning and conceptual knowledge at varying rates, personalization is particularly important. AI-supported science training improves conceptual clarity while reducing misconceptions through targeted explanations, flexible questioning, and real-time feedback (Chen & Xie, 2023).

In bilingual settings like Malaysian SJKC schools, AI-powered personalized learning is especially beneficial. ChatGPT can provide trilingual explanations, translate scientific terms, and automatically modify linguistic complexity (Holmes et al., 2019). This reduces language barriers and promotes deeper conceptual understanding.

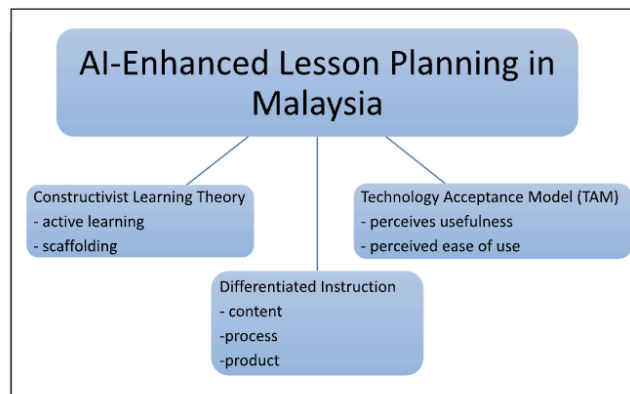
## 2.4 Theoretical Framework

The theoretical foundation draws upon three interrelated models. **Constructivist Learning Theory** (Piaget, Vygotsky) emphasizes that learners build understanding through experiences and reflection (Rabindran, 2020). ChatGPT facilitates constructivist learning by offering interactive materials, problem-solving tasks, and scaffolding that supports students' Zone of Proximal Development (Md Yusof, 2021).

**Differentiated Instruction Theory** addresses diverse learning needs by modifying teaching methods, environments, and content. ChatGPT supports differentiation by generating resources in multiple formats and varying complexity levels to accommodate different readiness levels, interests, and learning profiles (Tomlinson & Imbeau, 2023).

The **Technology Acceptance Model (TAM)** posits that perceived usefulness and perceived ease of use predict technology adoption (Davis, 1989). In AI integration, teachers and students are more likely to accept AI tools if they perceive these technologies as improving educational outcomes and being user-friendly (Hu & AlSaqqaf, 2021).

Figure 1 *Theoretical Framework for AI-Enhanced Lesson Planning in Malaysia*



### 3. Methodology

#### 3.1 Research Design

This study employed a convergent parallel mixed-methods design (Creswell & Creswell, 2023), in which quantitative and qualitative data were collected simultaneously and integrated during analysis. This approach allows for triangulation of findings and provides both breadth and depth in understanding ChatGPT integration.

#### 3.2 Participants and Sampling

The study focused on Science teachers in National-Type Chinese Primary Schools (SJKC) in the Hulu Langat district of Selangor. Participants were selected through purposive sampling for the qualitative component (30 teachers) to ensure rich, relevant data from teachers with firsthand ChatGPT experience. For the quantitative component, 100 teachers were surveyed, providing sufficient statistical power for descriptive and inferential analyses.

#### 3.3 Data Collection Instruments

**Semi-structured interviews** were conducted with 30 teachers to explore their experiences, challenges, and strategies regarding ChatGPT integration. The interview protocol was developed based on established AI-in-education frameworks and theoretical foundations.

**Structured surveys** were administered to 100 teachers using Google Forms. The survey included sections on demographic information, influence of ChatGPT on Science lesson planning, challenges in integration, and strategies for optimization, using 5-point Likert scales and open-ended questions.



### 3.4 Data Analysis

Qualitative data were analyzed using thematic analysis in NVivo, following Braun and Clarke's (2006) six-phase framework. Quantitative data were analyzed using descriptive statistics (frequencies, means, standard deviations) and inferential analysis (regression, ANOVA) in SPSS version 28. Integration occurred at the interpretation stage through triangulation.

### 3.5 Ethical Considerations

Informed consent was obtained from all participants. Anonymity and confidentiality were maintained through alphanumeric coding. Participants were informed of their right to withdraw at any time. Institutional ethics approval was obtained before data collection.

## 4. Findings

### 4.1 Quantitative Results

#### Research Question 1: Influence of ChatGPT on Science Lesson Planning

Survey results from 100 Science teachers indicated positive perceptions of ChatGPT's impact on lesson planning. On a 5-point Likert scale, 78% of respondents agreed or strongly agreed that ChatGPT improved the overall quality of their Science lesson plans ( $M=4.12$ ,  $SD=0.68$ ). Teachers highlighted ChatGPT's ability to increase student engagement ( $M=4.20$ ,  $SD=0.65$ ), with engagement consistently rated higher than other factors. Curriculum alignment received a positive rating ( $M=4.05$ ,  $SD=0.72$ ), indicating moderate-to-strong agreement that AI-generated content can be modified to comply with DSKP requirements.

**Table 1: Key Quantitative Trends in Teachers' Use of ChatGPT**

| Category                   | Key Finding                                           | Evidence      |
|----------------------------|-------------------------------------------------------|---------------|
| Pedagogical effectiveness  | Teachers perceive ChatGPT as improving lesson quality | 78% agreement |
| Student engagement         | ChatGPT-supported activities increase participation   | $M=4.20$      |
| Curriculum alignment       | Teachers can adapt AI-generated content to DSKP       | $M=4.05$      |
| Differentiated instruction | AI helps support different learning styles            | 65% agreement |
| Instructional efficiency   | ChatGPT reduces lesson preparation time               | $\beta=0.41$  |

Regression analysis revealed that efficiency ( $\beta=0.41$ ,  $p<.01$ ), creativity ( $\beta=0.28$ ,  $p<.05$ ), and engagement ( $\beta=0.22$ ,  $p<.05$ ) all positively predicted teachers' overall lesson effectiveness, explaining approximately 62% of the variation ( $R^2=0.62$ ).

#### Research Question 2: Challenges in ChatGPT Integration

Lack of professional training and development opportunities was the most significant challenge identified ( $M=4.05$ ). Time limitations ranked second ( $M=3.90$ ), with teachers noting that while ChatGPT speeds up drafting, it also requires more thorough review. Adaptation of ChatGPT outputs to meet diverse learner needs was the third significant challenge ( $M=3.78$ ).

**Table 2: Regression Analysis of Factors Influencing Adoption Willingness**

| Predictor Variable                 | Beta ( $\beta$ ) | Significance | Interpretation                                                      |
|------------------------------------|------------------|--------------|---------------------------------------------------------------------|
| Professional training availability | -0.37            | $p<.001$     | Lack of training significantly reduces adoption willingness         |
| Infrastructure availability        | -0.29            | $p<.01$      | Limited internet access and resources negatively influence adoption |
| Accuracy concerns                  | -0.12            | n.s.         | Not a statistically significant predictor                           |

The variables explained 55% of the variation in adoption willingness, highlighting that structural barriers, not attitude ones, are the biggest obstacles.

### Research Question 3: Strategies for Optimizing Integration

Teachers strongly endorsed enabling conditions for ChatGPT integration. Professional development and training received the highest rating ( $M=4.31$ ), followed by time allocation for meaningful use ( $M=4.27$ ), and clear guidelines and instructional structures ( $M=4.22$ ). Regression analysis showed that collaboration ( $\beta=0.38$ ,  $p<.001$ ) was the most significant factor influencing teaching efficiency, followed by PD training ( $\beta=0.32$ ,  $p<.001$ ) and time allocation ( $\beta=0.17$ ,  $p<.01$ ). These variables collectively accounted for 68% of the variation in perceived teaching effectiveness.

**Table 3: Teachers' Perceptions of Enabling Conditions and Strategies**

| Enabling Condition                     | Mean (M) | Strategies                                                                                       |
|----------------------------------------|----------|--------------------------------------------------------------------------------------------------|
| Professional development training      | 4.31     | Provide regular AI workshops, prompt engineering training, curriculum alignment support          |
| Time allocation for AI lesson planning | 4.27     | Allocate protected planning time, reduce administrative workload                                 |
| Clear guidelines and structures        | 4.22     | Develop institutional guidelines, provide prompt templates, create curriculum-aligned frameworks |

## 4.2 Qualitative Findings

### Thematic Analysis of Teacher Interviews

**Theme 1: Efficiency.** Participants frequently mentioned how ChatGPT made creating science lesson plans faster. Teacher 8 stated: "It helps structure lessons logically without excessive mental energy, simplifies workload during busy periods, and allows teachers to generate

lesson ideas in minutes." Teacher 10 mentioned: "It significantly reduces the time spent brainstorming activities and content ideas."

**Theme 2: Innovation.** ChatGPT significantly fosters innovation by providing teachers with creative ideas and varied approaches. Teacher 17 commented: "It makes me think beyond the textbook. For example, I got a suggestion to compare water evaporation to sweat drying after sports, and my students immediately related to it." Teacher 21 added: "I used ChatGPT to create interactive science activities in a game format. It made revisions much more fun and competitive."

**Theme 3: Structural Support.** ChatGPT provides significant structural support by helping teachers organize ideas and ensure logical content progression. Teacher 5 shared: "It can help teachers stick to frameworks like the 5E model (Engage, Explore, Explain, Elaborate, Evaluate), ensuring no important phases are skipped." Teacher 14 stated: "ChatGPT acts as a template generator, providing all the key components necessary for a lesson plan, including objectives, materials, tasks, and assessments."

### Challenges in Integration

**Lack of Professional Development and Training.** Teacher 4 reflected: "I only know the very basic functions of ChatGPT. Without proper training, I feel like I am not using it to its full capacity." Teacher 11 admitted: "Sometimes I am unsure how to phrase my prompts correctly, so the answers are not always relevant. Training on how to 'talk' to ChatGPT would help a lot."

**Unreliable Digital Infrastructure.** Teacher 27 explained: "Sometimes the Wi-Fi in school is very weak, and I can't access ChatGPT at all. At home it's fine, but in school I often have to rely on my phone." Teacher 16 added: "We only have one shared desktop in the science laboratory. It's not practical for all teachers to use ChatGPT whenever they need it."

**Content Accuracy and Reliability.** Teacher 8 shared: "The facts are usually correct, but sometimes the explanation is too general or not aligned with the way our syllabus phrases it." Teacher 22 noted: "I once got an example about snowstorms when teaching weather. That doesn't apply here, so I had to adapt it to monsoon rain."

### Strategies for Optimization

**Professional Development.** Teacher 19 suggested: "If the school can organize workshops, even short sessions, we will feel more confident using ChatGPT properly." Teacher 25 explained: "Some of my colleagues are already good at using ChatGPT. If they could share their techniques, it would save time for everyone."

**Guidelines and Templates.** Teacher 12 stated: "If we had clear guidelines that show how ChatGPT can be aligned with our syllabus, it would make adoption much easier."

**Peer Collaboration.** Teacher 8 observed: "If a group of us could test different ways of using ChatGPT and then share our experiences, it would benefit everyone, not just individuals."

### **4.3 Triangulation of Findings**

Triangulation confirmed strong alignment between survey and interview data on efficiency and creativity, reinforcing the conclusion that ChatGPT enhances lesson planning by saving time and inspiring innovative teaching ideas. However, the process also revealed an important divergence: while survey responses suggested that curriculum alignment was largely acceptable, interviews painted a more complex picture. Teachers frequently described the need to manually edit or adapt ChatGPT's outputs to ensure compliance with the Malaysian science syllabus.

For Research Question 1, both interviews and surveys confirmed that ChatGPT supports efficiency, creativity, and student engagement in lesson planning, though concerns remained about curriculum alignment requiring manual adjustment. For Research Question 2, both data sources highlighted systemic challenges such as insufficient training, unreliable internet access, and content accuracy issues. For Research Question 3, teachers identified strategies like targeted training, time allocation, and clear guidelines, with interviews placing stronger emphasis on peer collaboration through Professional Learning Communities.

## **5. Discussion**

### **5.1 Summary of Key Findings**

This study found that ChatGPT positively impacts planning efficiency, personalization, and student engagement when integrated into Science lesson planning in SJKC schools. Teachers reported that the planning process takes 30-50% less time due to ChatGPT's assistance, consistent with international evidence (Kaddouri et al., 2025). The results align with the Technology Acceptance Model (TAM), with teachers acknowledging high levels of Perceived Usefulness and Perceived Ease of Use.

ChatGPT enables customized instruction and content delivery, allowing teachers to tailor resources to different proficiency levels, cognitive readiness, and language backgrounds. This aligns with Constructivist Learning Theory and Differentiated Instruction principles. The tool's ability to generate bilingual and trilingual content is particularly valuable in SJKC contexts, reducing teachers' burden and increasing conceptual clarity for students.

Teachers reported that ChatGPT expanded their pedagogical ideas through novel Science activities, inquiry-based tasks, analogies, and real-world examples. This aligns with the SAMR Model, particularly at the Modification and Redefinition levels, where technology enables new forms of instructional design.

### **5.2 Discussion in Relation to Literature**

The findings corroborate international studies demonstrating AI's role in enhancing lesson planning efficiency and creativity. Studies in China and Singapore report similar findings where AI enhanced efficiency and creativity but required localized curriculum adaptation

(Tan et al., 2022). This situates the present study within a broader regional narrative, confirming that while ChatGPT has cross-contextual potential, its success depends heavily on contextualized policy frameworks and teacher readiness.

The challenges identified—lack of training, curriculum misalignment, and infrastructure limitations—echo findings from other Southeast Asian contexts (Rosli et al., 2022). The TPACK framework provides insight into why teachers struggle to integrate ChatGPT outputs with the Malaysian science syllabus, revealing gaps between technology, pedagogy, and content knowledge.

### 5.3 Discussion in Relation to Theory

The findings substantiate Constructivist Learning Theory by demonstrating that ChatGPT facilitates student-centered approaches through interactive suggestions, diverse examples, and immediate scaffolding resources. The tool enables teachers to create lessons around investigation, questioning, and hands-on reasoning—hallmarks of effective Science learning.

Differentiated Instruction Theory is supported by ChatGPT's ability to produce multiple versions of the same Science concept at varying difficulty levels. Teachers noted that the AI could on-the-spot generate materials for advanced, intermediate, and struggling learners, which is particularly valuable in mixed-ability SJKC classrooms.

The Technology Acceptance Model (TAM) explains teachers' adoption patterns. High Perceived Usefulness was evident, but Perceived Ease of Use was undermined by limited training, inaccuracies, and technical issues. This illustrates the importance of addressing both psychological and practical aspects of technology acceptance.

### 5.4 Implications

**For Teachers:** AI literacy is crucial. Teachers need to learn how to create good prompts, check truth and relevance, and be aware of ethical issues. ChatGPT will not replace professional judgment; teachers will become evaluators, adapters, and decision-makers. Professional Learning Communities (PLCs) can facilitate peer learning and collective inquiry.

**For School Leaders:** Administrators should provide structured, ongoing AI-centered professional development and ensure digital infrastructure readiness. Clear internal policies on data privacy, content verification, and academic integrity are essential. Leaders should create environments that support risk-taking, teamwork, and creativity.

**For Curriculum Designers:** Curriculum authorities should revise support documents to cover AI-based differentiation, inquiry-based learning, and formative assessment strategies. AI-related abilities should be incorporated into the syllabus to promote digital literacy and ethical technology use.

**For Policymakers:** National guidelines should address data protection, algorithmic bias, and responsible AI use. Frameworks must include criteria for verifying AI outputs against DSKP standards. Teacher autonomy should be preserved, with AI positioned as a supportive tool rather than a replacement for professional judgment.

## 5.5 Limitations

Several limitations should be acknowledged. The study's geographic scope is limited to SJKC schools in Selangor's Hulu Langat district, restricting generalizability. The reliance on self-reported data may introduce social desirability bias. The cross-sectional design captures perceptions at a single point in time. The sample may overrepresent tech-savvy educators, potentially omitting insights from less digitally proficient teachers. The absence of classroom observation limits understanding of real-world AI integration. Finally, the rapid evolution of AI technologies means findings may become outdated as platforms update.

## 5.6 Recommendations for Future Research

Longitudinal studies should investigate the enduring impacts of ChatGPT on pedagogy and learning. Student perspectives may yield insights into classroom engagement. Investigating other school types and subjects will enhance understanding of AI's educational capabilities. Research should examine how language adaptation, cultural norms, and geographical contexts shape ChatGPT's usability and perceived value in diverse Malaysian school settings. Studies incorporating classroom observations, peer assessments, or student feedback alongside surveys would provide more holistic views of AI's practical effects.

## 6. Conclusion

This mixed-methods study examined the integration of ChatGPT into Science lesson planning in SJKC schools in Selangor, Malaysia. Findings reveal that ChatGPT significantly enhances lesson planning efficiency, creativity, and student engagement. Teachers reported substantial time savings, improved lesson structure, and increased ability to differentiate instruction for diverse learners. However, challenges persist, including lack of professional development, curriculum alignment difficulties, and infrastructure limitations.

The study contributes to the growing body of literature on AI in education by providing context-specific evidence from Malaysian multilingual primary schools. The findings align with Constructivist Learning Theory, Differentiated Instruction, and the Technology Acceptance Model, demonstrating that ChatGPT can facilitate student-centered, personalized, and inclusive pedagogy when supported by appropriate institutional frameworks.

For ChatGPT to realize its full potential in Malaysian primary science education, systemic support is essential. This includes structured professional development, clear implementation guidelines, robust digital infrastructure, and ongoing research into long-term impacts. By addressing these systemic issues, ChatGPT may transform from a helpful tool into a driving force for innovative teaching and learning in Malaysian classrooms.



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# AI-Driven Decision Support Systems for School Leaders: A Systematic Literature Review of School Improvement Practices in Malaysian Urban Public Secondary Schools

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## Abstract

*This systematic literature review examined how artificial intelligence (AI)-driven decision support systems (DSS) are represented in existing literature as tools to support school leaders' decision-making for school improvement in Malaysian urban public secondary school contexts. Guided by Digital Leadership Theory, the Data-Driven Decision-Making Framework, Organisational Learning Theory and Sensemaking Theory, the review adopted a qualitative systematic literature review methodology. ERIC was used as the main structured database search, while Google Scholar and DOAJ were used as supplementary sources. A total of 363 records were screened at the title and abstract stage, 52 full-text articles were assessed for eligibility, 27 studies were appraised for quality, and 16 studies met the quality threshold for final thematic synthesis. Across these studies, 131 extracted data segments were coded and synthesised. Five themes were generated: AI-augmented leadership practices and decision-support functions; data-informed and predictive school improvement planning; leadership readiness, organisational learning and human-centred change; ethical governance, accountability and trust in AI-supported decision-making; and resource availability, equity and contextual fit for sustainable AI implementation. The findings indicate that AI-driven DSS can support school leaders by strengthening data interpretation, predictive planning, administrative efficiency, instructional leadership and targeted intervention. However, AI does not directly produce school improvement. Its value depends on leadership judgement, professional capacity, ethical governance, stakeholder trust, digital infrastructure and contextual adaptation. The study concludes that AI-supported decision-making should be understood as augmented school leadership, where AI supports but does not replace human interpretation, ethical responsibility and context-sensitive decision-making.*

**Keywords:** artificial intelligence; decision support systems; school leadership; school improvement; systematic literature review; Malaysian urban public secondary schools

## 1. Introduction

## 1.1 The Broader Context

The integration of AI in education is examined as part of a broader trend of leveraging technology to address complex educational challenges. Globally, AI is increasingly recognised as a critical tool for enhancing data-informed decision-making, optimising resource allocation, and improving both administrative and instructional efficiency (Chen et al., 2020; Holmes et al., 2019; Zawacki-Richter et al., 2019). As schools continue to evolve into data-rich environments, AI-driven DSS may enable school leaders to extract actionable insights and make informed, strategic decisions that support school improvement (Langeveldt, 2024; Mandinach & Gummer, 2016; Wang, 2021).

In Malaysia, urban public secondary schools face unique challenges, including resource constraints, increasing student diversity, and the pressure to meet national educational benchmarks (Noman, 2022; Ramalingam & Maniam, 2024). These challenges are further complicated by gaps in digital readiness and data utilisation in school leadership. The *Malaysia Education Blueprint 2013–2025* serves as a foundational policy context for the study, particularly its emphasis on innovation and data-informed leadership (Ministry of Education Malaysia [MOE], 2013). The Digital Education Policy strengthens digital capabilities, while the Malaysian National Artificial Intelligence Roadmap 2021–2025 provides broader strategic direction for AI adoption across sectors, and the National Guidelines on AI Governance and Ethics emphasise transparency, fairness, accountability, privacy and human oversight in responsible AI use (MOE, 2023; Ministry of Science, Technology and Innovation [MOSTI], 2021, 2024).

## 1.2 Identifying the Research Gap

Despite growing international interest in AI in education, there remains limited consolidated understanding of how AI-driven DSS support school leaders' decision-making for school improvement, particularly in Malaysian urban public secondary school contexts. Existing literature has increasingly examined AI in teaching, learning analytics, adaptive learning and educational technology, but comparatively fewer studies focus specifically on school leadership decision-making, strategic planning and evidence-informed school improvement (Chen et al., 2020; Holmes et al., 2019; Wang et al., 2024; Zawacki-Richter et al., 2019).

This gap presents a significant problem for Malaysian school leaders and policymakers. Urban public secondary schools operate in complex environments shaped by diverse learner needs, high enrolment pressure, uneven resource availability, digital readiness gaps and increasing expectations for data-informed leadership (MOE, 2013; Noman, 2022; Ramalingam & Maniam, 2024). Although AI-driven DSS may offer support through predictive analytics, pattern recognition, monitoring tools and evidence-informed planning, the leadership conditions required for meaningful use remain insufficiently synthesised (Langeveldt, 2024; Mandinach & Gummer, 2016; Mustafa et al., 2024; Wang, 2021).

### **1.3 The Need for the Present Study**

The problem is therefore not simply the limited availability of AI tools, but the absence of a clear, leadership-focused synthesis showing how such tools may be used responsibly and contextually for school improvement. Without such synthesis, AI adoption risks becoming fragmented, technically driven or disconnected from actual school improvement priorities. School leaders may either underuse AI due to limited readiness or over-rely on AI-generated outputs without sufficient professional judgement, ethical governance or contextual interpretation (Argote & Miron-Spektor, 2011; Noman, 2022; UNESCO, 2023; Weick, 1995).

This study addresses the problem by conducting a qualitative systematic literature review of scholarly and reputable institutional literature published between 2019 and 2025. Rather than claiming that AI directly produces school improvement, the study examines how existing literature links AI-supported leadership decision-making to evidence-informed school improvement planning and implementation.

### **1.4 Research Purpose and Questions**

The aim of this study was to synthesise existing literature on AI-driven DSS for school leaders and to examine how AI-supported decision-making is linked to school improvement in Malaysian urban public secondary school contexts.

The study was guided by three research questions:

- What global and Malaysian-relevant practices of AI-driven decision support systems for school leaders in supporting school improvement in Malaysian urban public secondary schools are reported in existing literature?
- What challenges in integrating AI-driven decision support systems into school improvement strategies in Malaysian urban public secondary schools are reported in existing literature?
- How is AI-supported decision-making by school leaders associated with school improvement in Malaysian urban public secondary schools within existing literature?

### **1.5 Significance of the Study**

This study is significant for a range of stakeholders. For policymakers, it provides evidence-based insights into how AI technologies can be harnessed to improve leadership decision-making and overall educational performance in Malaysian urban schools. For educators and school leaders, the research offers practical insights for integrating AI into leadership and instructional decision-making. Theoretically, the study contributes to educational leadership and technology integration by applying a leadership-focused framework comprising Digital Leadership Theory, the Data-Driven Decision-Making Framework, Organisational Learning Theory and Sensemaking Theory (Argote & Miron-Spektor, 2011; Mandinach & Gummer, 2016; Mandinach et al., 2006; Sheninger, 2019; Weick, 1995). Methodologically, the study demonstrates the feasibility of conducting a rigorous SLR using a single-reviewer model.

## 2. Literature Review

### 2.1 The Concept of AI-Driven Decision Support Systems

AI-driven DSS integrate AI technologies such as machine learning, predictive analytics and natural language processing to synthesise complex educational data into actionable insights (Chen et al., 2020; Holmes et al., 2019; Mustafa et al., 2024). These systems are distinct in their ability to analyse large volumes of heterogeneous data with speed and accuracy, employing algorithms capable of identifying trends, forecasting outcomes and generating automated recommendations (Langeveldt, 2024; Mandinach & Gummer, 2016).

