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Educational Management of Tatanén di Balé Atikan to Foster Students' Environmental Care Character at Elementary Schools

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Abstract. Fostering environmental care character in elementary school requires structured educational management rather than incidental activity. This study describes how the Tatanén di Balé Atikan (TdBA) program, a Sundanese local-wisdom policy of the Purwakarta Regency Government in Indonesia, is managed through Terry's Planning, Organizing, Actuating, and Controlling (POAC) functions, and how participants interpret that management as shaping students' environmental care character. A qualitative multi-site case study was conducted at SDN 1 Sindangsari (rural) and SDN 2 Bojong Timur (semi-urban) from October 2025 to January 2026. Data were generated through 30 observation sessions; semi-structured interviews with 2 principals, 2 program coordinators, 6 classroom teachers, and 2 school supervisors; 4 focus group discussions with 20 students; and analysis of 68 program documents. The data were analyzed deductively against POAC with inductive sub-coding using the Miles, Huberman, and Saldaña model. Planning is embedded in school work plans and budgets; organizing operates through decreed task forces extended to student farmer groups; actuating follows the five Pancaniti stages and is modeled through kindness-based leadership; and controlling is the weakest function because evaluation evidence is documented unsystematically. Land availability explains most differences between the two sites. The first four Pancaniti stages are evidenced in group practice, whereas internalization (Niti Sajati) is indicated only for some students. Character outcomes are therefore reported as participant-perceived and observationally indicated rather than as measured gains.

Keywords: Ecopedagogy, Educational Management, Elementary School, Environmental Care Character, Local Wisdom, Tatanén di Balé Atikan.

1 Introduction

The contemporary environmental crisis is no longer a distant, abstract threat relegated to the warnings of scientists; rather, it is a tangible, rapidly accelerating reality affecting global ecosystems, economic stability, and fundamentally, human survival. In the urgent context of 21st-century education, fostering a deeply ingrained environmental care character among the younger generation has transitioned from being a supplementary educational option to a non-negotiable imperative [1], and early

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environmental education is increasingly recognized as formative for later environmental dispositions [2]. Elementary schools, acting as the foundational landscape for cognitive and moral development, serve as the primary arena for embedding these vital ecological values through both formal and informal learning processes. Character education regarding environmental care is decidedly not merely about transferring rote ecological knowledge—such as memorizing the stages of the water cycle or listing types of pollution. Instead, it involves the profound internalization of ethical values that consistently manifest in concrete, daily actions designed to responsibly preserve, meticulously maintain, and actively restore the surrounding environment [3].

In Purwakarta Regency, West Java, this global environmental urgency is translated into a highly localized, innovative educational policy known as Tatanén di Balé Atikan (TdBA). Literally translating to "farming in the place of education," TdBA is a comprehensive character education movement deeply rooted in Sundanese local wisdom. It emphasizes food sovereignty, optimal land utilization, and the holistic restoration of the school ecosystem. It operates on the philosophical premise that by reconnecting children directly with the soil—teaching them how to cultivate, nurture, and harvest life—they learn empathy, patience, and respect for the Earth, an assumption consistent with research on school gardening and nature-based learning [4]–[6].

Despite the existence of various environmental initiatives across national educational landscapes, empirical evidence often uncovers a disappointing reality: students' ecological awareness frequently remains relatively superficial. This disconnect is visually evidenced by persistent littering habits in schoolyards, unnecessarily high single-use plastic consumption in canteens, and a pervasive lack of psychological belonging or stewardship toward the school's natural physical surroundings, reflecting the well-documented gap between environmental knowledge and pro-environmental action [7]. Academic research by Suherman et al. explicitly suggests that authentic character formation requires a highly specific, empathetic leadership strategy. They advocate for "kindness-based leadership" to ensure that students feel emotionally safe and intimately connected to the moral values being taught, rather than simply complying out of fear of punitive measures [8].

In Purwakarta, while the TdBA program has been broadly implemented across the regency, its systematic management through the analytical lens of classical management theory—specifically George R. Terry’s POAC (Planning, Organizing, Actuating, and Controlling) framework—remains critically under-researched [9]. Currently, there exists a notable gap between the lofty, idealized visions of the regional policy and the actual, boots-on-the-ground managerial implementation inside the schools. It is this managerial fidelity that ultimately determines the long-term sustainability and authentic impact of the ecological program [10].

The strategic integration of local wisdom into formal educational management is widely recognized as a hallmark of transformative education. Sulastri et al. compellingly argue that strategic planning in modern educational institutions must consciously adopt deep learning-based pedagogical models to successfully align localized cultural values with demanded global competencies [11]. The TdBA program perfectly represents this intersection. Within TdBA, agricultural practices are not

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viewed merely as low-level vocational skills aimed at producing future laborers; rather, they are positioned as an interactive, living medium for cultivating high-order thinking skills, complex problem-solving, and profound moral development. By intelligently utilizing educational technology and modern environmental methods, schools can successfully cultivate a curriculum that is both technologically savvy and deeply ecologically grounded [12]. Furthermore, as highlighted by Anwar et al., the integration of profound spiritual values—specifically the Islamic concept of Tauhid (the oneness of God)—into ecopedagogy provides a robust metaphysical foundation. This encourages students to respect nature not just as a resource, but as a sacred divine creation entrusted to human stewardship [13].

Effective and holistic management in schools also inherently involves preventing negative social behaviors. Phenomena like bullying, which deeply fracture the student community, can be effectively mitigated through the establishment of a positive, inclusive school culture. Collaborative environmental programs such as TdBA require students to work toward a common goal, which may reduce interpersonal friction and foster social cohesion. The pervasive crisis in modern education frequently stems from a severe psychological disconnection between students and their ancestral cultural-ecological roots. Thus, reconstructing school pedagogy based on local wisdom and Adab (proper ethical conduct) is absolutely essential for restoring a sense of educational balance and holistic human development [14]. This specific brand of transformative education heavily emphasizes vital 21st-century skills—namely critical thinking, creative innovation, and collaborative teamwork—achieved directly through hands-on, physically engaging environmental projects, in line with evidence on regular outdoor education [15].

School principals undeniably play a highly strategic role in navigating this institutional transformation. Through effective managerial leadership, principals maintain the sustainability of student enrollment, secure community trust, and ensure the quality of the implemented programs [16], [17]. Furthermore, transforming student management practices to increase active participation in non-academic, character-building activities requires resilient and adaptive organizational strategies.

