

Experiential and Sustainable Tourism: Teaching With Artificial Intelligence to Native Corn Producers in Tlaxiaco, Oaxaca

Diana Rubi Oropeza-tosca¹, Omar Jimenez-marquez², Rodolfo Martinez-gutierrez³, Gaudencio Lucas-bravo⁴, and Clara Ivette Rincón-molina⁵

ABSTRACT

In Tlaxiaco, Oaxaca, Mexico, native corn cultivation is integral to the region's cultural heritage. However, challenges like limited information technology access and high illiteracy rates hinder producers from diversifying income through sustainable tourism. This study introduces an Artificial Intelligence (AI)-based educational model to train native corn producers in transforming their products into culinary tourism experiences. Utilizing AI, it proposal to develop contextualized educational manuals, adaptive learning strategies, and visual content, enabling skill acquisition without requiring literacy or advanced digital proficiency. The initiative aims to empower the community and preserve cultural heritage by integrating Al-driven educational tools with traditional knowledge. Expected outcomes include training producers, creating accessible educational resources, launching gastronomic workshops as tourism products, added value products enhancing the regional economy through food commercialization, and safeguarding traditional culinary practices for future generations. This project represents a pioneering effort to merge traditional knowledge with emerging Al-driven educational technologies, creating a replicable and scalable model for rural development.

Keywords: Education and pedagogical innovation, Sustainable development and circular economy, Artificial intelligence in education

INTRODUCTION

In the heart of Oaxaca, Mexico, the cultivation of native corn stands as a living testament to the region's rich cultural and agricultural heritage.

¹Tecnológico Nacional de México – Instituto Tecnológico de Villahermosa, Villahermosa, Tab 86010, Mexico

²Tecnológico Nacional de México – Instituto Tecnológico de Tlaxiaco, Heroica Ciudad de Tlaxiaco, Oax 69800, Mexico

³Tecnológico Nacional de México – Instituto Tecnológico de Tijuana, Tijuana, B.C. 22430, Mexico

⁴Tecnológico Nacional de México, Benito Juárez, 03330, Mexico

⁵Tecnológico Nacional de México – Instituto Tecnológico de Tuxtla Gutiérrez, Tuxtla Gutiérrez, Chis 29050, Mexico

Oaxaca was a center of origin and domestication of corn, according to archaeological evidence. Corn is native to Mexico, and the Guilá Naquitz Cave in Oaxaca contains the oldest known remains of domesticated corn since 6250 years ago (Piperno & Flannery, 2001). Additionally, the Oaxacan Green maize variety, traditionally cultivated by the Zapotec people, is integral to the preparation of their distinctive green masa, reflecting the deep cultural significance of maize in Oaxacan heritage (Specialty Produce, n.d.). Indigenous communities in Mexico have preserved over sixty native varieties of maize through ancestral seed exchange practices, highlighting the profound biocultural heritage of the region (Vázquez, 2020). More than a staple food, native corn embodies a deeply rooted system of knowledge, identity, and intergenerational continuity. Stolmaker (1996) documented how family structures, gender roles, and economic practices in rural Oaxacan communities have been shaped by modernization while remaining anchored in ancestral beliefs and farming techniques. Similarly, Yee (2022) highlights how Mixtec communities have historically forged and defended their identity through collective organization and the preservation of cultural practices, even in urban migratory contexts influenced by indigenismo and structural racism. These insights reinforce the importance of initiatives in Tlaxiaco that seek to safeguard traditional maize cultivation not only for food security but also as a means of cultural resilience. However, these communities continue to face significant barriers (such as limited technological infrastructure and high illiteracy rates) that hinder their ability to diversify income and participate in sustainable activities like experiential tourism. Addressing these challenges requires culturally grounded, innovative approaches that build upon strengths while bridging knowledge gaps.

Food sovereignty in rural Mexico is not only a matter of agricultural productivity but is deeply intertwined with gender roles, economic policies, and community structures (Martínez, 2012). As Deere and León (2002) emphasize, the liberalization of the rural economy has placed disproportionate burdens on women, who often assume responsibility for food provisioning despite reduced access to resources and support systems. These gendered impacts must be considered when designing policies or interventions that aim to enhance food sovereignty. In this context, applied social sciences offer a valuable lens for analyzing the intersection of cultural practices, market dynamics, and social equity (Basquerote, 2024).

As highlighted by Kusch-Brandt (2022), efforts to redesign food systems must prioritize the ecological balance and social equity and public health outcomes.