For school leaders, the value of AI-driven DSS lies not merely in data processing but in decision support. Data dashboards, predictive models and automated analytics are useful only when leaders can interpret their outputs, connect them to school priorities and make context-sensitive decisions. This means that AI-driven DSS should be understood as part of a broader leadership process, where technology assists judgement but does not replace professional responsibility (Mandinach & Gummer, 2016; Wang, 2021).

### 2.2 Global, Regional and Malaysian Literature

Globally, AI-driven DSS have been implemented to enhance data-informed school leadership by enabling leaders to analyse academic, behavioural and operational data in real time (Chen et al., 2020; Perrotta & Selwyn, 2020). Key studies report that AI-driven DSS may improve student learning outcomes through intelligent tutoring systems, learning analytics dashboards and predictive models for early-warning interventions (Holmes et al., 2019; Martin et al., 2024; Wang et al., 2024).

In Southeast Asia, cultural context strongly influences adoption. Studies from Indonesia, Thailand and Vietnam suggest that teacher attitudes, comfort with technology and perceptions of AI utility significantly affect school leaders' decisions to implement AI systems (Mustafa et al., 2024; Wang et al., 2024). In these contexts, AI-driven DSS are most successful when introduced alongside inclusive capacity-building strategies that respect pedagogical norms and local values (UNESCO, 2023).

In Malaysia, the implementation of AI-driven DSS in urban public secondary schools remains fragmented and exploratory. Local research identifies barriers such as insufficient teacher training, limited awareness among school leaders and resistance to change as primary obstacles to AI adoption (Mustafa et al., 2024; UNESCO, 2023). Rather than indicating widespread AI-driven DSS implementation, the Malaysian literature suggests an emerging need for predictive analytics, adaptive platforms and data-informed tools that can support targeted intervention and strategic planning.

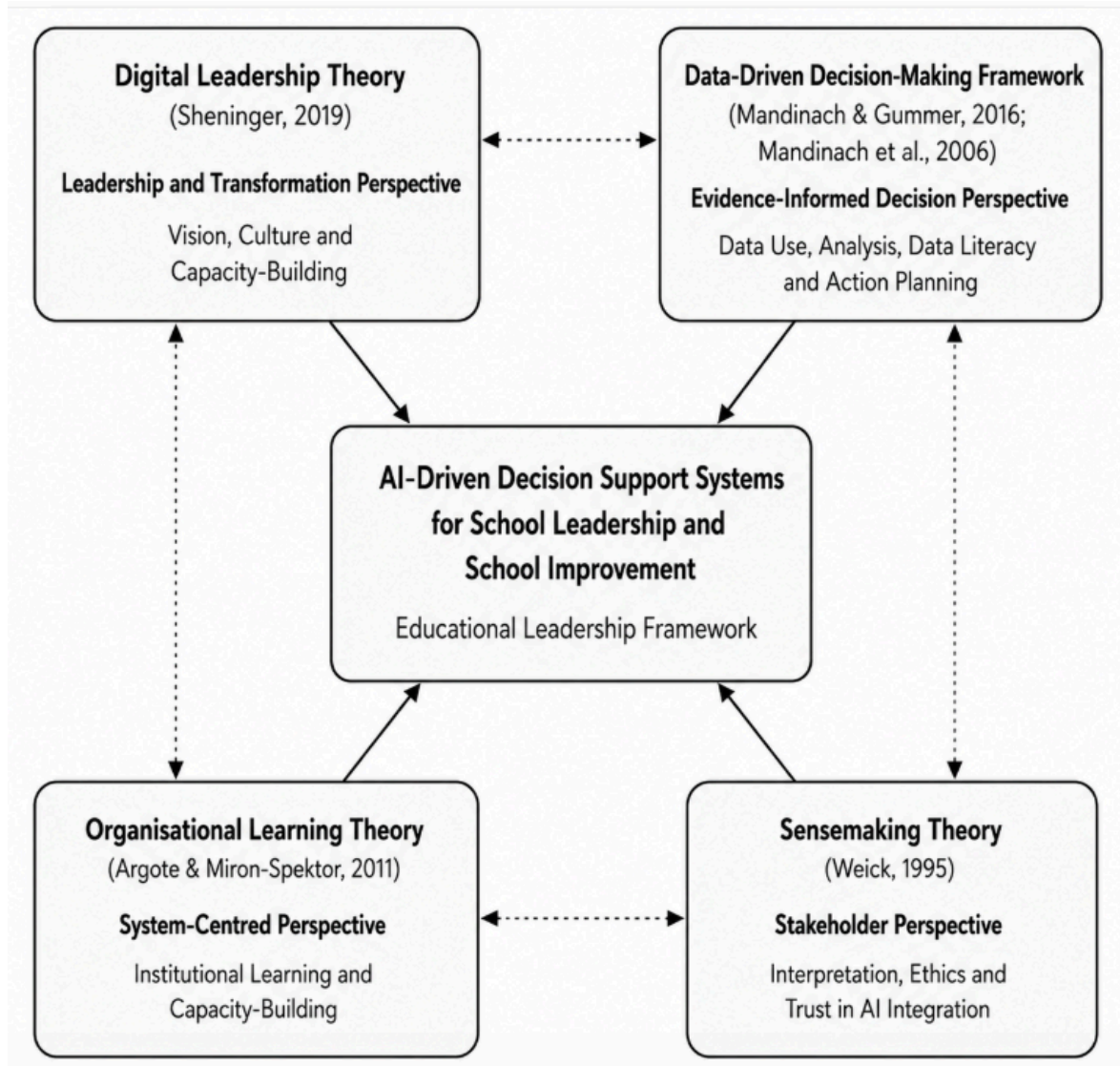
### 2.3 Theoretical Framework

The study is guided by four leadership-focused theoretical perspectives. **Digital Leadership Theory** explains how school leaders guide digital transformation and build readiness for responsible AI adoption (Sheninger, 2019). The **Data-Driven Decision-Making Framework** explains how educational data are interpreted and translated into



evidence-informed action (Mandinach & Gummer, 2016; Mandinach et al., 2006). **Organisational Learning Theory** explains how schools build collective capacity and embed new routines (Argote & Miron-Spektor, 2011), while **Sensemaking Theory** explains how school leaders interpret AI-generated information within complex and uncertain school contexts (Weick, 1995).

**Figure 1: Theoretical Framework** (Adapted from Argote & Miron-Spektor, 2011; Mandinach & Gummer, 2016; Mandinach et al., 2006; Sheninger, 2019; Weick, 1995)

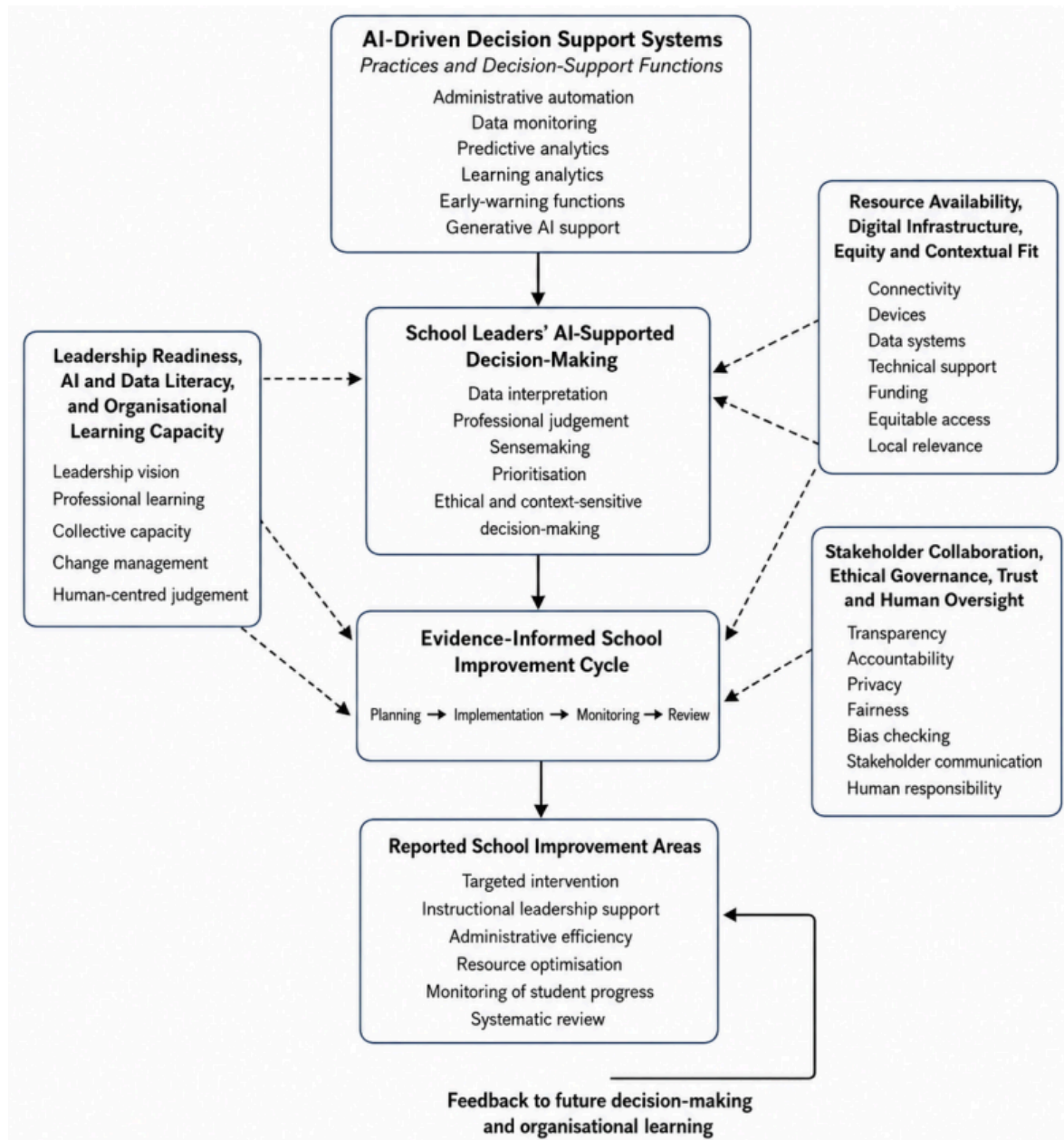


## 2.4 Conceptual Framework

The conceptual framework explains how AI-driven DSS may support school leaders' AI-supported decision-making and contribute to evidence-informed school improvement planning and implementation. The framework comprises a main pathway and three interrelated enabling and cross-cutting conditions. The main pathway begins with AI-driven DSS practices and decision-support functions, which inform school leaders' AI-supported decision-making. Through professional judgement, data interpretation, sensemaking and contextual prioritisation, school leaders translate AI-generated insights into evidence-informed school improvement planning, implementation, monitoring and review.

**Figure 2: Conceptual Framework** (Developed by the researcher based on literature synthesis)

The three enabling conditions are: leadership readiness, AI and data literacy, and organisational learning capacity; resource availability, digital infrastructure, equity and contextual fit; and stakeholder collaboration, ethical governance, trust and human oversight.



### **3. Methodology**

#### **3.1 Research Design**

This study adopted a qualitative systematic literature review (SLR) methodology. The unit of analysis was published scholarly and reputable institutional literature, rather than school leaders, teachers, students or schools. The study did not involve empirical fieldwork, interviews, surveys or the implementation of AI tools in school settings.

The SLR followed a structured, replicable and transparent process, adapting the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework to guide identification, screening, eligibility and inclusion (Page et al., 2021). The review focused on literature published between 2019 and 2025. The term K–12 was retained only as a database search and retrieval term because much of the international literature on AI in school leadership is indexed under this broader classification. During screening, eligibility review and synthesis, the analytical focus was narrowed to literature that directly or meaningfully informed public secondary school leadership, school improvement and Malaysian urban public secondary school relevance.

#### **3.2 Sources of Literature and Study Selection**

The evidence base consisted of peer-reviewed journal articles, academic conference papers and reputable institutional reports. ERIC was used as the main structured database search, while Google Scholar and DOAJ were used as supplementary sources. The search strings combined terms related to AI, decision support, school leadership and school level.

Inclusion criteria: peer-reviewed journal articles, academic conference papers or reputable institutional reports; published in English between 2019 and 2025; addressing AI-driven DSS, AI-supported decision-making, educational leadership or school improvement in K–12 or public secondary school contexts.

Exclusion criteria: blogs, editorials, opinion pieces, news items; publications outside the date range; studies focused only on higher education; studies centred solely on student use of AI without leadership decision-making relevance; studies lacking meaningful link to AI-supported leadership practice or school-level improvement.

#### **3.3 Data Collection and Analysis**

The review process included systematic searching, title and abstract screening, full-text eligibility review, quality appraisal, data extraction, coding and thematic synthesis. A structured quality appraisal rubric assessed four dimensions: clarity of objectives and theoretical alignment; appropriateness of research design and methods; quality of sampling and data collection; and relevance to AI-driven DSS in K–12 school leadership. Each dimension was scored on a 1 to 5 scale, producing a maximum possible score of 20. Studies scoring 15 or above were retained for extraction and synthesis.

Data extraction was conducted using a standardised extraction and coding matrix in Excel. The matrix captured study identification, author and year, title, country, setting, school level,

study type, AI tool or DSS used, leadership decision focus, school improvement linkage, extracted data segment, initial code, theme, research question mapping, conceptual framework lens, quality score and audit-trail notes.

Data were analysed using thematic analysis and thematic synthesis following Braun and Clarke's (2021) six-phase approach. The analysis combined inductive and deductive elements. Codes and themes were developed from the extracted literature, while interpretation was guided by the research questions and conceptual framework.

### 3.4 Ethical Considerations

Because the study used secondary literature only, it did not involve direct engagement with human participants. Ethical care was maintained by using published scholarly sources, accurately representing the meaning of reviewed studies and citing all sources in accordance with APA 7th edition requirements.

## 4. Findings

### 4.1 Search and Screening Results

The completed search process identified 21,856 records across all search runs. A total of 363 records were screened at the title and abstract stage. Following title and abstract screening, 52 records were included for full-text eligibility review. At full-text review, 25 articles were excluded, and 27 studies were retained after full-text review and moved to quality appraisal. The quality appraisal process narrowed the final evidence base to 16 studies that met the quality threshold. Across these 16 studies, 131 meaningful data segments were extracted and coded for thematic synthesis.

**Table 4.1: Search and Screening Summary**

| Review Stage                                      | Number |
|---------------------------------------------------|--------|
| Search runs logged                                | 14     |
| Approximate records identified across search runs | 21,856 |
| Records screened at title and abstract stage      | 363    |
| Records excluded at title and abstract stage      | 311    |
| Records included for full-text eligibility review | 52     |
| Full-text articles excluded                       | 25     |
| Studies retained after full-text review           | 27     |
| Studies passing quality appraisal                 | 16     |
| Final extraction segments coded                   | 131    |

## 4.2 Characteristics of Included Studies

The final evidence base consisted of 16 studies published between 2023 and 2025. The studies represented a range of international contexts including Cyprus, the United States, Germany, Turkey, Nigeria, Hong Kong SAR, Pakistan, Norway, Indonesia, Israel, and a multi-country Arab region study. Although no final included study was an empirical study conducted directly in Malaysian urban public secondary schools, several studies were retained because they provided transferable evidence for the Malaysian context, particularly in relation to school leadership, public secondary education, resource-constrained implementation, digital readiness, AI governance and school improvement planning.

**Table 4.2: Characteristics of Studies Included in Final Synthesis**

| Study ID | Author(s) & Year           | Country/Region  | School Level            | AI/DSS Focus                                   | Methodology            | Quality Score |
|----------|----------------------------|-----------------|-------------------------|------------------------------------------------|------------------------|---------------|
| S002     | Kafa (2025)                | Cyprus          | K–12                    | ChatGPT, AI for leadership decision support    | Qualitative            | 15/20         |
| S003     | Doss et al. (2025)         | USA             | K–12                    | Generative AI tools (ChatGPT, Gemini, Copilot) | Mixed-methods          | 16/20         |
| S005     | Renta-Davids et al. (2025) | Spain (scoping) | K–12                    | AI in educational leadership, governance       | Scoping review         | 17/20         |
| S006     | Pietsch & Mah (2025)       | Germany         | K–12                    | AI transformation, digital mindset             | Quantitative           | 16/20         |
| S007     | Kesim et al. (2025)        | Turkey          | K–12                    | AI influence on school culture and leadership  | Mixed-methods          | 15/20         |
| S012     | Kim et al. (2024)          | USA             | K–12                    | ChatGPT for problems of practice               | Qualitative case study | 15/20         |
| S014     | Ezenwagu et al. (2025)     | Nigeria         | Secondary               | AI-driven educational reforms                  | Descriptive            | 15/20         |
| S015     | Cheng & Wang (2023)        | Hong Kong SAR   | Basic education         | Digital transformation, AI in education        | Qualitative            | 16/20         |
| S019     | Dike & Kobani (2025)       | Nigeria         | Public senior secondary | AI and digital connectivity                    | Mixed-methods          | 15/20         |
| S020     | Friday (2025)              | Nigeria         | Secondary               | AI-driven governance, ethical challenges       | Descriptive            | 15/20         |
| S021     | Abideen et al. (2023)      | Pakistan        | Secondary               | Machine learning, data mining for enrolment    | Quantitative           | 15/20         |



|      |                        |                    |                 |                                              |                     |       |
|------|------------------------|--------------------|-----------------|----------------------------------------------|---------------------|-------|
| S022 | Lunde (2024)           | Norway             | K–12            | Learning analytics                           | Conceptual          | 16/20 |
| S023 | Gunadi (2025)          | Indonesia          | Elementary      | AI-assisted supervision, teacher performance | Qualitative         | 15/20 |
| S024 | Ghamrawi et al. (2025) | Multi-country Arab | K–12            | Generative AI, 5C's framework                | Conceptual          | 16/20 |
| S025 | Berkovich (2025)       | Israel             | K–12            | Generative AI in instructional leadership    | Quantitative survey | 16/20 |
| S027 | Kim & Wargo (2025)     | USA                | Rural K–12 STEM | AI integration in rural STEM education       | Qualitative         | 15/20 |

### 4.3 Quality Appraisal Results

Of the 27 studies appraised, 16 met the minimum quality threshold and were classified as "Pass". The final 16 studies had scores ranging from 15 to 17, with an average score of 15.5. Nine studies scored 15, six studies scored 16, and one study scored 17. The remaining 11 studies were excluded from the final synthesis because they scored below 15.

### 4.4 Thematic Findings

Five main themes were generated from the thematic synthesis.

**Table 4.4: Main Themes, Subthemes, and Supporting Studies**

| Theme                                                                                  | Subthemes                                                                                                                                                                           | Supporting Studies                                                     |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Theme 1: AI-Augmented Leadership Practices and Decision-Support Functions</b>       | Digital communication and coordination; shared digital workflows; administrative automation; AI-supported leadership decision support                                               | S002, S007, S012, S019, S020, S021, S023                               |
| <b>Theme 2: Data-Informed and Predictive School Improvement Planning</b>               | Data monitoring and analytics; predictive analytics and early warning; school improvement planning and priority setting; instructional leadership support; teacher decision support | S007, S012, S015, S019, S021, S022, S023, S025                         |
| <b>Theme 3: Leadership Readiness, Organisational Learning and Human-Centred Change</b> | Strategic vision and school-wide AI integration; change management; professional development; leadership readiness and AI literacy; human-centred judgement; organisational culture | S002, S003, S005, S006, S007, S012, S014, S015, S019, S023, S024, S025 |



|                                                                  |                                                                                                                                            |                                                            |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| <b>Theme 4: Ethical Governance, Accountability and Trust</b>     | Policy and governance frameworks; ethical risk, bias, privacy and fairness; accountability, transparency and trust                         | S003, S005, S007, S019, S020, S022, S024, S025             |
| <b>Theme 5: Resource Availability, Equity and Contextual Fit</b> | Infrastructure and technical capacity; equity and digital divide; contextual adaptation and local fit; resource-constrained implementation | S002, S005, S007, S012, S014, S015, S019, S022, S023, S027 |

**Theme 1: AI-Augmented Leadership Practices and Decision-Support Functions.** AI-supported leadership develops from strong digital foundations and is most valuable when it augments, rather than replaces, the professional judgement of school leaders. Digital communication systems and shared workflows create the information infrastructure required for AI-supported decision-making. Administrative automation reduces routine workload and enables leaders to focus on strategic planning, instructional leadership and school improvement priorities. Evidence from S002, S007, S019, and S023 suggested that AI tools could assist leaders by generating options, comparing alternatives, analysing information, identifying patterns and offering recommendations.

**Theme 2: Data-Informed and Predictive School Improvement Planning.** AI-driven DSS contribute most clearly to school improvement when it helps leaders transform data into priorities, interventions and sustained planning cycles. Predictive analytics and early warning systems can help leaders identify emerging concerns before they become more serious. Evidence from S019 and S022 indicated that school leaders used digital data, analytics platforms and reporting systems to monitor performance, identify patterns and support accountability discussions. Evidence from S012, S019, and S022 showed that AI and data systems were most useful when leaders used them to inform strategic priorities, intervention planning and improvement decisions.

**Theme 3: Leadership Readiness, Organisational Learning and Human-Centred Change.** AI-supported school improvement is fundamentally a leadership and organisational learning challenge, not merely a technological implementation task. Evidence from S003, S005, S006, S007, S014, S015, S019, S024, and S025 showed that AI integration required strategic vision and school-wide direction. Professional development was identified as a recurring need, with evidence from S003, S005, S007, S012, S014, S019, S023, and S025 showing that teachers and school leaders required sustained and role-specific training to use AI effectively.

**Theme 4: Ethical Governance, Accountability and Trust in AI-Supported Decision-Making.** Ethical governance is not an optional addition to AI implementation; it is a central condition for responsible AI-supported decision-making. Evidence from S003, S007, S020, and S024 showed that schools required clear rules, monitoring structures, academic integrity guidance and responsible AI-use policies. Evidence from S005, S020, and S025 identified issues such as bias, privacy, data security, opacity, unfairness and academic integrity. Without clear governance, AI tools may create risks related to privacy, bias, accountability, transparency, fairness, academic integrity and stakeholder trust.

**Theme 5: Resource Availability, Equity and Contextual Fit for Sustainable AI Implementation.** Sustainable AI-supported school improvement depends on resource readiness, equity-conscious planning and careful adaptation to local school contexts. Evidence from S002, S014, S015, S019, and S023 showed that AI adoption could be limited by weak internet connectivity, insufficient devices, maintenance issues, licensing costs, platform access, technical support gaps and uneven digital capacity. Evidence from S005, S007, and S023 suggested that AI adoption could widen inequalities when access to technology, expertise, funding and infrastructure was uneven.

## 4.5 Integrated Synthesis Across Research Questions

**Table 4.5: Research Question Synthesis Matrix**

| Research Question                                                            | Key Findings                                                                                                                                                                                                                                                               | Supporting Themes                  |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>RQ1: Global and Malaysian-relevant practices of AI-driven DSS</b>         | Practices range from digital communication and administrative automation to predictive analytics, instructional supervision and school-wide AI integration                                                                                                                 | Theme 1, Theme 2                   |
| <b>RQ2: Challenges in integrating AI-driven DSS</b>                          | Challenges include leadership readiness gaps, limited professional development, ethical governance concerns, infrastructure constraints and contextual adaptation needs                                                                                                    | Theme 3, Theme 4, Theme 5          |
| <b>RQ3: Link between AI-supported decision-making and school improvement</b> | AI-supported decision-making supports school improvement through data-informed planning, early intervention, instructional leadership, administrative efficiency and systematic review, but this link is conditional on responsible leadership and organisational capacity | Theme 2, Theme 3, Theme 4, Theme 5 |

## 5. Discussion

### 5.1 Summary of Key Findings

The findings indicate that AI-driven DSS have the potential to support school leaders in improving decision-making, but this potential is neither automatic nor purely technical. AI-supported decision-making is most useful when it helps school leaders organise information, interpret data, identify emerging risks, set improvement priorities, plan targeted interventions and strengthen instructional leadership. However, AI-driven DSS contribute meaningfully to school improvement only when supported by leadership readiness, professional competence, ethical governance, reliable infrastructure, stakeholder trust and contextual adaptation.

## 5.2 Discussion in Relation to Research Questions

**RQ1: Global and Malaysian-Relevant Practices of AI-Driven DSS.** The findings show that current practices range from basic digital coordination to advanced AI-supported decision functions. AI-driven DSS practice in school leadership can be grouped into several broad areas: administrative automation, digital communication and coordination, shared digital workflows, data monitoring, predictive analytics, instructional supervision, teacher decision support and school-wide AI integration. This finding is important because it shows that AI-driven DSS adoption does not begin with sophisticated tools alone. In many school settings, AI readiness begins with basic but disciplined digital leadership practices. This aligns with Kafa's (2025) finding that digital communication, documentation and workflow systems supported school coordination, administrative efficiency and emerging AI-supported leadership tasks.