The distinct novelty of this study lies in its rigorous analysis of TdBA management strictly through George R. Terry's POAC framework, contextualized specifically within the unique environments of rural and semi-urban primary schools in Purwakarta. Unlike previous educational studies that tend to focus purely on psychological behaviorism or curriculum mapping [18], [19], this research theoretically positions TdBA as a highly complex, comprehensive managerial process. It asserts that producing environmentally conscious students requires high organizational resilience to face global challenges in the digital era [16]. By meticulously examining the daily management practices at SDN 1 Sindangsari and SDN 2 Bojong Timur, this research aims to provide a replicable, empirically backed blueprint for how traditional local wisdom can be systematically managed to produce an environmentally conscious, highly capable future generation. Ultimately, the study seeks to deeply analyze how the functions of planning, organizing, actuating, and controlling are executed to guarantee that "environmental care" transcends being a mere painted slogan on a school wall, becoming instead a deeply lived, internalized character trait among students.

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The conceptual framework of the study is summarized in Fig. 1: the four POAC functions structure the program, the Pancaniti sequence organizes the actuating function, and the evidence on students is read through the three components of character.

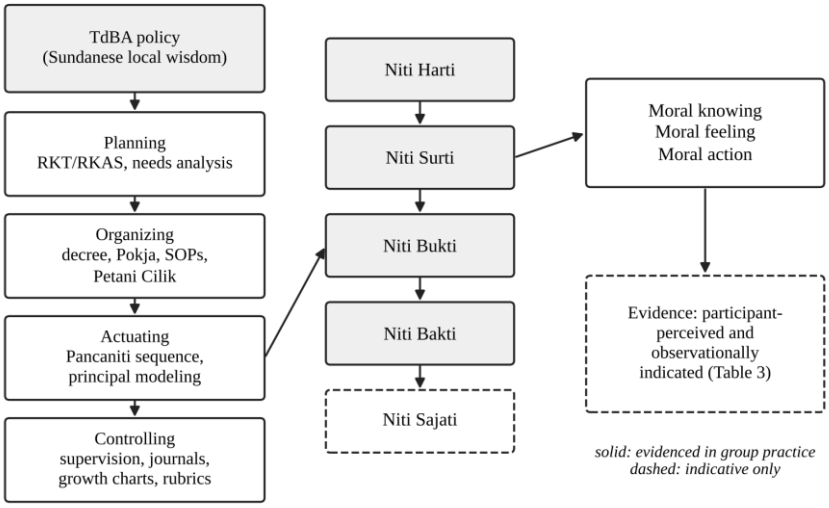


Fig. 1. Conceptual framework: POAC functions, the Pancaniti sequence within actuating, and the evidence base for students' environmental care character.

2 Methods

2.1 Research Design

This study rigorously employs a qualitative research approach utilizing a multi-site case study design. This specific methodological framework was intentionally selected to provide a highly nuanced, in-depth understanding of the complex management dynamics of the Tatanén di Balé Atikan (TdBA) program as it occurs in its natural, undisturbed setting. Qualitative inquiry empowers the researchers to accurately capture the subtle nuances of principal leadership styles, the authentic emotional participation of teachers, and the gradual, organic behavioral changes in students—elements that rigid quantitative metrics and standardized surveys might easily overlook or misinterpret [20]. The multi-site case study approach is universally recognized as particularly suited for investigating the "how" and "why" behind the application of specific management functions across varying educational contexts.

Because the study asks how four predefined management functions are enacted, the design is deductively oriented: the POAC framework [9] supplied the a priori analytical

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categories, while the qualitative design retained the capacity to register practices that those categories do not anticipate. The unit of analysis is therefore the managerial practice of the school, not the developmental trajectory of individual students.

2.2 Research Sites, Sampling Rationale and Treatment of Positive-Case Bias

The research was systematically conducted at two distinct primary educational locations: SDN 1 Sindangsari and SDN 2 Bojong Timur, both situated within the Purwakarta Regency. These specific schools were strategically selected via criterion-based sampling because they are widely recognized by the local educational authority as successful pioneers in implementing TdBA. Crucially, they possess distinct geographical and socio-demographic characteristics that uniquely influence their environmental management strategies—SDN 1 Sindangsari represents a more agrarian, rural setting with abundant land, while SDN 2 Bojong Timur represents a semi-urban environment requiring highly creative spatial optimization.

The authors acknowledge that selecting two schools recognized as successful pioneers introduces positive-case selection bias. The selection is deliberate and theory-driven rather than representative: the research question concerns how the managerial functions are operated where the program is reported to work, which is an exemplary-case logic, and the study therefore makes no claim about which practices separate effective from ineffective TdBA management. To limit confirmation bias within that design, five procedures were applied. First, each site was searched deliberately for disconfirming evidence through negative-case analysis, and the weaknesses identified, namely the evaluation documentation gap and the uneven pedagogical comprehension of teachers, are reported in the findings rather than set aside. Second, technique triangulation systematically compared what participants asserted with what was observed in the gardens and recorded in documents. Third, the two school supervisors interviewed also oversee non-pioneer schools in the same sub-districts and were asked explicitly to contrast the managerial practice of the two sites with that of schools where TdBA has stalled, which supplied an external reference point without adding a third case. Fourth, the authors recorded a reflexive memo before entering the field to bracket the expectation that pioneer schools would perform well. Fifth, member checking invited participants to challenge the draft interpretation rather than merely confirm it.

Including a school with weaker implementation would provide a stronger basis for identifying the managerial practices that distinguish effective from ineffective TdBA management. Such a contrast, however, requires an explanatory multiple-case design with deliberate variation on the outcome, which exceeds the descriptive aim of this study; it is stated as a limitation and formulated as the principal recommendation for further research.

2.3 Participants and Their Contribution to the Data Set

Participants were selected purposively on the criterion of direct involvement in the TdBA management cycle. Table 1 states, for every participant group, the exact number of participants per school, the technique through which their data were generated, and

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the analytical focus to which their data were applied. In total 32 participants took part, 16 at each school.

Table 1. Participants, data collection techniques, and analytical focus (n = 32)

Participant group	Code	n per school (SDN 1 / SDN 2)	Data collection technique	Analytical focus
School principal	P1–P2	1 / 1	Semi-structured interview, twice each (60–75 min); document walk-through of RKT and RKAS	Planning, budgeting, delegation, academic supervision, leadership practice
TdBA program coordinator	K1–K2	1 / 1	Semi-structured interview, twice each (60 min); observation of coordination meetings	Organizing, task division, SOP formulation, monitoring routines
Classroom teacher	G1–G6	3 / 3	Semi-structured interview, once each (45–60 min); observation of lessons and garden sessions	Curriculum integration, actuating, student assessment practice
School supervisor (pengawas sekolah)	S1–S2	1 / 1	Semi-structured interview, once each (45 min)	External supervision, policy fidelity, contrast with non-pioneer schools
Students, grades IV–V	A1–A20	10 / 10	4 focus group discussions, 5 students per group (25–30 min); non-participant behavioral observation; analysis of reflective journals	Experience of the Pancaniti stages, stated reasons for caring behavior, indicators of internalization

Student data were generated in group format rather than through individual interviews, in open school spaces and in the presence of the class teacher, for child-protection reasons set out in subsection 2.9. Student focus group transcripts and reflective journals were coded with the same framework applied to adult interviews, but were used to evidence the manifestation of character indicators and the students' own reasoning, not to score or rank individual children. School supervisors were included specifically to provide an external managerial perspective and a point of contrast with schools outside the sample.

