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Grassroots Movements and Environmental Knowledge Systems: A Political Ecology Perspective on Education

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Abstrak

Artikel ini menganalisis pendidikan agroekologi dalam Movimento dos Trabalhadores Rurais Sem Terra (MST) sebagai sebuah sistem pengetahuan ekologi-politik yang berperan dalam produksi identitas kolektif, kapasitas ekologis, dan artikulasi tuntutan agraria. Berdasarkan tinjauan pustaka dan analisis dokumen sekunder, penelitian ini menggunakan perspektif ekologi politik untuk menguji bagaimana pendidikan gerakan tersebut mengintegrasikan tiga dimensi: (1) kurikulum kritis yang menantang narasi agribisnis dan modernisasi teknokratis, (2) pedagogi berbasis praksis yang berakar pada kerja lapangan dengan menggabungkan validasi empiris serta transmisi pengetahuan antargenerasi, dan (3) pembentukan subjek ekologi-politik melalui ritual, kursus kader, dan internalisasi nilai-nilai kolektif. Hasil penelitian menunjukkan bahwa integrasi dari ketiga dimensi ini memungkinkan sekolah-sekolah MST berfungsi tidak hanya sebagai lembaga pendidikan teknis, melainkan juga sebagai arena reproduksi politik dan ekologis yang memperkuat posisi gerakan tersebut dalam konflik agraria kontemporer. Temuan ini mendukung argumen bahwa agroekologi dalam konteks gerakan sosial tengah bergerak menuju transformasi struktural, melampaui kooptasi teknokratis, serta berkontribusi pada perluasan wacana kedaulatan pangan dan pengakuan kebijakan. Penelitian ini memperkaya literatur tentang ekologi politik dan gerakan agraria dengan memosisikan pendidikan sebagai instrumen strategis dalam produksi sistem pengetahuan tandingan (counter-knowledge) dan pengorganisasian kolektif. Implikasi penelitian ini menunjukkan bahwa pendidikan agroekologi berbasis gerakan sosial memiliki relevansi strategis dalam mendukung kebijakan reforma agraria, memperkuat kedaulatan pangan, serta mendorong pengakuan sistem pengetahuan alternatif dalam tata kelola lingkungan dan pembangunan berkelanjutan

Kata kunci: *Agroekologi, Ekologi Politik, Kedaulatan Pangan, Pendidikan Gerakan, Reformasi Agraria, Sistem Pengetahuan*

Abstract

This article analyzes agroecological education in the Movimento dos Trabalhadores Rurais Sem Terra (MST) as a political-ecological knowledge system that plays a role in the production of collective identity, ecological capacity, and the articulation of agrarian demands. Based on a literature review and analysis of secondary documents, this study uses a political ecology perspective to examine how the movement's education integrates three dimensions: (1) a critical curriculum that challenges

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narratives of agribusiness and technocratic modernization, (2) a praxis-based pedagogy grounded in fieldwork that combines empirical validation and intergenerational knowledge transmission, and (3) the formation of political-ecological subjects through rituals, cadre courses, and the internalization of collective values. The results show that the integration of these three dimensions enables MST schools to function not only as technical educational institutions, but also as arenas of political and ecological reproduction that strengthen the movement's position in contemporary agrarian conflicts. These findings support the argument that agroecology in the context of social movements is moving towards structural transformation, transcending technocratic co-optation, and contributing to the expansion of the discourse on food sovereignty and policy recognition. This research enriches the literature on political ecology and agrarian movements by positioning education as a strategic instrument in the production of counter-knowledge systems and collective organizing. The findings also suggest that movement-based agroecological education has strategic relevance for supporting agrarian reform policies, strengthening food sovereignty, and advancing the recognition of alternative knowledge systems in environmental governance and sustainable development.

