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Exploring the Challenges of Establishing Smart Schools in Iraq Based on Thematic Analysis

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A B S T R A C T

Purpose: The present study aimed to explore the challenges of establishing smart schools in Iraq and to provide a comprehensive conceptual model for their development based on thematic analysis.

Methods and Materials: This study was conducted using a mixed-methods approach with a sequential exploratory design and an applied orientation. The qualitative phase employed deductive thematic analysis based on the Attride-Stirling approach to identify the challenges associated with establishing smart schools in Iraq. The statistical population consisted of educational experts, specialists, and individuals knowledgeable about educational digitalization in Iraq during the 2023–2024 academic year. Eighteen participants were selected through purposive and criterion-based sampling. Data were collected through semi-structured and in-depth interviews lasting approximately sixty to ninety minutes and were analyzed using MAXQDA 2020 software. The coding process was conducted at three levels, including basic, organizing, and global themes. To ensure data trustworthiness, the criteria proposed by Lincoln and Guba, including credibility, dependability, confirmability, and transferability, were applied.

Findings: The findings revealed that the implementation of smart schools in Iraq is affected by a multidimensional network of interconnected challenges categorized into six major domains: structural and infrastructural challenges, human resource and empowerment challenges, financial and economic challenges, technological challenges, legal and managerial challenges, and cultural-social challenges. The results indicated that human, governance, and cultural barriers were more influential than purely technological deficiencies. Weak technological infrastructure, insufficient teacher competencies, lack of continuous professional development, inadequate financial resources, organizational resistance, absence of comprehensive legal frameworks, weak institutional coordination, and low social acceptance were identified as the most significant barriers.

Conclusion: The findings demonstrated that the successful establishment of smart schools in Iraq requires an integrated and systemic approach that simultaneously addresses technological, organizational, cultural, financial, and governance-related dimensions.

Keywords: *thematic analysis, in-depth interview, smart school challenges, smart schools.*

1. Introduction

The rapid advancement of digital technologies and the expansion of intelligent systems have fundamentally transformed educational environments across the world. Educational systems are increasingly moving toward the integration of smart technologies, digital infrastructures, and data-driven management practices in order to enhance learning quality, improve educational efficiency, and prepare students for the demands of the digital age. In this context, the concept of smart schools has emerged as one of the most significant manifestations of educational transformation within the framework of the Fourth Industrial Revolution. Smart schools are not merely traditional schools equipped with technological devices; rather, they represent comprehensive educational ecosystems in which teaching, learning, management, communication, evaluation, and educational governance are integrated through digital technologies and intelligent systems (Lee & Lee, 2024; Mogas et al., 2022). The transition from conventional educational structures toward smart educational systems has become a strategic priority for many countries seeking sustainable educational development and digital competitiveness in the global knowledge economy (Gashti, 2022; Hadj Moussa & Abdelghani, 2020).

The emergence of smart schools is closely associated with broader developments in smart cities, digital governance, artificial intelligence, cloud computing, blockchain technologies, and the Internet of Things. Contemporary educational systems increasingly rely on technological infrastructures capable of facilitating real-time communication, adaptive learning environments, and intelligent educational management systems (Ben Hadda, 2017; Zardali & Amina, 2021). The implementation of Internet of Things technologies, digital attendance systems, and intelligent monitoring applications has expanded the operational dimensions of smart schools and enhanced their administrative and educational capacities (Anam et al., 2024; Rukhiran et al., 2022). Similarly, the spread of fifth-generation communication technologies has accelerated the development of digital educational services and created new opportunities for educational institutions to integrate intelligent learning systems into their operational frameworks (Ismail, 2023). These transformations indicate that smart schools are no longer optional educational innovations but are becoming essential components of modern educational systems.

Despite the growing importance of smart schools, the successful implementation of such systems remains highly dependent on the interaction among technological, organizational, managerial, cultural, and economic factors. Research has shown that the establishment of smart schools requires more than merely providing technological equipment and digital infrastructure. Effective implementation demands adaptive educational leadership, organizational readiness, professional development, and supportive governance mechanisms (Aisha, 2022; Al-Zaidi, 2022). School principals and educational leaders play a critical role in facilitating digital transformation processes, encouraging innovation, and managing resistance to technological change within educational institutions (Farahbakhsh et al., 2024; Lee & Lee, 2024). Consequently, educational leadership has increasingly been recognized as one of the key determinants of successful smart school implementation.