2.4 Data Collection Procedures and Coverage of the Cultivation Cycle

Fieldwork ran for four months, from October 2025 to January 2026, and comprised 30 observation sessions, 15 at each school, each lasting 90 to 120 minutes and scheduled to coincide with the TdBA timetable so that no additional activity was created for the

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research. Observation was recorded in field notes structured by the four management functions, with a separate column for unanticipated events. Interviews were audio-recorded with consent and transcribed verbatim; focus group discussions with students were recorded in written notes by two researchers independently, without audio or video recording of children.

The activities and crops followed at each site differed with land availability, and are specified in Table 2 so that the coverage of the agricultural cycle can be assessed. The four-month window covers one complete cultivation cycle of short-duration leafy crops, including two successive harvests, together with the vegetative and early generative phase of longer-duration fruiting crops. It does not cover the fruiting and senescence phases of those crops, nor the dry-season planting pattern, since the period falls within the west-monsoon rainy season. Findings concerning the managerial handling of seasonal variation therefore rest on participant accounts of previous cycles and on program documents, not on direct observation.

Table 2. Crops, activities, and cycle coverage observed at each site, October 2025–January 2026

Aspect	SDN 1 Sindangsari (rural, open land)	SDN 2 Bojong Timur (semi-urban, constrained land)
Cultivation medium	Open ground beds, communal compost pit	Polybags, verticulture racks, NFT hydroponic rack, bucket composter
Crops followed	Kangkung (water spinach), bayam (spinach), caisim (mustard greens), cabai rawit (bird's eye chili)	Kangkung, sawi (mustard greens), selada (lettuce, hydroponic), tomat (tomato)
Activities observed	Land clearing and bed preparation; soil amendment with organic matter; direct sowing and transplanting; watering rosters; weeding; botanical pesticide application; composting; harvesting; harvest sharing	Growing-medium preparation and polybag filling; sowing and transplanting; nutrient mixing and monitoring for the hydroponic rack; watering rosters; pruning and staking; composting of canteen organic waste; harvesting; harvest sharing
Cycle coverage attained	Two complete cycles of leafy crops (30–40 days each) observed from soil preparation to harvest; chili observed to the early generative phase only	Two complete cycles of leafy crops (28–35 days each) and one hydroponic lettuce cycle observed end to end; tomato observed to the early generative phase only
Not covered by the observation window	Fruiting and senescence of chili; dry-season planting pattern; crop failure and replanting events	Fruiting and senescence of tomato; dry-season planting pattern; hydroponic system breakdown events

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2.5 Operational Definition of Students' Environmental Care Character

The study did not administer a validated environmental-attitude scale, a pre-test and post-test, or an individual student assessment protocol. Environmental care character is therefore defined and evidenced qualitatively. Following Lickona's three components of character, namely moral knowing, moral feeling and moral action [3], environmental care character is operationally defined in this study as the observable and articulable disposition of a student to understand why the living environment requires care, to express concern for it, and to act to maintain it in circumstances where the action is not being enforced by an adult. Table 3 presents the six indicators derived from that definition, the evidence source for each, and the strength of evidence the data set actually supports.

Table 3. Operational indicators of students' environmental care character and their evidence base

Character dimension	Operational indicator	Evidence source	Strength of evidence obtained
Moral knowing	Student states a correct reason for a cultivation or waste practice, such as why organic matter is composted rather than burned, or why botanical rather than chemical pesticide is used	Student focus groups; reflective journals; teacher assessment records	Direct and convergent across both sites
Moral feeling	Student uses empathic language about plants, soil or animals unprompted, and notices a plant needing care before being instructed	Student focus groups; reflective journals; field notes from Niti Surti sessions	Direct and convergent across both sites
Moral action: initiative	Student waters, weeds or tends plants without instruction, including outside the scheduled TdBA session	Behavioral observation rubric completed by teachers; researcher field notes	Direct, recorded for the group; not quantified per individual
Moral action: waste behavior	Student separates organic from inorganic waste, does not litter in the schoolyard, and reduces food waste in the canteen	Researcher field notes including canteen and schoolyard observation; teacher rubric	Direct, with variation between classes
Moral action: service orientation	Student takes part in harvest sharing with family or community and states a service-oriented reason for doing so	Activity documentation and photographs; student focus groups; teacher reports	Direct for participation; stated reasoning varied in depth

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Character dimension	Operational indicator	Evidence source	Strength of evidence obtained
Consistency across settings	Caring behavior is sustained when no teacher is present and is reported to occur at home	Unobtrusive observation; parent accounts relayed through the school committee; teacher rubric	Indicative only; see subsection 2.10

This operationalization makes the limits of the claim explicit. The indicators evidence whether environmental care character is manifested and articulated by students participating in TdBA; they do not establish a measured increase relative to a baseline or to a comparison group. Throughout the Results and Discussion, statements about students' character are therefore formulated as participant-perceived and observationally indicated, and the enthusiastic participation of students in agricultural activity is reported separately from, and is not treated as evidence of, internalized environmental responsibility.

2.6 Documents and Program Instruments Analysed

Sixty-eight documents were collected and analyzed through document content analysis: the Annual Work Plan (RKT) and the School Activity and Budget Plan (RKAS) of each school (4); the principals' formal decrees establishing the TdBA task force (2); written standard operating procedures for field activities (6); teacher lesson plans integrating TdBA into thematic subjects (12); student reflective journals, sampled at one per participating student (20); plant growth measurement charts maintained by student groups (8); behavioral observation rubrics completed by teachers, one set per participating class (8); principals' academic supervision instruments and supervision notes (4); program activity reports with photographic documentation (2 sets); and the Purwakarta Regency policy documents governing TdBA (2). Each document was logged, coded with the same framework as the interview material, and used to corroborate or challenge interview claims.

The evaluation instruments named in the controlling phase are school-made rather than research instruments. The behavioral observation rubric used at both sites contains four indicators scored on a four-point scale: initiative in watering and tending without instruction; care in handling tools and plants; waste separation and refraining from littering; and cooperation, including willingness to share tasks and harvest. The reflective journal is a weekly free-writing prompt about the student's plant and feelings toward it. The plant growth chart records height and leaf count at fixed intervals. The content of these instruments was reviewed by the TdBA coordinator at each school, but none has undergone psychometric validation, inter-rater reliability testing or item analysis. They are consequently treated in this study in two distinct ways: primarily as managerial artifacts that evidence how the controlling function is enacted and documented, and only secondarily, and always in triangulation with researcher

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observation, as a source of evidence about student behavior. No finding in this article rests on rubric scores alone.

