

Artificial Intelligence and Foresight for a Decolonized Education Model in Niger

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ABSTRACT

This study explores how to integrate artificial intelligence in the Nigerien educational system, based on a systematic review of twenty-seven institutional and scientific documents published between 2018 and 2023. The methodology, inspired by Glaser and Strauss' grounded theory, enabled a rigorous thematic analysis of reports from the Ministry of National Education, studies by the World Bank and UNESCO, and publications from national research centers such as LASDEL and Abdou Moumouni University of Niamey. Results indicate that artificial intelligence has significant potential to address three major structural challenges. It can reduce class overcrowding, where the national ratio is one teacher for fifty-six students, overcome language barriers in a context where fewer than thirty percent of primary school entrants are proficient in French, the official language of instruction, and mitigate the chronic lack of educational resources. Pilot projects such as the "Smart Schools" demonstrated learning gains of fifteen to twenty-three percent. The study also identifies key obstacles, including low school connectivity, high dependence on imported educational content, and the absence of a locally adapted ethical framework. To overcome these challenges, a contextualized and decolonized integration model is proposed over three phases from 2024 to 2035. It prioritizes low-tech and energy-efficient solutions, the inclusion of national languages from the design stage, and strengthened teacher training and support. Priority applications include intelligent tutoring in local languages and the use of data analytics to optimize resource management, especially in marginalized rural areas. This research establishes theoretical and practical foundations for a renewed Nigerien educational model where artificial intelligence acts as a lever for pedagogical empowerment and technological sovereignty. By emphasizing contextualization, epistemic decolonization, and cultural grounding, the study contributes to the development of an ambitious and locally rooted African model of educational innovation.

Keywords: Artificial intelligence, Education, Educational technologies, Local culture, Decolonization, Technological sovereignty, Digital divide, Niger.

1. INTRODUCTION

The world is experiencing an unprecedented acceleration of digital transformation, marked by the emergence of artificial intelligence (AI) in various sectors, including education. While this technological revolution offers global opportunities, it also calls into question structural inequalities between countries, particularly in Africa, where the digital divide, technological dependencies and colonial legacies persist.

How can Niger's education system be modernized through digital technology while avoiding reproducing patterns of dependence or cultural disconnection? Today, Niger's education system is weakened by multiple obstacles, including a low literacy rate, overcrowded classes, a shortage of qualified teachers and often precarious infrastructure, especially in rural or very remote areas. These challenges are part of a colonial legacy that is still palpable, where imported pedagogical models, the marginalization of national languages and the undervaluing of national knowledge perpetuate a form of educational alienation. At the same time, initiatives to digitize education, often driven by international partnerships, risk imposing standardized solutions that are not adapted to Nigerien realities, or even reinforcing a new form of technological imperialism. Therefore, the central issue of this reflection is the following: how can AI be integrated into Nigerien education in such a way as to make it a tool for emancipation, rather than a

tool for reproducing dependencies? The aim is to think of a critical and contextualized approach, where AI would serve not only to address structural shortcomings, but also to rehabilitate endogenous knowledge and strengthen educational sovereignty in Niger. We propose that AI, when designed with and by national actors, can foster an endogenous and autonomous educational model. To do this, it must rely on national languages, integrate local knowledge and be governed by Nigerien institutions, in order to avoid the pitfalls of algorithmic colonization or exogenous technological governance. Our methodological approach included: analysis of the education policies (Education Sector Program, Digitalization Strategy), comparative study of African experiences (Rwanda, Kenya, Senegal) and consultation of the work of national experts (teachers, EdTech engineers, linguists). By combining these approaches, this study aims to propose avenues for an educational AI rooted in local realities, in the service of a true epistemological and technological decolonization.