Another critical dimension in the development of smart schools concerns teachers' competencies and their readiness to integrate technology into educational processes. Teachers are considered the central actors in digital educational transformation because the effectiveness of smart educational systems largely depends on their willingness and ability to adopt innovative teaching methods and digital technologies (Dowlati et al., 2021; Khosravi & Hajati, 2024). Previous studies have demonstrated that insufficient digital literacy, inadequate professional training, and resistance to technological change can significantly hinder the implementation of smart schools (Ghasemtabar et al., 2020; Mehravar Gigloo et al., 2020). The successful integration of educational technologies therefore requires continuous professional development programs that enable teachers to develop adaptive competencies aligned with evolving technological environments (Saoudi, 2019). In many developing educational systems, however, the absence of systematic teacher training programs remains one of the major barriers to digital transformation.

The technological dimension of smart schools also includes challenges related to infrastructure, maintenance, connectivity, and technological sustainability. Smart schools require stable communication networks, reliable electricity supply, digital learning platforms, advanced hardware systems, and integrated educational software (Al-Badi et al., 2020; Elbadawy & Elagami, 2021). In developing countries, infrastructural deficiencies often create substantial obstacles to the implementation of smart educational systems. Problems such as unstable internet connectivity, outdated

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technological equipment, weak technical support systems, and inadequate maintenance capacities may reduce the effectiveness of smart school initiatives and generate organizational inefficiencies (Kechagia, 2024; Moradi et al., 2019). Furthermore, the rapid obsolescence of technological systems imposes additional financial pressures on educational institutions, particularly in economically unstable contexts.

Financial and economic challenges constitute another major dimension influencing the implementation of smart schools. The establishment and maintenance of intelligent educational infrastructures require significant investments in hardware, software, training, maintenance, and technological upgrading (Al-Badi et al., 2020; Kechagia, 2024). In many developing countries, educational systems face serious budget limitations, inflationary pressures, and economic instability, all of which negatively affect long-term educational technology projects. Economic fluctuations and dependency on imported technological equipment may further increase implementation costs and reduce institutional sustainability. These challenges become particularly significant in countries experiencing political or economic instability, where educational modernization projects often encounter interruptions due to insufficient financial support or weak policy continuity.

In addition to technological and financial factors, cultural and social variables play a fundamental role in determining the success or failure of smart school initiatives. The adoption of educational technologies often encounters resistance from teachers, parents, and broader social groups due to concerns regarding cultural identity, social values, educational effectiveness, or ethical implications (Galian et al., 2023; Rafat Mohammad Said, 2017). Some studies have shown that excessive reliance on smart devices may contribute to behavioral and social challenges among students, thereby generating skepticism toward educational digitalization initiatives (Amira, 2019; Mohammad, 2025). Concerns regarding the impact of digital technologies on children's social communication, family dialogue, and psychological well-being have intensified public debates regarding the expansion of smart educational systems (Omar Adam, 2021). Consequently, the social acceptance of smart schools cannot be achieved solely through technological investment but also requires cultural adaptation, public awareness, and effective stakeholder engagement.

Family involvement has also emerged as an important factor influencing the effectiveness of smart educational systems. Smart schools increasingly depend on interactive communication between schools and families through digital platforms and intelligent communication systems. Research has indicated that family participation significantly enhances educational outcomes and facilitates students' adaptation to digital learning environments (Galian et al., 2023). However, low levels of digital literacy among parents, concerns regarding online learning environments, and limited awareness of smart educational systems may reduce family support for educational digitalization projects. Therefore, educational policymakers must address not only institutional readiness but also community readiness in order to ensure the sustainable implementation of smart schools.

Another important issue concerns the role of organizational culture in technology acceptance within educational institutions. Technology acceptance models suggest that individuals' perceptions of usefulness, ease of use, and organizational support significantly influence their willingness to adopt digital systems (Ghasemtabar et al., 2020; Mehravar Gigloo et al., 2020). In educational settings where organizational cultures are resistant to innovation or characterized by rigid administrative structures, digital transformation processes are likely to encounter substantial obstacles. Conversely, schools with adaptive cultures, collaborative leadership structures, and innovation-oriented management systems demonstrate greater success in implementing smart educational initiatives (Farahbakhsh et al., 2024). These findings emphasize the importance of organizational readiness and institutional culture in educational modernization efforts.