2.7 Data Analysis and Coding Framework

Analysis followed the interactive model of Miles, Huberman and Saldaña [21] through data condensation, data display and conclusion drawing with verification. Coding proceeded in two movements. The first was deductive: the four POAC functions [9] were established as a priori categories, and a start list of codes derived from the management literature was applied to transcripts, field notes and documents. The second was inductive: material that did not fit the start list was open-coded, and the resulting codes were clustered into sub-themes, which were then either located within a POAC function or retained as cross-cutting themes. Coding was performed independently by both authors on a common subset of four transcripts; discrepancies were resolved by discussion until a shared code definition was agreed, after which the remaining material was divided between them. Table 4 presents the resulting framework, distinguishing the codes applied deductively from the sub-themes that emerged inductively.

Table 4. Coding framework: deductive POAC categories and inductively emerging sub-themes

POAC category (deductive)	Codes applied deductively	Sub-themes emerging inductively	Principal data sources
Planning	Environmental and institutional analysis; RKT and RKAS integration; needs analysis of crops; curriculum mapping; resource allocation	Land-contingent planning logic, where abundant land produces curriculum-wide integration and constrained land produces intensification; budget embedding used deliberately as a sustainability device rather than as administration	Principal and coordinator interviews; RKT; RKAS; lesson plans
Organizing	Issuance of formal decree; task-force (Pokja) formation; technical and pedagogical division of labor; SOP formulation; external networking	Student micro-organizing through Petani Cilik groups treated as a character-formation device rather than labor allocation; deliberate shift of program dependence from individual teacher enthusiasm to institutional routine	Coordinator and teacher interviews; decrees; SOPs; observation of task allocation

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POAC category (deductive)	Codes applied deductively	Sub-themes emerging inductively	Principal data sources
Actuating	Pancaniti sequencing; principal role modeling; integration into thematic lessons; routine duty rosters	Kindness-based leadership read by participants as flattening hierarchy and lowering the cost of error; embodied learning, expressed as hands getting dirty, reported as the affective trigger for empathy	Observation; teacher, student and supervisor data; lesson documentation
Controlling	Academic supervision; monitoring visits; reflective journals; growth charts; behavioral rubrics; corrective action	Asymmetry between planning rigour and evaluation record-keeping; weak feedback loop from evaluation data into the following planning cycle; reliance on the principal's personal attention rather than on a system	Supervision instruments and notes; journals; charts; rubrics; supervisor interviews
Cross-cutting themes (retained outside POAC)	Not applicable	Uneven pedagogical comprehension among teachers; the curriculum-integration workload; contingency handling for pests and weather; parental and community expectations of the harvest	All sources

The transformation of raw material into a finding proceeded through four steps, from excerpt to open code, to sub-category, to POAC finding. For example, statements about the issuance of the formal decree and the written division of technical and pedagogical duties were coded as role formalization, clustered with codes on SOPs and on replacement arrangements during staff absence into the sub-category institutional routinization, and reported under Organizing as the finding that program continuity has been decoupled from individual teacher enthusiasm.

The overall procedure, from data generation through coding to verification, is summarized in Fig. 2.

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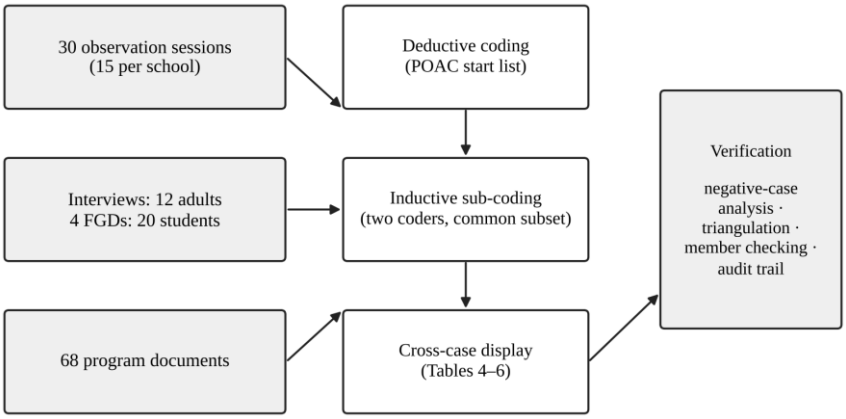


Fig. 2. Research procedure: data sources, two-stage coding, cross-case display, and verification.

2.8 Trustworthiness

Credibility was pursued through prolonged engagement across four months, source triangulation across principals, coordinators, teachers, supervisors, students and documents, technique triangulation between interview, observation and documentation, and member checking in which the ten adult participants reviewed the draft findings and were invited to contest the interpretation. Transferability is supported by thick description of each site's context, reported in Table 2 and in subsection 3.4, which allows readers to judge the fit to their own setting; the study does not claim statistical generalization. Dependability rests on an audit trail comprising field notes, transcripts, the coding framework with code definitions, the document log and analytic memos, retained by the authors, together with peer debriefing by one qualitative researcher external to the study. Confirmability was addressed through the reflexive memo described in subsection 2.2, in which the authors recorded their prior positive expectations of the two pioneer schools and revisited them at each analytic stage [20], following the trustworthiness criteria of Lincoln and Guba [22].

2.9 Research Ethics and Protection of Minors

Because the study involves elementary-school children, participant observation and potentially identifiable behavioral data, the following procedures were followed. Institutional permission was obtained in sequence: a research recommendation letter from the postgraduate program of Universitas Islam Nusantara, a research permit from the Education Office of Purwakarta Regency, and written approval from the principal of each school. Non-clinical educational research of this kind is not subject to mandatory national ethics-committee review in this setting, so the study was conducted

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under institutional permission and professional guidelines for research with children. The two schools are named in this article with the written consent of both principals and of the Education Office; no individual participant is identifiable.

Adult participants gave written informed consent after being briefed on the purpose, procedures, audio recording, intended publication and their right to withdraw at any point without consequence; no incentive was offered. For students, written consent was obtained from each child's parent or guardian through the class teacher before any student data were collected, and no data were generated from a child whose parent had not consented. Age-appropriate verbal assent was then sought from each child individually, restated at the beginning of every focus group discussion, and children were told in plain language that they could decline to answer or leave at any time; two children who chose not to take part were excluded without any consequence and are not counted in Table 1.

