TPM Vol. 32, No. S9, 2025
ISSN: 1972-6325
https://www.tpmap.org/

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MIND MAPS AS A LEVER FOR INCLUSIVE EDUCATION: CHALLENGES, PERSPECTIVES, AND STRATEGIES FOR INITIAL TEACHER TRAINING IN MOROCCO

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Abstract
In a Moroccan educational context where inclusion has become a major aspiration, this article examines the promising role of mind maps as an innovative pedagogical tool. We explore how mind maps can enrich initial teacher training, drawing on a rich and multidimensional theoretical framework that integrates self-efficacy, social representations, differentiated pedagogy, experiential learning, the ecological model, and stakeholder engagement. Our mixed-methods approach combined in-depth qualitative interviews with 30 participants and a quantitative survey conducted with 120 trainee teachers. The collected data were rigorously analyzed, notably through structural equation modeling (AMOS). The results, while revealing a still modest use (9%) of mind maps, highlight a very high perceived potential (71%) for fostering inclusion. Ultimately, mind maps emerge as an essential strategic lever for instilling a dynamic of pedagogical innovation in service of truly inclusive education in Morocco.
Keywords: inclusive education, initial training, mind maps, self-enjcacy, differentiated pedagogy, Morocco, SEM, AMOS.

1. INTRODUCTION

In the current educational landscape, shaped by profound reforms and a growing awareness of societal issues, inclusive education stands as a cornerstone. In Morocco, this ambition resonates with UNESCO's Sustainable Development Goals (SDG 4), which call for ensuring quality, equitable, and accessible education for all, without distinction [1]. However, the reality on the ground reveals a long way still to go: only 1.5% of children with disabilities are effectively integrated into mainstream classes, and often without the essential specialized support [2]. Faced with this situation, initial teacher training emerges as a strategic lever, a crucial anchor point for transforming this situation and building a truly inclusive school.

At the heart of innovative pedagogical tools, the mind map—this non-linear visual representation that organizes thought and facilitates the structuring of knowledge [3]
—offers immense potential, still largely untapped in teacher training programs. This article aims to explore in depth how mind maps can become a catalyst for the development of inclusive pedagogical practices within initial teacher training for Moroccan teachers. We will examine their capacity to equip future educators with the necessary skills to embrace learner diversity and create learning environments where every voice finds its place.

2. Problematic and Objectives

Facing the imperative of inclusive education and the untapped potential of mind maps, fundamental questions emerge. Do current initial training programs adequately prepare teachers for inclusive pedagogy? Are mind maps recognized and integrated as effective levers for inclusion in this training? What are the barriers and catalysts to their adoption?

The main objective of this study is to demystify how mind maps can be mobilized to cultivate inclusive competencies in future teachers. To do this, we will rely on a robust interdisciplinary theoretical approach and a mixed methodology, in order to offer a nuanced and pragmatic understanding of this dynamic.

3. THEORETICAL FRAMEWORK

Our research is situated within a multidimensional theoretical framework, drawing from various perspectives to understand the complexity of integrating mind maps into teacher training and their impact on

inclusive education. This theoretical weaving allows us to analyze the dynamics at play from different angles, thus offering a holistic understanding of the phenomenon.

3.1. Self-Enjcacy (Bandura, 1997)

The theory of self-efficacy, developed by Albert Bandura [4], posits that belief in one's own ability to succeed at a task directly influences motivation, engagement, and perseverance. In the context of teaching, a strong perceived self-efficacy among future teachers regarding their ability to implement inclusive practices is crucial. Mind maps, by offering a structured way to organize pedagogical content and plan differentiated sequences, can reinforce this perception of personal effectiveness, making the task of inclusive teaching more concrete and manageable.

3.2. Social Representations (Moscovici, 19a1)

Serge Moscovici [5] highlighted the importance of social representations in the construction of our collective reality. Regarding inclusion, stereotypes and prejudices can hinder the adoption of truly inclusive practices. Mind maps, by their visual nature and their ability to organize complex information in a non-linear way, can serve as a powerful tool to deconstruct these representations. By visualizing the plurality of learners' needs and profiles as resources rather than obstacles, they promote a change in social representations related to diversity and inclusion.

3.3. Differentiated Pedagogy (Perrenoud, 1997)

Philippe Perrenoud [a] emphasized the need for differentiated pedagogy to address the heterogeneity of students. Mind maps prove to be a particularly suitable tool for this approach. They facilitate the adaptation of content to various learning styles by offering a flexible and non-linear visualization, which is essential for a classroom where each student learns at their own pace and in their own way.