Key words: Agroecology, Agrarian Reform, Food Sovereignty, Knowledge Systems, Movement Education, Political Ecology

INTRODUCTION

The ecological crisis, concentration of land ownership, and increasing food insecurity are interrelated issues in contemporary agrarian societies. The contemporary ecological crisis must be viewed holistically, as the collapse of biodiversity, soil erosion, climate change, and food insecurity and dependence are intertwined phenomena mediated by land ownership structures and the power of agribusiness markets (Sauer, 2018). In many contexts, official policy responses and mainstream science tend to position solutions as technical problems, such as intensification through chemical inputs, hybrid/genetic varieties, and mechanization, while power relations that result in unequal access to land, market monopolies, and fragile ecosystems are overlooked (Giraldo & Rosset, 2018). It was against this backdrop that grassroots agrarian movements such as the *Movimento dos Trabalhadores Rurais Sem Terra (MST)* emerged, not merely as a demand for land redistribution, but also as a source of alternative environmental practices and knowledge that integrated the struggle for material space with the struggle for cognitive narratives about what constituted “legitimate agricultural knowledge.” (Right Livelihood, 2025). This preliminary study confirms that MST schools and education programs function as strategic infrastructure, or what is known as *edu-politics*, to shape land management practices that differ from the hegemonic agribusiness model.

Political ecology literature has long examined how environmental knowledge is produced, contested, and mobilized in agrarian conflicts, for example in studies Meek et al. (2024) on land concentration, modern agricultural technology, and the relationship between knowledge and power, while studies Giovanni (2024) Critical education emphasizes the pedagogical function in building collective consciousness and the political capacity of the subaltern. However, these two lines of literature tend to run parallel. Studies from Henderson & Zarger (2017) state that *political ecology* often focuses on resource conflicts and economic-political structures, while educational studies focus more on learning processes and subject formation without always linking them to territorial dynamics and concrete land management. A clear analytical gap is the lack of studies that place the educational process at the center of the political-ecological struggle, namely, systematically examining how the

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curriculum, practical methods, and political rituals in movement schools contribute to the production of agroecological knowledge that can challenge the hegemony of agribusiness. In other words, a theoretical and empirical synthesis is needed that links knowledge, pedagogy, and territoriality analysis within a single framework.

Based on this gap, the objective of this research is to analyze the MST education project from the perspective of the Political Ecology of Education to understand how educational institutions of the movement, such as schools, field training, and teaching materials, function as machines for the production and territorialization of alternative environmental knowledge, linking agroecological practices, soil care ethics, and collective political orientation. The novelty of this research lies in shifting the focus from viewing education solely as a by-product of social mobilization to viewing it as a core political technology that reconstructs knowledge-power relations and produces material capacity for food sovereignty and sustainable land management.

This article argues that the MST education project can be understood as a form of *"epistemic territorialization,"* which is a planned and integrated process that simultaneously claims space, both materially (land ownership and maintenance) and cognitively (the development of a counter-hegemonic agroecological knowledge system). The success of this process, according to the main hypothesis, depends on three mutually reinforcing elements: (1) a critical curriculum that deconstructs the technocratic narrative of agribusiness; (2) a praxis pedagogy that produces and validates knowledge through collective work on the land; and (3) the formation of political-ecological subjects (Sem Terra / Guardiões da Terra) that link technical skills with a moral-political commitment to defending alternative socio-ecological models. A further hypothesis states that when these three elements are integrated, movement schools not only give birth to sustainable agricultural practices, but also strengthen collective political positions capable of demanding recognition of public policy and negotiation in the arena of government and international relations.

LITERATURE REVIEW

Critical political ecology provides the main foundation for understanding the relationship between environmental change, knowledge production, and power relations. This approach rejects the view that environmental degradation is merely a technical issue, and instead frames it as the result of unequal political-economic processes, including land ownership concentration, agribusiness market domination, and state intervention through agricultural development policies. In this context, narratives such as the Green Revolution are understood as ideological projects that legitimize extractive models in the name of productivity and modernization, while simultaneously dismissing local knowledge and farmers' agroecological practices. Critical political ecology thus highlights that environmental knowledge is not neutral, but rather is produced and legitimized through specific power structures that determine natural resource management practices and the direction of development (Holt-Giménez, 2009).

