A Thematic Analysis of Interconnected Barriers to AI Adoption In Moroccan Education

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Abstract

This study explores the barriers that hinder the effective integration of Artificial Intelligence (AI) into Moroccan teaching practices. Data were collected from 71 K–12 teachers through a questionnaire combining demographic questions and one open-ended item on barriers to AI adoption, and responses were analysed using thematic analysis (TA) supported by NVivo software. The findings reveal ten major barriers to AI integration in teaching, namely: AI replacing teachers, resistance to change, data privacy and ethics concerns, financial constraints, information accuracy, lack of training, numeric infrastructure constraints, soft skills development for students and teachers, student interaction constraints, and time constraints. Overall, the results highlight the need for coordinated, multi-layered interventions at the national, institutional, and individual levels.

Keywords: Artificial Intelligence, Moroccan education, barriers to AI Adoption, Thematic analysis

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I- Introduction

The shift towards digital learning environments is reshaping traditional teaching methods and transforming education at all levels. This evolution is not only facilitating more adaptive and personalized learning experiences (Zulfiani et al., 2018), but it is also encouraging self-directed learning (Balakrishnan & Long, 2020) and redefining the teacher's role from a knowledge provider to a facilitator of learning (Murthy, 2023). As digital transformation accelerates, modern digital technologies have become essential components in the development of contemporary education systems (Irkha et al., 2024).

Recent studies show a generally positive attitude toward digital technologies among both educators and learners (Kharchenko et al., 2024). Among these technologies, AI is gaining prominence in education. However, several barriers continue to hinder its implementation in classroom.

Although AI is a central topic in educational discussions, AI remains largely absent from teacher training programs (Sperling et al., 2024). (Wang et al., 2025) emphasize that training should go beyond basic technical skills, prioritizing a deeper understanding of AI's pedagogical potential to enable an effective classroom integration. Similarly, (Kohnke et al., 2025) argue that the rapid evolution of AI necessitates the inclusion of comprehensive AI training in pre-service teacher education, to ensure future educators are equipped with both the skills and conceptual knowledge required to implement AI tools in their classrooms.

Beyond these practical issues, ethical considerations form another layer of barriers. Filiz et al. (2025) note that ethical concerns were among the major challenges teachers cited in AI integration (Filiz et al., 2025). Another psychological barrier for some educators is the worry that AI could replace teachers or reduce their importance (Karan & Angadi, 2023). Additionally, (Shata & Hartley, 2025) note that resistance to AI adoption in educational contexts may be attributed to time investment associated with its use, consequently, even when instructors possess the requisite self-efficacy to engage with AI technologies, such barriers may hinder the formation of positive attitudes toward the integration of AI into their pedagogical practices.

In the Moroccan context, Ismaili's qualitative study likewise underscores the urgency of structured AI training and strong school-level support systems as essential for building teacher AI literacy (Ismaili, 2024). Additionally, Lotfi and Laajan (2025) document that Moroccan teachers often contend with limited access to digital technologies and internet connectivity, compounded by a lack of adequate institutional support to facilitate meaningful integration of these tools into their pedagogical practice, which together with a lack of training severely limit AI integration (Lotfi & Laajan, 2025).

Despite the barriers, Moroccan teachers' attitudes appear cautiously optimistic. For example, a small qualitative study of English-language middle and high school teachers found that most had positive attitudes toward AI-generated content (Dahia, 2024) , viewing it as a potential pedagogical asset. Morocco have begun to respond, for instance, national plans have aimed to train thousands of teachers in digital skills, including some AI modules, but systematic evaluation of these efforts is pending. There is growing recognition that teacher education institutions must integrate digital literacy into curricula; early steps in this direction echo the international call for an "AI-literate" teaching force. In sum, raising teachers' digital literacy, aligning AI tools with classroom objectives, and alleviating ethical and technical concerns are all critical. This will require not only improving teachers' personal but also transforming schools' support structures.

These barriers are often interrelated. For instance, a teacher may express interest in adopting AI but face multiple simultaneous barriers, such as insufficient training, unresolved ethical concerns, and a lack of numeric infrastructure at their school. In such circumstances, delaying the adoption of AI becomes an understandable and pragmatic decision.

Identifying the barriers is the first step to removing them and enabling teachers to leverage AI's potential. Therefore, the objectives of the current study are: (1) to identify the key barriers that hinder the effective integration of AI technologies in teaching practices, and (2) to provide actionable insights to inform training programs and policy decisions that support equitable and sustainable AI integration in education. To address these objectives, the study seeks to answer the following research question: What are the main barriers that hinder the effective integration of AI technologies into teaching practices?