Confidentiality was protected as follows. All participants are referred to by code, as shown in Table 1, and no participant name appears in any research record beyond a single consent register held separately from the data. Student reflective journals were read on school premises with the class teacher present and returned the same day; no journal was removed from the school and no verbatim journal text that could identify a child is reproduced. No video recording and no photograph showing a child's face was made for research purposes, and the program photographs analyzed as documents were used for analysis only and are not published here. Observation took place exclusively during regularly scheduled TdBA activities in open, visible school spaces; no researcher was ever alone with an individual child, and all student interaction occurred in group settings with a teacher present. No health, family or other sensitive personal data were collected. Data are stored in password-protected files accessible only to the two authors and will be destroyed once the retention period required for publication has elapsed.

2.10 Methodological Limitations Acknowledged in Advance

Four limitations follow directly from the design and are stated here so that the findings are read within them. The purposive selection of two positively regarded sites restricts the study to describing how management functions operate where the program works, and not to identifying what distinguishes effective from ineffective management. The absence of a validated instrument and of a pre-test and post-test design means that no measured change in students' environmental attitudes or behavior is claimed. The four-month window covers one cultivation cycle of short-duration crops within a single season. Finally, the school-made evaluation instruments analyzed have not been psychometrically validated. These limitations are revisited, with their consequences for the findings, in subsection 4.1.

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3 Results

3.1 Planning: Integrating Deep Learning and Ecological Values

The initial phase of management, Planning, at both SDN 1 Sindangsari and SDN 2 Bojong Timur is decidedly not treated as a mere bureaucratic or administrative formality. Instead, it is treated as a highly strategic, deeply analytical process perfectly aligned with both mandatory regional policies and the unique, overarching vision of each school. The planning cycle proactively begins well before the academic year starts, involving a thorough, systematic environmental and institutional analysis. School leaders assess the exact square meterage of available arable land, evaluate the specific pedagogical competencies and agricultural knowledge of their teaching staff, and analyze the socio-economic backgrounds of their incoming students.

Crucially, both educational institutions have successfully and formally integrated the TdBA program directly into their most vital governance documents: the Annual Work Plans (RKT) and the School Activity and Budget Plans (RKAS). By explicitly embedding TdBA into the RKAS, the principals ensure that this character education initiative is financially supported with state funds, allowing for the purchasing of necessary agricultural tools, organic seeds, and composting materials. This structural and financial integration supports the program's continuity. This highly systematic approach perfectly aligns with the advanced concept of deep learning-based planning, which prioritizes the seamless alignment of institutional school goals with the specific cognitive and emotional development stages of the students [23].

In practical implementation, the planning contexts differ according to geography. SDN 1 Sindangsari, leveraging its rural setting and abundant physical space, heavily emphasizes the broad integration of TdBA across the entire thematic curriculum. Their planning involves mapping out large-scale crop rotations that mirror the changing local seasons. Conversely, SDN 2 Bojong Timur, operating in a semi-urban environment with restricted soil availability, focuses its planning on vertical farming, hydroponics, and intense student ownership of individual, containerized crops.

This robust planning phase explicitly includes a comprehensive "Needs Analysis" conducted collaboratively by the teachers. They determine exactly what types of resilient plants are biologically suitable for the local soil composition and, more importantly, how the life cycle of these specific plants can be utilized as a dynamic learning medium for core academic subjects. For example, planning how the growth rate of spinach can be used for data plotting in Mathematics, or how the composting process can illustrate chemical changes in Natural Sciences. By meticulously planning agricultural activities as a core, non-negotiable part of the daily curriculum, the schools ensure that environmental care is permanently elevated from an optional extracurricular "add-on" to a fundamental, inescapable part of the student's holistic learning experience. This sophisticated stage represents the teleological value of modern education, where absolutely every planned managerial action is purposefully directed toward the ultimate, overarching goal of ethical character formation.

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3.2 Organizing: Building Organizational Resilience through Role Clarity

Once the strategic blueprints are finalized, the management transitions into the Organizing phase. Organizing TdBA involves the deliberate creation of highly specialized task forces—locally referred to as Kelompok Kerja or Pokja—embedded directly within the formal school organizational structure. The school principal acts as the supreme director, officially delegating operational authority through a Formal Decree (Surat Keputusan) to a dedicated TdBA Program Coordinator. This coordinator then systematically oversees the division of labor among the classroom teachers, school guards, and supporting administrative staff.

At SDN 1 Sindangsari, the organization is intelligently bifurcated into two distinct but collaborative wings: technical functions (which oversee heavy land management, irrigation systems, and procurement of raw materials) and pedagogical functions (which ensure that lesson plans seamlessly integrate the garden activities, and handle student assessments). This absolute clarity of roles prevents operational overlap, eliminates confusion, and ensures that every single adult member of the school ecosystem knows their exact contribution to the overarching ecological mission. This highly structured organizational matrix is a prime example of organizational resilience; it allows the school institution to maintain strict program consistency and momentum despite the inevitable changes in staff personnel, budget fluctuations, or unpredictable weather patterns [24].

Furthermore, this organizing phase extends deeply into the student body itself. The students are not merely treated as passive laborers; they are organized into micro-management teams known as "Student Farmer" (Petani Cilik) groups. Each group elects a leader, a tool manager, and a daily monitor. Teachers described this arrangement as a way of developing leadership, peer communication, and collective responsibility.

To maintain order and safety, the schools establish rigid, written Standard Operating Procedures (SOPs) for all daily field activities. There are clear SOPs for how to properly handle gardening tools, the exact measurements for watering specific beds, the safety protocols for turning the compost pile, and the hygienic procedures for harvesting edible crops. This intense formalization ensures that the success of the program does not solely rely on the fleeting, individual enthusiasm of a single passionate teacher, but rather becomes an institutionalized, enduring school culture. Additionally, the organizing phase deliberately includes external community networks. The proactive involvement of the school committee (parents) and the invitation of local, professional farming experts as guest lecturers further strengthens the school's organizational web, providing the institution with the vital external expertise and communal support needed to sustain a highly productive, educational agricultural environment.

3.3 Actuating and Controlling: Kindness-Based Leadership and Monitoring

The Actuating (implementing) phase is where the planned values are put into practice. In the context of TdBA, actuating is uniquely and profoundly achieved through the implementation of the traditional Sundanese philosophical stages known as the "Pancaniti" (The Five Steps of Knowing):

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Niti Harti (Understanding): Teachers begin by providing the cognitive foundation. Students learn the biological facts about seeds, the science of photosynthesis, and the ecological danger of chemical pesticides.

Niti Surti (Empathy/Awareness): This is the emotional bridge. Students are guided to feel empathy for the environment. They learn to listen to nature, understanding that dry, cracked soil "feels thirst" and requires care.

Niti Bukti (Evidence/Practice): Here, action takes place. Students physically dig the soil, plant the seeds, and create the organic compost. Their hands get dirty. The theory becomes tangible evidence.