The Iraqi educational system currently faces substantial challenges associated with post-conflict reconstruction, infrastructural limitations, administrative instability, and technological underdevelopment. Although Iraq has made efforts to modernize its educational system and expand digital learning opportunities, the implementation of smart schools remains limited and fragmented. Many Iraqi schools continue to experience inadequate technological infrastructure, insufficient financial resources, unstable electricity supply, and shortages of qualified personnel capable of managing educational technologies. Furthermore, legal and governance frameworks necessary for supporting educational digital transformation remain underdeveloped, thereby limiting institutional coordination and policy consistency. These structural deficiencies create serious obstacles to the establishment of sustainable smart educational systems.

The Iraqi context also presents distinctive cultural and social complexities that may influence the implementation

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of smart schools. Educational modernization initiatives often interact with traditional social norms, cultural expectations, and varying levels of technological acceptance across communities. Resistance to technological transformation may emerge from concerns regarding cultural identity, educational quality, or social inequality. In addition, disparities between urban and rural regions in terms of technological access and educational infrastructure may intensify educational inequalities and complicate the implementation of nationwide smart school programs. Consequently, understanding the multidimensional challenges of smart school establishment in Iraq requires a comprehensive and context-sensitive analytical approach.

Although previous studies have investigated various aspects of smart schools, including technology integration, educational leadership, digital readiness, and educational innovation, there remains a significant research gap concerning the comprehensive analysis of challenges associated with smart school establishment in Iraq. Existing studies have often focused on isolated technological or managerial dimensions without examining the complex interactions among infrastructural, human, financial, cultural, and governance-related factors (Anam et al., 2023; Bouzid, 2022). Moreover, limited qualitative research has explored the lived experiences and perspectives of experts, policymakers, and practitioners regarding the practical barriers to implementing smart educational systems in developing and post-conflict contexts. Addressing this gap is essential for developing effective policy frameworks and contextually appropriate educational strategies.

Given the strategic importance of educational digital transformation and the growing necessity of intelligent educational systems in contemporary societies, identifying and analyzing the challenges of smart school implementation in Iraq represents a critical academic and practical issue. A comprehensive understanding of these challenges may contribute to the development of more effective educational policies, adaptive governance frameworks, sustainable technological strategies, and context-sensitive implementation models capable of supporting educational modernization in Iraq. Therefore, the present study aims to explore the challenges of establishing smart schools in Iraq through thematic analysis in order to develop a comprehensive conceptual model for smart school implementation.

2. Methods and Materials

2.1. Study Design and Participants

The present study was conducted with the aim of exploring the challenges of smart schools in order to propose a model for Iraq. Given the exploratory nature of the subject and the primary objective of the research, which was the design of a comprehensive model for the establishment of smart schools in Iraq, a mixed-methods approach (qualitative–quantitative) with a sequential exploratory design was employed. In terms of purpose, the study was applied research, and in terms of data collection time, it was cross-sectional. The research was conducted in two main phases: the first phase (qualitative), using thematic analysis to explore the challenges of smart schools, and the second phase (quantitative), using a descriptive-survey method to validate the designed model.

In the qualitative phase of the study, deductive thematic analysis based on the Attride-Stirling approach was used to investigate the challenges of establishing smart schools in Iraq in order to develop a model. This method is a qualitative approach that enables the researcher to identify patterns and key themes related to the phenomenon under study through in-depth data analysis. Thematic analysis is appropriate for studying concepts and social structures and is particularly applicable in cases where the objective is the extraction of major themes or the development of a framework for explaining a phenomenon. The coding process in this study was conducted according to the Attride-Stirling thematic analysis approach and at three levels: first, basic coding (identification of initial meaning units derived from the data); second, organizing coding (categorization and grouping of basic codes into intermediate themes); and finally, global coding (extraction of overarching and comprehensive themes encompassing the organizing themes).