Continuing with Freirean critical pedagogy, which views education as a political practice for building critical consciousness (conscientização) and liberating oppressed groups from structures of domination. Freire asserts that education is always biased; it can reproduce inequality or become a means of social transformation. Through dialogue, reflection, and

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active engagement of learners, education enables individuals and communities to understand the connection between their life experiences and broader social, economic, and political structures. In the field of environmental education, this approach rejects an apolitical orientation that only emphasizes individual behavioral change and instead encourages a critical understanding of the relationship between society and nature as one shaped by ideology and power. Education, in this perspective, becomes a space for praxis that connects knowledge with collective action (Freire, 1970).

Antonio Gramsci's thoughts on hegemony broaden the understanding of education as a field of struggle for “common sense” in society. Gramsci explains that domination is not only maintained through the coercive apparatus of the state, but also through cultural consensus and the production of ideas that are accepted as common truths. Departing from this line of thinking, Osborne (2017) developed the concept of Public Political Ecology as an approach that emphasizes political ecology as a political, ethical, and educational project in the Anthropocene era. This approach views ideas and knowledge as material forces capable of transforming society when produced and disseminated through praxis communities involving academics, social movements, and the wider public. Within this framework, education functions not only as a space for critical analysis, but also as a means of engaged scholarship that connects knowledge, environmental ethics, and collective action to address the ecological crisis.

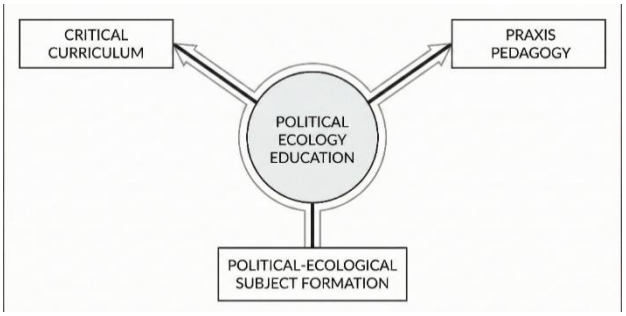


Figure 1. Three Dimensions of Political Ecology Education in Grassroots Movements
Source: Processed by Author (2026)

Based on Figure 1, a study from Meek (2015)operationalizes the Political Ecology of Education into three main dimensions of analysis. The first dimension is Critical Curriculum, which examines how MST teaching materials and educational discourse deconstruct hegemonic environmental narratives, such as the legitimacy of pesticides and monoculture, and relate them to power relations and structural inequality. The second dimension is Praxis Pedagogy, which highlights direct work-based learning in agroecological fields as a process of contextual and autonomous knowledge production, as also found in studies of food sovereignty education across the Americas. The third dimension is Political-Ecological Subject Formation, which is the process of forming the collective identities of Sem Terra and Guardião da Terra, linking technical skills with moral-political commitments to territorial protection and food sovereignty. A similar approach is also seen in the context of the Kichwa indigenous community in Ecuador, where education based on ancestral knowledge has

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become an arena for the struggle for power between the community and the state (Minoia et al., 2024). Thus, this framework enables the analysis of grassroots education movements as political practices that operate across local, national, and global scales.

METHODS

This study uses a secondary qualitative approach based on literature review and document analysis to understand education as a political-ecological arena in agrarian social movements. A qualitative approach was chosen because it allows researchers to interpret the meanings, narratives, and knowledge constructions produced by social actors in a particular context, rather than quantitatively measuring causal relationships. According to Creswell (2014), qualitative research focuses on exploring complex social phenomena through text and context analysis, making it relevant for examining how environmental knowledge, education, and power intertwine in grassroots movements such as the MST. The design is exploratory-conceptual and aims to build a theoretical understanding of the relationship between education, political ecology, and global environmental governance.