II- METHODOLOGY

Data collection procedure

Data were collected from 71 teachers using a questionnaire including closed-ended items to collect demographic information, such as sex, sector, age group, and educational cycle, as summarized in Table 1. An open-ended question was included to allow participants to describe the barriers they face in integrating AI technologies into their teaching practices.

Table 1. Demographic information

Variables	Categories	Percent %
Sex	Male	26,8%
	Female	73,2%
Sector	Private sector	53,5%
	Public sector	46,5%
Age group	Under 30 years	9,9%
	Between 31 and 40 years	46,5%
	Between 41 and 50 years	29,6%
	Over 50 years	14,1%
Level of education	Baccalaureate	5,6%
	Two-year degree (Bac+2)	12,7%
	Bachelor's degree (Bac+3)	49,3%
	Master's degree (Bac+5)	28,2%
	PhD	4,2%
Seniority	Less than 5 years	21,1%
	Between 5 and 10 years	28,2%
	Between 11 and 20 years	31,0%
	More than 20 years	19,7%
Educational cycle	Kindergarten	1,4%
	Primary school	63,4%
	Secondary (high school)	18,3%
	Vocational Secondary	16,9%

The qualitative responses were analysed using thematic analysis (TA), a flexible method used to identify and analyse patterns of meaning within qualitative data, particularly in relation to participants' lived experiences, perspectives, behaviors, and practices (Clarke & Braun, 2017). As noted by Clarke & Braun (2017), TA can be applied to both small and large datasets. It is suitable for case study research with a few participants as well as for large-scale studies involving over 60 participants, and it accommodates both homogeneous and heterogeneous samples. All this makes it particularly effective for exploring the diverse perspectives captured in this study.

After data collection, the authors organized and read teachers responses. Grammatical errors were corrected, and responses originally written in French were translated into English using DeepL Translator and Chatgpt. The accuracy of the French-to-English translations was then verified using Grammarly. The researchers then identified key themes and patterns based on this initial manual analysis.

Prior research has demonstrated that ChatGPT can support theme generation and coding (Perkins & Roe, 2024, (Naeem et al., 2025)), offering a complementary tool that accelerates the analytical process while preserving the essential role of the researcher's critical interpretation. Therefore, the same data were then analyzed using ChatGPT. The themes generated by this tool were compared with the manually derived themes, allowing the authors to identify any overlooked categories. Necessary adjustments were made based on this comparative process and data were then analysed using NVivo 10 software.

~~III-~~ Findings

The collected data revealed key themes reflecting the barriers to adopting AI technologies in teaching practices. These themes provide an analytical framework to organize teachers' responses, highlight their perceptions, and capture the complexity of their experiences with AI integration in education.

1.1. Frequency Analysis

The qualitative findings show the principal barriers faced by our sample's teachers (Figure 1). They are presented in a word cloud which is a graphic visualization that highlights the most frequently occurring words in a given text, offering a quick overview of the content (Padmanandam et al., 2021).

Figure 1. Word cloud of the main barriers of the use of artificial technologies in education

The word cloud show that teachers face barriers linked with the lack of access to adequate tools and internet infrastructure, both of which are essential for integrating AI technologies into educational settings. Additionally, teachers face barriers linked with insufficient training leading to a limited pedagogical knowledge about AI, resistance to change and an insufficient understanding of its ethical issues.

1.2. Emerging themes from the qualitative data

As identified through qualitative data, the key barriers encountered in the implementation of AI within educational contexts are presented below. Each theme is supported by some quotes from teachers.

1.2.1. Lack of training

The lack of adequate training is the most frequently cited barrier, with 27.77% of the total references. A significant number of educators expressed that they are not trained to use AI tools in the classroom, with one respondent commenting on the "*lack of training in this field,*" while another stated, "*I definitely need training on how to use artificial intelligence,*" and mentioned "*the difficulty of using these technologies in classrooms*."

1.2.2. Numeric infrastructure

The barrier of limited numeric infrastructure encompasses 26.53% of the total references. Numerous responses pointed to the lack of basic technological resources, including the "*absence of interactive whiteboards, projectors, computers, and internet connectivity in classrooms*,". Another respondent reported "*no internet or technological tools in the classrooms of Moroccan schools*".

