11th International Conference on Higher Education Advances (HEAd'25)
Universitat Politècnica de València, València, 2025
DOI: https://doi.org/10.4995/HEAd25.2025.20206

The Global South and the SDGs: Challenges and Opportunities for Higher Education in the Mexican Tropics from a case study

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How to cite: Rodríguez Luna, E.; Hernández Dávila, E. Y. (2025). The Global South and the SDGs: Challenges and Opportunities for Higher Education in the Mexican Tropics from a case study. In: 11th International Conference on Higher Education Advances (HEAd'25). Valencia, 17–20 June 2025. https://doi.org/10.4995/HEAd25.2025.20206

Abstract

To achieve the objectives and goals of the 2030 Agenda for Sustainable Development, the Northern and Southern regions must outline their own roadmaps. This study presents a case exemplifying the challenges and opportunities that emerge through a local analysis of the interdependence between poverty and higher education, specifically SDGs 1 and 2, where the educational bottleneck in transitioning from secondary to tertiary education constitutes a critical issue. The case study is situated in a region of the Mexican tropics, where high natural capital contrasts with a low Human Development Index (HDI) and high poverty levels.

Keywords: *End of poverty; Quality education; Regional sustainable development; Challenges of the Global South; Educational bottleneck.*

1. Introduction

Since 2015, the United Nations' 2030 Agenda for Sustainable Development has become a global paradigm, structuring the achievement of 17 Sustainable Development Goals (SDGs). Among them, Goal 4: Quality Education is essential as it interconnects with others (United Nations, 2015; UNESCO, 2015). However, significant disparities exist across countries, leading to diverse challenges in sustainable development. Amorós Molina et al. (2023) identified variations in higher education approaches: high-income countries emphasize academic integration of SDGs, while low- and middle-income countries apply them to address local challenges. This divergence aligns with the broader geopolitical categorization of the Global North and Global South (Hollington, 2015).

The Global South, encompassing much of Africa, Latin America, Asia, and parts of Oceania, faces distinct economic and development challenges compared to the wealthier Global North.

Additionally, 83.7% of the world's poor reside in rural areas (Global Multidimensional Poverty Index, 2024), necessitating targeted geopolitical and educational strategies.

While similarities exist among Global South nations, notable regional disparities highlight the need for tailored educational strategies. Mexico, despite being part of the Global South, displays sharp internal contrasts in human development and capital distribution. Therefore, a dual-level analysis is required: a macro-regional study (Latin America and the Global South) and a micro-regional study (a municipality within southeastern Mexico).

This study examines the educational bottleneck phenomenon, which limits access to higher education, within the context of SDG 1 (No Poverty) and SDG 4 (Quality Education). Furthermore, it proposes an educational strategy to facilitate the transition of upper secondary students into higher education, positioning them as agents of sustainable development.

2. Problem Statement

Education is a critical factor in economic growth and poverty reduction. It enhances employment and income opportunities but remains difficult to implement as a poverty alleviation tool (Berg, 2008). The relationship between low educational attainment and poverty creates a cyclical barrier to development.

Mexico's higher education system mirrors many regional challenges found across Latin America. According to IESALC (2025), inequality in access to higher education remains the greatest obstacle, particularly for students from low-income backgrounds and marginalized communities. Disparities within Mexico further complicate solutions, with southeastern states such as Veracruz, Oaxaca, and Chiapas demonstrating high biodiversity yet low Human Development Index (HDI) scores (UNDP, 2022; 2023).

A significant correlation exists between high poverty rates and low educational attainment. Several barriers contribute to this: limited access to education, high dropout rates, poor educational quality, negative intergenerational influences and sociocultural obstacles. Veracruz, for example, ranks below the national HDI average (UNDP, 2015), underscoring the urgent need for SDG 1 (No Poverty) initiatives. To effectively implement a sustainability roadmap, rural education systems require a systemic transformation. A key issue is the educational bottleneck, significantly reducing the progression of students to higher education.

Upper secondary education (bachillerato) is pivotal in shaping students' professional futures. According to ISCED, the Mexican bachillerato corresponds to ISCED Level 3. The Telebachillerato (TEBA) system, designed to expand rural education access, has not been updated pedagogically or technologically since its inception in 1980. Given that over 60% of Veracruz’s upper secondary institutions belong to TEBA, its modernization is crucial for regional sustainable development.

This study focuses on a territorial corridor spanning Veracruz and Oaxaca, where the Isthmus of Tehuantepec Interoceanic Corridor (CIIT) is being implemented. This regional development project demands educational innovations aligned with sustainability and workforce preparation. Notably, many municipalities within the CIIT corridor exhibit low HDI scores (0.709 in Oaxaca and 0.744 in Veracruz), high poverty rates, and declining natural capital—factors exacerbating educational exclusion.