**RQ2: Challenges in Integrating AI-Driven DSS.** The findings show that the challenges of AI integration are multidimensional. They are not limited to access to technology. Instead, they involve leadership readiness, AI literacy, professional development, organisational culture, ethical governance, infrastructure, equity and contextual fit. Leadership readiness emerged as a central challenge. School leaders need AI literacy, data interpretation skills, ethical awareness and the confidence to make informed judgements about AI-generated outputs. Professional development was another major challenge, with teachers and leaders requiring sustained, role-specific training rather than one-off workshops. Ethical governance also emerged as a major challenge, with AI-driven DSS raising concerns about student data privacy, algorithmic bias, fairness, accountability and transparency.

**RQ3: Link Between AI-Supported Decision-Making and School Improvement.** The findings show that AI-supported decision-making is linked to school improvement through improved data interpretation, earlier risk identification, targeted intervention, instructional leadership, administrative efficiency and more systematic planning. Predictive analytics and learning analytics platforms can support school leaders by identifying at-risk students, monitoring performance trends and informing timely interventions. However, the evidence does not support a simple claim that AI automatically improves schools. AI-driven DSS support school improvement only when school leaders interpret AI-generated insights responsibly and act on them within a clear improvement cycle. Data must be connected to school goals, staff capacity, student needs, ethical safeguards and contextual realities.

## 5.3 Discussion in Relation to Theoretical Framework

The findings are consistent with the conceptual framework, which positions AI-driven DSS as a decision-support mechanism that informs school leaders' AI-supported decision-making and contributes to evidence-informed school improvement planning and implementation. The findings support the role of AI-driven DSS as a decision-support mechanism. Evidence from the thematic synthesis showed that AI can help school leaders interpret data, identify trends, predict risks, generate options and support planning. This aligns with the framework's positioning of AI-driven DSS as a tool that strengthens, rather than replaces, evidence-informed leadership decision-making.

The findings also support the importance of leadership readiness, AI and data literacy, and organisational learning capacity as enabling conditions. Theme 3 showed that meaningful AI integration depends on leadership vision, AI literacy, professional learning, collective

capacity, change management and human-centred judgement. Resource availability, digital infrastructure, equity and contextual fit were also strongly supported by the findings. Theme 5 showed that connectivity, technical support, funding, devices and data systems shape whether AI implementation is feasible and sustainable. Stakeholder collaboration, ethical governance, trust and human oversight were also reinforced by the findings, showing that AI adoption requires trust, communication, support structures and partnerships.

## **5.4 Implications for Malaysian Urban Public Secondary School Leadership**

The findings have several implications for Malaysian urban public secondary school leadership. First, school leaders need to view AI as a strategic leadership tool rather than merely a technological innovation. AI-driven DSS should be connected to school improvement priorities, instructional leadership, resource planning and student support. Second, AI literacy should become part of leadership development. School leaders require the capacity to understand AI-generated outputs, evaluate their limitations, ask critical questions and make final decisions responsibly. Third, school leaders need to strengthen digital foundations before implementing advanced AI tools. Schools require reliable data systems, consistent documentation, coherent workflows and clear communication structures. Fourth, school leaders need to manage AI implementation as a change process. Teachers and staff may experience uncertainty, resistance or anxiety about AI. Leaders need to create a culture of guided experimentation, professional dialogue and shared learning. Fifth, school leaders need to protect trust. AI adoption in schools affects students, teachers and parents. Therefore, leaders must communicate clearly about how AI tools are used, what data is collected, how privacy is protected and how human judgement remains central.

## **5.5 Limitations**

The study has several limitations. First, the study adopted a single-reviewer SLR design. Although this approach is academically defensible for doctoral research and was supported by a structured quality appraisal rubric, audit trail, codebook and reflexive memos, it did not include inter-coder checking or dual-reviewer validation. Second, Scopus and Web of Science were not included in the database search. Although ERIC, Google Scholar and DOAJ provided education-focused, interdisciplinary and open-access coverage, the inclusion of Scopus and Web of Science could have strengthened the comprehensiveness of the search. Third, the final evidence base consisted of 16 studies. Although these studies were sufficient for thematic synthesis, the field of AI-driven DSS in school leadership remains emerging. Fourth, there was limited direct empirical evidence from Malaysian urban public secondary schools. Much of the evidence came from international or contextually comparable studies. Fifth, the study focused only on Malaysian urban public secondary school contexts and did not include rural schools. Sixth, the included studies varied in design, context, school level and AI focus. Seventh, the study was based on secondary literature only and did not involve interviews, surveys or direct engagement with Malaysian school leaders.

## **5.6 Recommendations**

Based on the findings, several recommendations are proposed. First, policymakers should develop clearer national or system-level guidance on the responsible use of AI in school

leadership and school improvement. Second, leadership development programmes should include AI literacy and data-informed decision-making. Third, schools should conduct AI readiness audits before adopting advanced AI-driven DSS. Fourth, schools should strengthen digital foundations. Before introducing complex AI tools, schools should ensure that communication systems, documentation workflows, student data systems and reporting processes are reliable and consistent. Fifth, AI implementation should be phased, beginning with small-scale pilots, guided experimentation, staff feedback and review cycles. Sixth, professional development should be sustained and role-specific. Seventh, school leaders should establish AI governance structures including policies, acceptable-use guidelines, data protection procedures and human oversight requirements. Eighth, school improvement planning should explicitly include AI-supported evidence use. Ninth, stakeholder engagement should be prioritised. Tenth, AI should be used to support equity rather than widen gaps.

## 5.7 Suggestions for Future Research

Several areas for future research emerged. First, empirical studies should be conducted with Malaysian urban public secondary school leaders to examine how they understand, adopt and use AI-driven DSS in practice. Second, future research could examine AI readiness among Malaysian school leaders. Third, school-based case studies could investigate how AI-driven DSS are integrated into school improvement planning. Fourth, future research could explore teachers' and middle leaders' roles in AI-supported school improvement. Fifth, further research is needed on AI governance in Malaysian schools. Sixth, longitudinal research could examine the longer-term effects of AI-supported decision-making on school improvement areas. Seventh, comparative studies could examine differences between urban, suburban, rural, public and private school contexts. Eighth, future research could investigate student and parent perspectives on AI-supported decision-making. Finally, future studies could evaluate professional development models for AI literacy in school leadership.

## 5.8 Conclusion

This study examined how AI-driven decision support systems are represented in existing literature as tools to support school leaders' decision-making for school improvement in Malaysian urban public secondary school contexts. The findings show that AI-driven DSS have meaningful potential to support school leaders by strengthening data interpretation, predictive planning, administrative efficiency, instructional leadership and targeted intervention. However, the study also shows that AI does not improve schools by itself. Its value depends on the readiness, judgement, ethics and capacity of the leaders and organisations that use it.

The central conclusion of this study is that AI-supported decision-making should be understood as augmented school leadership. AI can assist leaders by organising information, identifying patterns, generating options and supporting planning, but the responsibility for interpretation, ethical judgement, stakeholder engagement and contextual decision-making remains with human leaders. This conclusion is important because it positions AI as a support for leadership, not as a replacement for it.

For Malaysian urban public secondary schools, the findings suggest that AI-driven DSS should be introduced carefully and strategically. Schools need strong digital foundations, clear governance, professional development, stakeholder trust, adequate resources and



context-sensitive implementation. When these conditions are present, AI-driven DSS can support more evidence-informed, equitable and sustainable school improvement planning and implementation. The final implication of this dissertation is that the future of AI in school leadership should be neither overly optimistic nor resistant. AI should be approached with informed caution, ethical responsibility and educational purpose. Used responsibly, AI-driven DSS can help school leaders make better-informed decisions, but the deeper work of school improvement remains human, relational and contextually grounded.

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# Leadership as a Mediating Mechanism Between Contextual Pressures and Teacher Well-Being: A Study of International Schools in Jakarta, Indonesia

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## Abstract

*This qualitative study investigated the interplay between contextual factors and school leadership in influencing teacher well-being in international schools in Indonesia. Employing a qualitative-dominant design with survey data (N=32) serving a supplementary triangulation role, the research examined how intense competition among schools and heightened parental expectations contributed to challenges in educator well-being and burnout. Crucially, it explored the perceived role of school leadership in mediating these pressures. Data collected through semi-structured interviews with five teachers from two International Baccalaureate (IB) schools were analyzed using thematic analysis through the lens of Conservation of Resources (COR) Theory, Self-Determination Theory (SDT), and the Socio-Ecological Framework. The findings revealed that while contextual pressures were significant stressors, their impact was not inevitable. School leadership emerged as the critical mediating variable, determining whether external demands overwhelmed teachers or were effectively mitigated. Leadership practices that were proactive, supportive, and empowering—fostering autonomy, providing meaningful professional development, and building collaborative community—were identified as the most effective mechanisms for safeguarding well-being. Conversely, unsupportive or inconsistent leadership exacerbated stress and accelerated burnout. The study concludes that enhancing teacher well-being in high-pressure environments requires deliberate focus on developing leadership capacity, positioning school leadership as the central mediating mechanism for cultivating a resilient, sustainable teaching workforce.*

**Keywords:** *teacher well-being; school leadership; international schools; burnout; Conservation of Resources Theory; Self-Determination Theory; Indonesia*

## 1. Introduction

### 1.1 The Broader Context

In Indonesia's vibrant educational landscape, over 116 international schools have emerged as pivotal institutions catering to diverse expatriate and local communities (Database, 2023). These institutions bridge various cultures and aim to provide holistic education. However, amidst this complexity, the well-being of educators often takes a backseat. The influence of leadership on teacher well-being encompasses various concepts, including transformational leadership, invitational theory, leaders' interactions with faculty, and leadership strategies

(Owen, 2016; Yulianti et al., 2021). School leadership encompasses diverse fields, such as educational administration, organisational behaviour, and instructional leadership (Day et al., 2016).

To foster a positive perception of well-being within schools, school leaders must cultivate an understanding of their teams' functioning and their needs and desires (Gonzalez & Perez, 2017; Martinez, 2022). Establishing a positive school climate and environment that promotes faculty members' well-being requires a comprehensive understanding of leadership practices, theories, and the school context (Thomas, 2016; Rodriguez & Smith, 2020).

Indonesia stands as a vibrant tapestry of cultural diversity and rapid economic advancement, which has fostered the proliferation of international schools across the nation. With more than 100 international schools (Database, 2023), these institutions are dedicated to providing high-quality education to a cosmopolitan demographic, including expatriates and local families. Each school strives to create an educational environment that not only meets international standards but also resonates with the unique cultural fabric of Indonesia. However, the rapid expansion of international schools has given rise to numerous challenges that significantly impact the well-being of educators operating within these environments (Alves et al., 2020; Alam, 2022; Benevene et al., 2020; Bardach et al., 2021).

## **1.2 The Research Problem**

Teacher well-being is essential to educational quality, yet it is critically threatened in Indonesia's international schools. These institutions operate within a highly competitive landscape and are subject to exceedingly high parental expectations. These contextual factors create immense pressure on educators, leading to documented issues of stress, job dissatisfaction, and burnout, which subsequently compromise instructional quality and student outcomes.

While the existence of these external pressures is well-documented, a pivotal gap remains in understanding how school leadership actively mediates, exacerbates, or mitigates their impact on teacher well-being. Current research often treats these stressors as inevitable, without critically examining the internal capacity of the school—specifically, its leadership—to manage them. There is a conspicuous lack of research investigating the specific leadership practices and strategies that can buffer teachers from these demands within the unique socio-cultural context of Indonesia.

The absence of effective leadership mediation allows competitive and parental pressures to directly translate into teacher burnout and high turnover. This not only jeopardizes the welfare of educators but also threatens the financial stability and academic reputation of the schools themselves, ultimately undermining the quality of education they aspire to provide. Therefore, the core problem is not merely the presence of contextual challenges, but the lack of a clear understanding of the leadership mechanisms that determine their ultimate impact on educator well-being.

## **1.3 Research Purpose and Questions**

The objective of this study is to comprehensively explore the factors affecting teacher well-being in international schools in Indonesia, with a specific focus on investigating how

school leadership mediates the impact of contextual pressures—namely, competition among schools and heightened parental expectations—on educator stress, burnout, and overall well-being.

Three research questions guide this investigation:

- How do contextual factors—specifically competition among international schools and high parental expectations—shape teachers' experiences of well-being and burnout in Indonesia?
- What is the perceived role of school leadership in influencing teacher well-being, and how do leadership practices interact with the pressures of competition and parental expectations?
- What leadership strategies and support mechanisms do teachers identify as most effective in mitigating the negative effects of contextual pressures on their well-being?

## **1.4 Significance of the Study**

This study makes a distinct and original contribution by bridging two critical but often separate conversations in educational research: one on the contextual stressors in international schools, and another on the influence of educational leadership. While substantial research exists on teacher well-being globally, and the unique challenges in Indonesian international schools are increasingly noted (Alves et al., 2020), few studies explicitly position school leadership as the central mediating variable between these challenges and teacher outcomes.

The significance of this study is multifaceted. For teachers, it aims to empower educators by equipping them with the knowledge necessary to navigate challenges more effectively and adopt healthier coping strategies. For school administrators, it provides understanding of the systemic factors contributing to teacher burnout, enabling targeted interventions that improve teacher satisfaction and retention (Tanu, 2018). For policymakers, the findings can inform policies aimed at supporting teacher well-being, including workload management strategies, professional development programs focused on stress management, and initiatives that promote work-life balance (Alam, 2022; Mushtaq & Khan, 2019). On an academic level, this study contributes significantly to the existing body of knowledge regarding teacher well-being within the context of international schools, an area that remains relatively underexplored (Alves et al., 2020; Saeidipour et al., 2021).

## **2. Literature Review**

### **2.1 Teacher Well-Being in International Schools**

The well-being of teachers in international schools is a multifaceted concept shaped by a wide array of global, cultural, and organizational factors. Teachers in these settings encounter unique challenges as they navigate the demands of teaching in diverse, transnational environments. The well-being of international school teachers is affected by a complex interplay of individual, interpersonal, and systemic factors, including global mobility, cultural

adaptation, diversity and inclusion, professional identity and community, and organizational support.

**Global mobility** is a central feature of the experience of teachers in international schools, as many educators relocate from their home countries to work abroad. This transition entails not only logistical adjustments but also significant emotional and psychological challenges. Teachers in international settings often need to adjust to new cultural norms, languages, and socio-political contexts, all of which can have a profound impact on their well-being (Tran & Gomes, 2017). The process of adaptation can lead to feelings of disconnection and isolation, especially if teachers struggle to establish meaningful connections within their new communities.

**Cultural adaptation** is another significant factor affecting teachers' well-being in international schools. These educators often work with students from diverse cultural backgrounds, necessitating that they adopt flexible and inclusive pedagogical approaches. Effective cultural adaptation requires not only awareness of cultural differences but also the ability to respond to them sensitively and appropriately (Gay, 2018). Teachers in international schools frequently face the challenge of managing classrooms where students have varying levels of language proficiency, different cultural expectations around learning, and unique educational needs.

**Professional identity and community** are essential for teachers' well-being. In the close-knit environment of international schools, teachers often form strong bonds with colleagues and students, fostering a sense of professional identity that transcends national boundaries. This sense of belonging and identity can be a protective factor for teachers' well-being, offering essential social support and opportunities for collaboration (Gray et al., 2021). The transient nature of international school communities, however, poses emotional challenges. Teachers in these settings frequently have to say goodbye to colleagues and students and face the uncertainty of forming new relationships as others come and go.

**Organizational support** is a critical factor in promoting teacher well-being in international schools. Schools that prioritize teacher wellness often invest in resources such as professional development opportunities, mental health support, and work-life balance initiatives. Effective leadership that values transparency and fosters open communication can create a positive school climate where teachers feel respected and valued. Research has shown that when teachers perceive strong support from their school leadership, they are more likely to experience higher job satisfaction, greater engagement, and lower levels of burnout (Richards et al., 2020).

## 2.2 The Mediating Role of School Leadership

Educational leadership is not a monolithic concept but encompasses various styles and functions that directly impact faculty morale and well-being (Day et al., 2016). Transformational leadership, which inspires and motivates through a shared vision, has been linked to higher levels of teacher commitment and job satisfaction (Leithwood & Sun, 2012). Similarly, instructional leadership, focused on the quality of teaching and learning, and the principles of invitational leadership, which intentionally creates a welcoming and supportive professional environment, are critical for teacher success (Owen, 2016).

The Job Demands-Resources (JD-R) model provides a powerful lens to conceptualize leadership. Supportive leadership acts as a critical job resource that can buffer the negative effects of high job demands, such as workload and parental pressure (Bakker & de Vries, 2021). When leaders provide clear communication, meaningful professional development, and autonomy, they help meet teachers' core psychological needs as outlined by Self-Determination Theory: autonomy, competence, and relatedness (Ryan & Deci, 2017). Conversely, leadership that is perceived as unsupportive, top-down, or inconsistent constitutes a significant demand in itself and can lead to resource loss, accelerating the path to burnout as explained by Conservation of Resources (COR) Theory (Hobfoll, 1989).

Empirically, studies consistently show that leadership is a primary determinant of school climate. Leaders who foster trust, collaboration, and recognition create a resilient environment where teachers feel valued and supported, even amidst external challenges (Richards et al., 2020). They can act as a "circuit breaker" between parental demands and teachers by establishing clear communication protocols and managing expectations. They can reframe competitive pressures into a collective, supportive mission rather than a source of individual anxiety.

## 2.3 Theoretical Framework

This study is guided by an integrated theoretical framework comprising four complementary theories:

**Conservation of Resources (COR) Theory** (Hobfoll, 1989) provides insight into how individuals seek to acquire, retain, and protect resources they value. These resources may be material (e.g., salary), social (e.g., support from colleagues), or psychological (e.g., self-esteem). COR theory posits that stress arises when individuals perceive a threat to their resources or experience an actual resource loss. In educational settings, this can help explain why teachers feel stress or burnout when their valued resources, such as professional autonomy or social support, are lacking.

**Self-Determination Theory (SDT)** (Deci & Ryan, 2000) posits that individuals have three basic psychological needs: autonomy, competence, and relatedness. Meeting these needs is essential for intrinsic motivation, job satisfaction, and overall well-being. SDT suggests that school environments that nurture these three needs are likely to foster well-being and intrinsic motivation among teachers. Interventions that enhance teachers' autonomy, support their professional growth, and build strong social connections can lead to sustained improvements in well-being and job performance.

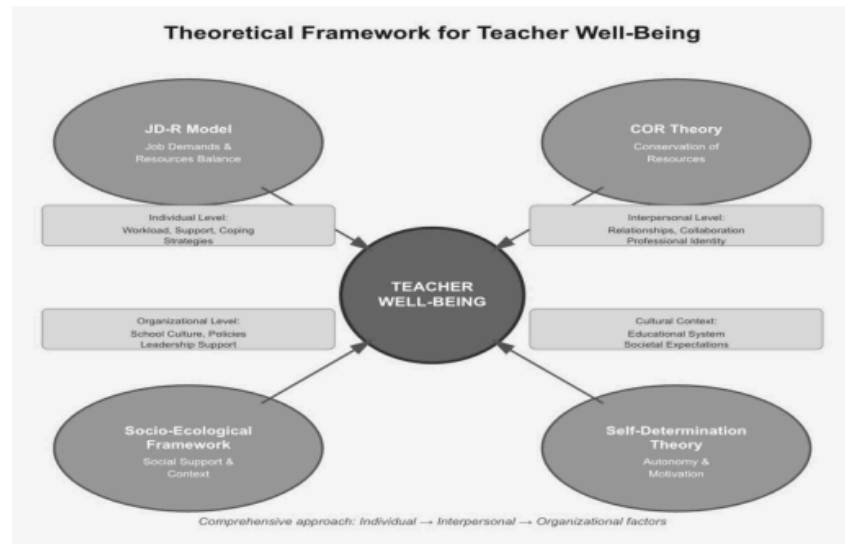
**The Socio-Ecological Framework** (Bronfenbrenner, 1979) emphasizes that individual well-being is influenced by multiple levels of interacting factors: intrapersonal, interpersonal, organizational, community, and societal. This framework provides a holistic approach for examining teacher well-being by considering how interactions across various levels shape educators' experiences.

**The Job Demands-Resources (JD-R) Model** (Bakker & Demerouti, 2017) divides work-related factors into two primary categories: job demands and job resources. Job demands are the physical, psychological, social, or organizational aspects of work that require sustained effort. Job resources are aspects of the job that help individuals achieve their work



goals, reduce job demands, and foster personal development. The JD-R model suggests that a balance between job demands and job resources is essential for promoting well-being.

**Figure 2.0: Theoretical Framework for Teacher Well-Being** (adapted from Hobfoll, 1989; Ryan & Deci, 2000; Bronfenbrenner, 1979; Bakker & Demerouti, 2017)

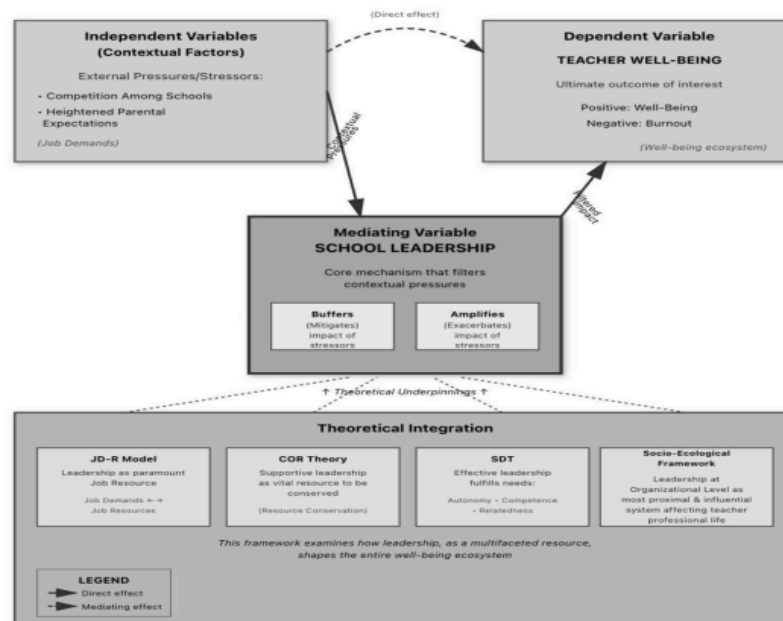


## 2.4 Conceptual Framework

The conceptual framework for this study establishes a model for understanding the dynamics of teacher well-being in Indonesia's international schools. Central to this framework is the positioning of **School Leadership** as the pivotal mediating variable that intervenes between external pressures and teacher outcomes. Specifically, the model identifies two primary Contextual Factors as independent variables: the intense **Competition Among Schools** and **Heightened Parental Expectations**. These factors represent significant external stressors that exert pressure on the educational environment.

Conversely, the dependent variable of ultimate concern is **Teacher Well-Being**, which includes its negative correlate, burnout. However, this framework posits that the relationship between contextual pressures and teacher well-being is not direct. Instead, **School Leadership** functions as the core mediating mechanism through which these external factors are filtered. In other words, leadership practices can either buffer (thereby mitigating) or amplify (thereby exacerbating) the impact of competitive and parental pressures on educators.

**Figure 2.1: Conceptual Framework of the Study Design**



## 3. Methodology

### 3.1 Research Design

A qualitative approach was selected to explore the varied experiences and perceptions of participants concerning teacher well-being in international schools. This method allows for an in-depth examination of complex social phenomena, particularly those related to human emotions, interpersonal relationships, and individual experiences, which quantitative methods often fail to fully capture. Teacher well-being, a multi-dimensional construct influenced by a range of personal, professional, and cultural factors, is especially well-suited for qualitative inquiry.

This qualitative inquiry is grounded in an interpretivist/constructivist research paradigm, informed by a social constructivist ontology which posits that reality is socially constructed, and a subjectivist epistemology which holds that knowledge is best developed through an understanding of the subjective meanings individuals ascribe to their experiences (Creswell & Poth, 2018; Denzin & Lincoln, 2018).

