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Optimizing infrastructure for better education: a TOPSIS-based study of Moroccan universities

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Introduction: Higher education has a lengthy history in Morocco, which is also undergoing ongoing reforms for sustainable growth. This study aimed to identify and prioritize the main educational challenges in Morocco's higher education system, focusing on obstacles that impact education quality and resource availability.

Methods: Relying on the Educational Challenges Theory, as well as models such as the Resource-Based View (RBV) and Systems Theory, the study employs the Technique for Order Preference by Similarity to Ideal Solution method to evaluate criteria such as overcrowded classrooms, obsolete equipment, under-equipped libraries, and insufficient digital infrastructure.

Results: The results reveal that overcrowded classrooms and obsolete equipment are the most critical challenges, highlighting the need for urgent infrastructure and digital resources reforms. The practical implications of this study suggest immediate interventions to modernize educational infrastructure. This research makes a significant contribution by using a quantitative approach to prioritize reforms, providing valuable recommendations for policymakers and institutional leaders seeking to improve the quality of higher education. Equally, the results of this study are an effective communication tool for the public and stakeholders to raise awareness of the importance of infrastructure for education. However, more research is needed in this field due to current technological advancements.

KEYWORDS
educational challenges, higher education, infrastructure, Morocco, policy reform, TOPSIS

1 Introduction

Higher education in Moroccan universities is a strategic sector that plays a fundamental role in the country's economic and social development (Moumin, 2024). However, this sector faces numerous challenges related to educational infrastructure, which directly affect the quality of teaching and students' academic success (Amaghouss and Zouine, 2022) mainly during the Pandemic period (Belamghari, 2022). Among these challenges are classroom overcrowding, outdated equipment, a lack of documentary resources in libraries, and insufficient digital infrastructure (Daniel et al., 2016). These issues have significant consequences, particularly on students' concentration, engagement, professional development, and, more broadly, their academic fulfillment (Alj and Bouayad, 2024).

The importance of this topic lies in the need to improve the quality of education in Morocco, especially in a context where globalization and technological advancements exert constant pressure on educational systems (Lazrak and Yechouti, 2017). Moreover, higher education is a key pillar for innovation and value creation in modern societies (Aithal and Maiya, 2023; Idrissi et al., 2021). Consequently, addressing these challenges is crucial to ensuring that Moroccan students receive adequate training that meets contemporary demands and remains competitive at the international level (Bhattarai and Yousef, 2025).

The central research question of this study can be formulated as follows: How do educational infrastructure challenges in Moroccan universities affect the quality of teaching, and what priorities should be addressed in the new university reform?

Thus, this study aims to: (1) Analyze the challenges faced by Moroccan universities in terms of educational infrastructure and identify the main factors influencing teaching quality, (2) Prioritize these challenges using the TOPSIS method, which enables a comparison of different alternatives based on multiple criteria and identifies the most critical issues, (3) Propose recommendations to improve infrastructure and, by extension, the quality of teaching in Moroccan universities, based on the study's findings.

This study is suggested to provide a clear vision of the main obstacles to enhancing Morocco's educational system and to propose practical and relevant solutions based on empirical data. The study is based on a sample of 200 students, who responded to a questionnaire highlighting different aspects of infrastructure quality. The responses will help establish priority actions and better target necessary investments.

Equally, the results of this survey are suggested to indicate that classroom overcrowding is the most critical issue, followed closely by outdated equipment and the shortage of documentary and digital resources. These factors, in addition to their impact on students' concentration and engagement, highlight the urgency of reforms in these areas. Applying the TOPSIS method will help guide policymakers toward strategic solutions to enhance the efficiency of Morocco's educational system.

2 Theoretical framework and literature review

The physical environment of universities constitutes a core component of *Educational Challenges Theory*, which conceptualizes learning outcomes as the product of interactions between infrastructure, pedagogical resources, institutional support, and digital accessibility (James, 2021). According to this framework, deficiencies in educational environments generate structural barriers that negatively affect student engagement, academic performance, and employability. A positive and stimulating environment enhances concentration, motivation, and academic success, whereas inadequate conditions hinder student achievement and teacher engagement (Bempechat and Shernoff, 2012). Several studies have confirmed the direct influence of the physical and classroom environment on students' ability to learn and focus (Lu et al., 2021). Overcrowded classrooms, for instance, reduce student participation and teacher–student interaction, thereby impairing concentration and learning efficiency (Marais, 2016). Similarly, the lack of appropriate study spaces, including group work areas and individual reflection zones, diminishes students' productivity and academic engagement (Kariippanon et al., 2018).