3. Case Study

3.1. The Educational Context of Santiago Sochiapan Municipality

The socio-economic conditions of municipalities within the Isthmus of Tehuantepec Interoceanic Corridor (CIIT) highlight significant development deficits. A key example is Santiago Sochiapan, bordering Veracruz and Oaxaca, where 85.4% of the population lives in poverty. With 13,062 inhabitants dispersed across 39,740 hectares, the area has 65 schools, including four Telebachillerato (TEBA) institutions, serving 350 students per cycle (SEV, 2020). The primary sector employs 71.9% of the workforce, with 24,242 hectares dedicated to livestock farming (61% of the municipal area). Santiago Sochiapan has over 9,000 indigenous households, with Zapotec spoken by nearly 50% of residents (Secretaría de Finanzas y Planeación, 2022).

Higher education is absent, making TEBA the highest academic level available, yet only 14% of the population completes it (Data México, 2020). The 2021-2022 dropout rate reached 23.4%, and a declining enrollment trend is evident: 1,598 primary students (ISCED Level 1), 626 secondary students (ISCED Level 2), and 397 Telebachillerato students (ISCED Level 3) (SEV, 2020; UNESCO, 2012).

This study examines TEBA Santa Teresa (TEBA ST), located in a rural CIIT community (population: 1,233). The local economy relies on livestock farming, with subsistence agriculture playing a secondary role (Secretaría de Finanzas y Planeación, 2022). TEBA ST has three state-appointed teachers and one municipal assistant, each covering six to nine subjects per semester. In 2023, 68 students enrolled, half Zapotec speakers, many balancing studies with family agricultural duties. Challenges include limited infrastructure, lack of internet, and inadequate teaching materials, hindering educational continuity. Many students leave school for subsistence labor, perpetuating intergenerational poverty (SEV, 2020).

Until February-July 2025, TEBA institutions followed the 2018 Educational Model for Upper Secondary Education (MEPEO 2018), with 42 subjects over three years. The Ecology and Environment (EMA) subject, last offered in the sixth semester, was used in a pilot program for situated learning, integrating agricultural experiences with ChatGPT as an educational tool.

3.2. Analysis of the Educational Bottleneck

The educational bottleneck refers to the phenomenon where fewer students progress and complete higher levels of education. This study argues that reversing this trend requires a micro-regional analysis, examining socioeconomic processes to address the various factors contributing to school dropout rates.

The student group in this pilot program typically played complementary roles within their family dynamics, assisting with agricultural tasks seasonally or as needed. Those who attended farms daily were more involved in livestock care and crop maintenance. These young people learned various agricultural and livestock management tasks, such as feeding, vaccinating, and deworming cattle; fumigating and fertilizing crops; harvesting limes; repairing fences; and selling agricultural and livestock products. Under our guidance as an ecologist and a pedagogue, we supervised this pilot program, tracking the students' progress until graduation from TEBA ST.

At the national level, the INEGI (2021) data on the educational bottleneck is exemplified in the trajectory of the 19 students who participated in the case study. Despite completing upper secondary education, only three students managed to continue their studies—highlighting economic and social barriers to higher education in rural communities. Additionally, nine students joined local agricultural activities, while three emigrated to the United States in search of better opportunities. This demonstrates how a lack of resources, infrastructure, and educational support pushes students into the labor market before they can access higher education. Others pursued informal entrepreneurship, enlisted in the National Guard, or started families, showing that young people seek alternatives to sustain themselves in the absence of educational opportunities.

According to the National Survey on Access and Retention in Education (ENAPE, 2021), 71.8% of students who dropped out were from low-income backgrounds, compared to 12.9% from higher-income families. Additionally, dropout rates in upper secondary education remain significantly high. Data from the Ministry of Public Education (SEP), as reported by INEGI, indicate that over the last 20 years, while dropout rates have decreased in primary and secondary education, they have increased in higher education. These findings emphasize the educational bottleneck in Mexico, where economic and social factors constrain educational continuity, particularly in the transition to higher education. This underscores the interdependence between poverty and education.

3.3. The Situated Learning Experience at Telebachillerato Santa Teresa

Courses at Telebachillerato (TEBA) institutions are primarily lecture-based, despite the system's original design for pre-recorded video lessons with instructional materials. Each subject includes a Student Guide, yet poor academic performance in Ecology and Environment (EMA)

has been observed over three years at TEBA ST, attributed to structural and personal factors such as student interest, study habits, and learning conditions. However, the study group displayed enthusiasm, suggesting that innovative strategies could enhance student engagement and performance. Consequently, a situated learning approach using ChatGPT was introduced for the EMA subject, chosen for its relevance to local issues and practical application.