1.2.3. Financial constraints

Financial limitations and lack of access to necessary resources were also frequently mentioned, accounting for 19.82% of the total coded references. For example, the cost of implementation was cited as prohibitive: *"The cost of implementing AI technologies can be financially prohibitive for some institutions"*.

1.2.4. Data privacy and ethics

Accounting for 18.57% of the total references, concerns related to data privacy and ethics constitute one of the most prominent barriers to the use of AI in education. Teachers expressed worries regarding the protection of student information and the trustworthiness of AI-generated content. One teacher stated: "*I'm afraid of being scammed or of sharing personal information about my students*," while another said: "*Ethical issues (privacy, academic dishonesty) are problematic*."

Beyond individual concerns, several teachers also raised issues about the lack of legislation regulating the use of AI in Moroccan education.

1.2.5. Change resistance

Mentioned in 4.92% of the coded references, change resistance relates manifests at various levels, including institutional rigidity and individual attitudes. For example, one teacher referred to "*the rigidity of curricula and official guidelines*," while another simply stated, "*Not interested in technology*." A third noted "*the lack of responsiveness and feedback tools among learners*,". Another participant emphasized the importance of "*showing flexibility among school principals, particularly those attached to traditional ideas and advocates of classical pedagogy*.". Finally, another teacher pointed out that "*resistance to modern teaching methods hinders the adoption of AI*."

1.2.6. Soft skills development

Another concern raised by teachers (3.80% of the references) was the potential negative impact of AI on the development of soft skills. Teachers expressed concerns that AI could lead to a *"reduction in the teacher's reflective capacity"*, as prolonged use of AI tools might replace or diminish the need for human engagement. Similarly, there was a worry about *"excessive dependence of students"*, as the constant reliance on AI might inhibit students' ability to think independently or develop necessary skills. One respondent even noted that AI might have *"negative repercussions on the brain and its creative activity"*.

1.2.7. Information accuracy

Although less frequently mentioned (2.38% of the references), concerns about the accuracy of AI-generated content appeared as a noteworthy barrier. Several teachers questioned the quality of the information produced by AI tools. One respondent noted issues related to *"the authenticity and credibility of the information"*, while another pointed out that *"the responses are not always logical or correct"*. This concern was further emphasized by a participant who remarked, *"The problem is that you always have to verify whether the information is accurate and meets the needs"*.

1.2.8. Students' interaction

Another barrier highlighted by 1.81% of the references concerns the lack of direct interaction between students and artificial intelligence technologies. The absence of such interactions prevents students from fully familiarizing themselves with these tools, thus limiting their learning and adoption of new technologies. One reference specifically mentioned the "*lack of student interaction with artificial intelligence technologies*". Furthermore, the "*lack of reaction and feedback tools for learners*" was cited as another barriers, suggesting that the absence of mechanisms

allowing students to actively interact with AI systems makes it more difficult for them to engage and progress.

1.2.9. AI Replacing Teachers

Although this concern was raised by a small proportion of participants (0.85%), the idea that AI could replace human teachers emerged as a psychological and professional barrier. One participant simply noted: "*Replacing the teacher*," while another stated: "*These technologies could replace teachers*." These statements, though limited in frequency, highlight an underlying anxiety about the displacement of educators by automated systems.

1.2.10. Time constraints

Another barrier mentioned by 0.41% of the references is the time constraint. The integration of artificial intelligence into the educational process can be hindered by the lack of time, both for teachers and students. One reference specifically mentions a *"time constraint"*, suggesting that the limited time available for preparation and teaching prevents optimal use of AI technologies. Another reference simply highlights *"time"* as a limiting factor, emphasizing that time management is crucial for the successful adoption of AI, but the already heavy workload makes it difficult to integrate it effectively into curricula.

Despite the numerous barriers identified, it is important to note that a small percentage of teachers (0.83%), 3 in total, reported that they did not face any barriers to the implementation of artificial intelligence in their teaching practices, with one teacher stating that, "*Currently, I observe no obstacles,*" highlighting that, for certain educators, the adoption of AI technologies in the classroom may not present significant barriers.

1.3. Visualisation of the identified barriers to AI Integration Using a Radar Chart

The radar chart *(see figure 2)*, illustrates the aforementioned barriers faced by teachers during the integration of Artificial Intelligence (AI) into their pedagogical practices. Using a radar chart in qualitative research allows for a comparative visualization of multiple thematic nodes at once, making it easier to identify which issues are most prominent. This graphical representation provides additional support to the thematic analysis by offering a clear, structured overview of the challenges encountered by teachers during the AI adoption process.