Beyond physical infrastructure, the *Educational Challenges Theory* emphasizes the critical role of technological and digital resources in shaping educational equity and learning quality. Outdated or insufficient technological equipment restricts access to learning materials, hampers digital skill development, and increases student frustration (Rahiem, 2020). A modern, well-equipped learning environment promotes motivation, academic ambition, and professional preparedness (Haleem et al., 2022; Spring, 2025). Engagement programs and digital platforms further facilitate the acquisition of labor-market-oriented competencies and improve access to educational content (Adeniyi et al., 2024).

In the context of digital transformation, equitable access to digital infrastructure is a fundamental dimension of *Educational Challenges Theory*, as it directly conditions students' academic inclusion and social participation (Das, 2024). Limited access to computers, internet connectivity, and digital platforms exacerbates educational inequality and restricts professional opportunities (Kulal et al., 2024). Consequently, universities must ensure inclusive access to digital resources to promote equal learning opportunities and academic success (Memon and Memon, 2025).

Within this theoretical framework, the present study conceptualizes *educational challenges* as systemic constraints that hinder learning quality and institutional effectiveness. Accordingly, four major challenges were identified: classroom overcrowding, obsolete equipment, under-equipped libraries, and insufficient digital infrastructure, based on their recurrent documentation in empirical research and their strong alignment with *Educational Challenges Theory* (Ghazali and Benbrahim, 2024). These challenges serve as the analytical foundation for defining evaluation criteria related to learning conditions, motivation, employability, access to information, and digital inclusion. This theoretical alignment ensures conceptual coherence between the abstract, literature review, and methodological framework, thereby strengthening the analytical rigor of the study.

2.1 Classroom overcrowding

An excessive number of students in a single classroom is a common issue in Moroccan higher education institutions (R'boul, 2024). Literature identifies several solutions to this problem:

- Constructing new schools and classrooms to allow students to engage actively; this directly addresses the need to spread out student enrollment over multiple years (Cobian et al., 2024).
- Promoting online learning, which reduces the number of students attending live classes (Atashinsadaf et al., 2024). However, global statistics indicate that distance learning follows similar patterns (Higgins et al., 2024). In general, this option seems appropriate.
- Implementing flexible schedules to avoid overcrowding during peak hours.
- Training additional teachers, which may be the most effective solution to mitigate classroom overcrowding (Das et al., 2025).

2.2 Outdated equipment

Another major limitation to the quality of higher education is the obsolescence of technological and laboratory equipment

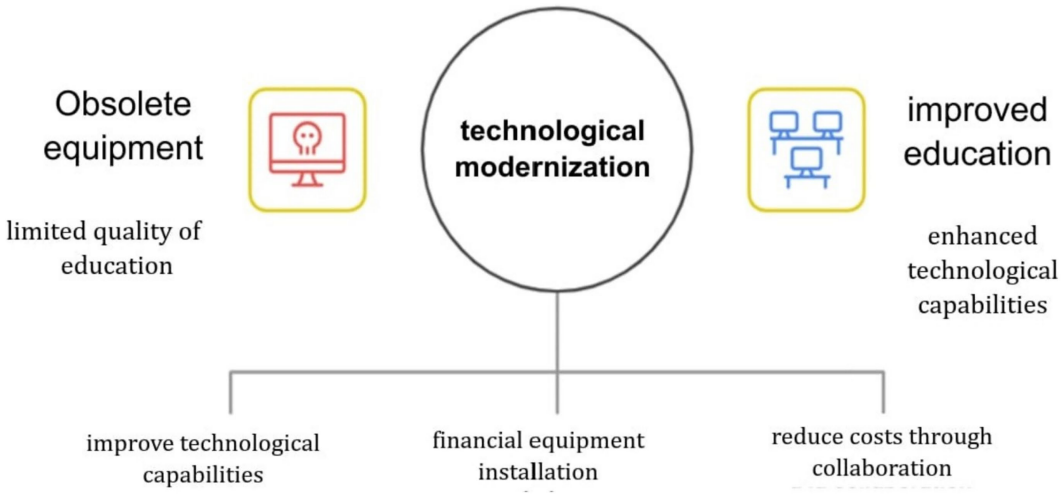

FIGURE 1
Suggested efforts and possibilities to enhance the outdated equipment for education.