3.4. Experiential Learning (Kolb, 1984)

David Kolb's model of experiential learning [7] emphasizes the importance of concrete experience, reflection, conceptualization, and active experimentation in the learning process. Creating mind maps engages teachers in active and reflective learning. By experimenting with the construction of these tools, reflecting on their usefulness, and conceptualizing their application in the classroom, future teachers gain a deeper understanding of inclusive practices.

3.5. Ecological Model (Bronfenbrenner, 1979)

Urie Bronfenbrenner's ecological model [8] invites us to consider the individual within their environment and the multiple systems (micro, meso, exo, macro) that interact and influence their development. The integration of mind maps into teacher training is thus conditioned by institutional, curricular, and relational contexts. An understanding of these interactions is essential for successful and sustainable implementation.

3.6. Stakeholder Engagement (Freeman, 1984)

R. Edward Freeman's stakeholder engagement theory [9] emphasizes the importance of collaboration among all concerned actors for the success of a project. In the case of integrating mind maps, collaboration among trainers, trainees, students, and parents is fundamental. Mind maps can become cognitive and social mediators, fostering communication and cooperation among these different stakeholders in the service of inclusion.

4. METHODOLOGY

To answer our research questions, we adopted a mixed methodology, combining qualitative and quantitative approaches. This triangulation of data allowed us to obtain a rich and nuanced understanding of perceptions and practices related to the use of mind maps in teacher training.

4.1. Sample and Data Collection

The qualitative phase of our study involved conducting 30 semi-structured interviews. These interviews were conducted with a diverse sample of participants, including trainee teachers, trainers, and school principals. Data collection took place in the Drâa- Tafilalet region, an area chosen for its specific structural challenges in inclusive education, thus offering a rich context for qualitative exploration.

The quantitative phase consisted of distributing a questionnaire to 120 trainee teachers enrolled in the Écoles Normales Supérieures (ENS) of Fès and Meknès. This questionnaire aimed to collect data on their perceptions and uses of mind maps, as well as on key variables such as perceived self-efficacy.

4.2. Measurement Instruments

For the qualitative interviews, a semi-structured interview guide was developed, allowing for in-depth exploration of pedagogical practices, perception of inclusion, use of visual aids, and experiences with mind maps. This approach fostered the emergence of personal narratives and nuanced perspectives.

The quantitative questionnaire used a Likert scale to measure teacher self-efficacy, adapted from the Tschannen-Moran and Hoy (2001) scale [10]. The reliability of this instrument was confirmed by a Cronbach's alpha coefficient of 0.83, attesting to its internal consistency. In addition, questions on the use of differentiated tools and openness to innovation were included.

4.3. Data Analysis

Qualitative data from the interviews were subjected to rigorous thematic analysis, following the principles established by Braun and Clarke (200a) [11]. This method allowed for the identification of

recurring themes and significant patterns in the participants' discourses, thus offering a deep understanding of the phenomena studied.

For quantitative data, we used structural equation modeling (SEM) with AMOS software. This advanced statistical approach allowed us to test complex relationships between variables, estimate direct and indirect effects, and account for measurement error, thus providing a robust analysis of the links between the use of mind maps, self- efficacy, and inclusive competencies.

5. RESULTS

Our investigations, conducted through a mixed-methods approach, yielded significant results, both quantitative and qualitative, shedding light on the current state of mind map usage and perception in teacher training in Morocco.

5.1. Quantitative Results

The data from our quantitative survey reveal clear trends regarding trainee teachers' familiarity with and use of mind maps. It is noteworthy that a2% of respondents have never been trained in the use of mind maps, and only 9% use them regularly. However, a high percentage of 71% believe that mind maps facilitate inclusion. These figures, though contrasting, highlight a perceived potential that remains largely underexploited. A significant correlation was observed between perceived self-efficacy and the use of mind maps ($r = 0.54$; $p < 0.01$), suggesting a positive link between teachers' confidence in their abilities and their propensity to use this tool.

Table 1: Mind Map Usage and Perception (n = 120)

Indicator	Percentage (%)
Teachers regularly using mind maps	9 %
Teachers trained in mind map use	38 %
Teachers perceiving their potential for inclusion	71 %

Structural Equation Modeling (AMOS) analysis validated a model illustrating the relationships between mind map use, self-efficacy, differentiated pedagogy, and inclusive education. The model fit indices confirm its robustness and validity, as detailed in Table 2.

