Research Article

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The basic is still basic: A biologist's reflection on experiential knowledge, ecological simplicity, and the wood-trees analogy in understanding complex systems

Abstract

In an era increasingly shaped by abstraction, metrics, and predictive models, the importance of foundational knowledge and experiential understanding is often overlooked. This reflective paper aims to examine the shared epistemological foundations between ecological science and historiographical perspectives, emphasizing the importance of experiential learning and grounded understanding, while arguing that returning to fundamental principles is essential for interpreting complex ecological and sociocultural systems. Drawing from personal academic experience and prior reflective work, this paper explores the intellectual convergence between ecological thinking in biology and the historiographical insights of Prof Khoo Kay Kim on Asian values and cultural diversity. It argues that meaningful understanding, whether in ecological systems or human societies, must begin with observation, local context, and respect for fundamental principles. The concepts of experiential learning and the "wood and trees" analogy are presented as shared epistemological anchors. By integrating reflections from teaching, field observation, and mentorship, this paper highlights the risks of abstraction detached from lived reality and reaffirms that foundational knowledge remains the true driver of intellectual integrity and scientific success.

Keywords: experiential learning; ecological observation; foundational knowledge; epistemology; complexity

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Introduction

In my journey as a biologist and ecotoxicologist, I have come to embrace a simple but enduring principle: the basic is still basic. This conviction is not theoretical. It is grounded in lived experience in the laboratory, in the field, and in the classroom. It is a philosophy shaped by observation, reflection, and years of engagement with students and ecosystems.[1]

Reading Khoo[2] reflections on Asian values, I found a deep resonance with my own thinking. Khoo[2] challenged the oversimplification of Asia and calls for a grounded understanding based on local beliefs and lived practices. His critique of abstraction is not confined to history or social science. It reflects a broader intellectual concern that extends into scientific inquiry itself. In my own reflective work, I have argued that the strength of any intellectual pursuit lies in its foundation, emphasizing that "big results grow from small well-tended beginnings" and that the basic remains the real mover of scientific success.[1]This paper is therefore a reflection on the shared epistemological ground between these perspectives.

The objective of this paper is to examine the shared epistemological foundations between ecological science by Yap[1] and historiographical perspectives by Khoo,[2] emphasizing the importance of experiential learning and grounded understanding. It further aims to argue that returning to fundamental principles is essential for accurately interpreting complex ecological and socio-cultural systems. This paper may also be viewed as a continuation of my earlier reflection,[1] but with a deliberate expansion in its epistemological scope. While the earlier work emphasized the importance of foundational thinking within biological science, the present reflection situates this principle within a broader intellectual landscape through engagement with Khoo.[2] This integration is important. It demonstrates that the call to return to basics is not confined to biology, but is a shared concern across disciplines. In this sense, the present work extends beyond a personal reflection and becomes part of an ongoing dialogue on how knowledge should be constructed, interpreted, and sustained.

In reflecting upon this convergence, it becomes increasingly clear that the integration of disciplines is not merely an intellectual exercise, but a necessity for meaningful knowledge construction. The perspective advanced by Khoo[2] is not confined to historiography; it represents a broader epistemological stance that resonates deeply with scientific inquiry. By recognizing local thinkers and lived experiences as legitimate foundations of knowledge, this approach challenges the dominance of abstract, decontextualized frameworks. In doing so, it elevates scientific thinking beyond technical execution toward a more reflective and responsible practice. This paper therefore does not only bridge biology and history, but also advocates for a scientific mindset that values understanding over mere output, and meaning over measurement.

Experiential learning as the foundation of knowledge

Khoo[2] insistence on understanding societies through local beliefs and lived realities mirrors the principle of experiential learning in ecological science. In my own teaching, I have consistently emphasized that knowledge must begin with observation rather than assumption.