(Vergara et al., 2020). Literature suggests the following possibilities (Figure 1):

- Investing in new targeted equipment to enhance technological capabilities, including computers, software, laboratory equipment, and tools (Singh et al., 2021).
- Public-private partnerships, which could serve as a financial resource for installing technological equipment and laboratories (Joudyian et al., 2021).
- Recycling programs, which could significantly reduce costs through collaborative efforts. For example, a global task force could lower costs through the recycling and reuse of existing equipment (White et al., 2022).

2.3 Under-equipped libraries

According to Lrhoul and Ameur (2022), many Moroccan university libraries lack adequate documentary resources and modernization. Investing in documentary resources such as books, journals, electronic databases, and digital resources ensures that libraries have "all the required collections to classify and name" a library. Additionally, modernizing library infrastructure, including information and communication systems, remains an urgent priority (Boachie, 2018). Establishing partnerships with national libraries or foreign universities can also help enrich collections and provide access to external resources (Lahyani et al., 2024).

2.4 Insufficient digital infrastructure

Appropriate digital infrastructure is essential for higher education (Tamer and Knidiri, 2023). Recommended solutions include (Figure 2):

- Expanding access to the Internet and computers, as they play a crucial role in information access and communication, facilitating online learning (Ali, 2020).
- Developing online course platforms, not just for remote learning but also to foster interaction between teachers and students (Oliveira et al., 2021).
- Providing training for students and teachers in digital tools, ensuring that training programs are available to help integrate technologies into learning (Valverde-Berrocoso et al., 2021).

3 Data and research methodology

3.1 Data collection

This study aims to assess the impact of infrastructure deficiencies on teaching and learning in Moroccan universities. We adopt a methodological approach based on the TOPSIS method to analyze responses collected through a structured questionnaire. The questionnaire was distributed online between March 27, 2024, and April 27, 2024, targeting students from various Moroccan universities. A total of 200 respondents participated in the study.

For sampling, we used a non-probabilistic convenience sampling method, as the targeted students were accessible through social media and other online platforms. The primary objective of the questionnaire was to collect quantitative data on how students perceive the impact of infrastructure deficiencies on their education. For each criterion, respondents ranked four alternatives representing various aspects of infrastructure deficiencies using an eight-point Likert scale (1 = no impact, 8 = major impact).

3.2 Research methodology

The weighting of evaluation criteria, a critical component of the TOPSIS approach, was conducted using a systematic, objective, and transparent procedure to ensure the robustness and reproducibility of the results. The relative importance of each criterion was assessed through structured expert judgment involving 12 experts selected based on their academic and professional expertise in higher education management, educational infrastructure, and public policy. Their assessments were complemented by evidence from relevant empirical studies (Corrente and Tasiou, 2023; Taherdoost and Madanchian, 2024).