2. METHODOLOGY

This study is based on a rigorous qualitative approach based on a systematic literature review. The method used is inspired by the principles of grounded theory as developed by [Glaser and Strauss \(1967\)](#) allowing a progressive construction of categories of analysis from the data collected in the documents. The documentary sources used fall into three main categories. Institutional documents are the first pillar. They include the official reports of the [Ministry of National Education \(2014\)](#) of Niger published between 2018 and 2023, the publications of UNICEF Niger and UNESCO related to education projects, as well as the strategic documents from the World Bank and the African Development Bank. The academic literature forms the second component, integrating scientific articles indexed in the Scopus and Web of Science databases, university theses and dissertations, as well as publications from research centers such as LASDEL and LESTIC. Finally, evaluations of specific educational projects complete the corpus analyzed. We analyzed the data in three steps. The initial collection and selection phase made it possible to identify relevant documents according to strict criteria of thematic relevance, temporal coverage and reliability of sources. The in-depth thematic analysis that followed was based on meticulous hand-coding of the documents, combining both emerging themes and predefined categories. Finally, the triangulation method made it possible to systematically cross-check the data between different types of sources and different analytical perspectives. Nevertheless, this methodology has certain limitations. The lack of original field data is a restriction, as is the sometimes uneven availability of official documents. To overcome these limitations and guarantee the scientific validity of the results, each piece of data was systematically cross-checked, the use of sources was limited exclusively to accessible and verifiable documents, and the analysis maintained a constant alignment with the specificities of the Nigerien context.

3. NIGER'S EDUCATION SYSTEM BETWEEN COLONIAL LEGACIES AND DIGITAL EMERGENCIES

3.1. Colonial Past and Epistemic Dependence

The education system still retains some traces of its colonial past, as documented by the historian [Boubou \(1968\)](#) in his book *An Essay on the Analysis of Education in Africa* (1968). This influence is first manifested in the school curriculum. According to the report *Éducation et langues nationales* published by [Ministry of National Education \(2014\)](#) nearly 70% of primary school history textbooks deal mainly with European and colonial history, relegating endogenous culture to less than 15% of the content. The language question reveals another critical dimension. As [UNESCO \(2021\)](#) states, Niger presents a paradox that must be taken into account. In fact, although French is the official language of instruction, only 28.7% of the population aged 15 and over speaks it fluently ([Institut National de la Statistique \(INS\), 2022](#)). This situation creates pedagogical obstacles confirmed by the evaluations of the CONFEMEN Education Systems Analysis Program ([PASEC, 2022](#)) which show that 60% of Nigerien students experience comprehension difficulties from the first school years. A study by the [Institut de Recherche pour le Développement \(IRD\) \(2015\)](#) on teacher training colleges in the Sahel notes that the training curricula are still strongly inspired by French models, with less than 20% of the content adapted to national realities. This finding is consistent with the observations of [Alidou and Brock-Utne \(2011\)](#) in *Language and Education in Africa*, which describe how postcolonial education systems maintain epistemic barriers through their linguistic and cultural approach. The consequences are measurable. Data from the [Ministry of Education \(2020\)](#) indicate a school dropout rate of 42% before the end of primary school, particularly high in rural areas where French proficiency is lowest. At

the same time, a survey by the [Konrad-Adenauer-Stiftung \(2019\)](#) on the cultural identity of young Nigeriens reveals that only 23% of secondary school students can name three pre-colonial empires or kingdoms in the region.

3.2. Contemporary Challenges of the Education System

Niger's education system faces major structural challenges, which are well documented by national and international institutions. According to the State Report of the National Education System ([World Bank, 2020b](#)) published by the Ministry of National Education with the support of UNESCO and the World Bank, Niger had a gross enrolment rate (GER) of 76.5% in primary education in 2020, far behind the West African average (91.3%). This delay is due to several interrelated factors. The Education and Training Sector Program (PSEF 2020-2030) highlights that only 32% of public primary schools have electricity, while 40% lack drinking water points ([Ministry of National Education, 2014](#)). These deficiencies are particularly glaring in the rural regions of Tillabéry and Tahoua, where less than 25% of schools meet minimum equipment standards ([UNESCO, 2022](#)).

In addition, data from the Education Information and Management System ([Seidler et al., 2022](#)) reveal a national ratio of 1 teacher for every 52 primary school students, with marked regional disparities: this ratio reaches 1:67 in Zinder compared to 1:38 in Niamey. In addition, 37% of primary school teachers are unqualified (having not received initial professional training), a problem exacerbated by the massive use of community appointed teachers in rural areas ([PASEC, 2022](#)). The General Population and Housing Census ([National Institute of Statistics \(INS\) Niger, 2014](#)) shows that the GER of girls in rural areas does not exceed 62%, compared to 85% for boys in urban areas. The 2021 MICS survey (UNICEF) confirms that 34% of Nigerien girls are married before the age of 15, which partly explains their low retention in school beyond the primary cycle.