Experiential tourism, particularly culinary tourism, offers a promising avenue for economic development by allowing visitors to immerse themselves in cultures through authentic food experiences (Falconi, Gonzáles & Oropeza Tosca, 2024). For Tlaxiaco's native corn producers, this presents an opportunity to showcase their traditional agricultural practices and culinary arts (such as the preparation of handmade tortillas and fresh cheese) which have demonstrated high acceptance among both rural and urban consumers (Arnés, Severiano-Pérez, & Astier, 2021), thereby fostering cultural appreciation and generating additional income.

Artificial Intelligence (AI) has emerged as a transformative tool in various educational contexts, offering adaptive learning methods that cater to diverse learner needs (Oropeza-Tosca, Ramón Santiago and Martínez Gutiérrez, 2023), AI-driven approaches have been explored to enhance learning experiences and outcomes. For instance, Neophytou and Liasidou (2024) suggest that integrating AI into sustainable tourism education can equip students with a more analytical understanding of sustainability issues. Additionally, Tapalova and Zhiyenbayeva (2022) highlight that AI facilitates personalized learning pathways, making education more accessible and effective for individuals with varying levels of prior knowledge and literacy. Furthermore, Halkiopoulos and Gkintoni (2024) discuss how AI can improve student engagement and performance by providing tailored educational content and adaptive assessments.

Integrating AI into educational initiatives for indigenous communities has shown promise in bridging traditional knowledge with modern technological advancements. Projects that blend indigenous knowledge with AI have demonstrated the potential to create adaptive co-management solutions, thereby fostering environmental conservation and cultural preservation (Coffey, 2024).

This project aims to develop an AI-based educational model tailored to the unique socio-cultural context of Tlaxiaco's native corn producers. By leveraging AI, the program seeks to create contextualized educational materials, including illustrated manuals, multilingual audio guides, and interactive content, designed to overcome barriers associated with literacy and technological access. These resources can facilitate the acquisition of skills necessary for transforming agricultural products into marketable culinary tourism experiences.

The initiative is structured around three core objectives:

Empowerment through Education. Equip native corn producers with the knowledge and skills required to engage in culinary tourism, thereby enhancing their economic prospects and fostering self-sufficiency (Figure 1).



Figure 1: Red corn in a plot of land in the Río Delgado micro-basin community in Tlaxiaco, Oaxaca.

Cultural Preservation. Promote and preserve traditional agricultural and culinary practices by integrating them into tourism offerings, adding that cultural heritage remains a living, dynamic aspect of community life.

Sustainable Economic Development. Establish a replicable model that combines traditional knowledge with AI-driven educational tools to create sustainable tourism experiences, contributing to the broader goals of economic diversification and environmental stewardship.

By focusing on these objectives, the project aspires to serve as a catalyst for positive change in Tlaxiaco, offering a scalable framework that can be adapted to similar communities seeking to harness the benefits of sustainable tourism while preserving their unique cultural identities.

MATERIALS AND METHODS

This study adopts a qualitative, participatory, and interdisciplinary methodology, grounded in the approach proposed by Oropeza-Tosca et al. (2025), which integrates field observation, community-based knowledge, and artificial intelligence (AI) tools for educational innovation in rural contexts. The research was conducted in two distinct field visits to Tlaxiaco, Oaxaca, specifically in the communities of the Río Delgado micro-basin, San Diego quarter, and El Vergel.

Phase 1. Participatory Observation and Identification of Circular **Economy Practices**

The first visit focused on direct observation of native corn production systems and the embedded circular economy practices in the Río Delgado microbasin. Researchers documented how families cultivate oats, barley, mustard, and native corn to feed small Holstein cows that have been bred locally for decades. These cows produce milk, which is used to make traditional fresh cheese, while corn residues are repurposed as cattle feed. The fields are irrigated with spring water from the micro-basin, and seeds are preserved across more than three generations, reflecting a deep intergenerational transmission of agroecological knowledge.

The research team for this phase included: a specialist in microenterprise development and business administration, a specialist in regional development and sustainability, a specialist in biochemistry and artificial intelligence in education. This phase enabled the identification of cultural, environmental, and productive dimensions necessary to contextualize the design of AI-based educational materials that reflect knowledge and needs. In line with regional planning strategies implemented in the Mixteca Oaxaqueña through geographic information systems (GIS) for communitybased decision-making (Jiménez Márquez, Vásquez Olvera, & García Hernández, 2024), the project emphasized the spatial and cultural specificity of each production practice as the foundation for tailored educational interventions.

Phase 2. Ethnographic Interviews and Al-Integrated Educational Strategy Design

The second visit deepened the ethnographic approach through semistructured interviews with native corn producers from San Diego and El Vergel. Interviews revealed that: Producers practice subsistence agriculture with a strong cultural motivation to preserve ancestral knowledge. The "cajete" planting technique is widely used to retain soil moisture during the early rains in April and May. Producers begin agricultural training during early childhood (ages 6–8), with active labor from age 12.