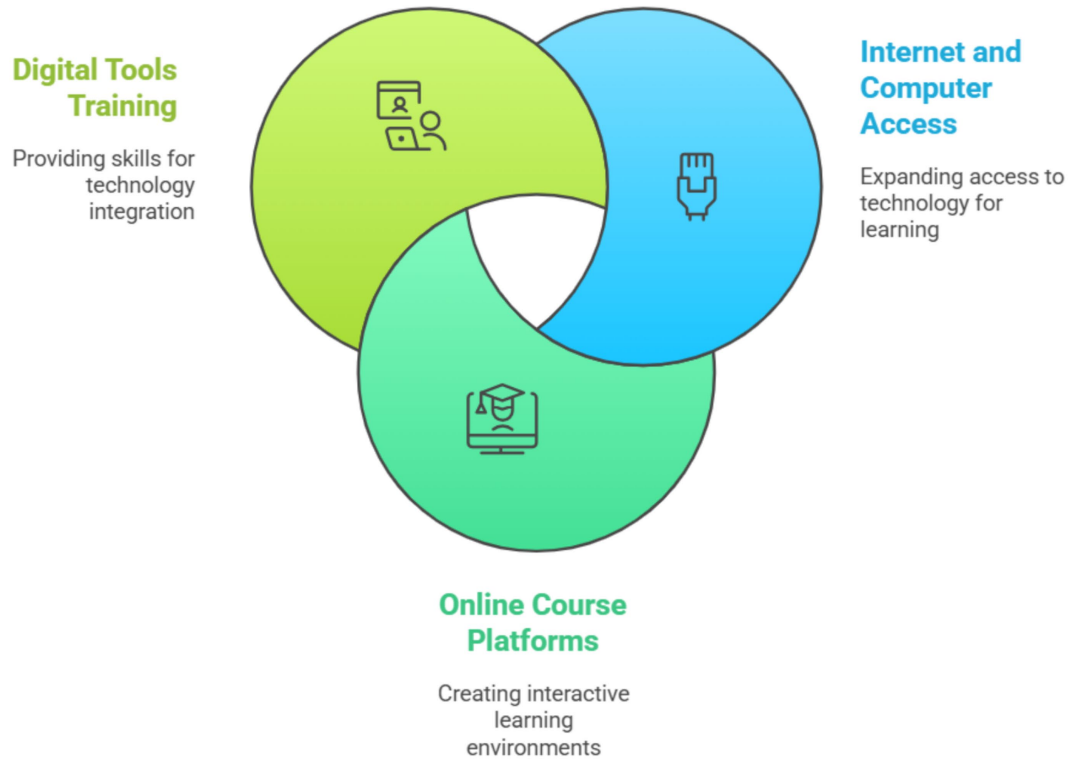

FIGURE 2
Recommended solutions to enhance digital education.

Each expert assigned importance scores to the criteria using a five-point Likert scale, ranging from very low (1) to very high importance (5), thereby minimizing subjective bias and enhancing consistency. The individual scores were then aggregated using arithmetic averaging, and the resulting values were normalized so that the sum of all weights equaled one, in strict compliance with TOPSIS methodological requirements. This procedure ensures proportional representation of each criterion while preserving their relative influence within the decision-making framework. The adopted weighting scheme thus provides a balanced and transparent representation of stakeholder priorities, strengthening the reliability, interpretability, and analytical validity of the final ranking of alternatives. The main steps of applying the TOPSIS method are detailed as follows:

Step 1: Decision Matrix.

Define alternatives and criteria, and organize each alternative's performance across each criterion into a matrix $[X = x_{ij}]$, where x_{ij} represents the performance score of alternative i for criterion j.

Step 2: Normalize the Decision Matrix:

Normalize to allow comparability across different units. The normalized value r_{ij} for each element x_{ij} in the decision matrix is calculated by:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \quad (1)$$

Where n is the number of alternatives. This scales the values to a range of [0,1].

Step 3: Weighted Normalized Decision Matrix.

Multiply each r_{ij} by the corresponding weight w_j of criterion j to form the weighted normalized value v_{ij}:

$$v_{ij} = w_j \times r_{ij} \quad (2)$$

Step 4: Determination of Ideal and Negative-Ideal Solutions:

Identify the ideal (best) solution A + and anti-ideal (worst) solution A−.

- For benefit criteria (where higher values are better), the ideal and anti-ideal values are the maximum and minimum values of the weighted normalized values v_{ij}, respectively.
- For cost criteria (where lower values are better), reverse the max and min conditions.

$$A^+ = \left\{ \max\left(v_{ij}\right) j \in J \right\} \quad (3)$$

$$A^- = \left\{ \min\left(v_{ij}\right) j \in J \right\} \quad (4)$$

Step 5: Calculation of Separation Measures:

Compute the Euclidean distance of each alternative from the ideal A^+ and anti-ideal A^- solutions. The separation from the ideal solution S_i^+ and from the anti-ideal solution S_i^- for each alternative i is calculated as:

$$S_i^+ = \sqrt{\sum_{j=1}^{m} (v_{ij} - A^+{}_j)^2} \quad (5)$$

$$S_i^- = \sqrt{\sum_{j=1}^{m} (v_{ij} - A^-_j)^2} \quad (6)$$

Where is the number of criteria.