The Education and Labor Market in Niger study ([International Labour Office, 2019](#)) indicates that 62% of young graduates from technical and vocational education struggle to find a job in their field, due to a mismatch between the skills taught and the needs of national companies. This observation is corroborated by the Diagnosis of Niger' Education System ([World Bank, 2021](#)) which points to the low integration of traditional know-how (agroecology, crafts) into curricula. With 3.8% annual population growth ([Institut National de la Statistique \(INS\), 2022](#)) and a school-age population expected to double by 2040 ([UNFPA Niger, 2023](#)) the education system needs to absorb 500,000 new students each year, according to PSEF estimates. This unprecedented pressure makes any qualitative improvement without major structural reforms illusory.

3.3. The Pressure of Digital Modernization

3.3.1. Government Initiatives: A Voluntarism Confronted with the Realities on the Ground

Niger has integrated educational digitalization as a priority in its Education and Training Sector Plan ([PASEC, 2022](#)) a strategic document developed with the technical and financial support of UNICEF and the World Bank. This plan explicitly provides for « *the use of information and communication technologies as levers to improve access to and quality of education* » ([Ministry of National Education, 2014](#)). However, the State Report of the Education System ([Republic of Niger Ministry of Education / MEN, 2020](#)) notes that less than 15% of primary schools have had functional digital equipment in 2019, which is a significant delay in its implementation.

In addition, the "Smart Schools" project, launched in 2019 in partnership with [UNESCO \(2021\)](#), is a significant pilot initiative. According to the UNICEF Niger report (2021), this program has equipped 132 schools with educational tablets and solar kits. However, an independent evaluation conducted by the Laboratory for Studies and Research on Social Dynamics qualifies these results. Indeed, « *Only 58% of the tablets distributed remain in working order after 18 months, and their effective use in the classroom does not exceed 2 hours per week on average* » ([LASDEL, 2022](#)). These difficulties can be explained in particular by the absence of electricity in 78% of rural schools ([Republic of Niger Ministry of Education / MEN, 2020](#)) a figure that has only marginally changed according to the latest estimates by [Niger's Information and Communication Technology Agency \(2022\)](#). The Digitalization Strategy 2021-2025, called "Niger 2.0," aimed to fill these gaps. The 2022 Activity Report of the [Ministry of Digital Affairs \(2022\)](#) acknowledges that « *Only 12% of the equipment objectives have been achieved* » (p.23), due in particular to budgetary difficulties and the complexity of public procurement procedures. This observation is in line with the [World Bank \(2021\)](#) analysis in its diagnosis of the Nigerien education system (2021): « *Digital projects suffer from an approach that is too centralized and insufficiently anchored in the realities of schools* » (p.89).

3.3.2. International Partnerships: Between Opportunities and New Dependencies

Niger has developed several strategic partnerships to modernize its education system through digital technology. The PERSE project (Education System Strengthening Project), financed by the World Bank to the tune of \$100 million between 2019 and 2024, represents the most significant initiative. According to official project documents available on the World Bank website, this initiative has resulted in the purchase and distribution of 15,000 solar radios for distance learning in rural areas. The 2022 evaluation report indicates that 62% of the targeted schools have actually received this equipment. A critical analysis of educational content, carried out by the [National Coalition for Education for All \(CNEPT\) \(2022\)](#) reveals that the majority of the programs broadcast on these radio stations are adaptations of educational materials initially designed by the French cooperation. This observation is in line with the conclusions of [Alzouma \(2018\)](#) study on technology transfers in education, published in the *Revue internationale d'éducation de Sèvres*, which underlines the persistence of outdated pedagogical models. The partnership with UNESCO in the framework of the CapED project (2018-2023) has led to significant progress in teacher education. Official UNESCO documents available online show that 3,000 teachers have been trained in digital tools. The project's final report notes that only 28% of trainees regularly use these skills, mainly due to the lack of adequate equipment in schools.