In 2023, a pilot program at TEBA ST involved 19 students, integrating traditional resources (Student Guide), practical knowledge from family farms (citrus and livestock), and ChatGPT. This novel approach facilitated the practical application of theoretical knowledge, strengthening the link between disciplinary cognitive learning (ecology) and environmental challenges. Students identified recurring patterns in their farm activities, connecting real-life experiences with academic content. Rural activities became learning experiences for scientific concepts, bridging the gap between text-based instruction and practical contexts while fostering critical and creative thinking. Students engaged in livestock care, tree planting, citrus harvesting, and farm maintenance. Notably, both male and female students were equally involved in these agricultural tasks, emphasizing the inclusive nature of situated learning. According to the student's assessment, the main results of this exercise are presented in the following table:

Table 1. Student Reflections on the Pilot Learning Experience

Aspect	Student Perception
Understanding of content	Improved through real-life application
Engagement	High interest due to relevance and context
Critical thinking	Enhanced via guided use of ChatGPT
Motivation	Increased by linking theory to daily life
Overall satisfaction	Positive; valued the practical approach

3.4. Key Outcomes of the Situated Learning Experience

As a conclusion, this experience enabled students to understand the complexity of the farms they frequently visit from a disciplinary perspective. They recognized themselves as active agents in their own learning, exploring new ways of thinking by linking theoretical concepts from the Student Guide with their practical applications in real-world contexts. Moreover, this methodology fostered a constructive vision of learning, facilitating the integration of applicable knowledge into everyday situations.

By connecting abstract theoretical-disciplinary concepts with the reality of citrus and livestock ecosystems, situated learning provided an immersive and meaningful experience. This approach enhanced critical thinking and the practical application of knowledge, while also strengthening key aspects such as active learning, interdisciplinarity, collaboration, reflection, and authenticity.

3.5. Evaluation and Future Implementation of the Pilot Program

To enhance future implementation, the evaluation of this pilot program was conducted from two complementary perspectives:

1. Practical Student Assessment: Students anonymously answered five final questions designed to assess the effectiveness of the methodology used, their perception of the learning process, and its impact on their academic and professional orientation. The responses were overwhelmingly positive, with some unexpected insights. Students reported that combining ChatGPT, the Student Guide, and farm experiences helped them understand topics with greater depth and clarity. They also noted that this approach was more effective compared to traditional abstract theoretical learning without practical connections. Furthermore, students highlighted that this methodology not only facilitated knowledge acquisition but also enabled them to visualize its real-world applications, reinforcing their interest in fields such as citrus production and livestock farming.
2. Expert Academic Analysis: The program was also evaluated by experts, who analyzed the structure and depth of the content covered, the relevance of the applied concepts, the coherence between theory and practice, and the development of students' critical thinking skills.

Based on these preliminary conclusions, we proposed the design of a complementary program to the EMA Student Guide, intended for use in 225 Telebachillerato institutions across the CIIT and its surrounding area. To this end, in 2024, we held working meetings with officials from the Veracruz Ministry of Education and analyzed alignment with federal programs in the region to initiate a series of workshops aimed at integrating federal and state sectoral policies necessary for regional sustainable development. Notably, our review of the budget allocated for the CIIT project revealed financial margins sufficient to scale up this pilot program at a regional level, aligning with CIIT's programmatic objectives.

Additionally, an agricultural sector analysis conducted by the federal government, using a logical framework approach to problem-solving, highlighted the need for professional training in this sector. This provided an opportunity to propose new educational programs in a hybrid higher education model (Technical University Degree with pathways to various Bachelor's Degrees related to regional sustainable development), based on our experiences (Rodríguez, Hernández & Ruiz, 2022; 2024) and other Latin American initiatives.

However, state and federal government transitions at the end of 2024 prevented the continuation of this proposal. Nevertheless, in the early stages of the new state and federal administrations, we identified opportunities that could ensure its feasibility in the near future, given the existing legal framework and the continuation of the CIIT project directives (Plan México, 2025).

The greatest challenge in achieving sustainable development goals lies in integrating sectoral policies and fostering institutional synergies to support viable regional proposals. In summary, this approach seeks to break the educational bottleneck and facilitate the transition of Telebachillerato graduates into higher education. We propose a situated teaching-learning model, focused on developing projects within the region's primary sector, enabling students to apply their knowledge directly to their local context and contribute to community development.

4. Conclusions

The analysis of this particular case, serving as a reference for the 240 Telebachillerato institutions within this territorial corridor of the Mexican tropics, allows us to identify both challenges and opportunities for regional sustainable development, aligning with those outlined for Latin America and the Global South.

Fundamentally, we confirm that designing and following a path toward sustainability is only possible through a historical and multidimensional regional analysis. Furthermore, while the United Nations' 2030 Agenda has been incorporated into development plans across all three levels of government (municipal, state, and national), the targets set for the designated timeframes have yet to be met in Mexico—a shortcoming also reflected in broader regional assessments (Latin America and the Global South). It is evident that without cross-sectoral policy integration and institutional synergy, achieving the 17 Sustainable Development Goals (SDGs) will remain out of reach.

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