The statistical population in the qualitative section consisted of two parts: the documentary section, in which documents and records related to education and technology in Iraq, as well as previous studies on smart schools, were reviewed; and the field section, which included experts, specialists, and individuals knowledgeable about the smartification of schools in Iraq during the 2023–2024 academic year. Participants were selected through purposive sampling and criterion-based techniques. The selection criteria included having at least ten years of experience in the field of education, familiarity with educational technologies, and direct experience in the area of smart

school implementation. In total, eighteen individuals were selected to participate in the semi-structured interviews.

2.2. Data Collection Tools

Data were collected through semi-structured and in-depth interviews, the questions of which were designed based on the research objectives and organized into six main domains, including structural and infrastructural challenges, human resource and educational challenges, financial and economic challenges, technological challenges, legal and managerial challenges, and cultural and social challenges. Each interview lasted approximately sixty to ninety minutes on average and, with participants' consent, was audio-recorded and subsequently transcribed verbatim.

2.3. Data Analysis

The data analysis process was carried out in six stages: data extraction and deep understanding of the interview content; initial coding and identification of one hundred and fifty primary codes; theme searching and grouping of similar codes; reviewing themes at two levels to ensure internal consistency; defining and naming the final themes with clear descriptions; and preparing the final report and presenting the conceptual model. MAXQDA version 2020 software was used for the organization and precise analysis of qualitative data.

To ensure the trustworthiness of the qualitative data, the four criteria proposed by Lincoln and Guba (1985) were applied. Credibility was established through prolonged engagement with the subject matter, member checking (presenting findings to five participants for confirmation of interpretive accuracy), and peer review (evaluation of findings by two qualitative research methodology experts). Dependability was ensured through detailed documentation of all research stages and recording the decision-making process related to coding procedures. Confirmability was achieved through external auditing of the research process and providing raw data, analytical notes, and decision-making procedures to external reviewers. Transferability was ensured through rich and detailed descriptions of the research context, participants, and research procedures.

3. Findings and Results

The thematic analysis demonstrated that the development of smart schools in Iraq faces a complex and multilayered network of interconnected challenges categorized into six major domains. The multiplicity and diversity of these challenges (30 basic themes) reflect the systemic and multidimensional nature of the issue and confirm that one-dimensional or purely technology-oriented solutions are insufficient for the successful implementation of smart schools. This finding is consistent with theories of organizational complexity and systemic approaches to educational technology development, which emphasize that digital transformation in education requires simultaneous and coordinated interventions across technological, human, organizational, economic, and cultural dimensions.

The findings further indicate that despite the significance of infrastructural and technological challenges (hardware-related challenges), software-related challenges, including human resources, governance, and cultural-social issues, are broader and more profound and exert a more fundamental influence on the success or failure of smart schools. In particular, teachers' and parents' cultural resistance, the absence of an appropriate legal and governance framework, and weaknesses in empowerment systems were identified as deeper structural barriers that cannot be resolved solely through the provision of equipment and infrastructure. This finding is aligned with the literature on digital transformation in education, which demonstrates that human factors and organizational culture play a more decisive role than technological infrastructure in the success of educational technology projects.

The analysis of relationships among the organizing themes indicates that these challenges do not operate independently; rather, they interact within a complex causal network and reinforce one another. For example, budget limitations (financial challenge) lead to inadequate acquisition of appropriate equipment and insufficient teacher training (infrastructural and human resource challenges), which in turn results in project failure and strengthens negative public attitudes (cultural-social challenge). This, subsequently, makes budget allocation even more difficult, thereby creating a vicious cycle. This interdependence suggests that an appropriate model for smart school development must adopt an integrated and systemic approach that simultaneously addresses all dimensions while considering the causal relationships among them.

One of the most prominent findings of this analysis is the substantial volume of governance and management-related challenges (six basic themes), which indicates a profound structural and institutional gap within the Iraqi educational system in supporting the development of smart schools. The

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absence of a comprehensive legal framework, national standards, monitoring and evaluation systems, and mechanisms for organizational coordination suggests that before any operational action is taken, there is a need to establish appropriate institutional and governance infrastructures. This finding is consistent with institutional theories and institutional economics, which emphasize that the sustainable development of modern technologies requires efficient institutional structures, transparent regulations, and appropriate governance mechanisms that define and guarantee the rights, responsibilities, and incentives of all stakeholders.