Table 2: AMOS Model Fit Indices

Index	Obtained Value	Recommended Threshold
χ^2/df	1.87	< 3
CFI	0.9a	$\geq$ 0.90
TLI	0.95	$\geq$ 0.90
RMSEA	0.054	$\leq$ 0.08
SRMR	0.041	$\leq$ 0.08

Figure 1: AMOS Model Path Diagram

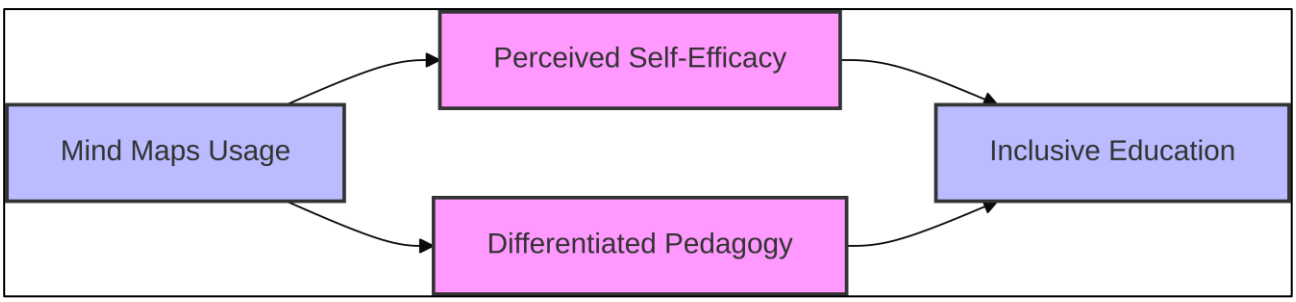

Figure 1: AMOS Model Path Diagram illustrating the hypothesized relationships tested between mind map use, self-efficacy, differentiated pedagogy, and inclusive education. Arrows indicate direct and indirect effects.

5.2. Qualitative Results

The semi-structured interviews enriched our understanding of the dynamics at play, providing insights into the perceptions and lived experiences of training stakeholders. Three main themes emerged:

- **Lack of Training:** Many participants expressed a pressing need for practical training. A trainee teacher from Errachidia confided: "I don't know how to build a mind map. It's not covered in our training." This observation highlights a deficit in current curricula, which do not adequately prepare future teachers for the use of this tool.
- **Recognized Potential:** Despite the lack of training, the potential of mind maps is widely recognized. A trainer from Ouarzazate testified: "My struggling students participate more easily when we use a mind map in class." This positive feedback

underscores the perceived effectiveness of mind maps in fostering engagement and participation among learners, especially those with specific needs.

- **Cultural Resistances:** The integration of mind maps also faces resistances related to established pedagogical practices. A trainee teacher from Tinghir expressed this frustration: "We talk about innovation, but we are always asked for classic, linear lessons." This observation reveals a tension between aspirations for innovation and the persistence of traditional pedagogical models, which favor a linear approach to teaching and learning.

These qualitative results complement the quantitative data, offering a more human and contextual perspective on the challenges and opportunities related to the integration of mind maps in initial teacher training in Morocco.

6. DISCUSSION

The results of our study paint a nuanced picture of the integration of mind maps into initial teacher training in Morocco. On the one hand, quantitative data reveal a still marginal use of these tools, with only 9% of trainee teachers using them regularly. This finding is corroborated by qualitative testimonies that highlight a glaring lack of practical training, as one trainee so aptly put it: "I don't know how to build a mind map. It's not covered in our training." This gap in initial training curricula constitutes a major obstacle to the widespread adoption of mind maps, despite their recognized potential.

On the other hand, the perceived potential of mind maps is remarkably high, with 71% of respondents believing they facilitate inclusion. This recognition is reinforced by the significant correlation between perceived self-efficacy and the use of mind maps ($r = 0.54$; $p < 0.01$). This link highlights the importance of teachers' self-confidence in adopting new pedagogical practices, in line with Bandura's (1997) self-efficacy theory [4]. The more competent teachers feel in using mind maps, the more inclined they are to integrate them into their teaching.

Mind maps, by their visual and non-linear nature, are particularly suited to differentiated pedagogy (Perrenoud, 1997) [a]. They allow for the adaptation of content to various learning styles and respond to classroom heterogeneity, thus promoting more inclusive education. Furthermore, their creation engages learners in an active and experiential learning process (Kolb, 1984) [7], which is essential for a deep appropriation of inclusive practices.