The study adopts a **qualitative-dominant design (QUAL-quant)**. The core inquiry is qualitative, grounded in an interpretivist paradigm and focused on understanding teachers' lived experiences through semi-structured interviews. The survey data serves a supplementary role, providing descriptive statistics that contextualize and triangulate the qualitative findings. This is not a full mixed-methods design with integrated quantitative analysis; rather, the survey functions as a supportive tool to enhance the credibility and trustworthiness of the qualitative interpretations.

### 3.2 Participants and Sampling

The study targeted educators from two private International Baccalaureate (IB) schools located in Jakarta. Participants were recruited from a "job-alike" event that gathered approximately 70 educators from the two schools. Around 32 individuals expressed interest in participating in the study, reflecting engagement and willingness to share their experiences.

For in-depth interviews, a **purposive sampling** technique was employed. Participants for interviews were selected based on their roles, willingness to share their experiences, and ability to provide relevant insights into factors influencing well-being. The final sample included 5 participants (4 females, 1 male) from the two schools, ensuring a balance of roles and backgrounds. Two teachers worked in lower secondary while three worked in upper secondary. Data saturation was determined when interviews with the fifth participant yielded no new codes related to the core themes of leadership mediation and well-being, consistent with Guest, Bunce, and Johnson's (2006) guidance that saturation in homogeneous qualitative samples often occurs within 6-12 interviews.

### 3.3 Data Collection Instruments

Two primary instruments were employed: a survey and semi-structured interviews.

**The survey instrument** was designed to gather demographic information and general trends related to teachers' perceptions of their well-being. The survey included demographic questions and Likert-scale items to capture teachers' perceptions of their job satisfaction, stress levels, and work-life balance. Crucially, and in alignment with the study's Conceptual Framework, the survey contained dedicated sections to assess school leadership. Specific scaled items required teachers to rate their leadership's effectiveness in key areas theoretically linked to buffering stress, such as providing trust, constructive feedback, and resources (Hobfoll, 1989; Ryan & Deci, 2000).

**Semi-structured interviews** were employed to explore teachers' personal experiences in greater depth. The interview protocol was explicitly designed around the research questions, with leadership as a central theme. The open-ended questions were crafted to explore the factors influencing teachers' mental health, with a consistent focus on the role of leadership in shaping those factors. For example, participants were asked directly to describe how school leadership helped them handle pressures from competition and parents, and to recall specific instances where leadership actions impacted their well-being.

### 3.4 Data Analysis

Data analysis followed a rigorous process of coding and theme development to uncover the various factors influencing educators' experiences, with a specific focus on the role of school leadership. **Thematic analysis** (Braun & Clarke, 2006; Nowell et al., 2017) was employed to systematically identify and categorize recurring patterns or themes in the interview data.

The analysis process began with familiarization with the interview transcripts. The next step involved coding the interview transcripts. Coding followed a **hybrid approach**: inductive coding captured emergent patterns directly from participant responses, while deductive coding applied a priori codes derived from the Conceptual Framework (e.g., 'Leadership Mediation', 'Parental Pressure', 'Resource Buffering'). Initial codes were then refined into more specific themes. The process of reviewing and refining themes was iterative, ensuring that the

identified themes accurately reflected the participants' experiences. **Member checking** was used to validate the findings, involving sharing preliminary findings with participants to confirm that the identified themes resonated with their lived experiences (Birt et al., 2016).

Quantitative frequencies from the survey were integrated to corroborate or contrast the qualitative themes, enhancing the validity of interpretation through triangulation.

### 3.5 Ethical Considerations

**Informed consent** was obtained from all participants before any data collection began. Participants were given an information sheet outlining the purpose of the research, the types of data to be collected, the potential risks and benefits of participating, and the measures taken to ensure confidentiality and anonymity.

**Confidentiality** was maintained throughout the study by anonymizing participant identities in all reports, publications, and presentations. All data collected, including interview transcripts and survey responses, were stored securely in password-protected files and were only accessible to the research team.

**Participants' autonomy** was respected throughout the research process, including their right to withdraw from the study at any time without facing any negative consequences. Every effort was made to minimize any potential discomfort or harm during the data collection process. The interviews were conducted in a respectful, empathetic, and nonjudgmental manner.

## 4. Findings

### 4.1 Overview of Thematic Structure

Three overarching themes emerged from the analysis:

**Theme 1: The Double-Edged Sword of Pressure** - external and internal demands that simultaneously motivate and strain teachers.

**Theme 2: The Centrality of Leadership and Support Systems** - the mediating influence of leadership and organizational climate on well-being.

**Theme 3: Teacher Agency and Coping Mechanisms** - personal resilience, adaptation, and strategies used to maintain equilibrium.

**Figure 4.1: Thematic Map** illustrating the interrelationships among the three main themes affecting teacher well-being in international schools in Indonesia. Pressure (Theme 1), Leadership and Support (Theme 2), and Teacher Agency (Theme 3) interact dynamically, influencing overall well-being outcomes.

## 4.2 Theme 1: The Double-Edged Sword of Pressure

This theme captures the paradoxical role of pressure within teachers' professional lives. While certain demands—academic excellence, parental engagement, and school reputation—can enhance motivation and performance, their excess leads to strain, fatigue, and emotional depletion (Maslach & Leiter, 2016). Three categories emerged: workload and work-life imbalance, parental expectations, and school competition and academic drive.

**Workload and Work-Life Imbalance.** Teachers consistently identified heavy workload as the most critical factor undermining well-being. The survey revealed that 59% of respondents reported symptoms consistent with burnout, while a majority cited workload as their primary stressor. Frequent deadlines, extensive marking, lesson planning, and administrative reporting extended far beyond contracted hours.

"If work is not done in school, it is done at home. When work is taken home, it reduces time for family or self-care." (Teacher B)

"Finding balance and setting boundaries would mean lowering the quality of the job. I usually work on weekends." (Teacher E)

These quotations illustrate that teachers experience an ongoing conflict between professional commitment and personal restoration. Interviewees repeatedly described the erosion of personal time, reporting that the academic calendar, assessment cycles, and co-curricular demands left little room for recovery. Several mentioned late-night preparation and weekend grading sessions.

"During peak periods, I sacrifice sleep, and lack of rest affects the next day's performance." (Teacher C)

**Table 4.1: Survey Responses on Workload and Burnout Symptoms (N=32)**

| Variable                                 | Category                     | Frequency (n) | Percentage (%) |
|------------------------------------------|------------------------------|---------------|----------------|
| Hours worked beyond school per week      | 0-5 hours                    | 7             | 22             |
|                                          | 6-10 hours                   | 11            | 34             |
|                                          | 11 hours or more             | 14            | 44             |
| Experienced stress due to workload       | Never / Rarely               | 5             | 16             |
|                                          | Sometimes                    | 8             | 25             |
|                                          | Often / Always               | 19            | 59             |
| Reported symptoms of teacher burnout     | Yes                          | 19            | 59             |
|                                          | No                           | 13            | 41             |
| Perceived work-life balance satisfaction | Satisfied / Highly Satisfied | 10            | 31             |
|                                          | Neutral / Dissatisfied       | 22            | 69             |

**Parental Expectations.** Parental expectations surfaced as another significant external pressure. A majority of survey respondents rated parental expectations as high, and over half reported facing unrealistic or excessive demands. Teachers described parents as increasingly assertive and performance-oriented, sometimes questioning grades, teaching methods, or disciplinary decisions.

"Parents expect their kids will always exceed expectations in terms of grades. Some parents request several meetings to pressure the teacher with questions on how can their children improve grades." (Teacher B)

"Sometimes parents want to get responses via messages to teacher in an urgent fashion even if the matter is not very urgent. The teacher feels pressured by parents who contact her outside school hours. If there is no replies, the parents may provide negative feedback in school surveys." (Teacher E)

**School Competition and Academic Drive.** The competitive ethos of international schooling emerged as a pervasive contextual stressor. A majority of survey respondents perceived competition among international schools as "Moderate," "High," or "Very High." Academic standards was the most frequently cited domain of competition, followed by extracurricular achievements.

"Leadership expects teachers to deliver high grades. Admin at times gives short, demanding and unrealistic deadlines in order to boost students grades and make the school more competitive when compared to other schools." (Teacher B)

"The attempts to increase student numbers, adds extra hours of work by requiring teachers to prepare more things and add programmes to keep students and parents interested." (Teacher E)

**Table 4.2: Perceived Competition Levels and Effects on Teachers (N=32)**

| Variable                                            | Category                                  | Frequency (n) | Percentage (%) |
|-----------------------------------------------------|-------------------------------------------|---------------|----------------|
| Perceived competition among international schools   | Very Low / Low                            | 3             | 9              |
|                                                     | Moderate                                  | 10            | 31             |
|                                                     | High                                      | 12            | 38             |
|                                                     | Very High                                 | 7             | 22             |
| Reported impact of competition on teaching practice | Adaptation of methods                     | 14            | 44             |
|                                                     | Higher expectations                       | 10            | 31             |
|                                                     | Improved motivation                       | 6             | 19             |
|                                                     | Increased stress                          | 2             | 6              |
| Leadership's approach to competition (themes)       | Adds pressure / Constant comparison       | 8 mentions    | —              |
|                                                     | Uses it to motivate / Healthy competition | 6 mentions    | —              |
|                                                     | Minimal focus / Balanced approach         | 5 mentions    | —              |
|                                                     | Strategic planning / Focus on strengths   | 4 mentions    | —              |

### 4.3 Theme 2: The Centrality of Leadership and Support Systems

Theme 2 underscores the pivotal role of leadership and institutional support in mediating external pressures. Leadership behaviour strongly shaped how teachers interpreted and coped with stressors. Supportive leaders provided affirmation, clear communication, and realistic expectations, while inconsistent or authoritarian approaches amplified strain. Three categories



were evident: leadership efficacy and style, formal well-being programmes, and informal peer and personal support.

**Leadership Efficacy and Style.** Leadership emerged as the single most influential determinant of teacher well-being. The survey data contained numerous open-ended responses where principals, coordinators, or department heads were mentioned as either sources of support or contributors to stress.

"Things changed radically in the past two years as one of the leaders is not supportive, creates false narratives and provides misleading information to the top management... there is no real support from school admin at the moment." (Teacher A)

"Any initiatives the school leadership has taken has posed more stress instead of relieving." (Teacher B)

"The new director listens, accepts feedback and provides channels for teachers to express their ideas and concerns. The teacher feels really supported." (Teacher E)

"Leadership is very kind and approachable." (Teacher D)

**Formal Well-Being Programs.** A majority of teachers confirmed that their school offered some form of well-being programme, yet the perceived effectiveness varied significantly. Teachers often expressed ambivalence toward such initiatives.

"This year there was a trip out of town for team building. It was on a Saturday, which is a rest day instead of having it during a workday. Teachers don't have time to meet." (Teacher A)

"Access to the counselors is provided to teachers... There are meetings and well-being workshops. Not much has been done in this regard." (Teacher B)

**Table 4.3: Presence and Perceived Effectiveness of Formal Well-Being Programmes (N=32)**

| Variable                               | Category                                          | Frequency (n) | Percentage (%) / Statistic |
|----------------------------------------|---------------------------------------------------|---------------|----------------------------|
| School has formal well-being programme | Yes                                               | 19            | 59                         |
|                                        | No                                                | 13            | 41                         |
| Perceived effectiveness of programme   | Mean score (1=Very Ineffective; 5=Very Effective) | —             | 3.2                        |

**Informal Peer and Personal Support.** Given inconsistencies in formal provisions, teachers relied heavily on informal networks. Survey responses showed "mindfulness practices" and "exercise" as the most common personal coping strategies. Qualitative accounts confirmed the centrality of peer relationships.

"I have a best friend in school with whom I discuss my issues." (Teacher C)

"Supportive, trustworthy colleagues make all the difference." (Teacher B)

#### 4.4 Theme 3: Teacher Agency and Coping Mechanisms

The third theme foregrounds teacher agency—the capacity to act intentionally to preserve well-being despite structural pressures. Teachers expressed both vulnerability and resilience, demonstrating adaptive behaviours that enabled professional continuity. Two categories were

identified: adaptation and innovation in teaching, and personal well-being strategies and suggested improvements.

**Adaptation and Innovation in Teaching.** Survey responses indicated that teachers often transformed competitive pressure into professional growth: a plurality reported adapting teaching methods as a key impact of competition. Teachers described an ongoing process of reflection and experimentation with pedagogy to maintain student engagement.

"I push myself to innovate every year instead of repeating old materials, even though it's time-consuming." (Teacher C)

"Competition forces us to refine pedagogy and stay current." (Teacher A, paraphrased)

**Personal Well-Being Strategies and Suggested Improvements.** Teachers articulated a clear awareness of what would enhance their well-being. The interview data revealed a range of practical and low-cost interventions suggested by participants.

"He would suggest more opportunities to collaborate, more transparency from the administration, open dialogue between different stakeholders and more resources. Teachers will be happy if they can express themselves openly." (Teacher A)

"Creating more flexibility in the workload will make teachers feel better. School leaders could provide a more peaceful atmosphere." (Teacher B)

"Cooking club, traveling club. Clubs for teachers." (Teacher C)

"Simple box to write how the person is feeling... the leaders can read the papers so they can have a better understanding of how teachers are feeling." (Teacher D)

**Table 4.4: Desired Supports and Improvement Suggestions by Teachers (N=32)**

| Suggested Intervention                   | Frequency (n) | Percentage (%) |
|------------------------------------------|---------------|----------------|
| More transparent communication           | 6             | 19             |
| Greater teacher autonomy                 | 5             | 16             |
| Manageable workload                      | 4             | 13             |
| Leadership advocacy (e.g., with parents) | 4             | 13             |
| More consistent feedback & support       | 4             | 13             |
| Peer-support / sharing groups            | 2             | 6              |
| Anonymous well-being feedback box        | 1             | 3              |

## 4.5 Cross-Thematic Interpretation

**Figure 4.2: Socio-Ecological Model of Teacher Well-Being in International Schools** (Adapted from Sansom, 2022; Inspired by Sallis, Owen, & Fisher, 2008)

Synthesising the three overarching themes reveals that teacher well-being operates within a multi-level system of influence:

- **Policy Context Level:** Curriculum demands and parental expectations create foundational pressures (Theme 1).
- **School Leadership Level:** Policies and well-being programmes implemented by school leadership determine how broader contextual pressures are filtered and managed (Theme 2).
- **Peer Relationships Level:** Support networks and team collaboration provide emotional support and practical assistance (Themes 2 and 3).

- **Teacher Agency Level:** Personal resilience and coping skills reflect individual capacity to maintain well-being through pedagogical adaptation, self-care practices, and boundary-setting (Theme 3).

The hierarchical structure illustrates how broader contextual factors create conditions that are then mediated by organizational leadership, supported by peer networks, and ultimately managed through individual agencies.

## 5. Discussion

### 5.1 Summary of Key Findings

The investigation systematically addressed three central research questions. Firstly, in response to RQ1, the data unequivocally pinpointed a triad of intense pressures: pervasive workload and work-life imbalance, elevated and often unrealistic parental expectations, and the relentless drive of institutional competition. These factors manifested as emotional exhaustion, systematically extended working hours, and a chronic erosion of boundaries between professional and personal lives.

Secondly, addressing RQ2, the findings powerfully confirmed the core proposition of the Conceptual Framework. Leadership emerged not as one factor among many, but as the pivotal mediating mechanism that determines how external pressures are experienced. Teachers navigating these pressures demonstrated remarkable resilience, primarily leveraging personal agency and informal peer support. Crucially, this reliance on personal and informal resources was often a direct response to the perceived ineffectiveness or absence of robust, formal institutional support structures.

Thirdly, RQ3 queried the support mechanisms teachers identified as most effective. Their collective voice called for leadership actions and resources that were structural, relational, and addressed root causes. The most desired interventions—transparent communication, manageable workloads, and consistent leadership advocacy—stand in stark contrast to one-off, tokenistic wellness events.

### 5.2 Discussion in Relation to Theory and the Conceptual Framework

The empirical findings provide robust validation for the integrated Conceptual Framework, positioning School Leadership as the pivotal mediating variable between external contextual factors and Teacher Well-Being.

**Leadership as the Mediating Mechanism.** The central proposition of the CF was that the path from external pressures to teacher wellbeing is not direct but is fundamentally shaped by school leadership. The findings overwhelmingly confirm this. The data revealed that the same contextual pressures led to starkly different wellbeing outcomes based entirely on the quality of leadership mediation. Where leadership was perceived as supportive, competition was described as a "Healthy competition" or an "Opportunity," and parental pressures were met

with "Good systems in place." Conversely, under unsupportive leadership, identical pressures were described as "Adds more pressure," "Constant comparison," and left teachers feeling "on our own." This dichotomy provides direct empirical support for the CF's core structure.

**Leadership as the Job Resource.** The findings animate the JD-R and COR theories. From a JD-R perspective, the demands of workload, competition, and parents consistently threatened to deplete teachers' energy. Supportive leadership—acting as a key resource—provided the necessary buffer. Examples such as a department head who "adjusts deadlines when workload is high" or a principal who "supported me when a parent demanded unfair grade changes" are clear instances of a job resource actively counterbalancing job demands.

Furthermore, the findings vividly illustrate COR Theory's concept of "resource caravans" through the mediating role of leadership. A supportive leader does not merely act as a single resource; they become a "caravan passageway" that enables the acquisition and protection of other crucial resources. When Teacher E reported that new leadership "listens, accepts feedback, and provides channels," this leadership resource fostered subsequent gains in resources of psychological safety, professional autonomy, and collaborative support. Conversely, when leadership "criticized my teaching publicly" or "changed policies without teacher input," it directly eroded resources of respect, trust, and motivation.

**The SDT Pathway to Wellbeing.** The data offers extensive evidence of SDT pathways in action. The expressed desire for "Greater teacher autonomy" and frustration with a lack of "transparent communication" reflect a thwarted Autonomy need. The negative impact of "short, unrealistic deadlines" on morale and the positive impact of "consistent feedback" demonstrate how leadership builds or undermines teachers' sense of Competence. The stark contrast between feelings of isolation under poor leadership and the sense of belonging fostered by "kind and approachable" leaders highlights the critical role of leadership in satisfying the need for Relatedness.

**Ecosystem within the Socio-Ecological Context.** The findings validate the CF's use of the Socio-Ecological Framework. The data confirms that the Macrosystem/Exosystem (competition, parental expectations) creates the overarching climate of pressure. However, its impact is processed and translated into daily reality within the Organizational Level—the mesosystem where leadership operates. The data demonstrates that this organizational level is the most proximal and powerful system influencing a teacher's professional life.

## 5.3 Implications

**Theoretical Implications.** This study makes three distinct theoretical contributions. First, it refines Conservation of Resources (COR) Theory by demonstrating how supportive leadership acts as a 'resource caravan passageway'—a concept describing how a single critical resource (leadership) enables the acquisition and protection of other resources (autonomy, peer support, psychological safety). Second, it extends Self-Determination Theory (SDT) by showing how leadership satisfaction of autonomy, competence, and relatedness operates specifically within high-pressure international school contexts. Third, it advances the Socio-Ecological Framework by positioning leadership as the critical mesosystem link between macro-level pressures and micro-level teacher outcomes.

**Practical Implications.** For school leadership development, there is an urgent imperative for leadership training to incorporate a core, non-negotiable focus on "Wellbeing Leadership."

This involves cultivating competencies in empathetic communication, proactive resource protection, and the deliberate creation of a school culture characterized by psychological safety and trust.

Schools must shift from implementing sporadic, generic wellbeing programmes to embedding wellbeing into the very fabric of school operations and policy. This requires a participatory approach, co-designing initiatives with teachers, ensuring they are scheduled within contracted hours, and focusing on improving the core work environment itself rather than merely offering coping mechanisms for a flawed environment.

For policy formulation, schools need to develop, communicate, and consistently enforce clear, humane policies covering digital communication (e.g., no email expectations after 6pm), workload management (e.g., caps on meeting times), and constructive parental engagement protocols.

**Impact on Stakeholders.** For school leaders, the findings provide a clear mandate that their leadership style is the most significant variable under their direct control that impacts teacher retention, morale, and professional effectiveness. For teachers, the findings validate their lived experiences and empower them to articulate their needs more effectively. For parents, understanding the link between certain demands and teacher burnout can foster a more collaborative home-school partnership. For policymakers and accrediting bodies, the findings present a compelling argument for including teacher wellbeing and supportive leadership practices as explicit standards within school accreditation frameworks.

## 5.4 Limitations

This study has several limitations. The contextual and methodological specificity means findings are deeply contextualized within two private IB schools in Jakarta, limiting transferability. The sample characteristics present limitations, as recruitment from a "job-alike" event may have introduced selection bias. The study relies entirely on self-reported data, susceptible to social desirability and recall biases. The study was designed to capture the essential voice of teachers but lacks multi-perspective data from school leadership, board members, and parents.

## 5.5 Recommendations

**For School Leadership and Policy:** Implement "Protected Time" policies mandating at least one afternoon per week free from meetings and administrative tasks. Develop and enact a "School Wellbeing Charter" co-created by teachers, support staff, and leadership, outlining collective commitments regarding communication boundaries and realistic timelines. Institute regular, structured wellbeing check-ins focused on workload, well-being, and support needs. Audit and strategically revise formal wellbeing programmes, prioritizing initiatives integrated into the school day and developed with teacher input.

**For Future Research:** Conduct a longitudinal cohort study to understand the evolution of teacher wellbeing and long-term impact of interventions. Undertake a multi-stakeholder, comparative study including perspectives of school leaders, board members, and parents. Investigate cross-cultural and cross-contextual dynamics through comparative studies between Indonesia and other regions.



# Conceptions of Teaching and Learning in Instrumental and Vocal Music Education: Perspectives from a Foundation in Music Programme

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## Abstract

*This qualitative study explores conceptions of teaching and learning in instrumental and vocal music education within the Foundation in Music programme at Seaview University. Focusing on piano, violin, and vocal instruction, the research examines how teachers and students understand their roles, experience the learning process, and influence one another. Data were collected through semi-structured interviews with four teachers and five students, classroom observations, and document analysis. The study is framed by Constructivist Theory, Experiential Learning Theory, and the Master-Apprentice Model. Findings reveal that music teaching is shaped by a balance between technical instruction, emotional engagement, feedback, student autonomy, and teacher-student relationships. Students' learning experiences were influenced not only by instructional approaches but also by motivation, confidence, support, and opportunities for active participation. The study concludes that effective instrumental and vocal music education extends beyond technical mastery and performance achievement. It requires pedagogical awareness, reflective practice, and meaningful teacher-student interaction. The findings contribute to a deeper understanding of music education in higher education and offer practical implications for improving teaching practices, curriculum development, and student engagement in music programmes.*

**Keywords:** *music education; instrumental and vocal pedagogy; conceptions of teaching and learning; teacher-student relationships; higher education; constructivist theory; experiential learning*

## 1. Introduction

### 1.1 The Broader Context

Historically, the teaching and learning of instrumental and vocal music has been firmly rooted in the intimate settings of music studios, conservatories, and specialized institutions. Unlike many educational disciplines where teachers often possess formal teaching qualifications, many instrumental and vocal instructors are accomplished musicians who draw upon experiential knowledge and informal pedagogical techniques (Creech, Hallam, Varvarigou, & Gaunt, 2022). This reliance on experiential learning has led to a scenario in which teaching methodologies are inherited from their own instructors, perpetuating a cycle of practice that often lacks robust theoretical foundations (López-Íñiguez & Bennett, 2022). Consequently,

the content of instrumental and vocal lessons remains largely undefined and is shaped by a complex interplay of factors, including the student, teacher, and institutional context. This complexity complicates the establishment of standardized curricula, further emphasizing the need for a refined understanding of teaching and learning in music education (Hallam, 2021).

Research on instructional practices within instrumental and vocal music education has consistently shown that traditional approaches prioritize performance outcomes over the processes involved in teaching and learning. Studies frequently emphasize the importance of musical performance as the primary measure of educational success, thereby neglecting the intricate pedagogical dynamics that facilitate effective teaching and learning (Evans & McPherson, 2023). As a result, a significant knowledge gap exists concerning how teaching and learning are perceived and enacted in the context of instrumental and vocal music education.

A pressing need for comprehensive studies that address this gap has become evident. Recent literature indicates that understanding how instrumental and vocal music educators and their students conceptualize their respective roles and learning processes can lead to enhanced educational practices, improved student experiences, and a more enriching learning environment (Creech et al., 2022). Insights gained from investigating these perceptions can serve as a foundation for developing innovative pedagogical strategies that better support student learning and engagement (López-Iñiguez & Bennett, 2022).