The data sources for this study consist of secondary data obtained from academic literature in the form of journal articles, scientific books, and book chapters discussing political ecology, critical pedagogy, and social movement education, as well as official documents and social movement publications such as curricula, educational materials, internal reports, and MST political statements. In addition, this study also utilizes policy reports and interview results that have been officially published in previous studies to enrich the empirical context. The use of this secondary data allows researchers to trace the dynamics of knowledge production and movement education within the framework of global-local relations, including its connection to issues of agrarian reform, agroecology, and cross-border sustainable development policies (Bowen, 2009).

Data analysis was conducted using Critical Content Analysis and Critical Discourse Analysis (CDA) approaches to examine texts, narratives, and educational documents of the movement in depth. These techniques were used to identify dominant themes, patterns of meaning, and counter-narratives that challenge the hegemonic discourse on development, agricultural modernization, and environmental sustainability. CDA specifically enables a critical reading of how language shapes power relations and the legitimacy of knowledge in the context of social movement education. This qualitative literature review approach is commonly used in the study of political science and environmental governance, particularly to analyze the role of non-state actors and transnational movements in shaping policy discourse and governance practices at the global and local levels (Fairclough, 2013).

RESULT AND DISCUSSION

Education in peasant movements such as the MST cannot be understood narrowly as the transfer of agronomic knowledge, but functions as an arena for political and epistemic articulation that challenges the dominance of technocratic knowledge about agriculture. The findings of Goris et al. (2021) in the focus on political ecology show that narratives of modern agrarian development tend to position technological innovations such as mechanical intensification, chemical inputs, and genetic improvement as the only route to productivity and food security. On the contrary, studies Vittori (2023) Regarding agroecology, the

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movement shows that community-based educational practices produce alternative epistemologies that emphasize ecological sustainability, social relations, and food sovereignty as a collective right, rather than merely a matter of market or productivity.

Furthermore, the findings of Naves & Fontoura (2022) shows that the educational process in MST has a dual function: on the one hand, it builds technical competence in agroecology, and on the other, it develops students' analytical capacity to understand the power relations that surround contemporary food systems. This pedagogical approach resonates with Freire's idea that education is an emancipatory praxis that combines critical reflection and transformational action. In the context of the peasant movement, education is not limited to producing technically “expert farmers,” but rather “political subjects” who are able to articulate agrarian and environmental claims into a broader structural struggle. Thus, education becomes an integral part of the movement's strategy in challenging agribusiness hegemony and renegotiating the relationship between land, production, and food politics.

In addition, the results of the study Rietveld et al. (2025) shows that movement education produces what can be called a form of epistemic territorialization, namely a process in which land, knowledge, and identity are combined in a collective project to maintain food autonomy and resist subordination to the capitalist agrarian system. This concept is in line with debates in political ecology regarding how environmental social movements produce ecological and cognitive spaces that are not only material but also symbolic. In the context of the MST, epistemic territorialization is manifested through a critical agrarian curriculum, field-based praxis pedagogy, and the construction of a collective “Sem Terra” identity as an ecological and political subject. Therefore, the following section of results and discussion will outline these dynamics in three main dimensions, namely critical curriculum, praxis pedagogy, and the formation of political-ecological subjects.

Critical Curriculum

The educational material at the MST agroecology institution demonstrates a systematic effort to challenge the agribusiness narrative that has long dominated the discourse on agricultural development. This approach is evident in the curriculum's emphasis on agroecology, seed sovereignty, and soil care as core principles that contrast with the orientation toward productivity based on chemical inputs and mechanization. These findings are consistent with studies Meek et al. (2024), which notes that agroecological education in peasant movements operates in “contested epistemic spaces,” where claims to legitimate knowledge about food production are constantly contested. Furthermore, Giraldo (2025) shows that agroecology as a practice and discourse is at the center of the conflict between agribusiness institutionalization and the social movement's transformation agenda, reinforcing the understanding that the MST curriculum acts as an instrument of epistemic resistance against agribusiness hegemony.