Niti Bakti (Devotion/Service): The students harvest the crops not for selfish consumption, but to share. They bring vegetables home to their families or cook them together at school to share with the less fortunate, learning that nature's bounty is meant for communal service.

Niti Sajati (True Wisdom): The intended endpoint, at which environmental care character is internalized, so that a student refrains from littering or wasting food because of ecological respect rather than adult supervision; as Table 5 shows, this stage is treated as a normative horizon rather than an observed outcome.

An empirical criterion is needed to show what places a student at one Pancaniti stage rather than another. Since the unit of analysis is managerial practice, the stages were not used to assess or classify individual children. They were treated as the sequence through which teachers organize the actuating function, and the study asked what evidence existed that the sequence was in fact being realized in student conduct and reasoning at group level. Table 5 states the criterion applied to each stage, the evidence source, and, crucially, how far the data support it.

Table 5. Criteria applied to each Pancaniti stage and the strength of evidence obtained

Pancaniti stage	Criterion applied in this study	Evidence source	Evidential status
Niti Harti (understanding)	Students in a focus group can state a correct causal reason for a cultivation practice, unprompted by the moderator	Student focus groups; reflective journals; teacher assessment records	Supported at both sites
Niti Surti (empathy and awareness)	Students use empathic or caring language about plants, soil or water without being cued, and identify a plant needing attention before an adult points it out	Field notes from garden sessions; student focus groups; journals	Supported at both sites
Niti Bukti (evidence and practice)	Students complete the physical cycle of soil preparation, sowing, watering and composting at least twice, as recorded on group duty rosters and in growth charts	Duty rosters; growth charts; researcher observation	Supported at both sites

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Pancaniti stage	Criterion applied in this study	Evidence source	Evidential status
Niti Bakti (devotion and service)	Students take part in harvest sharing with family, communal cooking or distribution, and state a service-oriented reason for doing so	Activity documentation; student focus groups; teacher reports	Participation supported at both sites; stated reasoning uneven in depth
Niti Sajati (authentic internalization)	Caring behavior is sustained with no adult present and transfers beyond the garden to waste behavior in the schoolyard and canteen and to practice reported at home	Unobtrusive observation; parent accounts relayed through the school committee; teacher rubric	Indicative only, recorded for some students and not established as stable

The distinction in the final column matters for the claim this article makes. Within the four-month window the data support the realization of the first four stages as observable group-level practice. The fifth stage, Niti Sajati, is not claimed as an attained outcome. Evidence of caring behavior sustained in the absence of adult supervision was recorded for a subset of students on a subset of occasions, and character internalization of this kind cannot be established over a single cultivation cycle. Niti Sajati is therefore reported in this article as the normative horizon that orients the program's actuating design and toward which early indications were observed, not as a verified developmental endpoint. Determining stage attainment for individual children would require longitudinal individual-level assessment, which this design deliberately did not undertake for the ethical reasons set out in subsection 2.9.

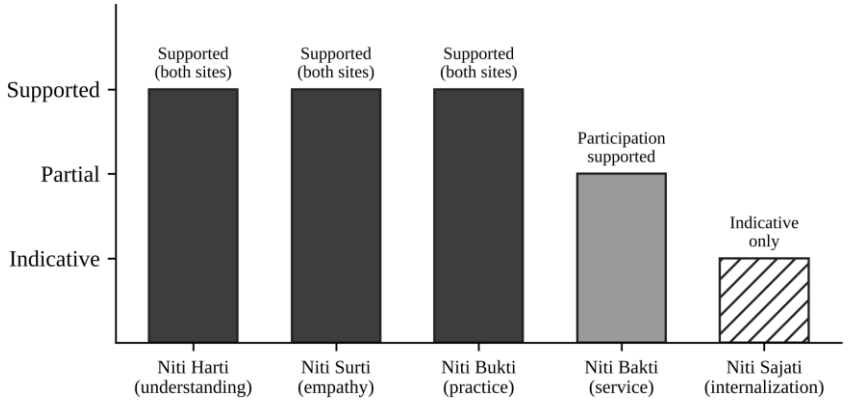


Fig. 3. Evidential status of the five Pancaniti stages within the four-month observation window (from Table 5).

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This complex psychological actuation is heavily dependent on the principal's leadership style. At both research sites, participants consistently identified the deliberate implementation of a kindness-based leadership strategy as the single most influential managerial practice. The account that follows is an interpretation of converging participant perceptions and observational records and is not a demonstration of measured effectiveness, since the design includes no comparison condition against which an effect could be estimated. Three strands of evidence converge. First, observation: in 11 of the 15 sessions at SDN 1 Sindangsari and 9 of the 15 at SDN 2 Bojong Timur, the principal was physically present in the garden during student planting or watering and worked alongside pupils rather than supervising from a distance. Second, interviews: all ten adult participants. linked that presence to teachers' and students' willingness to participate. Third, student focus groups, in which the same practice was described in affective terms. Read together, these strands indicate that the principal's embodied participation reduced hierarchical distance and lowered the perceived cost of making mistakes in front of adults, a condition that participants themselves articulated in terms close to psychological safety, and that the shared physical labor was interpreted as a marker of equality and common mission. Stated with the caution the data permit, kindness-based leadership is a participant-perceived and observationally consistent contribution to the actuating function rather than an outcome whose effectiveness has been demonstrated [8]. The supervisors interviewed offered partial external corroboration, contrasting this pattern with schools in which the program is delegated downward and the principal remains administratively distant. In character education, this form of authentic role modeling is widely regarded as a potent mode of actuating, and the present data are consistent with that proposition without testing it.

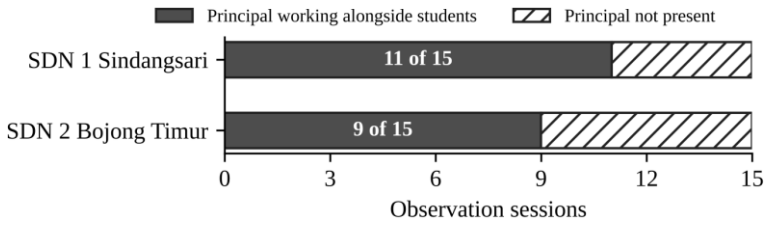


Fig. 4. Observation sessions in which the principal worked alongside students in the garden (15 sessions per school).

The final management phase, Controlling (Supervising), is systematically conducted through routine field monitoring and periodic pedagogical evaluation to ensure the program aligns with the Deming Cycle of continuous improvement [16]. Principals conduct formal "Academic Supervision" specifically tailored to the TdBA program, carrying observation rubrics to assess how effectively teachers are utilizing the garden space as an interactive learning medium rather than just a physical chore.