## 1.2 Identifying the Research Gap

Despite extensive research on music education, particularly in Western contexts, several significant gaps remain. Much of the literature focuses on instrumental and vocal music education, concentrating primarily on performance outcomes rather than the nuanced dynamics of teaching and learning processes. Additionally, there is limited research examining music education in developing countries like Malaysia, where Western pedagogical frameworks intersect with local cultural contexts.

One significant gap is the insufficient focus on the relational aspects of teaching and learning in music education. While considerable research has been conducted on technical and performance-based outcomes, less attention has been given to how relationships between teachers and students influence the learning process (Evans & McPherson, 2023). The teacher-student relationship can significantly impact student engagement, motivation, and ultimately learning outcomes (Creech et al., 2022). A strong rapport between educators and students fosters an environment conducive to learning, where students feel safe to express themselves creatively.

Another major gap is the limited research on music education in developing countries such as Malaysia. Most existing studies are based on experiences from Western countries, which may not be entirely applicable to the unique cultural and educational contexts found in developing nations (López-Iñiguez & Bennett, 2022). The Malaysian educational system blends Western pedagogical techniques with local cultural traditions, creating unique challenges for educators (Creech et al., 2022).

### 1.3 The Need for the Present Study

This study addresses these gaps by exploring the conceptions of teaching and learning in instrumental and vocal music education within the Foundation in Music programme at Seaview University. By examining the experiences of both teachers and students, the research aims to provide a more holistic understanding of pedagogical practices and their effects on learning experiences. The study is significant because it focuses on the relational dynamics between educators and learners, which are often overlooked in performance-oriented research.

### 1.4 Research Purpose and Questions

The primary objectives of this study are threefold:

1. To explore the conceptions of teaching and learning held by instrumental and vocal music educators and students.
2. To examine the relationship between teachers' and students' experiences in music education.
3. To investigate the relationship between teachers' conceptions of teaching and students' experiences of learning in instrumental and vocal music education.

To fulfill these objectives, the following research questions guide the study:

**RQ1:** What are the conceptions of teaching and learning among instrumental and vocal music teachers?

**RQ2:** How do students experience learning in instrumental and vocal music education?

**RQ3:** What are the relationships between teachers' and students' conceptions of teaching and learning?

### 1.5 Significance of the Study

This study's significance is multifaceted, aiming to enrich the field of instrumental and vocal music education through a comprehensive examination of pedagogical practices. By focusing on both teachers' and students' experiences and perspectives, the research seeks to illuminate the dynamics of teaching and learning that are often overlooked in existing literature. The findings are anticipated to have a profound impact on multiple aspects of music education, including curriculum development, teaching practices, student engagement, and the overall learning experience.

One of the primary contributions of this study is its potential to inform and enhance the professional development of instrumental and vocal music educators. Research suggests that effective teaching practices are critical in shaping students' learning experiences (Hallam, 2021). However, many educators in music education rely on inherited teaching methods without critically reflecting on their effectiveness. By investigating how educators conceptualize their teaching and the strategies they employ, this study will provide valuable insights that can be utilized in teacher training programs.

The significance of this research extends to curriculum designers and educational institutions responsible for developing music education programs. By examining the pedagogical

practices of effective teachers, the study can provide evidence-based recommendations for curriculum development that align with best practices in higher education (Bauer, 2020). The integration of innovative teaching methodologies, as informed by this research, will enable curriculum developers to create more engaging and relevant music programs.

## **2. Literature Review**

### **2.1 Concepts and Perceptions of Teaching and Learning in Music Education**

The concept of teaching and learning in instrumental and vocal music education has historically been shaped by the master-apprentice model, a traditional pedagogical approach where the teacher is regarded as the master of a particular skill, and the student assumes the role of an apprentice who learns through observation, imitation, and repetition (López-Íñiguez & Bennett, 2022). This model, which has deep roots in classical music training, is characterized by individualized instruction, allowing teachers to work closely with students to develop both technical proficiency and artistic interpretation (Creech et al., 2022).

Learning in music education is inherently cognitive and experiential, requiring both the intellectual understanding of musical concepts and the physical mastery of instruments or vocal techniques (Hallam, 2021). According to constructivist learning theories, students develop their knowledge actively rather than passively receiving information from an instructor. This perspective has influenced modern music education, encouraging student-centered learning approaches that promote active engagement, exploration, and creative problem-solving (López-Íñiguez & Bennett, 2022).

In addition to constructivist theories, experiential learning models, such as Kolb's Experiential Learning Theory (ELT), emphasize learning through direct experience, reflection, conceptualization, and experimentation (Kolb, 2015, as cited in Creech et al., 2022). Applied to music education, this approach suggests that students internalize musical concepts more effectively when they actively participate in music-making, engage in reflective practice, and experiment with different artistic interpretations.

### **2.2 The Master-Apprentice Model in Music Education**

The master-apprentice model is one of the oldest pedagogical frameworks in music education, particularly prevalent within Western classical traditions. For centuries, distinguished musicians have passed on their skills, techniques, and knowledge to students through a process that relies heavily on demonstration and repetition. In this model, the teacher, typically a master musician, demonstrates specific techniques or pieces, and the student is expected to observe and replicate these actions to develop technical proficiency (López-Íñiguez & Bennett, 2022). The student's role is primarily that of a recipient of knowledge, while the teacher maintains significant authority over the learning process.

In recent years, the traditional master-apprentice framework has evolved in response to new pedagogical insights, particularly those informed by constructivist learning theories. According to constructivism, learning is an active process in which students construct knowledge by engaging with content, reflecting on it, and applying personal insights (Hallam, 2021). In the context of music education, this approach emphasizes that while students still benefit from their teachers' technical expertise, they should also be encouraged to develop their artistic voices and interpretations. This shift reflects a growing recognition of the need for a more student-centered approach in music education, one that balances technical skill development with artistic expression (López-Iñiguez & Bennett, 2022).

## 2.3 Theoretical Framework

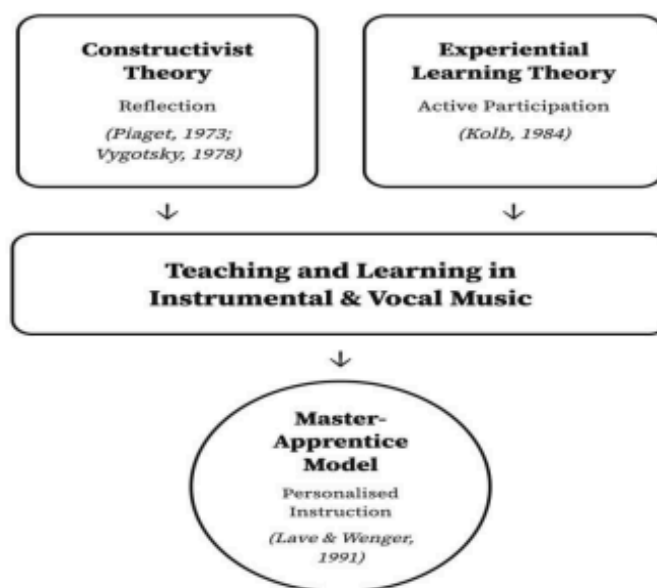
This study is guided by an integrated theoretical framework comprising three primary theories:

**Constructivist Theory** posits that knowledge is actively constructed by learners rather than passively absorbed (Vygotsky, 1978, as cited in López-Iñiguez & Bennett, 2022). In music education, this theory underscores the importance of students engaging with musical concepts, enabling them to form personal interpretations and deep understandings (Hallam, 2021). Applying Constructivist Theory to instrumental and vocal music education requires students to take an active role in their learning process through active participation, reflection, and collaborative learning.

**Experiential Learning Theory (ELT)**, developed by David Kolb, asserts that effective learning occurs through a four-stage cyclical process comprising concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb & Kolb, 2017, as cited in Creech et al., 2022). This model is particularly relevant to music education, where hands-on experience and reflection play critical roles in skill development. An essential component of Experiential Learning Theory is the role of feedback, which may come from teachers, peers, and self-assessment, guiding students through the learning cycle (Evans & McPherson, 2023).

**The Master-Apprentice Model** has a long-standing tradition in music education—particularly in instrumental and vocal instruction. In this model, the teacher (master) is seen as an expert while the student (apprentice) learns through observation, imitation, and repetition (Hallam, 2021). This traditional approach remains widely used in one-on-one lessons where teachers provide individualized instruction. Despite criticisms regarding its overly teacher-centered nature, the Master-Apprentice Model remains effective for developing technical skills due to its personalized guidance (López-Iñiguez & Bennett, 2022).

**Figure 2.0: Theoretical Framework** (adapted from Vygotsky, 1978; Kolb, 1984; Hallam, 2021)



## 2.4 Conceptual Framework

The conceptual framework for this study focuses on the interplay between three key variables:

**Teacher Conceptions:** This variable encompasses how teachers perceive their role, their pedagogical methods, and their understanding of teaching and learning in music education. It reflects the beliefs and attitudes that educators hold about their practice and the impact of these beliefs on their instructional choices (Hallam, 2021).

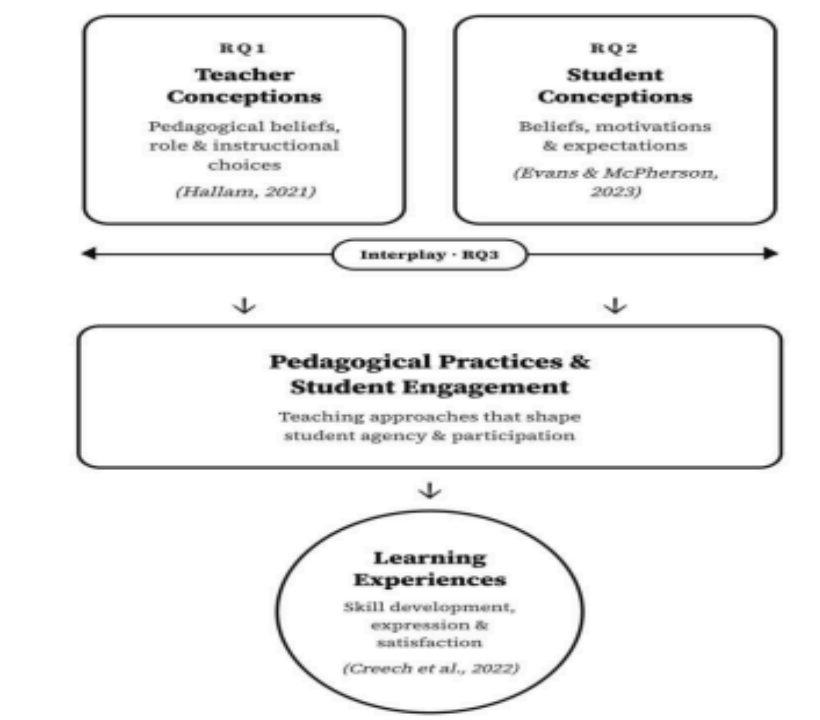
**Student Conceptions:** This variable captures how students perceive their learning experiences and engagement with musical material. It involves understanding students' beliefs about music education, their motivations for learning, and their expectations of the learning process (Evans & McPherson, 2023).

**Learning Experiences:** This variable encompasses how students experience and perceive their educational journey, including technical skill development, artistic expression, engagement, and overall satisfaction with the learning process (Creech et al., 2022).

**Figure 2.1: Conceptual Framework**

The framework outlined in this study directly informs the research questions central to understanding the dynamics of teaching and learning in instrumental and vocal music education. The first research question (RQ1) investigates the conceptions of teaching and learning among instrumental and vocal music teachers. The second research question (RQ2) focuses on the students' experiences in learning instrumental and vocal music. The third research question (RQ3) explores the relationships between these two sets of beliefs.





### 3. Methodology

#### 3.1 Research Design

In this study, the sample included four teachers (two vocal teachers, one piano teacher, and one violin teacher) and five students (two vocal students, two piano students, and one violin student). The chosen sample size—four teachers and five students—struck a balance between depth and breadth of data collection. According to Merriam and Tisdell (2016), qualitative studies often benefit from smaller sample sizes, as they allow for more in-depth exploration of participant experiences.

**Table 3.0: Demographic Profile of Teacher Participants**

| Teacher   | Gender | Primary Instrument | Years of Experience | Educational Background                           |
|-----------|--------|--------------------|---------------------|--------------------------------------------------|
| Teacher 1 | Female | Vocal              | 8 years             | Master of Music (Vocal Performance)              |
| Teacher 2 | Female | Vocal              | 12 years            | Doctor of Musical Arts (Vocal Pedagogy)          |
| Teacher 3 | Male   | Piano              | 15 years            | Master of Music (Piano Performance)              |
| Teacher 4 | Male   | Violin             | 10 years            | Bachelor of Music; Graduate Diploma in Education |

**Table 3.1: Demographic Profile of Student Participants**

| Student | Gender | Primary Instrument | Years of Study | Prior Musical Experience |
|---------|--------|--------------------|----------------|--------------------------|
|---------|--------|--------------------|----------------|--------------------------|

|                                                                                       |                            |                                                                                                                |                                                                                         |
|---------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| RO1: Explore conceptions of teaching and learning                                     | Remembering, Understanding | "Can you describe your overall philosophy or approach to teaching instrumental or vocal music?"                | "How would you describe your experience learning [instrument/vocals] in the programme?" |
| RO2: Examine the relationship between teacher and student experiences                 | Applying, Analysing        | "How do you engage students during lessons, and what strategies do you use to motivate them?"                  | "How do you feel about the way your music teacher interacts with you during lessons?"   |
| RO3: Investigate the relationship between teacher conceptions and student experiences | Evaluating, Creating       | "Do you think there is alignment between your expectations of students and their actual learning experiences?" | "Do you feel that your teacher's expectations align with how you learn best?"           |

In addition to semi-structured interviews, supplementary data were gathered through document reviews and classroom observations. Document analysis was essential in triangulating data and contextualizing classroom practices within broader institutional frameworks (Bowen, 2009). Classroom observations provided firsthand data on various elements of the learning environment, including instructional methods, student engagement levels, teacher-student interactions, and assessment practices.

### 3.4 Data Analysis

The data analysis process unfolded in four interconnected phases: data preparation and familiarization, initial coding, categorization, and thematic development and validation, utilizing ATLAS.ti as the primary Computer-Assisted Qualitative Data Analysis Software (CAQDAS).

**Data Preparation and Familiarization:** All responses via WhatsApp interviews were transcribed verbatim. Observational field

| Interview Source | Emerging Code         | Illustrative Phrase                                                        |
|------------------|-----------------------|----------------------------------------------------------------------------|
| Teacher 1        | Technical drills      | "I always start with a 10-minute drill to warm up the voice"               |
| Teacher 2        | Stage fright          | "Many students freeze up before the first note"                            |
| Student 1        | Slow practice helpful | "When I slow down and really focus, I make fewer mistakes"                 |
| Teacher 3        | Student autonomy      | "I allow students to choose some pieces—it makes a significant difference" |

**Categorization:** Using ATLAS.ti's "Code Co-occurrence" and "Network View" features, semantically related codes were grouped into higher-order categories.

**Table 3.4: Categorisation of Codes into Emerging Categories**

| Codes                                                    | Category                        |
|----------------------------------------------------------|---------------------------------|
| Positive feedback, encouragement, celebrating small wins | Teacher motivational strategies |
| Tuning problems, performance fear, time constraints      | Student learning barriers       |
| Peer learning, ensemble coordination, group feedback     | Collaborative pedagogy          |
| Demonstration, slow practice, breaking down passages     | Scaffolding techniques          |

**Thematic Development and Validation:** The "Network View" in ATLAS.ti facilitated the visual mapping of how categories interrelated. Overarching themes were derived through

## 4. Findings

### 4.1 Overview of Thematic Structure

Thematic analysis of teacher and student interviews, classroom observations, and document analysis revealed three overarching themes corresponding to the research questions:

**RQ1: Conceptions of Teaching and Learning Among Teachers** — Three themes emerged: (1) Pedagogical Approaches, (2) Role of Student Engagement, and (3) Challenges in Instructional Delivery.

**RQ2: How Students Experience Learning** — Three themes emerged: (1) Learning Motivation, (2) Effective Teaching Strategies, and (3) Challenges in Music Learning.

**RQ3: Relationships Between Teachers' and Students' Conceptions** — Three themes emerged: (1) Alignment and Misalignment in Teaching and Learning Expectations, (2) Student-Teacher Communication, and (3) Impact of Teaching Methods on Student Experiences.

### 4.2 RQ1: Conceptions of Teaching and Learning Among Instrumental and Vocal Music Teachers

#### Theme 1: Pedagogical Approaches

Teachers demonstrated a range of teaching methodologies, incorporating both traditional and student-centered approaches. Teacher 1 (Vocal) described: *"My teaching philosophy centers on three pillars: technical skills, artistic expression, and personal development. I aim to foster love and passion for vocal music while*

*practice more willingly." Teacher 4 observed: "I use encouragement and simple gestures like thumbs-up to create a supportive atmosphere. Sometimes a genuine 'well done' means more than any technical correction."*

### Theme 3: Challenges in Instructional Delivery

Teachers identified several challenges. Teacher 1 acknowledged: *"I tend to focus on my students' skills and technique, which sometimes causes problems. I have to carefully study the artistry of music and remind myself that technical precision without expression is hollow."* Teacher 2 noted: *"I face challenges like stage fright and technical limitations with students. These require patience, consistent practice, and personalized guidance."*

Teacher 3 observed: *"I encounter issues such as vocal strain and difficulty applying music theory. Students need regular feedback and gradual skill-building."* Teacher 4 stated: *"The learning process is lengthy. Some students lack foundational knowledge, which slows down the class. I have to differentiate instruction significantly."*

**Table 4.1: Summary of Teacher Conceptions**

| Theme                  | Key Insights                                                                                                           | Supporting Quotes                                                              |
|------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Pedagogical Approaches | Blend of traditional and student-centred approaches; emphasis on both technical proficiency and expressive development | "I tailor my strategies to accommodate individual learning styles" (Teacher 2) |
|                        |                                                                                                                        |                                                                                |



*appreciate the many opportunities to perform. Competitions and performances push me to practice harder."*

Student 3 (Vocal) stated: *"I find motivation in playing pieces I like and the joy of performing in concerts. When the music resonates with me personally, practice doesn't feel like work."* Student 5 (Vocal) added: *"Positive feedback from my teacher encourages me to keep improving. When she notices small improvements, it makes me feel like my effort matters."*

## **Theme 2: Effective Teaching Strategies**

Students identified several teaching methods that helped them learn. Student 1 valued: *"Demonstrations by the teacher, slow practice with guidance, and targeted exercises. Seeing my teacher demonstrate a passage correctly shows me what to aim for."* Student 2 appreciated: *"Lessons where I learn historical knowledge about the great composers without feeling bored. When my teacher connects music to stories and context, it comes alive."*

Student 4 noted: *"I learn best when we analyze musical pieces together rather than just practicing technique. Understanding why a piece is written a certain way helps me play it more expressively."* Student 5 observed: *"Group work helps because I can learn from my peers. Watching others struggle with the same challenges and overcome them gives me confidence."*

## **Theme 3: Challenges in Music Learning**











11. **Strengthen Industry Collaborations:** Invite guest artists for masterclasses, arrange internships with professional music organizations, facilitate attendance at professional performances, and create mentorship programs.
12. **Develop Holistic Assessment Frameworks:** Incorporate self-assessment and peer assessment, use portfolios, include reflective writing assignments, and assess process as well as product.

## 5.5 Limitations

Several limitations should be acknowledged. The small sample size (four teachers and five students) may not fully capture diverse perspectives. The study focused exclusively on piano, violin, and vocal music within a single institution, limiting applicability to other instruments, voice types, and institutional contexts. The qualitative nature of the data, while providing rich insights, may lack the precision of quantitative measures. The use of WhatsApp for interviews, while innovative, may have limited the richness of data compared to in-person interviews. The study was conducted over a three-month period, providing a snapshot rather than an examination of how teaching and learning conceptions evolve over time. The study relied heavily on self-report data, which may be subject to social desirability bias.

## 5.6 Suggestions for Future Research

Future research should consider longitudinal studies to assess the long-term impact of student-centered teaching methods; investigate the effectiveness of digital learning tools and AI in personalized music instruction; explore cross-cultural comparisons to understand how cultural differences influence student motivation and pedagogical approaches; examine the effectiveness of performance anxiety interventions; investigate effective models for teacher professional development; and explore how to effectively foster student agency and self-regulated learning. Mixed-methods approaches combining qualitative and quantitative data would provide a more comprehensive analysis.

## 6. Conclusion

This study investigated conceptions of teaching and learning among instrumental and vocal music educators and students within the Foundation in Music programme at Seaview University. The findings demonstrate that while teachers employ both direct instruction and student-centered learning approaches, a disconnect often exists between teacher expectations and student learning preferences. Students benefit from autonomy, structured support, and performance opportunities but frequently struggle with challenges such as time management and performance anxiety.

The study makes several contributions. Empirically, it provides rich qualitative data on how teachers and students experience music education in a tertiary setting. Theoretically, it extends and refines Constructivist Theory, Self-Determination Theory, and Cognitive Load Theory by applying them to the specific context of instrumental and vocal music education. Practically, it offers actionable recommendations for educators, students, institutions, and policymakers,



grounded in empirical evidence and theoretical frameworks. By focusing on a Malaysian tertiary institution, the study contributes to the limited literature on music education in developing countries and non-Western contexts.

The findings underscore the need for adaptive teaching strategies that balance technical mastery with creative expression, ensuring that students receive a well-rounded and meaningful music education. Implementing blended learning approaches, integrating technology, and fostering performance-based learning can significantly enhance the effectiveness of music education. Providing targeted professional development for educators, ensuring access to quality musical resources, and strengthening industry collaborations can help bridge the gap between theoretical instruction and real-world application.

Addressing challenges such as performance anxiety and time management through structured interventions can further support student success in instrumental and vocal music education. When students feel supported, engaged, and empowered in their learning, they are more likely to persist through challenges, develop their artistic voices, and achieve their full potential as musicians.

Music education is not merely about training performers; it is about fostering creativity, emotional expression, critical thinking, and personal growth. The best music education empowers students to find their unique voices, connect deeply with music, and share that connection with others. By building on the insights presented in this study, educators and policymakers can refine and enhance music education practices, creating more inclusive, engaging, and effective learning environments for future generations of musicians.

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# **The Impact of the Mid-Day Meal Scheme on Educational and Nutritional Outcomes in Low-Income Families in New Delhi: A School-Based Mixed-Methods Study**

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*University College Fairview*

## **Abstract**

*This mixed-methods study investigated the impact of the Mid-Day Meal Scheme (MDMS) on educational and nutritional outcomes among primary school children from low-income families in New Delhi. Drawing on Maslow's Hierarchy of Needs, Sen's Capabilities Approach, and Bronfenbrenner's Ecological Systems Theory, the study employed a concurrent mixed-methods design. Data were collected from 56 participants—40 students, 8 parents, and 8 staff and teachers—across five government schools through structured surveys, semi-structured interviews, and direct observations. Quantitative findings indicate that 85% of students reported improved attendance regularity, 90% expressed satisfaction with meal taste, and 85% reported feeling full after meals. However, notable variations emerged by school and gender. Qualitative analysis revealed persistent operational challenges, including an average 15-minute meal delivery delay, kitchen space constraints, and limited water supply. A cost-benefit estimation for Delhi indicates that benefits exceed costs (₹3,900 annual benefit per child vs. ₹2,700 annual cost), supporting program continuation. The study contributes to understanding stakeholder perceptions of MDMS in urban low-income settings and offers context-specific insights for policy improvement.*

**Keywords:** *Mid-Day Meal Scheme; school feeding; educational outcomes; nutritional outcomes; urban poverty; mixed-methods*

## **1. Introduction**

### **1.1 The Broader Context**

The goals of education in India are aptly stated in the National Education Policy (NEP) 2020, which emphasizes the critical role of education in fostering national development by achieving foundational literacy and numeracy by 2026 while advocating for inclusive and equitable learning environments (Ministry of Human Resource Development, 2020). Urban poverty in New Delhi presents distinctive challenges for education and nutrition. Approximately 14% of Delhi's population lives in slums and informal settlements (Census of India, 2011), where families face overcrowded housing, irregular employment, and limited

access to public services. Migrant families experience transient enrollment patterns that disrupt children's educational continuity (Sharma et al., 2023). Government schools in these areas frequently contend with overcrowded classrooms, insufficient kitchen facilities, unreliable water supply, and limited storage for food provisions—constraints that directly affect MDMS delivery (Ministry of Education, 2022, 2023).

