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Reviving Indigenous Agricultural Practices Through Curriculum Innovations in Rural Schools: A Case Study of Punjab

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Abstract

The traditional indigenous agricultural practices in Punjab are inter-generational in nature but are eroding due to modern industrial farming and lack of education integration. There is scope to preserve agriculture by merging this traditional knowledge with school education systems. A descriptive cross-sectional study was performed with a structured questionnaire distributed among 865 respondents in different rural districts of Punjab. The study population consisted of students, teachers, school administrators, parents, and farmers. A broad range of data was collected pertaining to awareness and attitudes towards current curriculum content, preferred teaching styles, perceived challenges, and suggestions with regard to the prevailing curriculum. Among the 865 respondents, 72% had some awareness of at least one indigenous practice of agriculture. The most common methods were composting, crop rotation, and use of native seeds. There was overwhelming support (89%) towards the addition of indigenous practices into the curriculum. Most respondents preferred hands-on learning like field trips (76%), school gardens (65%), and farm-based guest lectures (61%). Key obstacles identified included lack of adequately trained personnel (58%), insufficient time allotted in the curriculum (43%), and lack of educational materials (39%). The majority (81%) of respondents recommended teacher training and community involvement as vital support. The community broadly supports changes in curriculum that focus on indigenous agricultural practices in rural Punjab. Integrating stakeholders with a redesign of the curriculum and developing novel experiential learning activities productive of silos will go a long way in restoring conventional practices and achieving sustainable rural development.

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INTRODUCTION

Punjab, which has been referred to throughout history as the "breadbasket of India," is celebrated for its agricultural practices. The region was home to multiple communities that practiced indigenous agriculture, implementing only organic farming methods that stemmed from cultural traditions and nature, and strongly relied on collaboration. These methods include, but are not limited to, composting organic waste, crop rotation, herbal pest control, seed preservation, and mixed cropping [1, 2].

The agricultural revolution in the 1960s was a major turning point in Punjab's farming. The introduction of synthetic fertilizers and chemical

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pesticides alongside high-yielding crop varieties has increased food security; however, ecological traditions and wisdom have been neglected. The reliance on monoculture, overextraction of groundwater, and environmental harm are among the adverse consequences of agricultural modernization [3, 4]. There is a looming problem regarding the gradual loss of traditional farming practices and the increasing disconnect younger generations face toward agriculture.

Additionally, farming has been integrated with formal education, imposing an industrialized vision of agriculture on students and eliminating a globalized syllabus centered around sustainable practices [5]. Consequently, rural communities have become increasingly alienated from their farming origins, distorting traditional knowledge into something obsolete.

This divide not only impacts cultural self-identification but also the strength of the community to adapt to climate change issues, biodiversity depletion, and food scarcity [6].

The importance of education, particularly school education, in safeguarding and socializing Indigenous knowledge systems is acknowledged worldwide. Many scholars and even international bodies have paid more attention to the integration of traditional ecological knowledge into formal curricula as a route to sustainability, cultural revival, and holistic education [7, 8]. In areas where agriculture remains the predominant livelihood, curriculum innovations based on local knowledge systems have the potential to educate students, engage the community, and promote environmental conservation.

This study analyzes how curricular innovations in rural schools in Punjab can aid in the reintroduction of indigenous agricultural practices. This study strives to capture the views of key stakeholders—students, teachers, parents, farmers, and school managers—to discover the possibilities, obstacles, and approaches to integrating traditional knowledge with contemporary education. The results are expected to support policy, pedagogy, and community participation processes designed to facilitate modern education with Indigenous knowledge, thereby enhancing sustainability and agricultural culture rooted in the region.

METHODS

Study Design and Setting

This research utilized a descriptive cross-sectional study design to evaluate perceptions, awareness, and attitudes toward incorporating indigenous agriculture into the school curriculum in rural schools in Punjab. The research was conducted from January to April 2025 in selected rural districts, such as Ludhiana, Mansa, Bathinda, Ferozepur, and Sangrur, which are agriculturally progressive and have a rich cultural heritage regarding traditional farming wisdom.