Step 6: Calculation of Relative Closeness to the Ideal Solution:

Determine the relative closeness C_i^+ of each alternative to the ideal solution using the following formula:

$$C_i^+ = \frac{S_i^-}{S_i^+ + S_i^-} \quad (7)$$

Where C_i^+ ranges from 0 to 1, with values closer to 1 indicating alternatives closer to the ideal solution.

The weights assigned to the evaluation criteria were determined based on their relative influence on educational quality, using expert judgment and a review of prior studies in the field of education management (Epifanić et al., 2021; Huang et al., 2022). Each criterion was rated according to its perceived importance, and the resulting scores were normalized so that the total weight equals one, in line with the requirements of the TOPSIS method (Asghari et al., 2017). This weighting procedure ensures that educational impacts with greater systemic consequences exert a stronger influence on the final prioritization of challenges.

Table 1 summarizes the decision framework by linking four major educational challenges (A1-A4), treated as decision alternatives, with five impact-based criteria (C1–C5). In contrast to conventional MCDM applications, where alternatives typically represent solution strategies, this study conceptualizes challenges as alternatives to rank existing problems and identify priority areas for policy intervention. The criteria represent the multidimensional consequences of these challenges on learning conditions, motivation, employability, access to information, and digital inclusion. This framework enables a comprehensive and transparent prioritization of educational constraints, thereby providing a robust analytical basis for applying TOPSIS and supporting evidence-based decision-making.

TABLE 1 Evaluation criteria and alternatives for educational challenges.

No	Code	Alternative	Code	Criterion
1	A1	Overcrowded classrooms	C1	Learning and concentration difficulties
2	A2	Obsolete equipment	C2	Demotivation of students and teachers
3	A3	Under-equipped libraries	C3	Lack of preparation for labor market demands
4	A4	Insufficient digital infrastructure	C4	Difficulties in accessing information and documentation resources
			C5	Digital exclusion

3.3 Data analysis

Recorded data were organized in Excel spreadsheets, and descriptive statistics, including means, scores, and percentages, were calculated for each variable. The Decision Matrix was first analyzed using Principal Component Analysis (PCA) as an exploratory tool to examine the underlying structure of the dataset and to visualize the relationships among criteria and alternatives, given the presence of multiple parameters ($n = 9$). PCA was applied solely to facilitate data interpretation and did not influence the weighting process or the TOPSIS ranking results.

In this analysis, coded alternatives were considered as dependent variables (four alternatives), while coded criteria were treated as independent variables (five criteria). The PCA results were displayed in a two-dimensional plot representing the percentage of explained variance. All statistical analyses were performed using SPSS version 25.

4 Results and discussion

The decision matrix (Table 2), containing the raw scores for each alternative according to the criteria, is used to assess the relative impact of educational challenges. It serves as the basis for data normalization in the subsequent steps. This stage relies on the matrix for calculating the scores in the decision matrix.

This result normalizes the scores to eliminate disparities related to the scales of the criteria (Figure 3 and Table 3). This ensures a fairer comparison of the alternatives, which is essential for the subsequent analysis. Normalization is performed according to Equation 1.

After normalization, the scores are weighted according to the relative importance of each criterion (Table 4). This refines the analysis by highlighting the most impactful alternatives. The weighting is carried out following Equation 2.

The positive and negative ideal solutions serve as reference points to evaluate the performance of each alternative in relation to the best and worst possible scenarios (Table 5). This step is described by Equations 3, 4 for calculating the ideal solutions.

Table 6 calculates the distance of each alternative from the ideal solutions. It quantifies the gap between each alternative and the optimal and unfavorable outcomes. This distance is calculated using Equations 5, 6.