The Mid-Day Meal Scheme (MDMS), recognized as one of the world's largest school feeding programs, serves as a strategic policy intervention to combat malnutrition and promote educational equity. Launched in 1995 under the National Programme of Nutritional Support to Primary Education, the MDMS provides free cooked meals to children in government and government-aided schools. The Government of India allocates approximately ₹12,000 crore (USD 1.5 Billion) annually to the program, reaching approximately 120 million schoolchildren (Ministry of Education, 2022). Research has demonstrated that the MDMS has positively impacted enrollment rates, particularly among socially disadvantaged groups and girls (Hoque, 2023). Studies indicate that prolonged exposure to school feeding programs can enhance learning outcomes, with improvements in reading and math scores among beneficiaries (Chakraborty & Jayaraman, 2019).

## 1.2 Identifying the Research Gap

Despite the MDMS's acknowledged potential, its effectiveness in improving health status and academic achievement of primary school pupils, particularly in urban low-income settings, remains underexplored. While significant attention has been given to overall benefits, there is a lack of focused research on how the scheme impacts younger children, leaving critical gaps in understanding its ability to address challenges unique to this age group. While MDMS has demonstrated success in improving enrollment and attendance in rural areas, its implementation in urban contexts like New Delhi presents unique challenges often compounded by overcrowded schools, inadequate infrastructure, and socio-economic disparities (Singh et al., 2020). A fundamental issue lies in the lack of comprehensive studies evaluating both educational outcomes (school attendance, retention, academic performance) and nutritional outcomes (health indicators, cognitive function, physical development) simultaneously. Existing research often examines these outcomes in isolation (Chaudhary et al., 2021).

Moreover, implementation faces significant operational barriers including logistical issues such as delays in food distribution, inconsistencies in meal preparation, and inadequate infrastructure for monitoring (Verma et al., 2022). The roles of key implementers—teachers, parents, school administrators, and community organizations—remain underexplored. Another critical gap lies in the absence of reliable data on tangible outcomes (improved health indicators, increased school participation) and intangible outcomes (enhanced cognitive function, social equity, community engagement) in urban settings.

## 1.3 The Need for the Present Study

This research addresses these gaps by focusing specifically on implementation and outcomes of MDMS in low-income families in New Delhi. It evaluates the roles of key implementers, assesses financial and logistical costs and barriers, and explores both tangible and intangible outcomes. By identifying critical barriers and proposing evidence-based recommendations, this research endeavors to enhance the program's overall effectiveness, contributing to policy

development by offering a more nuanced understanding of how to address interrelated issues of malnutrition and educational inequity.

## **1.4 Research Purpose and Questions**

The purpose of this study is to evaluate the ways in which the MDMS raises school enrolment, attendance, and retention rates in low-income areas of New Delhi, investigating the degree to which MDMS acts as a motivating factor for pupils and how stakeholders contribute to the program's successful execution.

The study addresses three research questions:

1. How does the Mid-Day Meal Scheme influence school attendance and perceived regularity among primary school children from low-income families in New Delhi?
2. How has the MDMS impacted the nutritional outcomes and overall well-being of schoolchildren in urban low-income settings?
3. What systemic challenges hinder MDMS implementation in New Delhi's urban settings?

## **1.5 Significance of the Study**

This study offers significant theoretical and practical contributions. Theoretically, it bridges the gap between education and nutrition policy by examining both aspects simultaneously, highlighting their intertwined nature. It synthesizes research from educational psychology, nutrition science, and public policy to offer a holistic perspective on how integrated interventions can address systemic inequities (Agarwal & Das, 2020; Rathi et al., 2022). Practically, the findings provide evidence-based insights for policymakers regarding operational challenges, resource allocation, and program design. Educators and school administrators will benefit from understanding how MDMS can be utilized to improve attendance, retention, and academic performance. Community stakeholders will gain actionable strategies for engaging with schools and local governments to improve implementation.

# **2. Literature Review**

## **2.1 Global School Feeding Programs**

Globally, school-based feeding programs have emerged as effective strategies for improving child health and fostering educational achievement. The World Food Programme (WFP, 2021) highlights successes in countries such as Brazil, Ghana, and across sub-Saharan Africa. Brazil's Programa Nacional de Alimentação Escolar (PNAE) stands out for its holistic approach combining nutritional support with economic empowerment of local farmers (Sonnino et al., 2019). Silva et al. (2021) observed notable improvements in students' energy

levels, cognitive performance, and attendance under the PNAE. In Ghana, the Ghana School Feeding Programme yielded increased enrollment and retention rates, with particularly positive effects among girls (Gelli et al., 2019). Experiences in sub-Saharan Africa reinforce positive impacts, with Bundy et al. (2018) documenting a 20% increase in attendance.

In Europe, school feeding initiatives are characterized by comprehensive integration into educational and public health systems. Finland and Sweden offer free, nutritionally balanced meals to all students, with alignment to dietary guidelines and incorporation of food education into the curriculum (Kumpulainen et al., 2021). In the United Kingdom, free school meals for disadvantaged children have reduced food insecurity and been linked to academic gains (Holford & Rabe, 2020).

## **2.2 The Mid-Day Meal Scheme in India**

In India, MDMS has emerged as a cornerstone policy for addressing child malnutrition, improving school participation, and promoting educational equity. Afridi (2010) reported a 30% reduction in malnutrition rates in rural areas due to consistent implementation. Singh et al. (2021) highlight that attendance and retention rates have significantly increased in states with efficient implementation. However, urban experience reveals distinct challenges. In cities like New Delhi, overcrowding, poor infrastructure, and inconsistent meal quality can undermine effectiveness (De et al., 2022). Urban children face different nutritional needs requiring context-specific dietary planning. Studies reveal concerns about nutritional adequacy, with meals occasionally lacking essential micronutrients like iron, zinc, and vitamin A (Sharma et al., 2021). Community engagement and governance play pivotal roles; urban schools frequently lack robust community involvement, limiting transparency and accountability (Jha & Kumar, 2020).

## **2.3 Barriers to Effective Implementation**

Persistent barriers include infrastructural limitations—many schools lack proper kitchens, clean water facilities, and safe storage (Garg & Mandal, 2019). Administrative inefficiencies such as delays in fund disbursement, irregular food supplies, and weak monitoring systems disrupt consistent operation (Singh & Kumar, 2020). Nutritional inconsistencies compromise impact on child health (Rao & Swaminathan, 2018). Stakeholder engagement remains inadequate, with limited training for cooks and insufficient community participation (Jha et al., 2021).

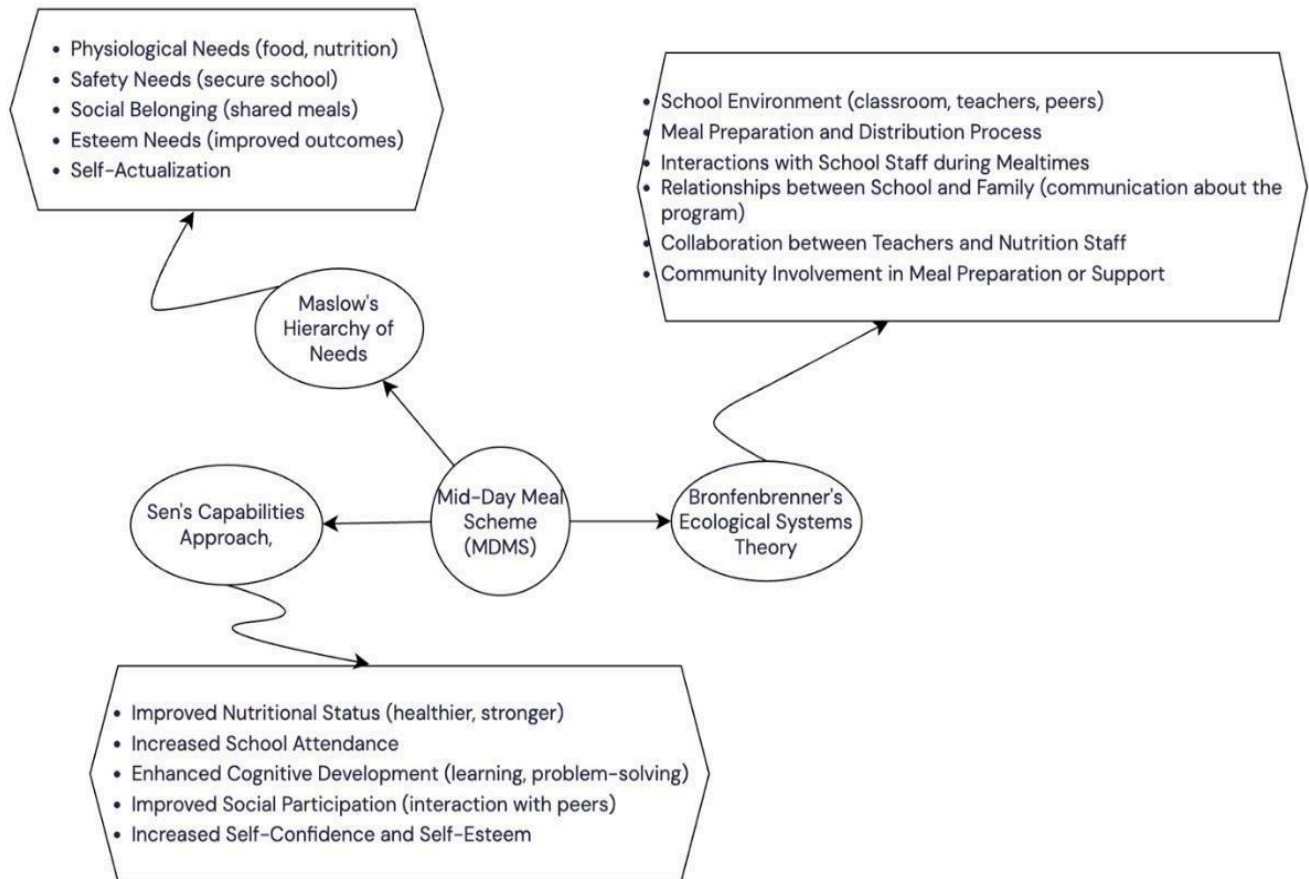
## **2.4 Theoretical Framework**

The theoretical foundation draws upon three interrelated models: Maslow's Hierarchy of Needs, Sen's Capabilities Approach, and Bronfenbrenner's Ecological Systems Theory. Maslow's theory (1943) provides a framework for analyzing how MDMS addresses foundational physiological needs before advancing to higher-order psychological needs. Sen's Capabilities Approach (1999) positions MDMS as an enabler that expands children's capabilities to attend school, retain knowledge, and achieve lifelong benefits. Bronfenbrenner's Ecological Systems Theory (1979) provides a holistic framework for understanding how MDMS interacts with children's environments across multiple levels—microsystem (immediate school environment), mesosystem (school-home



relationships), exosystem (supply chains, district oversight), and macrosystem (national policy commitment).

**Figure 1: Theoretical Framework** (adapted from Bronfenbrenner, 1979; Maslow, 1943; Sen, 1999)



## 3. Methodology

### 3.1 Research Design

This study employed a concurrent mixed-methods design (Creswell & Creswell, 2023), in which quantitative and qualitative data were collected simultaneously and integrated during analysis. The concurrent approach allowed for triangulation of findings within the same time frame, essential given field access constraints in urban Delhi schools. Quantitative data assessed measurable impacts through structured surveys measuring attendance, meal satisfaction, and perceived well-being. Qualitative data explored lived experiences of stakeholders through semi-structured interviews and direct observations.

### 3.2 Context and Setting

The study was conducted in five government and government-aided schools in suburban New Delhi serving low-income neighborhoods. Schools were selected based on MDMS participation, predominant low-income family enrollment, and location in marginalized areas. School kitchens ranged from dedicated rooms with basic equipment to multi-use spaces with limited storage and constrained ventilation. Meal service typically occurred during the midday interval, with supervision shared among teachers and designated MDMS focal persons.

### 3.3 Participants and Sampling

Data were collected from N=56 participants across three stakeholder groups: students (n=40), parents (n=8), and staff and teachers (n=8). Students were enrolled in Grades 3-8 at participating schools implementing MDMS for at least one academic year. Purposive sampling with stratification by school was employed. Inclusion criteria for schools: participation in MDMS, serving predominantly low-income families, and location in marginalized or suburban New Delhi areas. Stratification across Delhi zones aimed to account for regional diversity. Parent participants were primary caregivers of sampled students. Staff participants included teachers, head teachers, MDMS coordinators, cooks, and kitchen staff actively involved in implementation.

### 3.4 Data Collection

**Student surveys** were interviewer-administered to address RQ1 and RQ2. Domains included recent attendance, perceived regularity changes since MDMS, meal satisfaction (taste rating 1-5), satiety (fullness 1-5), perceived well-being changes (energy, minor illness frequency), and MDMS uptake.

**Parent surveys** used a short format gathering perceptions of attendance change, household food expense adjustments, reported dietary diversity, and overall satisfaction with food quality/cleanliness.

**Teacher and administrator interviews** were semi-structured, covering training sufficiency, staff adequacy, supply delivery timing, kitchen infrastructure, monitoring workload, observed student engagement, and improvement strategies.

**Non-participant observation** focused on meal start timing, queue length and flow, portioning practices, student behavior, hygiene routines, and class resumption timing using structured checklists.

### 3.5 Data Analysis

Quantitative data were analyzed using descriptive statistics (frequencies, percentages, mean responses) and inferential analysis (Mann-Whitney U test for gender comparisons) in SPSS version 28. Qualitative data were analyzed thematically using ATLAS.ti software, with open coding to identify emergent patterns clustered into broader themes. Intercoder reliability was assessed using Cohen's Kappa ( $\kappa=0.76$ ). Integration occurred at the interpretation stage through comparison and synthesis.

### 3.6 Ethical Considerations

Written informed consent was obtained from all adult participants. For students, both parental consent and student assent were obtained using age-appropriate explanations. All participants were informed of their right to withdraw. Data were anonymized with alphanumeric codes. Institutional review board approval was obtained.

## 4. Findings

### 4.1 Quantitative Results

#### Attendance and Educational Outcomes (RQ1)

Among all surveyed students (N=40), 38 reported attending school in the last school week, indicating near-universal short-term attendance. Further, 34 indicated their school regularity had improved since MDMS implementation. In contrast, only 4 of 8 parents perceived an improvement in their child's attendance.

**Table 1: Student Perceptions of Attendance Regularity by Gender (n=40)**

| School       | Gender | N         | Reporting Improvement | Not Reporting Improvement |
|--------------|--------|-----------|-----------------------|---------------------------|
| School A     | Female | 3         | 2                     | 1                         |
| School A     | Male   | 5         | 5                     | 0                         |
| School B     | Female | 3         | 1                     | 2                         |
| School B     | Male   | 5         | 4                     | 1                         |
| School C     | Female | 6         | 5                     | 1                         |
| School C     | Male   | 2         | 2                     | 0                         |
| School D     | Female | 4         | 4                     | 0                         |
| School D     | Male   | 4         | 3                     | 1                         |
| School E     | Female | 4         | 3                     | 1                         |
| School E     | Male   | 4         | 4                     | 0                         |
| <b>Total</b> |        | <b>40</b> | <b>33</b>             | <b>7</b>                  |

Subgroup analysis revealed variation across schools and gender. Girls in School A and School D reported the highest perceived improvements (100%). Among boys, highest improvements were reported in School C (100%) and School B (80%). A Mann-Whitney U test found no significant gender differences in taste ( $U=38.5$ ,  $p=0.42$ ) or fullness ( $U=34.0$ ,  $p=0.25$ ) ratings.

#### Nutritional Outcomes (RQ2)

Student self-reports indicated strong perceived nutritional benefits: 36 out of 40 rated meal taste as good or excellent (4-5/5), 34 reported feeling full or very full after eating, all 40 reported increased energy since MDMS implementation, and 30 reported fewer minor illnesses.

**Table 2: Nutritional Outcomes of the MDMS Policy (N=40)**

| Outcome                            | Number of Students |
|------------------------------------|--------------------|
| Attended school in last 30 days    | 38                 |
| Improved regularity since MDMS     | 34                 |
| Taste rated good/excellent (4-5/5) | 36                 |
| More energy since MDMS             | 40                 |
| Fewer illnesses since MDMS         | 30                 |

Parent-reported data indicated limited dietary diversity: staples and vegetables were frequently served (50-63% of students received them  $\geq 3$  days/week), but only 28% received fruit or egg with similar frequency.

## 4.2 Qualitative Findings

### Operational Challenges

Teachers, administrators, and kitchen staff consistently identified supply delivery delays as a significant challenge. Data revealed an average delivery delay of 15 minutes across sites, resulting in rushed preparation or postponed service. Many schools operated with undersized kitchens and insufficient storage. Staff reported infrastructure limitations with three explicit mentions of space constraints and three reports of equipment shortages. Consistent challenges included lack of running water for handwashing and infrequent kitchen deep cleaning.

### Stakeholder Experiences

Teachers frequently described juggling educational duties with supervisory responsibilities. One teacher commented: *"We are supposed to teach, but half the morning goes in checking supplies and supervising food distribution."* Another noted: *"Children eat in classrooms. After that, it takes time to clean before we can resume lessons."*

Cooks highlighted issues with ingredients, working conditions, and social recognition: *"Sometimes dal arrives late or in less quantity. We have to adjust recipes"* and *"We have one large pot, but no gloves or aprons. It's hot and risky."*

Teachers perceived improved attendance and punctuality post-MDMS, though views varied by school context: *"For many of these children, this is the only complete and guaranteed meal of the day. You can see the difference in their concentration in the afternoon class."*

## 4.3 Integrated Findings

Integration revealed several patterns. While MDMS is widely perceived to encourage school attendance, its impact varies by school context and student gender. Student satisfaction with taste and fullness corroborates reports of reduced hunger and greater classroom energy. However, persistent operational challenges—delivery delays, space constraints, equipment shortages—were consistently identified across both quantitative and qualitative measures. The divergence between student self-report (85% seeing improved regularity) and lower parental perception (50%) highlights the importance of multi-informant assessment.

## **5. Discussion**

### **5.1 Summary of Key Findings**

The study found that MDMS is widely perceived by students and teachers as a successful intervention encouraging school attendance, alleviating hunger, and contributing to well-being. Quantitative data revealed 85% of students reported improved attendance regularity, 90% expressed satisfaction with meal taste, and 85% reported feeling full after meals. However, notable variations emerged by school and gender. Qualitative analysis revealed operational challenges including average 15-minute meal delivery delays, kitchen space constraints, and limited water supply.

### **5.2 Discussion in Relation to Literature**

The findings corroborate international literature affirming school feeding programs as effective incentives for attendance (Bundy et al., 2018; Afridi, 2010). The attendance improvement aligns with studies showing MDMS benefits in rural areas, though urban implementation presents distinct challenges (De et al., 2022). Student satisfaction with taste and fullness (90% and 85%) exceeds some previous findings, possibly reflecting the acute food insecurity context where any meal is highly valued (Gelli et al., 2019).

The divergence between student and parent perceptions (85% vs. 50% reporting improvement) extends existing literature by highlighting communication gaps within the program's ecosystem. This may be explained through Bronfenbrenner's Ecological Systems Theory: parents (mesosystem) may not directly observe daily attendance patterns that students and teachers (microsystem) experience.

Operational challenges identified—delivery delays, infrastructure constraints, water supply issues—directly reflect implementation gaps documented in literature (Singh & Kumar, 2020; Garg & Mandal, 2019). The average 15-minute delivery delay and space constraints corroborate findings from urban school studies (Rathi et al., 2022; Verma et al., 2022).

### **5.3 Discussion in Relation to Theory**

The findings substantiate Maslow's Hierarchy of Needs: MDMS successfully addresses foundational physiological needs (food, satiety), enabling progression toward higher-order needs (belonging, esteem) within the school environment. Student reports of increased energy (100%) and fewer illnesses (75%) indicate the scheme meets basic needs, creating conditions for cognitive engagement.

Sen's Capabilities Approach is reflected in MDMS as a tool expanding freedoms. By providing a guaranteed meal, the scheme expands children's capability to attend school regularly and participate without hunger distraction. The economic relief for families expands parental capability to allocate resources to other aspects of children's well-being.

Bronfenbrenner's Ecological Systems Theory provides the most comprehensive lens. The study captures impacts and challenges across all levels: microsystem (improved student energy, teacher-student interactions), mesosystem (school-home communication gaps, teacher workload conflicts), exosystem (supply chain delays, inconsistent water supply), and macrosystem (MDMS as national policy commitment to social equity). Persistent implementation challenges highlight that positive microsystem outcomes are often constrained by failures at exo- and macrosystem levels.

## 5.4 Limitations

Several limitations should be acknowledged. The small sample size (N=56) limits statistical power and generalizability. The study relies exclusively on self-reported and perception-based data without objective measures such as anthropometric assessments or clinical health records. The cross-sectional design captures stakeholder perspectives at a single point in time and cannot establish causal relationships. Elements of convenience sampling were present, which may introduce selection bias. The geographic scope is limited to four suburban government schools in Delhi, and findings should not be generalized to all urban settings or other states.

## 5.5 Implications

**For Policy:** The findings support program continuation, as a cost-benefit estimation for Delhi indicates benefits exceed costs (₹3,900 annual benefit per child vs. ₹2,700 annual cost). Policymakers should invest in kitchen infrastructure, reliable water storage, and efficient localized supply chains. Dietary diversity should be enhanced through revised menu guidelines ensuring regular inclusion of protein and micronutrient-rich foods.

**For Practice:** Schools should be provided resources to hire dedicated MDMS coordinators, decoupling teaching from meal logistics. Formal feedback channels should be established for regular input from students, parents, and frontline staff. Teacher training programs should incorporate MDMS management components.

**For Research:** Future studies should employ longitudinal designs tracking outcomes over time, include objective nutritional measures (anthropometric data), examine implementation across diverse urban contexts, and investigate the relationship between meal quality and learning outcomes.

## 6. Conclusion

### 6.1 Summary of the Study

This mixed-methods study evaluated the impact of the Mid-Day Meal Scheme on educational and nutritional outcomes in urban low-income schools in New Delhi. Data from 56 participants across five schools revealed that MDMS is widely perceived as a successful



intervention encouraging attendance, alleviating hunger, and contributing to well-being. However, persistent operational constraints—delivery delays, infrastructure deficits, resource limitations—consistently mediate implementation quality.

## 6.2 Implications

MDMS stands as an indispensable policy for promoting educational equity and food security in urban India. The cost-benefit estimation confirms that benefits exceed costs, supporting program continuation. However, continuation must be accompanied by targeted strengthening: infrastructure investment, logistical reform, dietary enhancement, and stakeholder communication. The study's recommendations provide a roadmap for transforming MDMS from a foundational social safety net into a robust, efficient programme for child development.

## 6.3 Recommendations for Future Research

Longitudinal studies tracking outcomes over multiple years are needed to assess whether perceived improvements are sustained. Research incorporating objective nutritional measures (anthropometric data, clinical health records) would strengthen evidence. Comparative studies across different urban contexts in India would enhance generalizability. Investigation of the relationship between meal quality and specific learning outcomes would inform program refinement.

## 6.4 Concluding Thoughts

The Mid-Day Meal Scheme represents a critical intervention addressing intertwined challenges of malnutrition and educational inequity in urban India. While the program shows considerable promise, its full potential is constrained by operational and systemic barriers. By addressing infrastructure deficits, logistical inefficiencies, and stakeholder communication gaps, policymakers can transform MDMS from a well-intentioned subsidy into a reliably effective intervention capable of shaping healthier and better-educated futures for India's most vulnerable children.

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## Exploring Artificial Intelligence as a Tool for Differentiation and Inquiry in IB Computer Science

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### Abstract

*This mixed-methods study examined the use of artificial intelligence (AI)-supported prompts to enhance the ability of IBDP Computer Science students to work more independently towards the outcomes of a selected programming unit on arrays. Grounded in a problem of practice concerning student dependence on direct teacher explanation while supporting mixed levels of readiness, this bounded single-case study with an embedded intervention used AI-supported prompts designed for inquiry-based and differentiated learning. Quantitative data were collected from 36 students (22 DP1, 14 DP2). Qualitative data were collected through interviews with three teachers, supported by student reflections, classroom observations, and learning artifacts. Findings indicate that AI-supported prompts improved conceptual understanding, supported a partial shift toward greater autonomy, and enabled more personalized pacing. However, these gains were conditional: teacher mediation remained essential for verification, clarification, and responsible use. The study contributes subject-specific evidence on how AI can function as a tutor-like scaffold in IBDP Computer Science when embedded within structured, differentiated, and teacher-mediated learning environments.*

**Keywords:** *Artificial Intelligence in education, IBDP Computer Science, differentiated instruction, inquiry-based learning, computational thinking*

### Introduction

Artificial intelligence is transforming education through feedback provision, task personalization, and assistance with inquiry-based learning processes. In the International Baccalaureate Diploma Programme (IBDP), which promotes student-centered learning, conceptual understanding, and academic integrity, AI has particular relevance. IBDP Computer Science uniquely blends conceptual content, problem-solving skills, and independent inquiry expectations. The recently revised DP Computer Science curriculum (first teaching 2025, first assessment 2027) emphasizes computational thinking, modern application of subject content, and student justification of responses (International Baccalaureate Organization [IBO], 2025).