Educational attainment among producers is high, with 75% holding a university degree, combining academic knowledge with traditional practice. Milpa cultivation remains a fundamental strategy, involving maize, beans, squash, quelites, and other complementary crops. Division of labor within families supports both agricultural and service-sector participation to reinforce household economies. Oral traditions, rituals, and religious beliefs play a central role in the preservation of agroecological practices, including offering mezcal to the earth before planting and engaging in communal work through "tequio."

The second field team included: a specialist in molecular biology and biofertilizers, a second specialist in regional development and sustainability, a specialist in regional planning and administration, a mycology expert exploring mushroom production using corn stalk residues.

Integration of AI in Educational Strategy

Building on insights from both visits, for the project is proposal to developed contextualized educational content using AI to: generate illustrated manuals and multilingual audio guides, adapt content for individuals with limited literacy or digital access, simulate real-life situations to support experiential learning in sustainable tourism, reinforce traditional knowledge through digital means while respecting cultural integrity.

AI tools can be selected and trained based on the community's linguistic, educational, and technological profile, ensuring that the educational model could be accessible, culturally relevant, and scalable to other rural regions. Moreover, adopting a sustainable and quality-driven approach to digital training (especially in rural settings) requires the use of reliable certification mechanisms and adaptive technologies that uphold the standards of learning effectiveness (Kayosa, Lapina, & Kozlovskis, 2022).

To illustrate the pedagogical strategy proposed in this project, Table 1 presents a comparative view of how traditional knowledge from native corn-producing communities can be integrated with artificial intelligence (AI) tools to achieve specific educational outcomes. The integration strategy was designed to respect and enhance knowledge systems while leveraging the adaptability of AI to address challenges such as limited literacy and digital access. By aligning key cultural practices, such as milpa cultivation, oral traditions, artisanal food preparation, and communal learning, with tailored digital resources, the educational model fosters experiential learning, cultural preservation, and the development of market-ready tourism products. This

Table 1: Table comparing traditional knowledge + Al integration.

synergy between tradition and technology reflects the project's broader goal of promoting sustainable and inclusive rural development.

Traditional Knowledge AI-Based Educational **Expected Outcome** Tool Milpa system and Simulations of planting Reinforcement of farming agroecology and product identity through transformation experiential learning Oral transmission of Multilingual audio guides Cultural preservation and rituals and myths accessibility for non-literate learners Cheese and Illustrated step-by-step Creation of tourism-ready tortilla-making manuals food products traditions Community-based Interactive learning Peer learning and digital learning (tequio) platforms collaboration

RESULTS

The proposal of implementation of the AI-based educational model in the native corn-producing communities of Tlaxiaco, Oaxaca, yielded significant outcomes for work across three areas: institutional and territorial linkage, documentation of traditional knowledge and circular economy practices, and development of inclusive educational content using AI.

- 1. Strengthening of Institutional and Territorial Collaboration. A major outcome of the project is the establishment of a strategic partnership with the Municipal Government of the Heroic City of Tlaxiaco (Jorge Octavio Hernández Martínez, Jairo Jiménez Santiago and all the team), which provided access to producers, community venues, and logistical support for the development of the initiative. This collaboration enabled continuous dialogue between municipal authorities, the Instituto Tecnológico de Tlaxiaco, and participating research networks, aligning the project with the sustainable development agenda and the Sustainable Development Goals (SDGs). Additionally, a pathway was established to incorporate the project outcomes into the Voluntary Local Review (VLR Tlaxiaco, 2025) as part of the Agenda 2030 process, positioning Tlaxiaco as a reference for sustainable rural innovation at the national and international levels.
- 2. Identification of Circular Economy Practices and Native Corn Preservation. Field visits led to observe and the documentation of regional circular agricultural practices, where farmers cultivate oats, barley, mustard, and native corn to feed small Holstein cows, which in turn produce milk used to make tlaxiaquian fresh cheese. Corn residues are repurposed as fodder, irrigation is carried out with spring water from the micro-basin or mountains near, and seeds are preserved within families for over three generations, highlighting deeply rooted

intergenerational agroecological knowledge. Ethnographic interviews confirmed that traditional milpa systems (intercropping of corn, beans, squash, and leafy greens) remain central to household food systems and cultural identity. Farming knowledge is transmitted from early childhood, integrating formal education with agricultural training from the ages of 6 to 8, and intensive labor by age 12. Rituals and symbolic practices were also observed, including offering mezcal to the earth before planting, the use of tequio (communal labor), and agricultural activities tied to religious observances and a kind of cosmovision.