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Evaluation tools for the students are highly diverse and creative. Teachers utilize reflective student journals (where children write about their feelings toward their growing plants), highly detailed plant growth measurement charts, and behavioral observation rubrics that track a student's initiative in watering plants without being prompted. However, qualitative observations during this study revealed a critical managerial gap: the physical documentation of these evaluation results is often much less systematic and organized than the rigorous planning phase. To address this, school management should use the data from these monitoring and evaluation sessions as the empirical basis for the subsequent year's planning cycle [25]. Effective, data-driven controlling ensures that the program remains strictly on its intended track and that any unforeseen obstacles—such as sudden pest infestations, adverse weather, or a dip in student participation—are identified early and addressed promptly through rapid corrective managerial actions.

The provenance and limits of these evaluation instruments are specified in subsection 2.6: the journals, growth charts and behavioral rubrics are school-made managerial artifacts whose content was reviewed by the program coordinator but which have not been psychometrically validated, and they are used here primarily as evidence of how the controlling function is documented. The behavioral rubric scores four indicators, namely unprompted initiative in tending plants, care in handling tools and plants, waste separation and refraining from littering, and cooperation including the sharing of tasks and harvest. Evaluation data entered the conclusions of this study in one direction only: they were read against researcher observation and interview accounts to establish whether the controlling function produced usable information, and the asymmetry identified, that is, meticulous planning documentation alongside unsystematic evaluation records, is itself one of the study’s managerial findings rather than a judgment about the students.

3.4 Cross-Case Synthesis: Common Patterns and Context-Specific Practices

For a systematic multi-site comparison, Table 6 sets the two schools side by side across the four management functions and the five further dimensions on which they diverge, so that findings common to both sites can be separated from practices that are specific to a rural or a semi-urban context.

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Table 6. Cross-case matrix: SDN 1 Sindangsari and SDN 2 Bojong Timur

Dimension	SDN 1 Sindangsari (rural)	SDN 2 Bojong Timur (semi-urban)	Common or specific
Planning	Broad integration of TdBA across the thematic curriculum; planning of large-scale seasonal crop rotation; needs analysis oriented to soil and crop suitability	Planning oriented to spatial intensification through verticulture and hydroponics; individual containerized crop ownership per student; needs analysis oriented to media, nutrient supply and space	Common: embedding in RKT and RKAS, pre-year environmental analysis. Specific: extensive versus intensive planning logic
Organizing	Task force bifurcated into technical and pedagogical wings; school guard holds a defined technical role; farmer-expert guest involvement from the surrounding village	Single coordinated task force with teachers holding combined technical and pedagogical duties; parental committee more prominent in supplying materials than labor	Common: decree-based delegation, written SOPs, Petani Cilik student groups. Specific: degree of structural differentiation
Actuating	Pancaniti enacted through whole-class work on shared beds; harvest shared communally and with neighboring households	Pancaniti enacted through individual responsibility for a named plant, aggregated into group racks; harvest cooked together at school	Common: Pancaniti sequence, principal role modeling, integration into lessons. Specific: collective versus individual locus of responsibility
Controlling	Monitoring by direct field walk-through; growth charts maintained per bed; supervision notes handwritten	Monitoring by rack and container inspection; growth charts maintained per student; some recording in spreadsheet form	Common: academic supervision, reflective journals, rubrics, and the documentation gap. Specific: unit of record, that is, bed versus individual plant
Land availability	Abundant open arable land adjacent to classrooms	Restricted ground area requiring vertical and container solutions	Specific: the primary contextual driver of all other divergences
Curriculum integration	Integrated across most thematic subjects, with mathematics, natural sciences and language most frequently linked	Integrated more selectively, concentrated in natural sciences and mathematics, with integration constrained by session length	Common: integration is planned, not incidental. Specific: breadth of integration

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Dimension	SDN 1 Sindangsari (rural)	SDN 2 Bojong Timur (semi-urban)	Common or specific
Student participation	Rotating whole-class duty rosters; participation visible in group terms	Individual plant ownership alongside group rosters; participation traceable to the individual student	Common: students organized, not merely mobilized. Specific: traceability of individual contribution
Evaluation mechanisms	Reflective journals, growth charts, teacher rubric, principal supervision; records collected but not consolidated	The same instruments with partial digital recording; consolidation still incomplete	Common: instruments identical in kind and the feedback loop into planning weak at both sites
Obstacles identified	Uneven teacher pedagogical comprehension; pest pressure; competing use of land for school events	Space constraint; cost and technical maintenance of the hydroponic installation; shorter time available per session	Common: teacher comprehension and curriculum load. Specific: land versus technology constraint
Observable character indicators	Strongest evidence on service orientation and collective waste behavior	Strongest evidence on sustained individual initiative and on care in handling plants	Common: moral knowing and moral feeling evidenced at both sites. Specific: which moral-action indicator is most visible

Three findings are common to both sites and are, within the limits of a two-case design, the candidates for transferable managerial propositions. First, the program is financially and administratively anchored in the RKT and RKAS, which participants at both schools treated as the decisive condition of continuity. Second, authority is delegated by formal decree to a coordinator and extended organizationally into student groups, so that the program does not depend on the enthusiasm of a particular teacher. Third, the controlling function is the weakest link at both sites: the instruments exist and are used, but their output is not consolidated into a form that feeds the next planning cycle, which indicates that the gap is systemic to the program's design rather than attributable to either school.

The divergences, by contrast, are consistently traceable to land availability, which operates as the contextual variable from which the other differences follow. Abundant land at the rural site permits extensive planning, structural differentiation of the task force into technical and pedagogical wings, and a collective locus of student responsibility, and it yields the clearest evidence on service-oriented behavior. Spatial constraint at the semi-urban site forces intensification, which in turn produces individual plant ownership, individual-level record keeping, and the clearest evidence on sustained personal initiative, at the cost of a narrower curriculum integration and a

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dependence on technical infrastructure. For practice this suggests that the managerial template of TdBA is portable while its pedagogical arrangement is not: a semi-urban school adopting the program should expect to reproduce the decree-based organizing and budget anchoring, but to redesign the locus of student responsibility around individual rather than collective units.

4 Discussion

The educational management of Tatanén di Balé Atikan (TdBA) is best read as a synthesis of local wisdom and structured modern management principles [26]. By applying the POAC framework, the two schools studied in Purwakarta Regency have moved their initiatives beyond symbolic environmentalism, such as the display of "Go Green" posters, toward a structured and institutionalized form of ecopedagogy. Whether this synthesis is replicable beyond comparable pioneer schools is a question this two-case design can raise but not settle.

The planning phase observed reflects a crucial macro-transition toward transformative education. In this model, students are explicitly not treated as empty vessels or passive recipients of theoretical information, but rather as highly active, empowered participants in the complex dialogue of local food sovereignty [27]. This is strongly supported by the deployment of deep learning models that intricately ensure the curriculum remains highly responsive to both the developmental psychology of the child and the pressing socio-ecological needs of the surrounding community [11].