Table 1

Exploration of Smart School Challenges for Developing a Model in Iraq

Global Themes	Organizing Themes	Basic Themes
Structural and infrastructural challenges	Technological infrastructure challenges	Communication infrastructure challenges in smart schools
		Technology equipment and digital tools challenges
		Energy supply and sustainability challenges
	Spatial and physical structure challenges	Physical structure and spatial challenges
		Standardization and spatial integration challenges
Human resource and empowerment challenges	Human resource competency and capability challenges	Teachers' lack of readiness and digital competency challenges
		Shortage of specialized human resources and technical support challenges
		Cultural and organizational resistance to digital transformation challenges
	Professional development and continuous improvement challenges	Lack of continuous training and professional development programs challenges
		Lack of systematic competency development and advancement challenges
Financial and economic challenges	Budget and financial provision challenges	Educational budget limitation and insufficiency challenges
		Exorbitant implementation and operational cost challenges
	Macroeconomic environment challenges	Inflation and declining purchasing power challenges
		Currency fluctuation and import dependency challenges
		Macroeconomic instability and investment uncertainty challenges
Technological challenges	Hardware and technology access challenges	Technology infrastructure obsolescence and deterioration challenges
		Limited access to advanced and modern technologies challenges
	Support, maintenance, and integration challenges	Weakness and insufficiency of technical support challenges
		Maintenance, repair, and spare parts supply challenges
		Lack of system integration and compatibility challenges
Legal, policy, and managerial challenges	Legal and regulatory challenges	Lack of a comprehensive and supportive legal framework challenges
		Ambiguity, contradiction, and lack of clarity in regulations challenges
	Managerial and organizational challenges	Weak strategic and executive project management challenges
		Lack of organizational coordination and integration challenges
	Standardization and monitoring challenges	Lack of national standards and criteria challenges
		Weak monitoring, supervision, and evaluation system challenges
Cultural and social challenges	Social resistance and acceptance challenges	Lack of social acceptance and social resistance challenges
		Conflict with cultural-religious values and norms challenges
		Negative societal attitudes and pessimism challenges
	Family awareness and participation challenges	Lack of public awareness and digital literacy challenges
		Parents' resistance and lack of family support challenges

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4. Discussion and Conclusion

The findings of the present study demonstrated that the establishment and development of smart schools in Iraq are influenced by a complex network of structural, technological, managerial, economic, human, cultural, and governance-related challenges. The thematic analysis revealed that these challenges are not isolated barriers but interconnected and mutually reinforcing factors that collectively shape the success or failure of smart school implementation. One of the most important findings of the study was that infrastructural and technological barriers remain among the primary obstacles to the implementation of smart educational systems in Iraq. Challenges such as weak communication infrastructure, unstable electricity supply, inadequate technological equipment, and lack of technological integration were repeatedly emphasized by participants. These findings are consistent with previous studies that identified technological infrastructure as a prerequisite for successful smart school implementation (Al-Badi et al., 2020; Elbadawy & Elagami, 2021; Kechagia, 2024). In developing countries, digital educational transformation is highly dependent on reliable technological ecosystems, and deficiencies in infrastructure significantly reduce the effectiveness of educational technology projects.

The findings also indicated that the technological challenges experienced in Iraqi schools are not limited to the absence of digital equipment but extend to issues of maintenance, technological sustainability, and technical support. Participants highlighted the rapid obsolescence of technological systems, limited access to advanced technologies, and insufficient technical expertise as major barriers to educational digitalization. This finding aligns with the studies of (Anam et al., 2024; Rukhiran et al., 2022), which emphasized that smart educational environments require integrated technological ecosystems capable of continuous adaptation and technical updating. Without effective maintenance systems and technical support structures, even technologically equipped schools may fail to achieve sustainable educational outcomes. The findings therefore confirm that smart school development should be viewed as a continuous and dynamic process rather than a one-time technological investment.

Another major finding of the study concerned the central role of human resource challenges in determining the effectiveness of smart school initiatives. Teachers' lack of digital competencies, insufficient professional training, and resistance to technological transformation were identified as among the most influential barriers. This finding supports previous research emphasizing that teachers are the principal agents of educational digital transformation and that the success of smart schools largely depends on their technological readiness and adaptive competencies (Khosravi & Hajati, 2024; Lee & Lee, 2024). Educational technologies cannot independently transform learning environments unless teachers possess the pedagogical and technological skills necessary for their effective integration into teaching and learning processes.