Finally, the relative proximity coefficient measures the closeness of each alternative to the positive ideal solution. This allows for ranking the alternatives and prioritizing the actions to be taken. This step uses Equation 7 to calculate the proximity coefficient. The results presented in Table 7 highlight the varying degrees of closeness of each alternative to the positive ideal solution, reflecting their relative performance. Alternative A1 exhibits the highest closeness coefficient (35.78), indicating it is the most favorable option and should be prioritized in decision-making. A2, with a coefficient of 31.15, ranks second, showing a moderately strong alignment with the ideal criteria. In contrast, A3 and A4 have noticeably lower coefficients (20.64 and 12.43, respectively), signaling less suitability compared to the leading alternatives. This ranking underscores the importance of focusing resources on the top-performing alternatives while considering improvements or adjustments for the lower-ranked options. Overall, the proximity coefficient effectively quantifies each alternative's relative advantage, guiding strategic prioritization.

TABLE 2 Decision Matrix.

Code	C1	C2	C3	C4	C5
A1	4,23	4,27	3,96	3,48	3,26
A2	4,52	4,52	4,33	3,83	3,92
A3	4,04	4,53	4,4	4,7	3,81
A4	4,16	4,47	4,52	4,56	4,72

TABLE 3 Normalized decision matrix.

Code	C1	C2	C3	C4	C5
A1	0,5	0,48	0,46	0,42	0,41
A2	0,53	0,51	0,5	0,46	0,49
A3	0,48	0,51	0,51	0,56	0,48
A4	0,49	0,5	0,52	0,55	0,6

TABLE 4 Weighted normalized decision matrix.

Code	C1	C2	C3	C4	C5
A1	0,1,047	0,1,056	0,0965	0,0834	0,0782
A2	0,1,119	0,1,118	0,1,055	0,0918	0,0940
A3	0,1,000	0,1,120	0,1,073	0,1,126	0,0914
A4	0,1,030	0,1,105	0,1,102	0,1,093	0,1,132

TABLE 5 Positive and negative ideal solution.

Matrix	C1	C2	C3	C4	C5
A+	0,1,119	0,1,120	0,1,102	0,0834	0,0782
A-	0,1,000	0,1,056	0,0965	0,1,126	0,1,132

TABLE 6 Distance positive and negative ideal solutions.

Code	S_i^+	S_i^-
A1	0,01670953	0,04585097
A2	0,01850124	0,03260894
A3	0,03432673	0,02514903
A4	0,04446268	0,01519434

TABLE 7 Relative closeness value.

Code	C_i^+	Rank	Closeness coefficient
A1	0,73,290,605	1	35,7,784,159
A2	0,63,801,262	2	31,1,459,849
A3	0,42,284,509	3	20,64,211
A4	0,25,469,489	4	12,4,334,893

The analysis of the results obtained from applying the TOPSIS method reveals a clear prioritization of infrastructure-related challenges in higher education in Morocco. The method enabled the ranking of challenges based on their impact on the quality of education. The results show that classroom overcrowding is the most pressing challenge, followed by outdated equipment, access issues to libraries, and digital infrastructure.

4.1 Classroom overcrowding

The proximity coefficient for classroom overcrowding (C = 0.7329) indicates that this is the most impactful issue in Moroccan higher education. This finding aligns with the literature, notably (Akkari, 2014; Bennafla et al., 2018), who emphasize the negative effects of overcrowding on concentration, participation, and interaction in classrooms. The impact of overcrowding on teaching quality is well-documented, highlighting the need to expand learning spaces to provide students with a healthier and more conducive learning environment.

4.2 Outdated equipment

Outdated equipment (C = 0.6380) ranks second among the challenges. This factor underscores the urgent need to modernize educational equipment, particularly in laboratories and computer rooms. Research by Mardis et al. (2018) also highlights the importance of modern technological infrastructure in providing relevant training aligned with labor market demands. The necessity for continuous technological renewal is therefore crucial to maintaining education quality and meeting employers' expectations.

4.3 Access to educational libraries

Limited access to educational libraries (C = 0.4228) is another significant challenge for student success. Access to library resources is critical for research and the development of critical thinking skills (Indah et al., 2022; Wang et al., 2023). As emphasized by Chukwuji (2020), a well-equipped library is a key indicator of support for learning and research. Investments in library infrastructure, particularly in the expansion and modernization of available resources, including digital materials, should be prioritized (Bello and Adepegba, 2023).