The MST curriculum includes not only technical agricultural skills, but also reflective content that links agricultural practices to the history of Brazilian agrarian politics. Training modules and publications place technical issues such as organic composting, intercropping, and agroforestry practices within a broader framework of land rights, ownership structures, and the role of the state in food regulation. The presence of content that connects agricultural knowledge and macro-level power structures indicates that the MST curriculum is not merely

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technical training, but a form of “agrarian pedagogy” that combines ecological learning with socio-political learning (Fiore et al., 2024). This indicates that agrarian education in peasant movements often operates as a tool for building collective capacity and political understanding of the global food system.

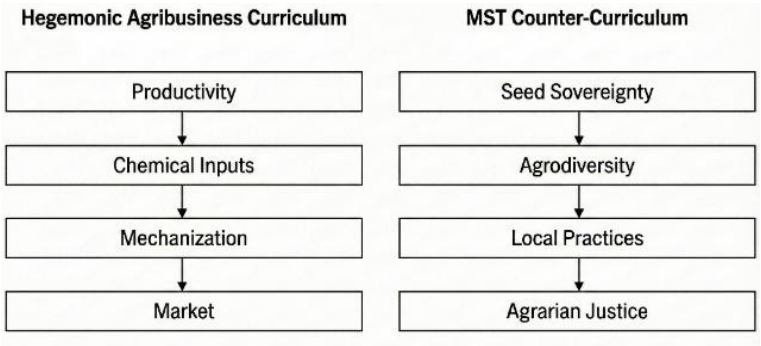


Figure 2. Agribusiness Curriculum vs Counter-Agroecology Curriculum
Source: Processed by Author (2026)

Figure 2 shows the epistemic opposition between mainstream agribusiness curricula and agroecology movement curricula, particularly in terms of objectives, instruments, and value foundations. Agribusiness curricula tend to emphasize productivity based on chemical inputs, mechanization, and market integration, which historically have been oriented toward commodity expansion and technocratic rationality. In contrast, the MST agroecology curriculum departs from seed sovereignty, agrodiversity, local knowledge practices, and the agenda of agrarian justice as the foundation for learning and food production. These differences show that the movement's educational curriculum not only proposes alternative technologies but also renegotiates the relationship between knowledge, the environment, and power, making education a contest between two agricultural models that aim to maintain different orders.

The MST curriculum also includes a process of epistemic revalorization of local knowledge and farmers' experiences as sources of scientific legitimacy, which are placed on an equal footing with academic knowledge. This revalorization takes the form of an emphasis on field practices, ecological observation, and intergenerational learning, as well as in the publication Cadernos de Agroecologia, which has reached at least 15 editions and serves as a medium for codifying agroecological knowledge produced by the MST community and movement networks. This kind of knowledge codification is important in political ecology because it transforms local experiences into an epistemology that can be consolidated, distributed, and maintained in the broader arena of epistemic conflict.

Furthermore, the MST curriculum serves as a counter-framing medium against agribusiness-style technocratic solutions that are often framed as neutral, scientific, and the only path to “food security.” From a political ecology perspective, the narrative of technological neutrality is part of the power infrastructure that organizes scientific legitimacy and the agricultural input market. (Holt-Giménez, 2022). By framing agroecology as an

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agenda for food justice rather than merely a production technique, the MST curriculum questions who has the right to be a producer of knowledge, and for whose benefit that knowledge is operated. Thus, agroecology education cannot be understood without including the dimensions of power and knowledge conflicts.

However, the literature also notes tensions that arise when the MST agroecology curriculum interacts with state institutions and international donors. In the context of massification, there is a risk that the curriculum will shift to become more technical and less political due to incentives for standardization, accreditation, and the need for administrative compatibility with the formal education system. This phenomenon has been noted by Giraldo (2024) as a form of "institutional co-optation pressures," which is when social movements must negotiate with institutional logic that removes political aspects for the sake of technical efficiency. Nevertheless, the available evidence shows that MST has so far maintained the core of its critical curriculum as an important component of the movement's strategy in fighting for food sovereignty and agrarian reform.