As a teacher of this subject, an ongoing classroom challenge has been that students often approach difficult programming concepts with strong reliance on teacher explanation and direction. Some students enter with prior programming experience, while others encounter important concepts for the first time. In mixed-ability classes, teachers struggle to support novices without slowing the pace for more experienced students, all while maintaining rigor and student ownership. This issue becomes especially visible when students are expected to ask questions, debug code, test algorithms, and explain concepts rather than simply reproduce answers provided by the teacher.

AI may help address this tension. Rather than using AI to generate answers quickly, students could use AI to generate structured questions, explanations, and personalized assistance. By designing AI-supported prompts, educators could help students with concept exploration, questioning, idea testing, and perseverance. However, the use of AI in computer science education raises concerns about over-reliance, superficial understanding, authorship, and the visibility of student thinking (Holmes et al., 2019; Kasneci et al., 2023).

This study explores the use of AI-supported prompts to enable students to achieve curriculum goals in IBDP Computer Science through inquiry-based approaches and differentiated learning. The study is bounded within a selected unit on arrays and involves three teachers and 36 students (22 DP1, 14 DP2). Three research questions guide the study: how AI-supported prompts influence student autonomy and personalization of learning; how AI-supported prompts support inquiry-based and differentiated learning; and what are the perceived affordances and limitations of AI-supported prompts in helping students meet curriculum objectives.

## Literature Review

Artificial Intelligence in Education (AIED) refers to the intentional use of computational systems that classify, predict, generate, or engage in discourse to support teaching and learning within justified pedagogical and ethical boundaries. Ouyang and Jiao (2021) describe three modes of human-AI joint arrangement: AI-Directed (instructional AI that adapts to learner models), AI-Supported (decision-support tools for teacher professional judgment), and AI-Empowered (students using AI to plan investigations and critique AI-generated artifacts).

The most common AI tools in education fall within four families. Intelligent Tutoring Systems provide hints and adapt tasks to skill levels, showing moderate improvements with constructive tasks and immediate feedback (VanLehn, 2011). Automated feedback engines provide grading and feedback on programming errors, but their educational impact depends on ability to justify feedback (Keuning et al., 2018). Learning Analytics Dashboards provide visualizations of student activities to guide differentiation (Jivet et al., 2020). Conversational and generative AI can produce programs, test cases, and explanations on demand, with studies cautioning on blind acceptance of plausible but incorrect results (Denny et al., 2023).

International literature reveals that AI tools are novel and powerful, but pedagogy and governance models need to evolve to keep reasoning visible. U.S. scholarship emphasizes teacher-driven changes in specific learning tasks with verification-first pedagogy (Barke et al., 2023; Denny et al., 2023). European guidance favors program- or department-level

governance with non-negotiables such as viva voce, process portfolios, and declarations regarding AI use (Jisc, 2023; UK Department for Education, 2023). Both converge on the notion that AI is not a substitute for human expertise but a pedagogical mediator whose usefulness must be explicitly framed.

Research gaps identified include conceptual gaps where autonomy and personalization are defined too broadly for IBDP Computer Science; pedagogical and methodological gaps where cross-sectional surveys cannot show impact of specific AI-supported prompting; practical and contextual gaps where implementation influences are not explored; and lack of subject-specific intervention evidence.

## Theoretical Framework

An integrated theoretical framework guides this study, consisting of constructivist inquiry, self-determination theory, differentiated instruction, and TPACK. Constructivist perspectives view learners as active questioners, testers, explainers, and revisers of ideas (Vygotsky, 1978). Self-determination theory emphasizes autonomy, competence, and relatedness as drivers of intrinsic motivation (Ryan & Deci, 2020). Differentiated instruction provides a pedagogical lens for student support regarding readiness, pace, and learning needs (Tomlinson, 2017). TPACK explores the integration of technological, pedagogical, and content knowledge (Mishra & Koehler, 2006).

### Figure 2.0: Theoretical Framework

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*A layered diagram showing constructivism, SDT, differentiated instruction, TPACK, and sociocultural perspectives as design constraints at the top; teacher practices (prompt design, scaffolding, verification routines) as the mediating layer in the middle; and student processes (thinking, questioning, debugging, testing, explaining, revising) and learning outcomes (conceptual understanding, computational thinking, autonomy) at the bottom. The figure reinforces the claim that AI does not enhance learning just by being there; it depends on how the teacher uses prompt and task design, scaffolds, checking processes, and accountability.*

The framework suggests that any improvement from the use of AI-supported prompts in IBDP Computer Science is mediated, not direct. The theories positioned at the top of the model serve as design constraints. Teacher practices in the middle section constitute the key mediating layer. Student processes, thinking evidence, and learning outcomes are positioned below as the domain where effects will be seen.

## Conceptual Framework

### Figure: Conceptual Framework

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*diagram showing teacher facets (IB-aligned TPACK, assessment literacy, readiness to use AI critically) and implementation elements (well-designed prompts, differentiated scaffolds, check-first routines, reflection opportunities) influencing student engagement (attention,*



*confidence, persistence, quality of questions, reflective judgment), which in turn influence program-relevant outcomes (conceptual understanding, computational thinking in Theme B, ATL development, clearer authorship of student work).*

The conceptual framework moves the theoretical discussion into a logic of the study. It conceptualizes AI-supported prompting in IBDP Computer Science as a process of effects by design where teacher factors and implementation choices influence student engagement, questioning, and independence, which in turn impact the student learning-related outcomes valued in the programme.

## **Methodology**

### **Research Design**

A mixed-methods bounded single-case design was used with an embedded classroom intervention. The implementation of AI-supported arrays mini-units within IBDP Computer Science in one school constituted the bounded case. This design was selected because the research problem required both explanatory evidence and evidence of patterns: measurable evidence of change in student confidence, understanding, and independence, alongside qualitative explanation of how students and teachers experienced the intervention (Creswell & Plano Clark, 2018).

### **Participants and Sample**

Participants comprised 36 students (22 DP1, 14 DP2) and 3 teachers. Students were distributed equally across two differentiated pathways: 18 completed the Beginner Arrays Mini-Unit and 18 completed the Advanced Arrays Mini-Unit. Prior programming experience varied: 14 students (38.9%) had learned a little programming before, 13 (36.1%) had studied programming as part of a previous course, 4 (11.1%) were entirely new, and 5 (13.9%) had significant prior experience.

### **Intervention Materials**

The intervention included two differentiated one-week array mini-units. The beginner pathway was designed for students newer to programming, containing more scaffolding, straightforward language, smaller conceptual leaps, and tightly controlled AI prompts. The advanced pathway targeted more confident students, requiring more independent work, open-ended problem solving, tracing, debugging, testing, and explicit comparison of approaches. In both pathways, AI was presented as a tutor for learning, not as an answer engine.

### Differentiated Pathway Structure:

- **Beginner Arrays Mini-Unit (Appendix 1):** Step-by-step explanations, simpler examples, guided tracing, structured debugging support, frequent self-check questions
- **Advanced Arrays Mini-Unit (Appendix 2):** Open-ended inquiry, independent code refinement, comparative solution analysis, complex testing and debugging scenarios

## Data Collection and Analysis

Quantitative data were collected through pre-unit and post-unit student surveys measuring confidence, understanding, teacher dependence, and perceptions of AI support. Qualitative data were collected through semi-structured teacher interviews, student reflections, classroom observations, and student work samples. Quantitative analysis employed descriptive statistics (frequencies, percentages, mean responses). Qualitative analysis employed thematic analysis following Braun and Clarke (2022). Integration of quantitative and qualitative findings occurred through comparison and synthesis.

## Findings

### Quantitative Results

Before the intervention, students reported low confidence in key areas. Arrays understanding had a pre-unit mean of 2.36 (on a 1-5 scale), tracing confidence 2.36, testing confidence 2.53, and debugging confidence 2.50. Teacher dependence was high (M=3.56).

After the intervention, students reported substantially improved outcomes. Arrays understanding showed the clearest positive outcome, with a post-unit mean of 4.00 and 77.8% of students agreeing or strongly agreeing that they understood arrays more clearly. Tracing confidence increased to M=4.14 (77.8% agreement). Debugging confidence increased to M=3.81 (69.4% agreement). Students agreed that AI helped them understand array concepts more clearly (M=3.81), learn at a pace suited to their level (M=4.00), and support tracing, testing, debugging, or improving code (M=4.14).

At the same time, 69.4% of students agreed that teacher support was needed even while using AI, and 86.1% agreed that AI responses needed to be checked carefully before being trusted. Additionally, 80.6% indicated they would like to use this kind of AI-supported learning again for other Computer Science topics.

**Table: Selected pre-post mean comparison (1-5 scale, N=36)**

| Construct            | Pre-unit mean | Post-unit mean | Change |
|----------------------|---------------|----------------|--------|
| Arrays understanding | 2.36          | 4.00           | +1.64  |
| Tracing confidence   | 2.36          | 4.14           | +1.78  |

|                      |      |      |       |
|----------------------|------|------|-------|
| Debugging confidence | 2.50 | 3.81 | +1.31 |
| Teacher dependence   | 3.56 | 4.25 | +0.69 |

Comparison across learning pathways revealed that students in the advanced pathway reported stronger post-unit arrays understanding ( $M=4.28$ ) and tracing confidence ( $M=4.39$ ) than students in the beginner pathway ( $M=3.72$  and  $M=3.89$  respectively). Students in the beginner pathway reported a stronger perception that the pathway matched their readiness ( $M=4.11$  versus 4.00).

## Qualitative Themes from Teacher Interviews

Three teachers participated in semi-structured interviews. Thematic analysis revealed several recurring patterns.

All three teachers described wide variation in students' prior programming experience as a major challenge. Teachers identified decomposition, tracing, debugging, testing, and problem initiation as recurring difficulties. Arrays were described as particularly revealing because the unit required students to manage both conceptual and procedural demands simultaneously.

Teachers viewed the AI-supported intervention positively when AI was embedded in a structured learning routine. They valued that students could ask for another explanation or a different way of understanding a concept without immediately waiting for the teacher. The two differentiated pathways were seen as appropriate and useful.

Teachers indicated that AI supported inquiry most effectively when students used it to ask better follow-up questions, compare explanations, and explore alternative approaches. However, inquiry was not automatically produced by the presence of AI; when students used AI mainly to retrieve answers, the quality of inquiry weakened.

Teachers identified affordances including accessible explanation, flexible pacing, support for tracing and debugging, increased willingness to persist, and greater opportunity for differentiated access. Limitations included students trusting AI too quickly, accepting plausible explanations without checking, and confusing support with genuine understanding. Teacher mediation remained central for clarifying misconceptions, verifying AI responses, and reinforcing responsible use.

## Qualitative Themes from Student Reflections

Student reflections ( $N=36$ ) revealed several recurring patterns. Half of the students (50%) described uncertainty about how to begin programming tasks. All students (100%) described some form of teacher dependence before the intervention.

About two-fifths (39%) highlighted step-by-step explanation, repeated examples, or paced clarification as especially helpful in understanding arrays more clearly. A very large majority (94%) referred to tracing, testing, debugging, or code improvement as major areas in which AI supported their learning. Students stated that AI was useful because it could help trace code step by step, suggest better test cases, or offer debugging hints without fully replacing the task.

More than one-third (39%) explicitly linked the unit to stronger confidence or greater willingness to attempt programming tasks more independently. However, this increased independence was described as partial rather than complete. Students did not describe AI as replacing the teacher but as giving them more confidence to engage with difficulty before depending on teacher explanation.

Three-quarters (75%) referred to the need to verify AI responses or continuing uncertainty about whether AI explanations were fully correct. Students repeatedly noted that teacher support remained important for confirming whether an AI response was correct and relevant.

## **Triangulated Findings**

Integration of quantitative and qualitative data revealed five triangulated patterns. First, improved conceptual clarity in arrays and related programming processes was supported across all data sources. Second, greater confidence and partial movement towards independence were evident, though teacher mediation remained important. Third, differentiated pathways supported mixed-readiness learners in different ways, with advanced students reporting stronger outcomes and beginner students valuing pathway fit. Fourth, AI functioned most effectively as a tutor-like support for tracing, testing, debugging, and iterative improvement. Fifth, teacher mediation and critical verification remained essential, with 86.1% of students agreeing that AI responses needed to be checked carefully.

## **Discussion**

### **Interpretation of Findings**

The findings indicate that AI-supported prompts contributed meaningfully to student understanding, supported autonomy, and enabled personalized pacing in IBDP Computer Science. The post-unit gains in arrays understanding (from  $M=2.36$  to  $M=4.00$ ) and tracing confidence (from  $M=2.36$  to  $M=4.14$ ) represent substantial perceived improvement. Student reflections consistently described step-by-step explanations, repeated examples, and debugging hints as valuable forms of support.

However, these gains were conditional rather than automatic. Teacher mediation remained essential for verification, clarification, and responsible use. The finding that 86.1% of students agreed that AI responses needed to be checked carefully underscores that AI was not experienced as a replacement for human judgment. Instead, AI functioned as a scaffold whose educational value depended on how it was integrated into structured learning routines (Holmes et al., 2019; Ouyang & Jiao, 2021).

The differentiated pathway design proved important in responding to variation in learner readiness. Students in the advanced pathway reported stronger arrays understanding and tracing confidence, while students in the beginner pathway more strongly valued the structured progression and pathway fit. This aligns with Tomlinson's (2017) emphasis that

differentiation should provide different levels of scaffolding while maintaining common learning goals.

## **Relationship to Theoretical Framework**

The findings align with constructivist perspectives, as AI-supported prompts functioned as scaffolding that helped students construct understanding through explanation, testing, and revision (Vygotsky, 1978). Self-determination theory is reflected in the partial movement towards greater autonomy, though this autonomy remained supported rather than absolute, consistent with Ryan and Deci's (2020) emphasis that autonomy develops through structured support that builds competence over time. TPACK is evident in the finding that effective AI integration depended on teacher orchestration of prompts, tasks, feedback processes, and guidance for responsible use (Mishra & Koehler, 2006).

## **Affordances and Limitations**

Affordances of AI-supported prompts included improved conceptual understanding, real-time feedback and explanation, increased student autonomy, and personalized learning through differentiated pathways. Students particularly valued AI for tracing, testing, debugging, and code improvement.

Limitations included the need for critical verification, risk of superficial learning and overreliance (Kasneci et al., 2023), variability in AI response quality, and the continuing necessity of teacher mediation. Some students accepted AI responses without adequate checking, and AI-generated explanations could sometimes be incomplete or not fully appropriate for the specific task.

## **Implications for Practice**

For IBDP Computer Science teachers, several practical implications emerge. AI-supported prompts should be embedded within structured learning routines that include understanding, writing, tracing, testing, debugging, improvement, and reflection. Verification-first processes should be established prior to incorporating automation. Assessment should reward process and reasoning, not just final output (Jisc, 2023). Clear expectations for disclosure and responsible use should be taught explicitly.

Differentiation remains important. The beginner and advanced pathways demonstrated that different levels of scaffolding and challenge can support learners with different readiness levels while maintaining common learning goals (Tomlinson, 2017). Schools should consider department-level coherence in AI expectations and shared language for discussing responsible use (UK Department for Education, 2023).

## **Limitations**

This study has several limitations. The bounded single-case design means findings are closely tied to one school setting, limiting generalizability. The sample size (N=36) was sufficient for descriptive analysis within the case but relatively small. The intervention duration was one

week, capturing short-cycle change rather than long-term development. Self-reported survey data are limited by subjectivity, though triangulation with teacher interviews, student reflections, and work samples partially addressed this. The absence of a control group means the study cannot claim causal effects with certainty.

## Conclusion

This mixed-methods study examined AI-supported prompts in a selected arrays unit within IBDP Computer Science. The findings indicate that AI-supported prompts can contribute positively to conceptual understanding, supported autonomy, and personalized learning. Students reported clearer understanding of arrays, stronger confidence in tracing, testing, and debugging, and greater willingness to continue working through programming tasks rather than depending immediately on teacher explanation. AI was most effective when it functioned as a tutor-like support for explanation, tracing, testing, debugging, and iterative improvement.

However, these benefits were conditional. Teacher mediation remained essential for validation, clarification, and responsible use. AI did not replace the teacher but changed the form of support available. The differentiated pathways supported learners with different readiness levels in different ways, with the beginner pathway offering access through stronger scaffolding and the advanced pathway supporting refinement and greater independence.

The study contributes subject-specific evidence to a field often discussed in generic terms. For IBDP Computer Science, AI-supported prompts can make a meaningful contribution to inquiry-based and differentiated programming learning, but only when embedded within structured, teacher-mediated environments that preserve verification, explanation, and critical thinking. As AI continues to evolve, educators must be prepared to use it responsibly and effectively to enhance student learning outcomes while maintaining the principled values of the IB Diploma Programme.

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# Leadership Models in International Education: An Exploratory Systematic Review

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## Abstract

*This systematic review investigates evolving trends in leadership models within international education, focusing on adaptability to globalization, technological change, and accountability pressures. Analyzing 360 peer-reviewed studies published between 2013 and 2023 through bibliometric and thematic analysis, the study identifies transformational, distributed, and instructional leadership as dominant, together accounting for 75% of the literature. However, temporal analysis reveals significant shifts: distributed leadership has overtaken transformational as the most studied model in recent years (29% vs. 27%), while culturally responsive leadership more than doubled from 6% to 13%. Findings expose critical geographical imbalance (North America 32.8%, Europe 30.3%, Asia 21.7%, Africa 7.8%, Latin America 7.5%) and methodological skew toward qualitative approaches (50%). The study proposes the Tri-Dimensional Adaptive Leadership Model (TALM), integrating transformational vision, distributed collaboration, and cultural responsiveness as an integrative framework for international school leadership. Recommendations address policy, practice, and future research priorities including digital leadership, sustainability, geographical diversification, and leader wellbeing.*

**Keywords:** *leadership models, international education, systematic literature review, distributed leadership, culturally responsive leadership, adaptive leadership*

## 1. Introduction

The 21st century has ushered in significant transformations within educational leadership, driven by globalization, technological advancement, demographic changes, and intensifying accountability pressures (Leithwood, Harris, & Hopkins, 2020; Harris & Jones, 2020). In both developed and developing nations, schools increasingly compete on a global stage, with international assessments such as PISA serving as critical benchmarks for evaluating institutional effectiveness (Schleicher, 2019). International schools, characterized by cultural diversity, transnational mobility, and complex governance structures, have become key sites where leadership models are tested, adapted, and contested (Ainscow, 2023; Bunnell, 2021).

The integration of information technology has revolutionized educational delivery, transforming traditional pedagogical methods into more engaging and interactive experiences.

Digital platforms enable real-time assessment, personalized learning, and global collaboration, yet they also demand new leadership competencies (Rajeev Ranjan, 2023; Ertmer & Ottenbreit-Leftwich, 2018). The COVID-19 pandemic accelerated this digital transformation, thrusting school leadership into unprecedented territory as leaders navigated remote learning, community resilience, and wellbeing crises (Netolicky, 2020).

In this context of rapid change, effective school leadership has emerged as a crucial factor influencing a school's ability to adapt and thrive. Research consistently demonstrates that strong leadership is essential for fostering positive school culture, enhancing teacher effectiveness, and improving student outcomes (Leithwood et al., 2020; Day & Gu, 2021). The landscape of educational leadership encompasses diverse models: instructional leadership focuses on teaching quality; transformational leadership emphasizes inspiration and shared vision; distributed leadership recognizes collective responsibility across stakeholders (Hallinger, 2020; Spillane, 2015).

Despite recognition of leadership's critical importance, the field remains fragmented. Numerous leadership models have been proposed and studied, often in isolation from one another. Existing reviews tend to focus on specific models or broader theories without systematically analyzing how research focus has shifted over time in response to global changes (Hallinger, 2020; Neumerski, 2013). A significant gap exists in understanding which leadership models dominate contemporary discourse, how research trends have evolved, and what contextual factors shape these patterns.

This study addresses three research questions:

1. Which leadership models in education receive the most scholarly attention in contemporary research?
2. How have research trends on leadership models evolved over time, particularly in response to global and technological changes?
3. To what extent do contextual factors—such as globalization, technological innovation, and accountability pressures—influence research trends in leadership models?

## 2. Literature Review

### The Concept of Leadership Models

Leadership models in education provide structured frameworks guiding how school leaders approach their roles, interact with stakeholders, and make critical decisions. The recent surge of interest reflects the need for leaders to adapt to increasingly complex environments influenced by globalization, technological innovation, and shifting accountability measures (Litz, 2021).

**Transformational leadership** focuses on inspiring and motivating staff, fostering a culture of collaboration and innovation (Leithwood & Azah, 2019). Transformational leaders articulate compelling visions, promote innovative practices, and provide individualized support. This model is associated with improved teacher performance and student outcomes, though critics note its potentially top-down, leader-centric orientation (Gumus et al., 2021).

**Instructional leadership** emphasizes direct leader involvement in teaching and learning processes, working closely with teachers to enhance instructional practices, curriculum development, and student assessment (Day & Sammons, 2016). This model ties leadership actions directly to academic performance but may neglect staff morale and community engagement.

**Distributed leadership** advocates shared leadership responsibilities across the institution, emphasizing collective responsibility rather than concentration in a single individual (Gumus et al., 2020; Harris, 2019). This model fosters collaboration and inclusivity but faces implementation challenges in hierarchical cultures.

**Adaptive leadership** emphasizes responsiveness to external pressures—globalization, technological disruption, evolving student needs—while maintaining internal coherence (Spulber, 2022). This model proved particularly relevant during COVID-19, when leaders rapidly transitioned to remote learning.

**Culturally responsive leadership** recognizes and responds to diverse cultural backgrounds of students and staff (Khalifa, 2018, 2022). Culturally responsive leaders prioritize understanding cultural dynamics, adapting practices to meet stakeholder needs, and creating inclusive environments where diversity is viewed as strength.

### **Global Practices and Regional Perspectives**

Globally, educational leadership has shifted toward culturally adaptive and globally minded practices. Cosmopolitan leadership and culturally intelligent leadership prioritize cultural sensitivity and global thinking (Ang & Van Dyne, 2018; Earley & Ang, 2020). Transformational leadership remains widely adopted for its ability to unite diverse populations under shared vision (Duderstadt et al., 2020).

In Southeast Asia and Malaysia specifically, leadership reflects a blend of Western philosophies and Asian cultural values emphasizing collectivism, respect for authority, and social harmony (Aziz & Nor, 2021; Chen, 2021). The Malaysian Education Blueprint 2013–2025 positions school leaders as central to reform, promoting transformational and distributed leadership as mechanisms for school improvement (Hashim & Razak, 2019; Zaid et al., 2018). Culturally responsive leadership is particularly important given Malaysia's multicultural heritage of Malay, Chinese, Indian, and indigenous communities.

### **Research Gaps**

Several critical gaps persist in the literature. First, leadership research remains Western-centric, with most studies conducted in North America and Europe, limiting applicability to non-Western contexts (Lumby & Foskett, 2019; Oplatka, 2020). Second, there is a lack of longitudinal studies tracking long-term leadership impact on school outcomes (Robinson et al., 2020; Sun & Leithwood, 2020). Third, research on digital leadership remains limited despite technology's transformative role (Anderson & Dexter, 2020; Hussin, 2021). Fourth, the unique contextual challenges of international schools—cultural diversity, staff mobility, multiple accountability frameworks—remain underexplored (Bunnell, 2021; Savva, 2021).

### 3. Methodology

#### Research Design

This study employed a systematic literature review (SLR) following PRISMA 2020 guidelines (Page et al., 2021), integrating bibliometric analysis using VOSviewer and CiteSpace (van Eck & Waltman, 2017) and thematic analysis following Braun and Clarke's (2006) six-phase framework.