4.4 Digital infrastructure

Although digital infrastructure (C = 0.2547) received the lowest ranking, its impact remains noteworthy, especially in the current context of increasing digitization in education. As noted by Agormedah et al. (2020) and Liu et al. (2020), access to the internet and online learning platforms is essential for quality education. While this factor is less urgent than the others, it should not be overlooked in higher education improvement policies. The digital infrastructure in Morocco was neglected during the last few decades (Richter, 2023), but after the COVID-19 pandemic, the government was oriented to this option to reduce the impact on the education process (Nachit and Belhcen, 2020).

4.5 Relative contribution of each factor

Analyzing the relative importance of the different factors to the overall issue provides a clearer picture of their impact. Classroom overcrowding accounts for 35.8% of the problem, making it the most influential factor. Outdated equipment contributes 31.1%, followed by libraries (20.6%) and digital infrastructure (12.4%).

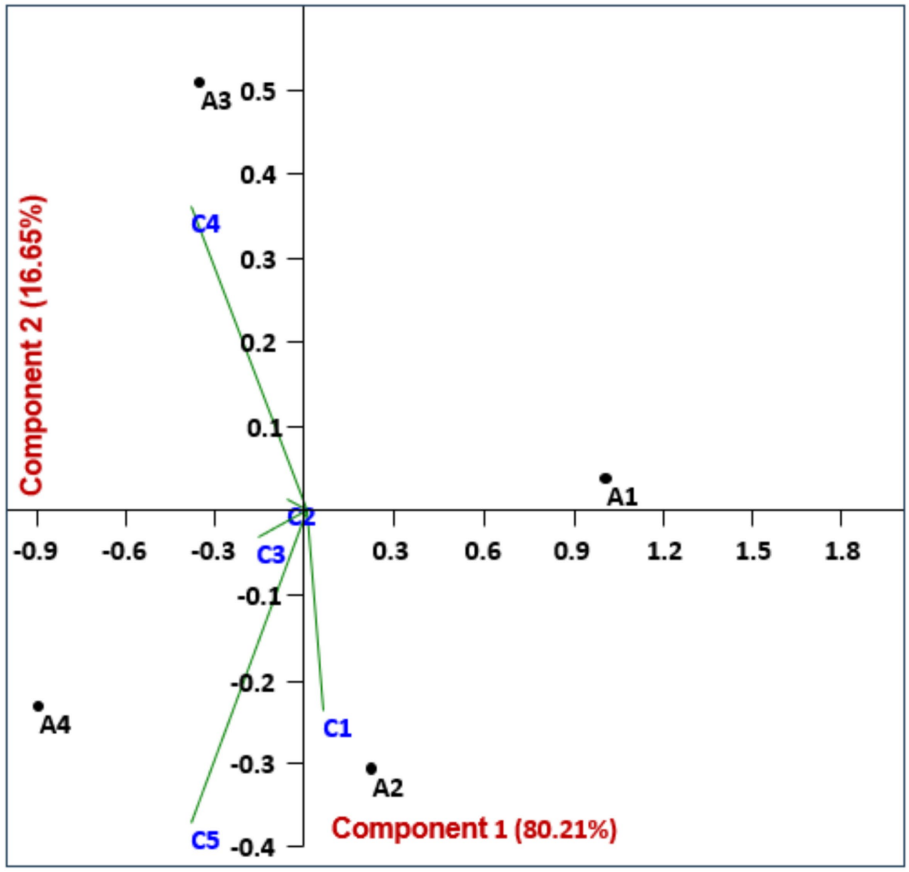

FIGURE 3
PCA plot of scores to eliminate disparities related to the scales of the criteria.

This distribution clearly shows that overcrowding and outdated equipment are the two most urgent issues to address. However, investments in libraries and digital infrastructure are also necessary to enhance education quality, even if their impact is less immediate (Timotheou et al., 2023).