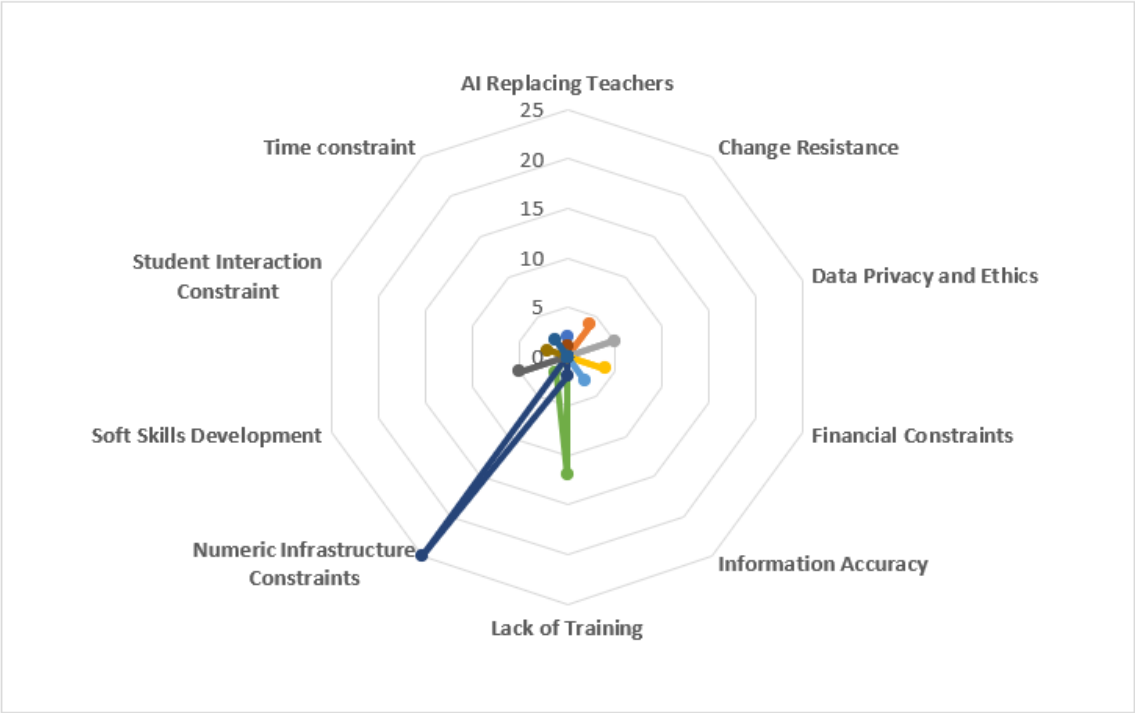

Figure 2.Frequency of Identified barriers Faced by Teachers During AI Integration

Each axis of the radar represents a node corresponding to a specific barrier identified through qualitative data analysis, such as "AI Replacing Teachers," "Financial Constraints," "Change Resistance," "Information Accuracy," among others. The spread and extent along each axis indicate the frequency with which each barrier was mentioned by teachers in the data. The graph clearly shows that "Numeric Infrastructure Constraints" were the most frequently cited barriers, highlighting a major barrier to AI integration. Other barriers like "Soft Skills Development" and "Information Accuracy" appear with lower frequencies, suggesting they were less commonly reported by the participants.

DISCUSSION

The current qualitative research offers a perspective on the barriers hindering AI integration in Moroccan education. Among these, the most frequently cited issue is the limited professional development opportunities. Many teachers expressed feeling unprepared to meaningfully incorporate AI into their pedagogical practices without such targeted training, an issue that risks widening the existing digital skills gap. The lack of numeric infrastructure appears as the second most frequently barriers cited in the collected data. It includes limited access to internet connectivity and essential software. These findings are consistent with those of Lotfi and Laajan (2025), who emphasize that inadequate teacher training, limited access to technology and a general lack of institutional support hinder the integration of AI in education (Lotfi & Laajan,

2025). **T**eachers also voiced concerns about ethical concerns, financial constraints, and the reliability of AI-generated content, highlighting the multidimensional nature of the barriers they face. In countries like Morocco, where legal frameworks may lag behind technological development, such concerns can significantly erode teacher confidence and willingness to adopt AI tools.