Practical Pedagogy

Educational practices in the agrarian movement place fieldwork at the center of knowledge formation, where the learning process takes place through variety trials, collective planting, observation of soil conditions, and mechanisms for exchanging experiences between farmers. This pedagogical format combines short theory sessions that serve as an introduction, while knowledge validation occurs in the field through a cycle of observation–experimentation–reflection, as mapped out in the evaluation of the Farmer Field Schools (FFS) model in the context of agroecology. (FAO TECA, 2022). The study by Mdiya et al. (2024) shows that field-based approaches improve farmers' analytical capacity regarding ecological changes and facilitate the adoption of sustainable practices.

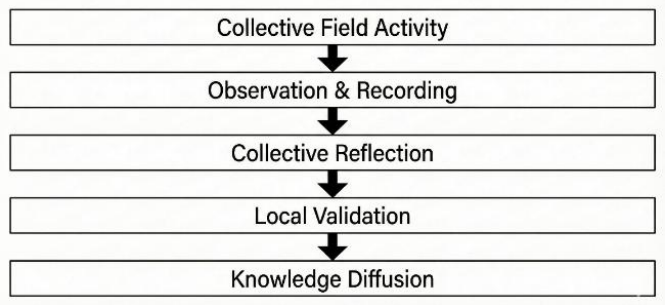


Figure 3. The Pedagogy of Praxis Process
Source: Processed by Author (2026)

Figure 3 illustrates the pedagogical flow of practice in movement-based agroecology education, where the learning process begins with collective field activities that generate empirical data through observation and monitoring. This data is then processed through group reflection to assess the relevance, effectiveness, and ecological context of specific practices. This stage allows knowledge to be validated at the local level based on experience, community preferences, and specific agroecosystem conditions, before finally

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being disseminated through adoption, seed exchange, collective practices, or technical documentation (diffusion & adoption). This flow shows that knowledge in praxis pedagogy does not move in a linear-technocratic manner, but through a socio-ecological cycle that emphasizes field experience, collective deliberation, and local applicability as the main validation criteria.

In addition to regular practice sessions, this field approach utilizes participatory methods such as Group-PVS (Participatory Varietal Selection) and participatory plant breeding, which enable participants to test varieties, evaluate agronomic performance, and determine superior varieties according to local preferences. Studies in Occelli et al. (2024)show that group-PVS strengthens community-based selection processes and accelerates variety diversification at the field level. This type of knowledge validation mechanism is also recommended in the World Bank report on Participatory Varietal Selection as an instrument that enhances information sovereignty and agroecological adaptation at the local level (Walker, 2006).

From a theoretical perspective, this praxis-based learning model can be interpreted through the Freirean lens: participants are not merely objects receiving knowledge, but become “subjects reading the world” who reflectively reconstruct their practices in the context of ecological change and power relations. Meek's (2024) analysis notes that agroecological education in social movements in Brazil serves as a medium for producing critical ecological literacy while building collective capacity in the struggle for food sovereignty. Meanwhile, Mann (2019) emphasizes that education for food sovereignty works through an ethical-political logic that is difficult to co-opt by technocratic narratives because its validation process relies on community experience and assessment.

Furthermore, empirical evidence shows that praxis pedagogy produces knowledge that is contextual, adaptive, and connected to the specific ecological experiences of the region, rather than simply a series of technical instructions that can be generalized. Several FFS evaluations and on-farm studies have noted increases in crop biodiversity, reductions in pesticide use, and the strengthening of collective decision-making mechanisms as outcomes related to the field learning process. Intergenerational knowledge transmission also plays an important role because field practices provide a space where historical experiences and agronomic techniques can be brought together and recontextualized in new conditions, a mechanism that rarely occurs in formal technocratic education (Bakker et al., 2021).

Thus, praxis pedagogy functions not only as a learning method, but also as an epistemic mechanism that strengthens the resilience of local knowledge against the logic of agribusiness modernization. Because its validity is validated through collective experience, plurality of varieties, and specific ecological conditions, this knowledge is more difficult to co-opt by technocratic projects that seek to standardize techniques and commodities. In the context of movements, this epistemic output has a significant political dimension: the production of field knowledge builds collective capacity while strengthening claims to land, seed, and ecological territory a relationship that has been identified in the global agroecology movement.