Target Population and Sampling

The target population included those directly and indirectly associated with rural education and agricultural activities, such as

- Learners in secondary schools (within the age bracket of 13–18)
- Education specialists, primarily at the secondary and primary teaching levels
- Educational supervisors and designers at the school level
- Apprenticeship and vocational agriculturists
- Guardians/Parents of learners enrolled in primary and secondary education

In Table 1, the representation of each stakeholder group was performed using a stratified purposive sampling technique. The annexed schools and villages in the five districts were chosen because of their willingness to participate, degree of agrarian education, and level of accessibility. The 865 sample respondents were distributed as follows:

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Table 1. Distribution of sample respondents by stakeholder group.

Stakeholder group	Sample size (n)
Students	312
Teachers	203
School Administrators	89
Parents	136
Farmers	125

Instrumentation

The data were gathered using a questionnaire created after reviewing the relevant literature, conducting focus group discussions, and consulting with professionals in education, agriculture, and local knowledge systems. Both closed-ended and Likert-scale questions were incorporated into a single questionnaire divided into six main sections.

1. Demographics (age, occupation, education level, district)
2. Awareness of Indigenous Agricultural Practices
3. Perceptions on Curriculum Inclusion
4. Preferred Teaching and Learning Methods
5. Challenges in Implementation
6. Recommendations and Willingness to Participate

The tool was pilot-tested with 30 participants for clarity, validity, and reliability, providing multiple options to choose from regarding the ambiguity of words. The items were modified as appropriate.

Data Collection Procedure

Data were gathered using personal interviews and school-centered surveys, which were facilitated by trained field workers who spoke both Punjabi and English. For students, questionnaires were administered in group settings in classrooms in the presence of teachers. Unlike students, farmers, and parents, who were approached on a one-on-one basis at their homes and community centers by field investigators.

Voluntary participation was used as the guiding principle, and consent was obtained from all adult participants. For adults younger than 18 years, approval was received alongside their legal guardian's consent.

Ethical Considerations

This research followed the ethics of educational and social research. The Institutional Ethics Board of Desh Bhagat University approved this study. Participants were granted anonymity, confidentiality, and the freedom to withdraw at any point without prejudice. No rewards were given, and all information was collected exclusively for scholarly reasons.

Table 2. Awareness of indigenous agricultural practices.

Practice	Awareness (%)
Composting	83
Crop Rotation	76
Use of Native Seeds	68
Natural Pest Control	61
Rainwater Harvesting	49
Mixed Cropping	42

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Data Analysis

Quantitative information was encoded and analyzed using Excel and SPSS (version 25). Responses were summarized using descriptive statistics, including frequencies, percentages, and cross-tabulations. Responses were systematically organized in tables that provided relevant focus on trends and comparisons across stakeholder categories.

The responses to the open-ended questions were themed and used alongside the quantitative results to provide further explanation and insight into the attitudes, barriers, and benefits that were perceived.

RESULTS

As shown in Table 2, stakeholder responses indicated that the level of awareness of indigenous agricultural practices among the rural population in Punjab is high. A significant proportion of respondents (approximately 83%) reported being acquainted with the process of composting, which was identified as the most recognized traditional practice. This indicates the deep-seated cultural practices in rural farming families, where organic waste recycling is cultivated and regarded as a natural fertilizer.

The second most acknowledged practice was crop rotation, which was cited by 76% of the respondents. This indicates that there is still some level of understanding of the ecological benefits of maintaining soil fertility by reducing pest organisms through crop rotation. The use of indigenous seeds, which 68% of respondents cited, also illustrates a fair amount of retention of traditional practices that are framed around local climate and soils and are crucial to biodiversity and the processes that sustain life. Of great significance, 61% of respondents reported that they were aware of the use of neem extracts, ash, or intercropping as herb pest deterrents, indicating that a large portion of the population still possesses knowledge of ecological methods despite the increasing use of chemical pesticides.

On the other hand, the practice of mixed cropping and rainwater harvesting was less known, with only 49% and 42% of respondents acknowledging the techniques, respectively.

This gap concerning the lack of awareness of rainwater harvesting (RWH) systems is alarming, especially when juxtaposed with Punjab's looming water crisis and water resource management for conserving sustainable development. Equally, the limited knowledge base on mixed cropping may serve as an indicator of the monocropping paradigm that was advanced during the Green Revolution, which eroded diverse and more adaptable farming systems.