The study further revealed that professional development systems in Iraq are insufficiently prepared to support digital educational transformation. Participants emphasized the absence of systematic training programs and sustainable empowerment mechanisms for teachers and educational staff. This finding corresponds with the research of (Dowlati et al., 2021; Saoudi, 2019), which demonstrated that continuous professional development constitutes a fundamental requirement for smart school implementation. In educational systems where professional development programs are fragmented or underdeveloped, teachers often experience uncertainty and anxiety regarding technological adaptation, leading to resistance against innovation. Therefore, strengthening teacher empowerment systems should be considered one of the core strategic priorities in Iraqi educational modernization policies.

The findings also highlighted the critical role of organizational culture and technology acceptance in shaping the implementation of smart schools. Cultural resistance among teachers, school administrators, parents, and educational organizations emerged as one of the deepest and most persistent barriers to digital transformation. This finding is consistent with technology acceptance theories and organizational culture research, which emphasize that successful technological innovation depends not only on technological availability but also on institutional attitudes, values, and organizational norms (Ghasemtabar et al., 2020; Mehravar Gigloo et al., 2020). Participants reported that many educational actors continue to perceive digital transformation with skepticism due to concerns regarding educational effectiveness, social consequences, or cultural compatibility. These attitudes create institutional resistance that limits the implementation of innovative educational practices.

The cultural and social dimensions of smart school development were further reflected in participants' concerns regarding parental resistance and public distrust toward

educational digitalization. The findings demonstrated that some families perceive excessive technology use as potentially harmful to students' social behaviors, communication patterns, and psychological well-being. These findings are aligned with previous studies that reported concerns regarding the effects of smart devices on children's behavioral and social development (Amira, 2019; Rafat Mohammad Said, 2017). Moreover, participants indicated that low levels of digital literacy among parents contribute to misunderstandings regarding the educational functions of smart schools, thereby reducing family support for technological reforms. These findings reinforce the argument that smart school implementation requires broad societal awareness and active stakeholder engagement rather than purely institutional interventions.

Another significant finding of the present study relates to the importance of educational leadership and governance structures in facilitating digital transformation. Participants consistently emphasized the absence of clear legal frameworks, weak institutional coordination, and ineffective strategic management as major barriers to smart school development in Iraq. This finding supports earlier studies demonstrating that leadership quality and governance systems are essential determinants of educational innovation success (Aisha, 2022; Al-Zaidi, 2022). Educational leaders play a crucial role in coordinating technological initiatives, reducing resistance to change, mobilizing organizational resources, and establishing adaptive institutional cultures. In contexts where governance structures are fragmented or unstable, digital transformation projects are more likely to encounter implementation failures.

The findings further showed that the Iraqi educational system lacks comprehensive regulatory and policy frameworks capable of supporting smart educational transformation. Participants referred to the absence of national standards, monitoring systems, evaluation mechanisms, and institutional coordination structures. This institutional weakness creates ambiguity in implementation processes and limits accountability among stakeholders. The findings are consistent with studies emphasizing the importance of governance systems and policy integration in educational digitalization projects (Farahbakhsh et al., 2024; Mogas et al., 2022). Smart schools require coherent educational policies, standardized implementation procedures, and integrated governance systems capable of ensuring sustainability and institutional continuity. Without such frameworks, technological reforms often remain fragmented and unsustainable.

Financial and economic challenges also emerged as one of the most influential dimensions affecting smart school implementation in Iraq. Participants identified insufficient educational budgets, inflation, currency fluctuations, and economic instability as major obstacles limiting investment in educational technology. These findings are aligned with previous research indicating that digital educational transformation requires substantial and sustainable financial resources (Al-Badi et al., 2020; Kechagia, 2024). In economically unstable environments, technological projects frequently suffer from interrupted funding, inadequate maintenance, and inability to update technological systems. Participants additionally emphasized that dependence on imported technologies increases implementation costs and intensifies vulnerability to economic fluctuations. These findings suggest that smart school policies in Iraq must incorporate long-term financial sustainability strategies rather than relying solely on short-term technological investments.