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The Formation of Political-Ecological Subjects

Movement education is not neutral but explicitly incorporates ethical-political dimensions that emphasize land rights, collective solidarity, and intergenerational responsibility, so that the agroecology curriculum serves a dual function as a medium for technical transfer and political moral formation. This finding is in line with Meek's (2024) analysis, which shows that MST education links food production practices with political projects of food sovereignty and territorial defense, thus making schools a space for articulating movement values. Vittori's (2023) study also shows that agroecological education in MST operates as ecopedagogy that combines technical and ethical-collective dimensions, resulting in a normative orientation towards the protection of living territories.

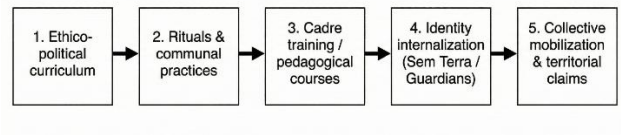


Figure 4.
Source: Processed by Author (2026)

Figure 4 illustrates how agroecological education in the movement facilitates the process of forming political-ecological subjects through a series of interrelated stages, beginning with an ethico-political curriculum that articulates collective values and principles of food sovereignty, followed by rituals and communal practices that strengthen social cohesion and internalization of values, and cadre training/pedagogical courses that function as institutional mechanisms for cadre development. These three elements contribute to identity internalization (Sem Terra/Guardians) in which participants develop political and ecological identities while linking them to technical expertise, ultimately culminating in collective mobilization and territorial claims as organized political action. This visual emphasizes that movement education not only produces technical skills but also shapes collective subjects capable of defending territories and formulating long-term agrarian agendas.

In addition to the curriculum module, subject formation takes place through community rituals, seasonal ceremonies, and annual pedagogical courses for cadres who internalize the values and orientation of the movement. In an official report on the massification of agroecology, the MST explains that education is not solely aimed at producing agroecology technicians, but multipliers of the movement who preserve the land and seeds as an integral part of collective identity (Engelmann, 2023). This statement is consistent with the documentation by Melito & Fernández (2025) which affirms that agroecology is understood as a political project and social identity in the international arena.

From a theoretical perspective, this process can be understood as a counter-hegemonic practice following Gramsci, in which movement education produces alternative common sense related to food, the environment, and collective welfare. Meek (2024) shows that learning in MST builds a new cognitive framework in which “sustainable agriculture” is positioned as a collective obligation rather than an individual consumption preference. A similar phenomenon is also reported by Mann (2019) in a study on food sovereignty education that produces ethical subjects with a political commitment to global food system change.

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The formation of the "Sem Terra / Guardians of the Land" identity also links agroecological technical expertise with long-term political commitments, such as to agrarian reform, seed sovereignty, and ecosystem protection, so that technical skills cannot be separated from normative orientations and collective strategies. This is evident in Vittori's (2023) work, which emphasizes that MST education produces "ethical-technical subjects" who are not only capable of producing food but also defending the territory from the logic of agribusiness.

Finally, the formation of a political-ecological subject has practical implications for the sustainability of the movement: a collective identity rooted in ethics and field experience functions as an internal reproduction mechanism that maintains organizational stability and continuity of the movement's agenda. This finding is in line with the discourse of agrarian movement studies, which shows that education is a political infrastructure that enables movements to maintain their long-term agenda even in the face of institutional pressure and external attempts at depoliticization (Melito & Fernández, 2025).

Integration of Dimensions and Implications of Transformation

The three dimensions outlined above critical curriculum, praxis pedagogy, and the formation of political-ecological subjects form a mutually reinforcing architecture of movement education. Critical curriculum provides the language and knowledge framework to challenge agribusiness and technocratic modernization narratives; praxis pedagogy provides an arena for empirical validation through field experience; and political-ecological subject formation ensures the continuity of commitment and collective capacity needed to sustain these practices at the community level. The integration of these three elements explains why education in the movement does not stop at technology transfer, but functions as a system for reproducing values, knowledge, and actions.