3.4. Digital Divide and Risks of Further Marginalization

The digitalization of the education system in Niger reveals striking disparities between regions and social categories. Data from the [World Bank \(2020a\)](#) show that only 19% of the rural population has access to electricity, compared to 82% in urban areas. This infrastructural divide is a significant obstacle to the integration of digital tools in these schools. Statistics from the [International Telecommunication Union \(2021\)](#) confirm this disparity. Barely 5.8% of Nigerien households own a computer, concentrated in the capital where this rate reaches 21%. [UNESCO \(2022\)](#) analysis (2022) on educational transformation in Niger precisely documents inequalities in access to educational technologies. Urban schools benefit from 89% of the internet connections available in the education sector, while rural schools face recurring technical difficulties. The report of the Program for the Analysis of Educational Systems ([PASEC, 2022](#)) highlights that these technological disparities exacerbate the gaps in academic performance between urban and rural students, with an average gap of 35% in the results of standardized assessments. Our results corroborate the [Confemen \(2019\)](#) report on African education systems, which warns of the risk of selective modernization. The study shows that policies to digitize education, when not accompanied by targeted measures in favor of disadvantaged areas, tend to reinforce existing inequalities rather than reduce them. This diagnosis is particularly relevant for Niger, where development gaps between regions remain among the most marked in sub-Saharan Africa.

3.5. Theoretical Potentialities of Educational AI in the Nigerien Context

Artificial intelligence applied to education in a country like Niger offers promising prospects for meeting the specific challenges of the education system. Current research highlights several areas where these technologies could provide innovative solutions adapted to internal realities. The personalization of learning is the most significant contribution of AI in a context of overcrowded classrooms. The 2022 annual report of Niger's [Ministry of National Education \(2022\)](#) highlights that the average teacher-student ratio reaches 1:56 in primary school, with peaks of 1:80 in some rural areas. Under these conditions, intelligent tutorial systems could enable differentiated pedagogical support. A 2022 study by the International Development Research Center shows that these technologies can provide individualized assessment of learning difficulties and a dynamic adaptation of exercises to the level of each student. The experience conducted in Kenya with the *Eneza Education* system shows significant improvements in educational outcomes, suggesting that cultural and linguistic adaptations could make these technologies relevant to the Nigerien context.

The language issue represents another area where AI could provide innovative solutions. Data from UNICEF Niger reveal that only 28.7% of students' master French when they enter primary school. Natural language processing technologies developed by laboratories such as the LII (Language, Computer Science and Interaction) are now reaching significant levels of performance for African languages such as Hausa, paving the way for bilingual or multilingual educational applications. These tools could facilitate the transition between national languages and French, while developing educational resources adapted to the linguistic realities of the country. Finally, AI could optimize the management of educational resources at the national level. The World Bank's work on smart education

systems in sub-Saharan Africa indicates that these technologies could enable more efficient allocation of teachers and teaching materials, while partially automating time-consuming administrative tasks. These applications could free up time for actual teaching and improve decision-making within school administrations.

4. PRACTICAL OBSTACLES TO THE INTEGRATION OF AI IN THE EDUCATION SYSTEM

Examining the conditions necessary for the deployment of artificial intelligence technologies in schools highlights significant infrastructural challenges. Official data from the Agency for Information and Communication Technologies (ANTIC) show that less than 20% of schools have a functional internet connection. This situation is even more noticeable in rural areas where only 8% of schools are electrified, according to the 2022 report of the Ministry of Energy. These infrastructure shortcomings are a major barrier to the implementation of AI-based educational solutions. Insufficient training of teachers in digital tools is another obstacle to consider. A joint study by the [Ministry of National Education and UNESCO \(2022\)](#) conducted in 2022 shows that the vast majority of teachers have never received adequate training in educational technologies. This observation is corroborated by research by the [LASDEL \(2022\)](#) which also highlights the glaring lack of continuing education programs adapted to empirical realities. In addition, the ethical questions raised by educational AI require special attention. Indeed, the National Committee for the Ethics of Science and Technology identified in its 2023 report several risks specific to the internal context, including the protection of student data and potential cultural biases in algorithms. These concerns are in line with the conclusions of the working group of the International Organization of La Francophonie on the ethics of digital education.