Table 3 shows that the perception of curriculum integration reveals a disparity between the educational content offered and the rural community's expectations regarding indigenous agricultural knowledge. Only 28% of respondents agreed that any reference to Indigenous farming was an aspect of the existing school curriculum. This very low percentage means that traditional ecological knowledge is still largely omitted from formal education systems, which is a missed opportunity to bridge academic learning with local culture and environment.

In stark contrast, a noteworthy majority (89%) of participants strongly supported when asked whether schools include traditional farming methods in the curriculum. This widespread agreement illustrates that Indigenous practices are valued not only for cultural heritage but also for preparing students with relevant sustainable living skills.

Table 3. Curriculum integration perceptions.

Statement	Agree (%)
Curriculum includes indigenous practices	28
Schools should teach traditional farming techniques	89
Students would benefit from learning these practices practically	85

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Table 4. Preferred teaching methods.

Method	Support (%)
Field Visits	76
School Gardens	65
Guest Lectures by Farmers	61
Storytelling & Folk Media	48
Audio-Visual Content	53

That being said, the perspective described above is further supported by 85% of respondents who out of the total considered students would benefit from learning these practices using hands-on activities. These findings document a shift away from passive learning toward participation, where students engage with their environment, learn from elders, and soak in agricultural wisdom as they work. These findings reflect the prevailing global educational trends that emphasize hands-on, community, and culture-centered learning.

In Table 4, the results on the preferred teaching methods show that a blending of a hands-on approach with the local community was strongly preferred for teaching indigenous agricultural practices. The most popular method was field visits, supported by 76% of respondents. Such preferences suggest that learners value instructional methods such as fieldwork, where actual agricultural processes are taught in real life instead of theoretical classwork. Experiential learning enhances the understanding of the subject matter by improving lesson retention and encouraging a love of farming among the region's children.

School gardens were also popular, with 65% of participants supporting them. These living laboratories allow students to actively participate in the processes of composting, cropping, and using indigenous seeds in guided education from the classroom. They provide a template for active and sustainable participation in agriculture and reinforce students' responsibility, environmental ethics, and cooperation through joint efforts.

Guest lectures by farmers were also considered an important pedagogical means, supported by 61% of the respondents. The participation of local professionals in teaching class breaks intergenerational barriers and respects rural elders' wisdom. Such lessons increase students' appreciation of traditional practices and bond schools with their communities. Such lessons deepen the appreciation of local farming practices and promote stronger bonds between communities and schools. Of all respondents, 53% believed that utilizing audio-visual tools was effective and could be employed where complex processes needed to be taught, or where uncommon practices that could not be easily demonstrated in real time were documented.

Slightly lower in rank at 48% was storytelling and folk media, but it still held preference. These culturally relevant approaches are critical for fostering values, history, and traditions in a captivating and effective way.

Table 5. Challenges in implementation.

Method	Support (%)
Field Visits	76
School Gardens	65
Guest Lectures by Farmers	61
Storytelling & Folk Media	48
Audio-Visual Content	53

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Support for incorporating indigenous agricultural methods into the rural school curriculum is high, but obstacles remain. In Table 5, the most frequently cited obstacle was inadequately trained teachers, which 58% of respondents singled out as a major problem. This suggests a serious lack of educator training in teaching content on traditional farming practices. Most teacher training institutions continue to emphasize modern scientific pedagogy while ignoring indigenous knowledge systems, leading to a skills gap that stagnates curriculum growth.

Another significant barrier was the lack of time within the existing schedule, which was acknowledged by 43% of respondents. There is a preoccupation with preparing learners for standardized tests, which narrows the focus to core subjects, leaving little room for non-routine topics. This circumstance limits the range of project work, fieldwork, and interdisciplinary teaching, all of which are essential for the meaningful teaching of indigenous agriculture.

The absence of learning materials cited by 39% of respondents adds to the difficulty of achieving the desired outcomes. Inadequate textbooks, teachers' and students' activity guides, visual aids, and relevant local culture's content of instruction undermine the ability of educators to deliver exciting lessons. Additionally, the lack of context-specific educational materials compromises curriculum coherence and adaptability across schools.