#### Search Strategy and Selection

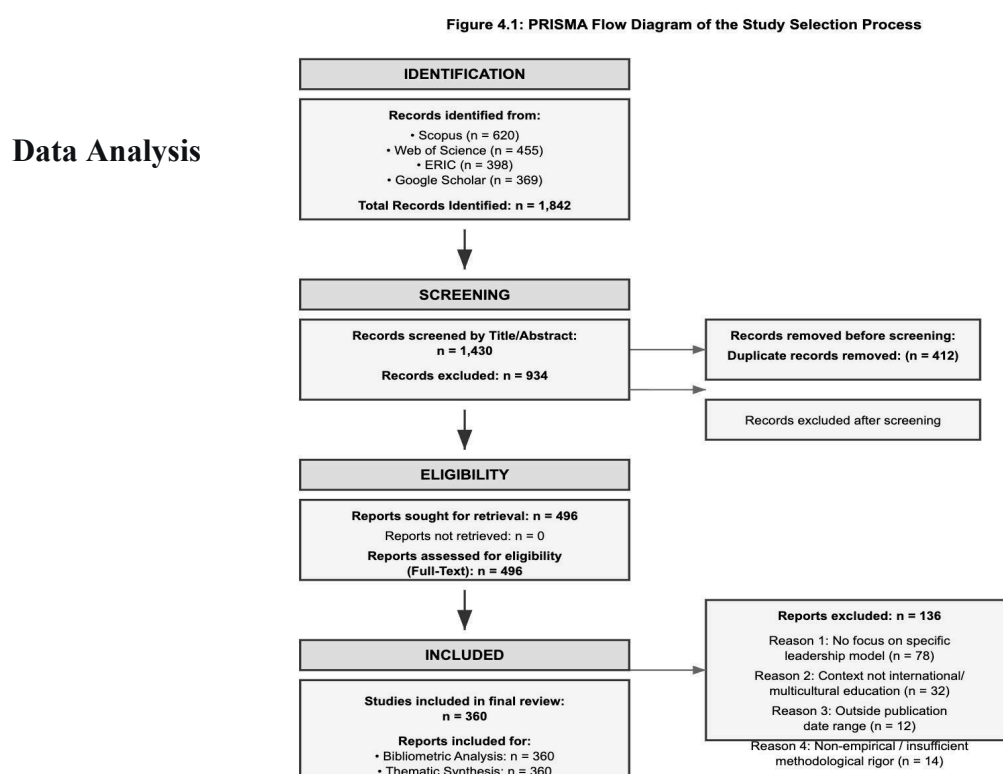
Four databases were searched: Scopus, Web of Science, ERIC, and Google Scholar, covering publications from 2013 to 2023. The search strategy combined three concept groups using Boolean operators: (1) leadership terms ("educational leadership," "school leadership," "principal"); (2) model terms ("transformational leadership," "distributed leadership," "instructional leadership," "model," "framework"); and (3) context terms ("international education," "international school," "global," "transnational").

**Inclusion criteria:** peer-reviewed journal articles or conference proceedings; English language; published 2013–2023; explicit focus on leadership models in international, multicultural, or comparative education contexts.

**Exclusion criteria:** books, book reviews, dissertations, opinion pieces; publications before 2013; leadership in purely national contexts without international dimensions; leadership in non-educational sectors.

The initial search yielded 1,842 records. After duplicate removal (412), title and abstract screening (934 excluded), and full-text review (496 to 360), **360 studies** were retained for final analysis.

**Figure 1: PRISMA Flow Diagram** (adapted from Page et al., 2021)



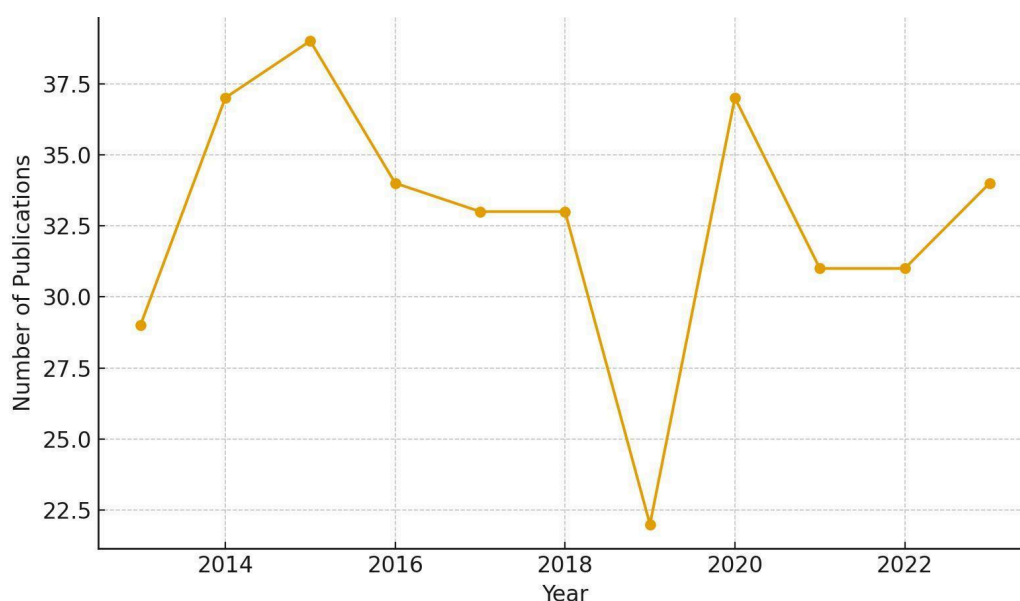
Bibliometric analysis examined citation patterns, publication trends, keyword co-occurrence, and collaboration networks. Thematic analysis followed six phases: familiarization, initial coding, theme searching, theme review, theme definition, and report production. Quality appraisal used CASP checklists, with studies flagged as "low-rigor" interpreted cautiously rather than excluded.

## 4. Findings

### Descriptive Overview of the Literature Corpus

**Annual publication trends** revealed a mean of 33 studies per year, with notable fluctuations. Early peaks occurred in 2014 (37 publications) and 2015 (39 publications). A sharp decline appeared in 2019 (22 publications), followed by a resurgence in 2020 (37 publications), plausibly linked to COVID-19's impact on leadership discourse (Harris & Jones, 2020).

**Figure 2: Annual Publication Trend (2013–2023)**



**Geographical distribution** showed significant imbalance. North America contributed 32.8% of studies, Europe 30.3%, Asia 21.7%, Africa 7.8%, and Latin America 7.5%. This pattern reflects broader structural inequalities in global research production, where Global North scholars have greater access to funding, high-impact journals, and research infrastructure (Crossley & Watson, 2020).

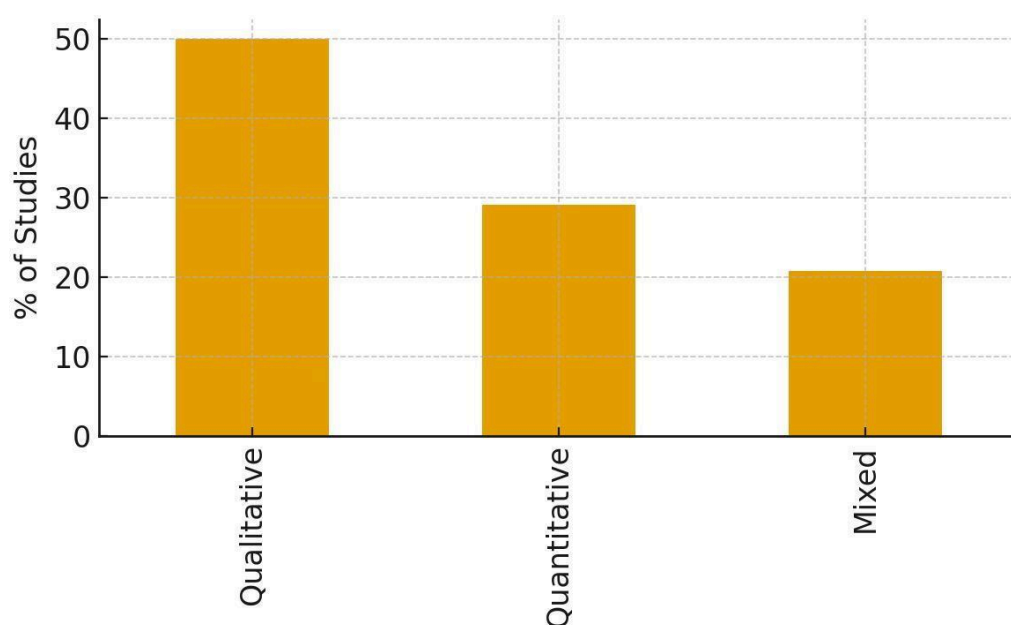


**Table 1: Distribution of Studies by Region**

| Region        | Percentage | Cumulative |
|---------------|------------|------------|
| North America | 32.8%      | 32.8%      |
| Europe        | 30.3%      | 63.1%      |
| Asia          | 21.7%      | 84.8%      |
| Africa        | 7.8%       | 92.6%      |
| Latin America | 7.5%       | 100.1%     |

**Methodological orientations** revealed a clear preference for qualitative paradigms. Qualitative approaches accounted for 50% of studies (case studies, interviews, ethnographic observations). Quantitative methods represented 29.2% (surveys, statistical modeling). Mixed-methods designs represented 20.8%, reflecting growing recognition of methodological pluralism.

**Figure 3: Distribution of Research Methods**



**Leading publication outlets** showed concentration within specialized journals. The top five journals—Leadership and Policy in Schools, Educational Review, Compare, International Journal of Educational Management, and School Leadership & Management—accounted for 47.2% of all publications.

**Table 2: Leading Journals by Publication Count**

| Journal                                         | Articles | Primary Database       |
|-------------------------------------------------|----------|------------------------|
| Leadership and Policy in Schools                | 50       | Web of Science, Scopus |
| Educational Review                              | 49       | Scopus, ERIC           |
| Compare                                         | 49       | Web of Science, Scopus |
| International Journal of Educational Management | 48       | Scopus, Web of Science |
| School Leadership & Management                  | 43       | ERIC, Google Scholar   |

### **Bibliometric Analysis Findings**

**Citation analysis** identified the most influential works. The most cited study was a 2021 European qualitative investigation on culturally responsive leadership (138 citations), reflecting heightened engagement with diversity, equity, and inclusion (Khalifa, 2022; Santamaria & Santamaria, 2022). Other highly cited works included a 2015 European study on servant leadership (135 citations) and a 2020 African study on instructional leadership (133 citations).

**Keyword co-occurrence analysis** using VOSviewer identified four distinct clusters:

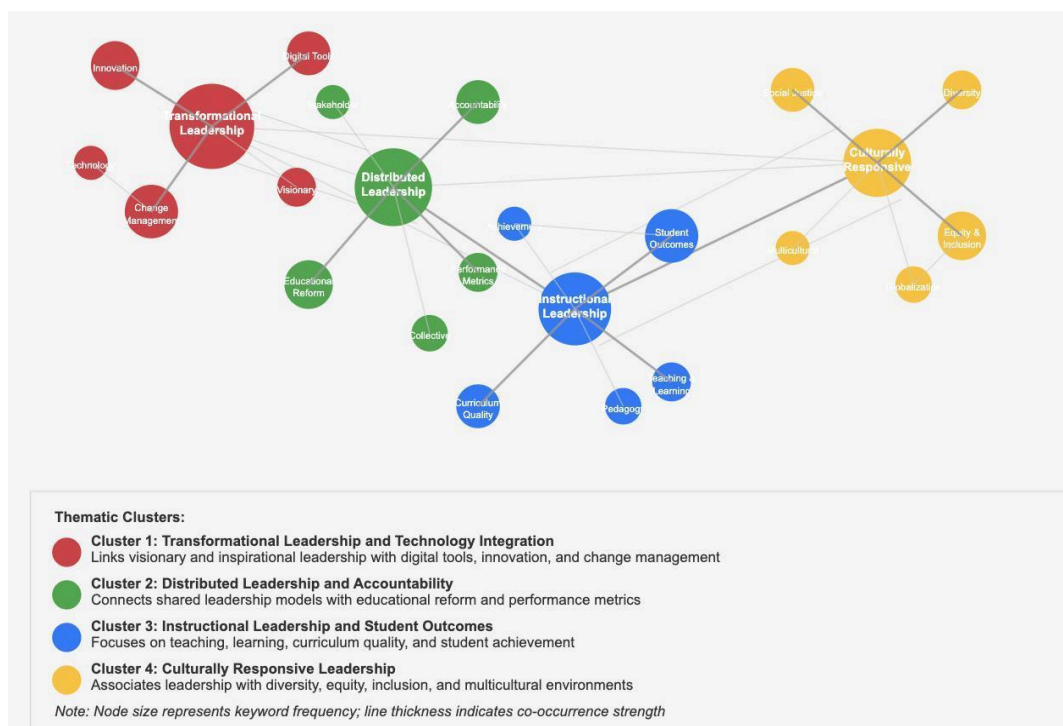
**Cluster 1 (Transformational Leadership and Technology Integration):** Connects visionary, change-oriented leadership with digital learning, innovation, and organizational change. Its prominence reflects how transformational leadership has been reframed during digital transformation and post-pandemic recovery (Netolicky, 2020).

**Cluster 2 (Distributed Leadership and Accountability):** Links shared leadership approaches with educational reform, performance metrics, and stakeholder pressures. Distributed leadership is positioned as a strategy for meeting intensifying accountability demands (Baker et al., 2020; Harris & DeFlaminis, 2016).

**Cluster 3 (Instructional Leadership and Student Outcomes):** Represents research directly tying leadership practices to teaching quality, curriculum implementation, and student achievement, reflecting the enduring influence of accountability frameworks (Leithwood et al., 2020).

**Cluster 4 (Culturally Responsive Leadership):** Emphasizes leadership practices informed by equity, diversity, inclusion, and global citizenship. Its rapid growth signals the influence of globalization and social justice movements on leadership discourse (Khalifa, 2022).

**Figure 4: Keyword Co-occurrence Clusters**



## Dominant Leadership Models

Transformational, distributed, and instructional leadership together accounted for approximately 75% of all studies. Transformational leadership was the single most frequently examined model (30%), followed by distributed leadership (25%) and instructional leadership (20%).

**Table 3: Evolution of Leadership Models (2013–2017 vs. 2018–2023)**

| Model                 | 2013–2017 (%) | 2018–2023 (%) | Absolute Change |
|-----------------------|---------------|---------------|-----------------|
| Transformational      | 33            | 27            | -6              |
| Distributed           | 20            | 29            | +9              |
| Instructional         | 25            | 18            | -7              |
| Servant               | 12            | 8             | -4              |
| Culturally Responsive | 6             | 13            | +7              |
| Other                 | 4             | 5             | +1              |

**Key shifts:** Distributed leadership overtook transformational as the most studied model in the later period (29% vs. 27%). Culturally responsive leadership more than doubled from 6% to 13%, reflecting global equity movements. Servant and instructional leadership declined in relative focus.

## Influence of Contextual Factors

Thematic synthesis identified three contextual factors as critical drivers shaping leadership research:

**Globalization** has fueled the prominence of culturally responsive leadership by foregrounding diversity, equity, and inclusion as core leadership imperatives. Leaders are expected to prepare students for a globalized society while navigating cross-cultural complexities (Harris & Jones, 2020; Khalifa, 2022).

**Technological change** has reinforced the role of leaders as facilitators of digital integration. Studies highlight leaders' responsibilities in providing professional development, resourcing digital infrastructure, and cultivating cultures of innovation (Ertmer & Ottenbreit-Leftwich, 2018; Netolicky, 2020).

**Accountability pressures** have driven interest in distributed leadership as a mechanism for shared responsibility and data-driven decision-making. Accountability frameworks link to reform agendas pushing leaders to balance compliance with innovation (Baker et al., 2020; Pont, 2020).

**Table 4: Contextual Themes and Evidence**

| Theme          | Example Evidence                                                                                                    |
|----------------|---------------------------------------------------------------------------------------------------------------------|
| Globalization  | Promotion of inclusive, culturally responsive leadership to address diverse student needs (Harris & Jones, 2020)    |
| Technology     | Emphasis on leadership enabling digital integration and innovation (Ertmer & Ottenbreit-Leftwich, 2018)             |
| Accountability | Advocacy for collective, data-driven leadership models responding to performance-based regimes (Baker et al., 2020) |

## 5. Discussion

### Interpretation of Key Findings

The persistence of transformational, distributed, and instructional leadership reflects the resilience of conceptual frameworks deeply embedded in scholarly and policy discourses. However, their shifting proportions indicate evolving priorities. Distributed leadership's rise from 20% to 29%—overtaking transformational leadership—aligns with post-pandemic recognition that collaborative, networked leadership is essential for navigating complex, rapidly changing environments (Harris & Jones, 2020). The limitations of "heroic," leader-centric models have become increasingly apparent (Gumus et al., 2021).

Culturally responsive leadership's surge from 6% to 13% reflects global movements for equity, inclusion, and decolonization in education (Smith, 2021). In international schools, where classrooms are microcosms of global diversity, CRL provides a crucial framework for navigating difference and promoting belonging (Khalifa, 2022; Santamaria & Santamaria,

2022). This growth signals broader epistemic rebalancing, as alternative epistemologies from Global South contexts begin reshaping dominant discourse (Crossley & Watson, 2020).

The geographical imbalance (Global North 63%) risks universalizing Western-centric models to contexts where collectivist values, respect for hierarchy, and community-based decision-making dominate (Oplatka, 2020; Chen & Gu, 2021). Leadership theories developed in individualist Western contexts may not be directly applicable or effective in Asian, African, or Latin American education systems without cultural adaptation.

The methodological skew toward qualitative approaches (50%) provides depth, contextual richness, and narrative power—which may explain why qualitative studies dominate the most-cited list. However, over-reliance on small-scale qualitative designs limits generalizability and the ability to establish causal relationships between leadership models and outcomes (Gorard, 2022). More longitudinal and mixed-methods research is urgently needed.

### Cross-Cutting Themes

Three cross-cutting themes emerge from the synthesis. First, **hybridization of leadership models** reflects recognition that no single paradigm is sufficient. Effective leaders draw simultaneously on transformational, distributed, instructional, and culturally responsive practices depending on context (Harris & Jones, 2020; Ainscow, 2023).

Second, **equity and digitalization as dual imperatives** are reshaping leadership agendas. Leaders must harness technology to expand access while addressing digital divides that risk exacerbating inequality. The intersection of these imperatives creates both opportunities and tensions (Ertmer & Ottenbreit-Leftwich, 2018; Netolicky, 2020).

Third, **complexity of accountability** permeates leadership models differently across contexts. Distributed leadership is often justified as an accountability strategy, instructional leadership links to measurable outcomes, and transformational leadership mobilizes commitment to reform agendas. However, accountability pressures often conflict with equity and innovation (Gorard, 2022).

### The Tri-Dimensional Adaptive Leadership Model (TALM)

Based on the synthesis of findings, this study proposes the **Tri-Dimensional Adaptive Leadership Model (TALM)**, an integrative framework that synthesizes transformational, distributed, and culturally responsive leadership paradigms into a cohesive, future-oriented conceptual tool.

#### Figure 5: The Tri-Dimensional Adaptive Leadership Model (conceptual diagram)

The TALM is organized around three interdependent dimensions:

#### Dimension 1: Transformational Vision (Strategic Orientation)

Anchored in the capacity to articulate vision, inspire commitment, and mobilize stakeholders toward shared goals. In international contexts, transformational vision aligns diverse cultural expectations with institutional missions. This dimension draws on Leithwood et al. (2020) and Duderstadt et al. (2020).

### **Dimension 2: Distributed Collaboration (Operational Orientation)**

Reflects recognition that leadership is collective practice spread across multiple actors. Distributed collaboration is not delegation but intentional cultivation of shared agency through professional learning communities, collaborative decision-making, and peer mentoring (Ng, 2021; Harris, 2019).

### **Dimension 3: Cultural Responsiveness (Ethical Orientation)**

Positions inclusivity, equity, and diversity as foundational to leadership rather than secondary considerations. Goes beyond symbolic multiculturalism to include structural changes: inclusive curricula, anti-racist practices, and student voice mechanisms (Khalifa, 2022; Santamaria & Santamaria, 2022).

**Table 5: Dimensions of the Tri-Dimensional Adaptive Leadership Model**

| Dimension                 | Orientation | Core Function                                                                          | Key Scholars                                    |
|---------------------------|-------------|----------------------------------------------------------------------------------------|-------------------------------------------------|
| Transformational Vision   | Strategic   | Articulate vision, inspire commitment, mobilize stakeholders                           | Leithwood et al., 2020; Duderstadt et al., 2020 |
| Distributed Collaboration | Operational | Cultivate shared agency, professional learning communities, collective decision-making | Harris, 2019; Ng, 2021; Spillane, 2015          |
| Cultural Responsiveness   | Ethical     | Embed equity, inclusion, diversity as foundational leadership imperatives              | Khalifa, 2022; Santamaria & Santamaria, 2022    |

### **Adaptive Integration: The Dynamic Core of the Model**

The defining feature of TALM is its adaptive orientation. Unlike earlier models emphasizing fixed traits or stable practices, TALM frames leadership as dynamic integration in response to shifting contexts. In crisis situations (e.g., COVID-19), leaders may foreground transformational vision to sustain morale while relying on distributed collaboration for operational complexity (Harris & Jones, 2020). In culturally diverse contexts, leaders may emphasize cultural responsiveness as the guiding principle while aligning transformational goals with equity agendas (Santamaria & Santamaria, 2022). In digital innovation initiatives, leaders balance vision-driven technological adoption with distributed professional development (Ertmer & Ottenbreit-Leftwich, 2018).

This adaptability aligns with complexity theory in educational leadership, which posits that effective leadership emerges from continuous interaction with dynamic systems rather than static adherence to prescriptive models (Uhl-Bien & Arena, 2018).

### **Practical Applications of TALM**

The TALM offers several practical applications. For leaders in practice, the model serves as a reflective framework to assess whether current practices overemphasize one dimension at the expense of others. For policymakers, TALM provides a tool for designing balanced leadership standards that go beyond managerial or outcome-driven metrics. For professional development, TALM can structure leadership training curricula, with modules organized around visioning, collaboration, and responsiveness.



## Implications for Policy, Practice, and Research

**For policy:** Integrate equity and digital readiness into leadership standards; move away from rigid accountability toward balanced approaches combining quality assurance with innovation; create platforms for South-North knowledge exchange to avoid reproducing epistemic inequities.

**For practice:** Develop adaptive leadership repertoires beyond single-model training; embed equity audits into leadership routines; embrace digital cultures of innovation; prioritize leader and teacher wellbeing as integral to sustaining effective leadership (Day & Gu, 2021).

**For research:** Expand geographical scope and epistemic diversity beyond Global North dominance; advance digital leadership scholarship examining AI, learning analytics, and ethical dimensions; integrate sustainability and social justice into leadership studies; conduct longitudinal research tracking leadership impact over time.

## Limitations

Several limitations must be acknowledged. The reliance on published academic literature may overlook valuable unpublished research, including conference presentations and dissertations (publication bias). The selection of specific databases may influence literature capture. Language restrictions (English-only) exclude important research conducted in other languages, limiting generalizability, particularly for Global South contexts where research is often published in local languages. The analysis of contextual factors relying predominantly on bibliometric methods may not fully capture complexities of how external factors shape leadership research.

## 6. Conclusion

This systematic review of 360 studies published between 2013 and 2023 reveals that educational leadership research is simultaneously stable and shifting. Transformational, distributed, and instructional leadership remain dominant, together accounting for 75% of the literature. However, significant temporal shifts have occurred: distributed leadership has overtaken transformational as the most studied model (29% vs. 27%), while culturally responsive leadership has more than doubled (6% to 13%), reflecting global equity movements and decolonization agendas.

Critical imbalances persist. Geographical distribution remains heavily skewed toward North America (32.8%) and Europe (30.3%), with Africa (7.8%) and Latin America (7.5%) significantly underrepresented. Methodological orientation favors qualitative approaches (50%), limiting generalizability. These patterns risk universalizing Western-centric models to contexts where collectivist values and different cultural norms dominate.

The proposed Tri-Dimensional Adaptive Leadership Model (TALM) synthesizes transformational vision, distributed collaboration, and cultural responsiveness into an integrative framework for international school leadership. TALM's adaptive orientation enables leaders to shift dimensional emphasis based on context—crisis situations may

foreground transformational vision; diverse cultural contexts may elevate cultural responsiveness; reform environments may emphasize distributed collaboration.

Future research must prioritize geographical diversification, digital leadership, sustainability, and leader wellbeing to ensure leadership scholarship remains relevant, inclusive, and impactful. The contribution of this study lies in demonstrating that the future of leadership research is not about discovering the next "best" model in isolation, but about cultivating leaders and systems capable of navigating complexity through equity, adaptability, and shared responsibility.

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