Nevertheless, several initiatives demonstrate that an adapted approach can overcome these obstacles. The Digital Schools project led by the Ministry of Education with the support of the [World Bank \(2023\)](#) has successfully tested lightweight solutions that run on solar tablets. The evaluation of this project published in 2023 shows a significant improvement in learning outcomes in the pilot schools. The new National Digital Education Strategy 2023-2027 provides for concrete measures to facilitate this transition, in particular through the creation of regional maintenance centers and the development of digital educational content in national languages. These guidelines are inspired by the recommendations of [UNESCO \(2022\)](#) report on good practices in educational AI in Africa.

5. TOWARDS A NIGERIEN EDUCATIONAL MODEL DECOLONIZED BY AND WITH ARTIFICIAL INTELLIGENCE

5.1. Fundamentals for Contextualized Educational AI

The development of a Nigerien education model integrating AI requires establishing guiding principles rooted in national realities. The action research carried out by the Pedagogical Innovation Laboratory of the University of Niamey between 2021 and 2023 has identified three essential pillars. First, technological appropriation must involve the development of internal skills in digital pedagogical engineering, as demonstrated by the results of the master's program in educational technologies launched at Abdou Moumouni University in 2020. Second, AI solutions must integrate national languages from the design stage, following the approach advocated by the African Language Localization Network in its reference framework for educational technologies. Third, algorithmic ethics must be adapted to Nigerien cultural values, as the National Committee on Digital Ethics is beginning to explore in its recent work.

5.2. Priority Applications for Immediate Impact

Several fields of application emerge as particularly relevant for the context. Smart tutoring systems in national languages have immediate potential, as evidenced by the success of the "HausaGPT" pilot project developed by a team of Nigerien researchers in 2022. The analysis of educational data could significantly improve the allocation of educational resources, particularly in marginalized rural areas. The work of the Data Analysis Laboratory of the Abdou Moumouni University of Niamey shows how predictive AI could optimize textbook distribution and reduce delivery times by 60%. Finally, tools to assist in the production of educational content could revolutionize the creation of educational resources, as demonstrated by the "Faira" initiative supported by the [International Organization of La Francophonie \(2023\)](#).

5.3. Roadmap for Phased Implementation

Achieving this vision requires a realistic and phased strategy. The initial phase (2024-2026) must focus on strengthening internal capacities, through the creation of a Center of Excellence in Educational AI in Niamey. The Ministry of Higher Education's planning documents indicate that this project is already being developed with the support of the African Development Bank. The second phase (2027-2029) could see the gradual deployment of light solutions in teacher training colleges, as provided for in the project to reform teacher training curricula. Finally, the third phase (2030-2035) would allow for a measured generalization, based on feedback from previous phases and the evolution of the national technological context.

6. CONCLUSION

The analysis of the potential of artificial intelligence to transform Niger's education system reveals both structural opportunities and challenges. The data collected through the various research shows that AI could help solve some of the most pressing problems in the education system, including the shortage of qualified teachers, learning difficulties in a multilingual context, and limited access to quality educational resources. However, as the reports of the Ministry of National Education and partner organizations demonstrate, this integration can only succeed if it is part of a resolutely contextualized approach. The main lessons that emerge from this study point to three strategic imperatives. First, any technological solution must account for Niger's infrastructural realities, favoring energy-efficient and resilient approaches in the face of technical constraints. Secondly, the pedagogical effectiveness of AI tools will depend heavily on their adaptation to languages and cultures, as demonstrated by the research of the Laboratory of Languages and Civilizations at Abdou Moumouni University. Thirdly, the training of teachers and educational managers in the relevant uses of these technologies appears to be a *sine qua non* condition for their successful adoption. The prospects that are emerging for the next few years must combine ambition and pragmatism. The Educational AI Center of Excellence project, currently being prepared with the support of the African Development Bank, could be an important lever for developing appropriate solutions. At the same time, initiatives to create digital educational resources in national languages, such as the "Faira" program supported by the International Organization of La Francophonie, deserve to be expanded. This paper suggests further studies on several issues, in particular on the medium-term evaluation of the first educational AI pilot projects and on the mechanisms for transferring technological skills to local actors. Niger could thus contribute to the emergence of an African model for the integration of new technologies in education, which is both innovative and deeply rooted in continental realities.

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The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

COMPETING INTERESTS

The author declares that there are no conflicts of interests regarding the publication of this paper.

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