These findings are consistent with agrarian-political ecology literature that views agroecology as a field of conflict between two directions: structural transformation versus technocratic co-optation. Giraldo & Rosset (2018) have shown that agroecology can be reduced to "green techniques" that are compatible with the market or, conversely, become a means of resistance and reorganization of the food system. Using this framework, the results of this study show that the MST tends to be on the transformation pole, using education to assert food sovereignty, strengthen community production capacity, and maintain epistemic autonomy. In other words, education functions as an institutional filter that prevents co-optation through the continuity of praxis and collective identity.

The further consequences of this three-dimensional integration are at the level of policy and recognition. Movement education can be interpreted as an instrument for articulating political demands, especially on issues of agrarian reform, food sovereignty, and seed protection, which have emerged in national and international forums. Here, education is not merely a means of improving farmers' technical capacity, but part of a strategy to gain political legitimacy and policy recognition for alternative agrarian development models. This reinforces the initial hypothesis of the study that education plays an important role in expanding the agrarian movement's sphere of influence beyond the domain of food production to the domains of discourse and public policy.

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Beyond the Brazilian context, the concept of epistemic territorialization also offers important insights for agrarian governance and civil society initiatives in Indonesia and other developing countries. Recent debates on Indonesia's food system indicate that the pursuit of food security through technocratic and market-oriented approaches often generates tensions with food sovereignty, local participation, and ecological sustainability (Indriastuti et al., 2024). Similarly, legal-ecological assessments of the Food Estate program demonstrate that top-down agricultural policies may weaken local knowledge systems, marginalize indigenous communities, and intensify agrarian conflicts when community participation is limited (Wisnaeni & Najib, 2025). In this regard, the MST experience suggests that educational processes can function not merely as capacity-building mechanisms but also as political spaces through which communities produce ecological knowledge, strengthen collective organization, and negotiate more inclusive forms of environmental governance.

The Indonesian experience also illustrates that local ecological knowledge remains a crucial resource for strengthening sustainable agriculture under changing environmental conditions. Studies of farming communities show that adaptive agricultural practices are continuously developed through locally accumulated ecological knowledge, collective learning, and flexible decision-making rather than through technological intervention alone (Yusriadi et al., 2024). Likewise, recent research on Indonesian smallholder farmers highlights that the transition toward agroecological systems depends not only on technological innovation but also on farmers' perceptions, social learning, and community participation (Batas et al., 2025). Therefore, rather than treating the MST model as a blueprint to be directly replicated, its concept of epistemic territorialization provides a useful analytical framework for integrating agrarian reform, participatory education, and locally grounded knowledge into more democratic and sustainable food governance in Indonesia and other developing countries. Accordingly, the broader contribution of the MST experience lies not in exporting a Brazilian model of agrarian reform, but in demonstrating how education can operate as a political-ecological institution that reconnects knowledge, territory, and collective action within contemporary food governance.

CONCLUSION

This study shows that education in MST functions as a political-ecological arena that integrates critical curriculum, praxis pedagogy, and the formation of political-ecological subjects into a single project of epistemic territorialization. Education not only produces technical skills in agroecology, but also constructs a framework of knowledge and collective identity that challenges agribusiness hegemony in the cognitive, ecological, and political domains. These findings reinforce the argument that education in agrarian movements does not function as a complementary activity to social mobilization, but rather as a political technology that produces ecological-communitarian capacities while expanding the scope of action for organizations in contemporary agrarian conflicts.

Furthermore, the three-dimensional synthesis shows that when critical curricula, field praxis, and political-ecological subjects are integrated, movement schools have the potential to drive broader food system transformation, rather than merely adopting agroecological techniques. This implication is important for political ecology literature because it positions education as a mediating variable that is often overlooked in studies on resource conflicts,

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agrarian reform, and food sovereignty. At the same time, these findings open up space for further research to examine how movement education negotiates with state institutions and transnational actors in the process of agroecology massification, as well as how tensions between transformation and technocratic co-optation are managed at the levels of policy, discursive representation, and field practice.

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