However, the integration of mind maps also faces cultural resistances. The testimony of a trainee, "We talk about innovation, but we are always asked for classic, linear lessons," illustrates the tension between aspirations for innovation and the persistence of traditional pedagogical models. These conservative social representations (Moscovici, 19a1) [5] can hinder the adoption of tools that disrupt established habits.

Technological Opportunities and Risks

The digital age offers new perspectives for the use of mind maps. Dedicated digital tools and generative artificial intelligence could greatly facilitate their creation and personalization, making these tools even more accessible and effective. Imagine AI capable of suggesting mind map structures based on content, or adapting existing maps to the specific needs of a student. These advances could democratize the use of mind maps and make them even more relevant for differentiated pedagogy.

Nevertheless, it is crucial to remain vigilant about potential risks. Excessive reliance on digital tools could create a new digital divide, excluding teachers and students in areas with low connectivity or without access to necessary equipment. It is imperative to ensure that technological integration is equitable and does not further widen existing inequalities. The simplicity and accessibility of pen and paper, which contributed to the initial success of mind maps, should not be forgotten in favor of an all-out digitalization.

7. Recommendations

In light of the results of this study, it appears imperative to implement concrete strategies to foster better integration of mind maps into initial teacher training in Morocco. These recommendations are structured around several axes:

- **Integration into Initial Training Curricula:** The Ministry of Education and teacher training

institutions should systematically integrate the teaching and practice of mind maps into their programs. This includes dedicated modules, practical workshops, and assessments focusing on their pedagogical use.

- **Trainer Training:** It is crucial to train trainers themselves in the use and didactization of mind maps. Mastery of this tool by trainers is a prerequisite for them to effectively support future teachers.
- **Practical Workshops for Trainee Teachers:** Offer regular practical workshops where trainee teachers can experiment with creating and applying mind maps in differentiated pedagogical sequences. These workshops should focus on solving concrete problems and sharing best practices.
- **Encourage Experimentation and Personalization:** Encourage trainee teachers to experiment with mind maps in their own practices and adapt them to their needs and those of their future students. Personalization of the tool promotes its appropriation and effectiveness.
- **Creation of Collaborative Environments:** Schools and training centers should encourage the creation of environments where teachers can exchange practices, share their mind maps, and collaborate around these visual cognitive tools. This collaborative dynamic strengthens mutual learning and the dissemination of pedagogical innovations.
- **Awareness of Digital Tools and AI:** While prioritizing accessibility, it is important to raise awareness among future teachers about the potential of digital mind mapping tools and the prospects offered by generative artificial intelligence, while training them in a critical and ethical use of these technologies.

8. Limitations of the Research

While this study provides valuable insights into the integration of mind maps in initial teacher training in Morocco, it is important to acknowledge certain inherent limitations of our approach. Firstly, the study focused on a specific region (Drâa- Tafilalet for the qualitative part and the ENS of Fès and Meknès for the quantitative part), which may limit the generalizability of our conclusions to the entire Moroccan territory. Educational contexts, available resources, and cultural dynamics can vary significantly from one region to another.

Secondly, part of our data relies on participants' statements (perceptions, self- assessment of usage). Although this data is valuable for understanding representations and intentions, it may sometimes differ from actual practices. Direct classroom observations or longitudinal studies would be necessary to measure the direct and long-term impact of mind maps on students' inclusive learning.

Finally, our study did not deeply explore the impact of different types of training (initial vs. continuous, theoretical vs. practical) on the adoption and effectiveness of mind maps. These avenues for future research could further enrich our understanding of the optimal conditions for integrating this tool.

9. CONCLUSION

Ultimately, this study highlights the considerable potential of mind maps as a didactic tool for inclusive teacher training in Morocco. Their widespread adoption, far from being a mere superficial innovation, would not only strengthen teachers' skills in differentiated pedagogy but also reshape initial training as a dynamic space for innovation and pedagogical transformation. The mind map, by its visual, flexible, and collaborative nature, can become a strong symbol of modern pedagogy, capable of meeting the challenges of inclusive education.

The question remains: can the mind map truly embody the renewal of a visual, inclusive, and collaborative pedagogy in Moroccan teacher training? The results of our research suggest that the answer is a resounding yes, provided that the necessary efforts are made to overcome obstacles related to lack of training and cultural resistances. It is by investing in continuous training and encouraging a culture of experimentation that we can unleash the full potential of this tool in service of a more just and equitable education for all.

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