The respondents further argued that the lack of stakeholder interest reported by 32% underlines a heretofore overlooked problem concerning parents, policymakers, and school management that fail to understand the relevance of indigenous knowledge systems in formal schooling.

In the absence of skilled advocacy and proper awareness activities, there exists apathy toward curriculum change, even when there is support from the community at lower levels.

These practices have been well incorporated into schooling systems, and Table 6 shows that the respondents to these surveys provided effective recommendations that would serve to further incorporate indigenous agricultural practices into the curricula of rural schools. Almost all participants (approximately 81%) strongly agreed with the topical focus on Indigenous issues proposed for teaching specialization. This illustrates the need not only for content knowledge of traditional farming systems but also for the skills to teach such content in culturally sensitive ways that are likely to engage students. Such immersion can be achieved through rural farming community internment programs or workshops.

Local farmers known to participants emerged alongside teacher-farmers, according to 76% of respondents, as being critical to learners' education with respect to the locality. These partnerships are crucial in the context of practical instructional lessons, where farmers join as co-instructors. These partnerships serve to endorse traditional skills and knowledge, intergenerational learning, and respect toward communities and schools. In addition, learners can have direct encounters with the local environment and practices of the area, which are usually excluded from the formal curriculum.

As highlighted in the findings, the proposals made by including indigenous content in existing textbooks, with the support of 68% of the participants, without formally pioneering them, was also considered important.

Table 6. Recommendations.

Recommendation	Support (%)
Teacher Training on Indigenous Topics	81
Collaboration with Local Farmers	76
Inclusion in Textbooks	68
Support from NGOs and Govt Agencies	64

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Including textbooks acknowledges the importance of Indigenous knowledge and guarantees its dissemination to a wide rural population. This would require curriculum developers to collaborate with knowledge custodians, specialists, and teachers to tailor appropriate and refined content for the targeted region.

In conclusion, 64% of the respondents collaborated to capture support from non-governmental organizations and government bodies. They can be helpful in terms of offering technical materials, finance, training sessions, and promotional resources. Endorsement of government policy is particularly important to enlarge these endorsed actions and institutionalize them into the country's education system.

DISCUSSION

The sociocultural and ecological arguments for restoring indigenous agriculture to the curriculum of rural schools in Punjab are noteworthy. It is quite impressive to note that respondents, especially when it comes to awareness of composting (83%), crop rotation (76%), and the use of indigenous seeds (68%), displayed high levels of awareness. This suggests that traditional practices hold a significant level of appreciation and acknowledgment among rural societies, even amidst years of industrial farming. This perspective aligns with the preexisting literature that stresses the emplaced strength of indigenous knowledge that finds its source in community experiences and folklore.

Formal education is widely perceived to be disconnected from local ecological systems and northern practices that learners wish to engage in. This sentiment was captured among participants, with 89% responding in favor of including these practices in the school curriculum. Punjab stands out in this context as it has an acute need to address agricultural issues such as soil erosion, groundwater pollution, and dwindling biodiversity. The region's farming practices are in dire need of a shift toward ecological sustainability. Traditionally, these agricultural methods tend to be more balanced and offer lower external input usage, which is easily adaptable to both education and practice. The advocacy for experiential learning through field trips (76%), school gardens (65%), and farmer guest speakers (61%) illustrates a shift toward situated, hands-on teaching from a rural education perspective. These preferences align with international educational policies that focus on the importance of rural and Indigenous place-based learning. By learning from their environments and community elders, students obtain technical skills while learning to appreciate their cultural heritage and ecological responsibilities. These findings also highlight the considerable integration challenges that require immediate attention to enable holistic approaches. The lack of adequately trained teachers (58%) was the most prioritized barrier. This highlights the issue of teacher training programmes that include little to no teaching content on Indigenous knowledge systems or rural teaching pedagogies, which is indeed a context-specific gap in the literature [7]. Other overriding problems, such as limited curriculum time (43%) and a lack of appropriate learning materials (39%), exacerbate the problem. These gaps align with other research conducted in similar environments where educational policies override local relevance due to prevailing standardized ideological curricula [8, 9].