Optimizing infrastructure for better education in Morocco after COVID-19 has become a strategic priority to strengthen resilience and equity in the sector (Ait Si Ahmad et al., 2021; Rarhoui, 2025). The pandemic exposed significant gaps in digital access and school facilities, prompting the government to invest in connected class-rooms, expand internet access, and partner with private actors to equip rural schools with ICT tools and teacher training, as seen in initiatives like "Connected Classrooms – Dir Iddik" and the DigiSchool project (Dib, 2023; Outoukarte et al., 2023). These efforts build on the national education reform roadmap (2022–2026) and broader digital transformation goals, aiming to reduce disparities and prepare students for a digitized economy. Additionally, recent budget increases for education and infrastructure expansion, such as new schools and classrooms, underscore an ongoing commitment to improving physical and digital learning environments. Through these measures, Morocco seeks not only to recover from pandemic disruptions but also to modernize its education system for long-term quality and inclusivity.

The successive stages of the TOPSIS analysis provide a structured and analytically robust evaluation of educational challenges by progressively refining the initial information contained in the decision matrix (Cai et al., 2022). The normalization and weighting steps are particularly critical, as they ensure that differences in measurement scales do not bias the results while simultaneously emphasizing criteria with greater educational significance, a practice consistent with prior TOPSIS-based studies in the education sector (Acuña-Soto et al., 2021; Anes and Abreu, 2025). The construction of positive and negative ideal solutions offers a meaningful benchmark that enables a comparative interpretation of each challenge in relation to optimal and worst-case educational conditions, as highlighted by Shafizan Jaafar et al. (2025) and Troussas et al. (2025). The distance measures further enhance the analysis by quantifying how far each alternative deviates from these benchmarks, allowing for a more nuanced understanding of their relative severity. Finally, the relative proximity coefficient synthesizes all previous steps into a single, interpretable indicator that supports clear prioritization of educational challenges. This integrated approach aligns with earlier empirical findings showing that TOPSIS effectively captures the multidimensional nature of complex educational decision problems and strengthens the validity of the resulting rankings (D'Adamo et al., 2025; Zhao et al., 2025).

5 Conclusion

The research aimed to address four major factors influencing the quality of education in Moroccan universities: classroom overcrowding, outdated equipment, lack of library resources, and insufficient digital infrastructure. The results helped prioritize these challenges, showing that, in order of priority, classroom overcrowding is the most significant issue. This is followed by outdated equipment, a lack of

library resources, and finally, insufficient digital infrastructure. These findings align with observations from existing literature and highlight the importance of each factor in higher education quality.

Additionally, the TOPSIS method identified relative priority levels, confirming the urgent need to address classroom overcrowding and improve equipment. While this research has identified key intervention areas, further studies on larger samples and cost–benefit analyses are recommended to develop viable and adapted solutions. Despite the importance of the obtained results, some limitations must be considered. Firstly, the sample size may be insufficient for full generalization of the results. The collected responses come from a limited number of universities, which may restrict the representativeness of the data for the entire education sector. Finally, the study does not account for the long-term impacts of necessary investments, which limits the cost–benefit analysis of certain interventions. This study opens several avenues for future research. One perspective would be to expand the sample to a greater number of universities, both public and private, to validate the results on a national scale and analyze regional disparities. Furthermore, another research avenue could explore the impact of technological advancements on digital infrastructure and the integration of new teaching methods, such as hybrid or distance learning. This would deepen the understanding of challenges related to adapting higher education to 21st-century requirements.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were complied with the ethical principles outlined in the Declaration of Helsinki and adheres to Moroccan Law No. 09–08, which protects individuals in the processing of personal data. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because this study was conducted in Morocco using an anonymous questionnaire, and we confirm that such alterations have not distorted the scholarly meaning. All participants were informed about the purpose of the study and their voluntary participation. No personally identifiable or sensitive data were collected.

Author contributions

AK: Visualization, Resources, Validation, Writing – review & editing, Writing – original draft, Investigation, Conceptualization. NK: Validation, Writing – original draft, Conceptualization, Software, Methodology, Visualization. IA: Validation, Visualization, Supervision, Writing – review & editing, Data curation. SA: Visualization, Validation, Investigation, Conceptualization, Writing – review & editing.

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