- 3. Development of Inclusive and Accessible AI-Based Educational Content. Based on the ethnographic and agricultural insights gathered, AI-generated educational materials are proposal to design to reflect community contexts and overcome barriers related to literacy and digital access. These resources included: illustrated manuals for low-literacy users, multilingual audio guides (Spanish and Indigenous languages), interactive simulations to support experiential learning in culinary tourism. These materials enabled self-directed learning and skill-building among native corn producers, particularly in sustainable tourism design. It is worth noting that 75% of the interviewed producers held university degrees, indicating strong potential for the adoption and expansion of AI-assisted educational tools within these communities. Although this can vary widely depending on the geographic area of the municipality and the culture of each family.
- 4. Initial Steps Toward Experiential Tourism Design. With academic guidance, the community can begin conceptualizing prototypes of experiential tourism products centered on native corn, artisan food production (cheese, tortillas), traditional mushroom foraging, and traditional culinary practices. These prototypes aim to be developed into full tourism offerings that promote cultural heritage, environmental stewardship, and economic diversification for the Tlaxiaco region.

The implementation process of the educational model follows a structured sequence grounded in participatory research and iterative design. As illustrated in Figure 2, the project begins with a community diagnosis phase, which identify assets, challenges, and educational needs. This is followed by ethnographic observation, focusing on circular economy practices and the transmission of cultural knowledge related to native corn production. These findings can inform the design of AI-based educational materials, including illustrated manuals, multilingual audio guides, and interactive simulations tailored to the community's linguistic and literacy context. The materials can be applied in workshops with producers, facilitating skill development in culinary tourism. As a result, the project can culminate in the cocreation of prototype experiential tourism or sustainable community tourism products that integrate traditional knowledge with sustainable economic strategies.

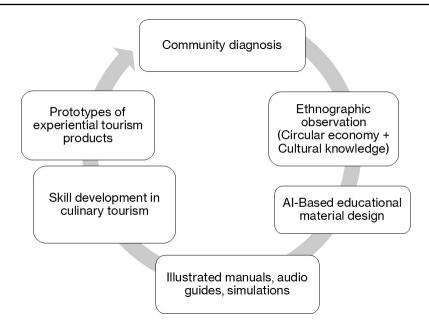


Figure 2: Sequential flow of the Al-enhanced educational model implementation.

Interviews and participatory observation confirmed that women in the Tlaxiaco region play a central role in food processing and the conservation of native corn varieties in which men cultivate them, and women mostly irrigate them, much like the resistance strategies of migrant women elsewhere, who leverage traditional knowledge as a form of economic and cultural empowerment (Fernández Quiroga, 2024). This demonstrates the strength of the tlaxiaquian people to work hard even in conditions of migration, since this population has many migrant relatives or at least have been migrants themselves at some point in their lives.

CONCLUSION

This study establishes that integrating artificial intelligence (AI) with traditional knowledge can be a powerful catalyst for community empowerment, cultural preservation, and sustainable economic development. Through a participatory and interdisciplinary approach, native corn producers in Tlaxiaco can be recognized as cultural knowledge holders and as key actors capable of innovating within their own contexts, generating opportunities to diversify their employment opportunities and strengthen self-consumption for food sovereignty. The strong institutional collaboration established with the Municipal Government of the Heroic City of Tlaxiaco, Secretariat for Agri-Food Promotion and Rural Development (SEFADER), along with academic and community partnerships, play a central role in grounding the educational model in real territorial needs. The identification of circular economy practices, deep-rooted agroecological systems, and intergenerational knowledge transmission highlights the rich

potential of these communities to lead sustainable tourism initiatives from within

By developing AI-assisted educational resources tailored to regional realities, such as illustrated manuals, multilingual audio guides, and experiential learning simulations, this project offers a replicable and scalable framework for rural development. These tools enable accessible and inclusive learning for producers with varying levels of digital literacy, aligning with the Sustainable Development Goals (SDGs) and contributing directly to the Voluntary Local Review (VLR Tlaxiaco, 2025). During the participatory design of tourism products, special attention should have to the texture, aroma, and flavor of tortillas made with native corn varieties. This can allow for assessing the systemic competitiveness of corn derivatives, potentially strengthening the region's economy. These characteristics are crucial for the development of gastronomic tourism experiences, as previous studies have shown that consumer acceptance of tortillas is closely related to their sensory and physicochemical properties (Iuga, Ávila Akerberg, González Martínez, & Mironeasa, 2019). These considerations must guided both the educational materials and the development of prototypes of regional gastronomic experiences for tourists.

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