To address these barriers, the findings suggest adopting a single strategy with multiple layers as the goal. The requirement for training teachers in Indigenous topics (81%) was central. Training programs must focus on reconstructing indigenous knowledge within the instructional design content frameworks for educators in rural contexts.

This may involve working with local ethnic experts, agricultural universities, and relevant NGOs to collaboratively create training modules [10]. Involvement with local farmers (76%) is both symbolically and practically important. It recognizes farmers as knowledge holders and strengthens the relationship between schools and communities [11].

The incorporation of traditional knowledge systems into textbooks was also considered vital (68%). Reforming textbooks can be seen as addressing a more fundamental problem within the system to

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achieve a coherent longitudinal direction. Nonetheless, this inclusion must be careful, avoiding idealizing or trivializing traditional activities. This calls for meticulous capturing, verification, and situating within context—the work of anthropologists, educators, agricultural scientists, and community members [12].

The assistance of non-governmental organizations and state bodies (64%) is also crucial. Such stakeholders are important for resource mobilization, organizing pilot projects, and lobbying for policy changes. The National Education Policy (NEP) 2020 offers useful guidance in these aspects, particularly focusing on the infusion of local content, employment skills, and environmental sustainability into school education. This momentum allows for the systematic restoration of traditional agricultural knowledge in the design of educational innovation.

The addition of conventional farming practices in schools, when viewed at a macro level, supports the adoption of the Sustainable Development Goals (SDGs), explained in detail in the document, specifically 4 (quality education), 12 (responsible consumption and production), and 15 (life on land). Teaching young people about agriculture through the prism of indigenous knowledge has the potential to enhance long-term food security, climate change adaptability, and rural development.

This study, in general terms, strengthens the argument that education combines cultural revitalization and ecological restoration, marking a return to ecology through engineering. In this context, multicultural education is a solution to local and global challenges. This solution is applicable to rural schools that combine textbook education with community-based education and foster an environmentally responsible population that understands their culture and strives to advance technology in ways that benefit life. The findings provide guidance for curriculum developers concerned with inclusive active learning approaches. In addition, they stimulate further inquiry into implementation processes, teacher preparedness, and learner achievement.

CONCLUSION

The results of this research highlight the particular and increasing agreement among various respondents, including students, educators, parents, and even farmers, about the need to revamp indigenous agricultural studies using education in schools in the Punjab region. Ignoring the 89% of respondents that advocated for including traditional farming methods into the curriculum, alongside the overwhelming preference for practical fieldwork, indicates that curriculum change is not only wanted but possible.

This study shows that indigenous knowledge systems are still alive and well among rural dwellers, especially in the form of composting, crop rotation, and seed saving. However, the education system currently offered heavily emphasizes industrialized approaches that are rarely compatible with local ecology or the local economy. A more active approach needs to be taken, one that goes beyond superficial attempts at inclusion and instead focuses on the groundbreaking disruption of existing curricula, teaching, and community participation.

Policy frameworks and partnerships are equally important. The integration of farmers as part of the teaching-learning process, development of locally relevant textbooks, NGO, and government proactive support were vital for success. These components work together to form the ecosystem needed to aid the meaningful revival of indigenous agriculture.

Despite these successes, the research has also highlighted the lack of trained teachers, limited hours available to teach them, and an overall lack of resources as some of the major underlying barriers.

To tackle these challenges requires a systemic approach, such as reforming the subsidized education policy, revising the curriculum, providing adequate resources for professional teacher training, and developing region-specific instructional materials.

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Focusing beyond the reforms and changes needed in the education sector, the use of indigenous agricultural technologies informs us of more advanced issues. It contributes to environmental conservativeness and cultural identity, strengthens the independence of the people, helps in food security, and promotes development within society. If the education taught in schools is sensitive to natural customs and traditions, ecological wisdom, rural schools in Punjab can be drivers of a sustainable and comprehensive future.

Advocating for indigenous agricultural methodologies in school syllabi is an urgent socio-cultural call. Rural schools can foster environmental practices, multi-generational knowledge, and revitalization by addressing societal heritage. This requires assessing the impact of customized curricula on learners and communities. and agricultural practices in this region.

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