One of the theoretically significant observations of this study concerns the role of executive leadership. Participants across both sites described the managerial leadership of the principal as the engine room driving the program's continuity, and the observational record is consistent with that description. The data indicate, rather than confirm, that where school leadership is anchored in kindness, empathy and shared physical labor, a school culture emerges which participants experience as physically and emotionally safe, and in which students report feeling secure enough to explore, to make mistakes and to form a connection with the natural world [8]. This leadership approach is interpreted by participants as a response to the crisis of Adab, that is, the erosion of ethical discipline and respect, in a highly digitized educational environment, and TdBA is seen to reinstate respect for biological life, the value of physical work and the virtue of patience [14]. The organizational resilience demonstrated by the task forces at both sites further allowed technical and logistical difficulties to be met through communal problem-solving and the creative optimization of limited resources. These are interpretations of converging qualitative evidence, not effects estimated against a comparison condition.

However, the ambitious transition to a fully integrated, holistic ecological school is certainly not without significant systemic hurdles. The modernization and integration of technology within these environmental methods—such as utilizing smart sensors for soil moisture, or mobile applications for students to track daily plant growth—is still very much in its infancy across Purwakarta and requires substantially more financial investment and teacher training.

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Additionally, while participants described high levels of student engagement and enthusiasm, the managerial consistency of the controlling and supervision functions remains a persistent challenge. School leadership needs a more systematic, preferably digitized, monitoring system that uses empirical data to drive real-time decision-making [28].

Taken together, the findings indicate that when agricultural activity is managed as a core pedagogical strategy rather than as an afterthought, it can function as a vehicle for developing twenty-first-century skills. Participants described, and observation recorded, students reasoning through problems such as yellowing leaves or soil acidity, devising ways of processing their harvest, and sustaining collaboration through the shared maintenance of the gardens. On the evidence of these two cases, the promise of environmental education appears to lie in combining structured organizational management with culturally resonant ecological action; establishing that this combination produces the skills described would require the measurement design set out in subsection 4.1.

4.1 Limitations and Directions for Further Research

The contribution of this study is bounded in four ways that follow from its design. First, both sites were selected because the local educational authority regards them as successful pioneers, which makes the account an analysis of how management operates under favorable conditions. It cannot establish which managerial practices distinguish effective from ineffective implementation, because no case with weak implementation was included; the measures described in subsection 2.2, namely negative-case analysis, technique triangulation, supervisor contrast accounts and reflexive bracketing, reduce confirmation bias within the design but do not substitute for variation on the outcome. Second, the study reports no measured change in students' environmental attitudes or behavior. No validated environmental-attitude scale, behavioral checklist with established reliability, or pre-test and post-test was administered, so the character findings are participant-perceived and observationally indicated, and the enthusiastic participation of students in agricultural activity must not be read as equivalent to internalized ecological responsibility. Third, the four-month window covers one cultivation cycle of short-duration crops in a single rainy season, so seasonal contingency and crop failure were documented through accounts rather than observed. Fourth, the evaluation instruments analyzed are school-made and psychometrically unvalidated, and student data were generated in group settings in the presence of teachers, which may have introduced social desirability.

Three lines of further research follow. An explanatory multiple-case design that deliberately includes schools with stalled implementation would isolate the managerial practices that make the difference, and would test whether budget anchoring and decree-based delegation, the two conditions common to both sites here, function as the necessary conditions these findings suggest. A mixed-methods longitudinal design using a validated ecological attitude and behavior instrument with pre-test and post-test measurement, and with individual-level tracking under appropriate ethical safeguards, would establish whether the character gains that participants perceive are detectable as

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change. Fieldwork spanning both the rainy and the dry season and more than one full fruiting cycle would allow the managerial handling of seasonal contingency, which this study could only reconstruct from documents and accounts, to be observed directly.

5 Conclusion

Applying the Planning, Organizing, Actuating and Controlling (POAC) framework to the Tatanén di Balé Atikan (TdBA) program is shown by this study to be a workable and, in the judgment of the participants, a productive managerial strategy for cultivating environmental care character in elementary students. The conclusion is analytic rather than statistical: it describes how the four functions were enacted at two schools where the program is reported to succeed, and it reports character outcomes as perceived by participants and indicated by observation rather than as measured gains.

This study concludes that planning which is strategic and embedded in school budgets and curricula provides the program's structural foundation, and that participants at both sites treated this embedding as the decisive condition of its continuity. Organizing that is designed for resilience, specific in its allocation of roles and extended to students and the wider community sustains the program's operation independently of individual enthusiasm. Actuating guided by the Sundanese Pancaniti sequence and modeled through the hands-on example of principals is the mechanism through which participants account for the internalization of environmental values, with the first four stages evidenced in group practice and the fifth, Niti Sajati, reported as a normative horizon rather than a verified attainment. Controlling through routine academic supervision maintains the program's direction, but it was the weakest of the four functions at both sites and its documentation did not feed back systematically into the following planning cycle.

Operational challenges remain, particularly the need for more systematic documentation of student evaluations and for a deeper integration of agricultural technology. Within those limits, the evidence gathered at these two schools indicates that TdBA has established a working "Green School Culture" in which local Sundanese wisdom and the demands of global sustainable education goals are held together in everyday school practice. Whether that culture persists beyond pioneer schools, and whether it yields measurable change in students' environmental behavior, remain open questions for the research proposed above.

Recommendations: School principals should strengthen their internal evaluation and monitoring systems, transitioning from anecdotal observations to structured, data-driven developmental tracking. Furthermore, the regional government and educational policymakers should continue to support TdBA through sustainable funding, specialized teacher training in ecopedagogy, and basic infrastructure development. Future research could explore the integration of digital tools and artificial intelligence in TdBA management to further enhance its operational efficiency and maximize its pedagogical appeal to the highly digitized Alpha generation.

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DECLARATIONS

Author Contributions

Conceptualization, R.U. and N.K.; methodology, R.U. and N.K.; investigation and data curation, R.U.; formal analysis, R.U. and N.K.; writing—original draft preparation, R.U.; writing—review and editing, N.K. Both authors have read and agreed to the published version of the article.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Research Ethics and Informed Consent

The study was conducted under a research recommendation from the postgraduate program of Universitas Islam Nusantara, a research permit from the Education Office of Purwakarta Regency, and written approval from both principals. Adults gave written informed consent; written parental consent and the verbal assent of each child were obtained before any student data were collected (see Section 2.9). Both schools are named with the written consent of the principals and the Education Office.

Data Availability Statement

Anonymized field notes, the coding framework, and document logs are available from the corresponding author upon reasonable request. Focus-group notes and student journals are not publicly available because they involve minors.

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