An important aspect of the findings concerns the interconnected nature of the identified challenges. The thematic analysis demonstrated that financial, technological, managerial, cultural, and human challenges interact within a multidimensional causal network. For example, limited financial resources reduce investment in teacher training and technological infrastructure, which subsequently decreases implementation quality and reinforces social skepticism toward smart schools. This negative social perception may then reduce political support and future educational investment, thereby generating a self-reinforcing cycle of institutional weakness. This finding is highly consistent with systemic theories of educational innovation and organizational complexity, which argue that digital transformation requires simultaneous interventions across multiple dimensions (Lee & Lee, 2024; Mogas et al., 2022). The findings therefore suggest that isolated or one-dimensional reform strategies are unlikely to succeed in the Iraqi context.

The study also demonstrated that smart schools should not be conceptualized merely as technologically advanced educational institutions but rather as integrated sociotechnical systems that combine technology, leadership, governance, culture, pedagogy, and community participation. Participants repeatedly emphasized that technological infrastructure alone cannot guarantee educational innovation unless accompanied by organizational readiness, supportive governance, and social acceptance. This finding aligns with previous studies that

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viewed smart schools as multidimensional ecosystems rather than hardware-centered projects (Anam et al., 2023; Galian et al., 2023). Consequently, educational policymakers in Iraq must adopt holistic and context-sensitive approaches capable of addressing the broader institutional and cultural environment surrounding educational transformation.

Another important implication of the findings is that smart school implementation in Iraq requires balancing technological modernization with local cultural and social realities. Participants indicated that some imported technological models may not fully align with local educational conditions, social expectations, or institutional capacities. This observation supports the argument that educational innovation models should be localized and adapted to contextual realities rather than directly transferred from technologically advanced societies (Gashti, 2022; Noumia & Farida, 2019). Effective smart school models for Iraq therefore require culturally responsive frameworks capable of integrating modern educational technologies with local institutional capacities and social values.

The findings of the present study ultimately demonstrate that the development of smart schools in Iraq is not solely a technological project but a comprehensive institutional transformation process involving educational governance, organizational culture, economic sustainability, technological infrastructure, human capital development, and social participation. The complexity and multidimensionality of the identified challenges indicate that successful implementation requires integrated strategic planning, long-term policy commitment, and coordinated stakeholder collaboration. In this regard, the study contributes to the existing literature by providing a context-specific understanding of the barriers affecting smart school development in Iraq and by highlighting the necessity of systemic and multidimensional educational reform approaches.

One of the limitations of the present study was its focus on qualitative data collected from a relatively limited number of experts and specialists within the Iraqi educational system. Although purposive sampling enabled the selection of informed participants, the findings may not fully represent the perspectives of all educational stakeholders, particularly students and parents from different regions of Iraq. Additionally, the study was conducted within a specific temporal and institutional context, and changes in educational policies or technological conditions may influence future interpretations of the findings. Another limitation concerns the scarcity of comprehensive national statistical data related to smart school implementation in Iraq, which restricted the possibility of broader quantitative comparisons.

Future research should investigate the effectiveness of proposed smart school models through quantitative and mixed-methods studies involving larger samples across different Iraqi provinces. Comparative studies between urban and rural educational settings may also provide deeper insights into regional disparities affecting smart school implementation. In addition, future studies could examine the perspectives of students, parents, and policymakers regarding digital educational transformation in order to develop more inclusive educational models. Longitudinal research investigating the long-term impacts of smart educational systems on educational quality, student performance, and institutional sustainability would further contribute to the advancement of knowledge in this field.

From a practical perspective, the findings suggest that Iraqi educational policymakers should prioritize the development of integrated governance frameworks capable of supporting sustainable smart school implementation. Investment in technological infrastructure should be accompanied by comprehensive teacher training programs, institutional capacity building, and mechanisms for continuous technical support. Educational authorities should also design public awareness initiatives aimed at increasing digital literacy and strengthening family participation in smart educational systems. Furthermore, the establishment of national standards, monitoring systems, and long-term financial strategies may contribute significantly to the sustainability and effectiveness of smart school initiatives in Iraq.

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in studies involving human participants were under the ethical standards of the institutional and, or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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