Often viewed through a psychological lens, resistance to change was perceived by teachers as a structural issue. Participants cited rigid curricula and institutional inertia as a significant barrier. This finding challenges the notion that resistance to adopt AI is rooted solely in individual mindset; instead, it points to the need for systemic reform across multiple levels of the education system.

Teachers also perceive that the use of AI limits both the development of soft skills and students' interaction, highlighting the major role that human interaction plays in the learning experience. These results are consistent with those of (González-Rico & Lluch Sintes, 2024), emphasizing that the successful development of soft skills cannot be limited to the use of technological solutions but rather requires a combination of technological support and meaningful human interaction.

Some teachers also expressed the fear that AI could one day replace their role, which they consider as a barrier to use it in the classroom. However, the literature emphasizes that AI is primarily perceived as a complementary tool. For example, a study conducted in South Korea shows that teachers recognize the potential of AI to reduce administrative tasks and support personalized learning, while highlighting its socio-emotional deficit, which remains an exclusive attribute of humans (Oh & Ahn, 2024)

Another barrier highlighted by teachers concerns time constraints. The integration of AI into pedagogical practices indeed requires a considerable investment of time, particularly in terms of learning to use, explore the tools' functionalities and adapt them to the needs of the classroom. The literature confirms that this constraint is among the major barriers to the adoption of AI in education (Ahmed et al., 2025; Prabhakar, 2024).

Despite all these barriers, three teachers reported facing any barriers in integrating AI into their classrooms. This situation may be explained by contextual factors, such as working in schools equipped with adequate digital infrastructure, or by individual factors, including prior participation in training programs, a positive attitude toward AI adoption, or engagement in self-directed learning.

All these results underscore the necessity of coordinated interventions:

- **At the national level:**

It is essential to include AI competencies in school curricula and to support researchers in fostering innovation in this field. Curriculum reform should be complemented by the launch of partnerships with edtech companies, as well as the funding of projects aimed at evaluating models of AI integration in educational contexts. The Moroccan government should also ensure that educational practices related to AI are aligned with national agendas, such as Maroc Digital 2030, and international guidelines, such as those of UNESCO. Finally, monitoring the impacts (both positive and negative) of AI integration in classrooms would contribute to the continuous improvement of teachers' pedagogical practices and ensure that AI integration is both effective and sustainable.

- **At the institutional level:**

Digital leadership training for administrators is vital for creating supportive environments. Schools should also improve their digital infrastructure. It's also recommended that these institutions form AI integration committees, with teachers, administrators, and IT specialists, to guide the adoption process and align it with educational objectives.

At the individual level:

We strongly recommend implementing teacher collaboration and peer mentoring programs for AI use. It's also crucial that teachers have access to practical training focused not only on technical skills but also on ethical considerations.

LIMITATIONS

To guide future research, it's important to acknowledge some limitations of this study. For one, the sample size of 71 teachers, while representing all educational levels and both public and private schools, is relatively small. This may limit how widely the findings can be applied. Also, the qualitative data came from a single open-ended question. Although this was suitable for an exploratory study, more detailed interviews or focus group discussions in future research would provide richer insights.

CONCLUSION

Using a qualitative analysis of teacher feedback, this study set out to understand the barriers teachers encounter when trying to bring AI into their classrooms. A range of interconnected barriers were found, from insufficient training and poor infrastructure to ethical doubts and a lack of time. These problems often feed into one another: for example, inadequate training can increase

ethical worries, while limited access to tools can breed skepticism. This institutional inflexibility then makes it harder for schools to embrace new technology.

The findings have important implications, both for how we think about this issue and for what we do about it. For policymakers in Morocco and similar regions, it's clear that AI integration isn't just about providing tools; it's about fundamentally changing the entire educational system. We must invest not only in technology like computers and internet access but also in building teachers' skills for the long run. Professional development should go beyond simply showing teachers how to use a new tool; it needs to cover the ethical and the practical applications of AI.

In the end, integrating AI into education is a challenge that is as much about people, ethics, and institutions as it is about technology. By focusing on what teachers themselves think and feel, this research highlights the urgent need for a more supportive and thoughtful approach to implementation. Ultimately, the future of AI in education will be defined not just by how innovative we are, but by how much we value understanding of the people at the very heart of the learning process.

Building on the qualitative finding provided by this analysis, future studies should quantify the relationships between the identified barriers and school context (public vs. private sectors and rural vs. urban schools in Morocco). This could be achieved using advanced methods like Structural Equation Modeling (SEM).

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