The conceptual framework visualized in Figure 1 illustrates how experiential learning-defined as knowledge acquisition rooted in direct observation and "lived realities"-serves as the critical foundation for meaningful knowledge and the application of theory across different disciplines. The diagram identifies a prominent "Gap" (highlighted on the right) that persists in traditional education when rote memorization is prioritized over comprehension.[3,4] As shown in the "Pathway to Scientific Knowledge" (centre), this gap can only be bridged when "Observation" precedes "Assumption." This sequence moves beyond mere cognitive knowing to true "Understanding," which the model defines explicitly as the prerequisite for application. Learning, in this view, is a cycle rather than a linear process; meaningful knowledge derived from experience subsequently refines future observation, a crucial dynamic for developing adaptive scientific and social understanding.

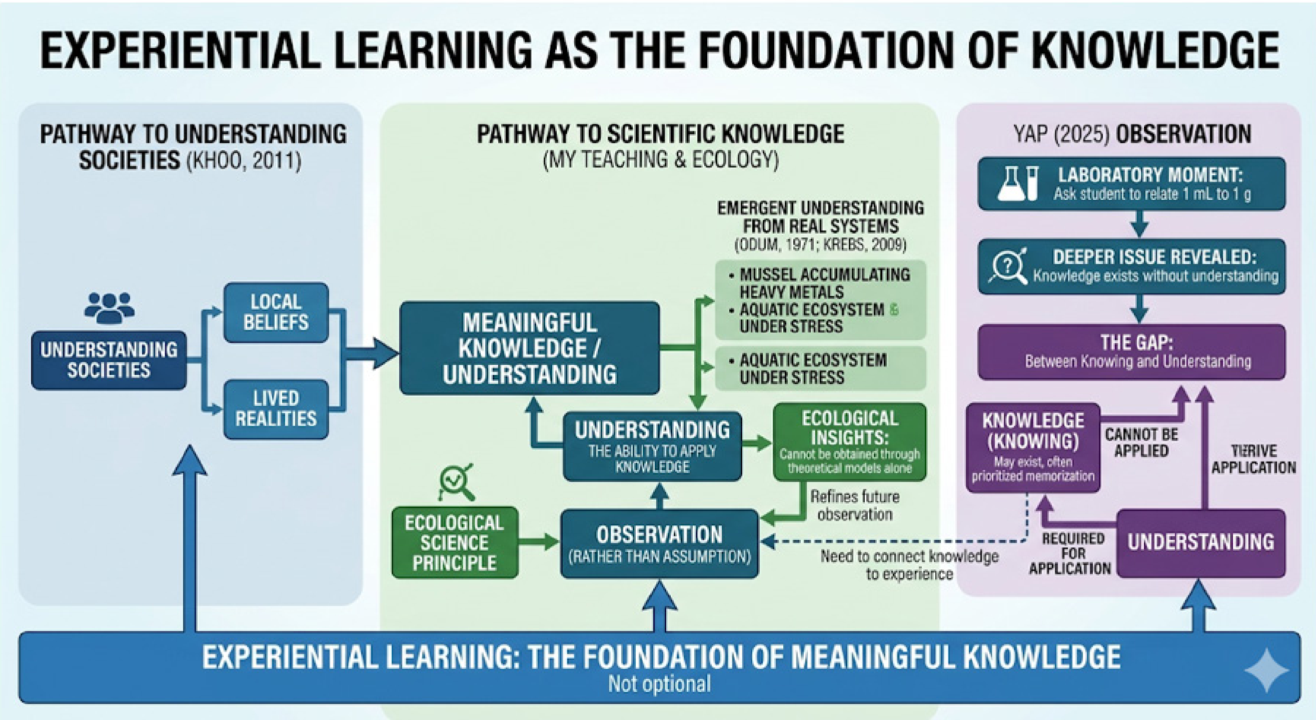

Figure 1 A conceptual model of experiential learning as the epistemic foundation in sociology, ecology, and education. Note: This diagram was generated with the assistance of Gemini (Google AI).

In Figure 1, this iterative, observation-first approach mirrors the foundational principles of ecological science (centre and bottom). The model shows that meaningful "Ecological Insights" (green boxes) must arise from the direct study of real-world systems, such as a "Mussel Accumulating Heavy Metals," rather than solely relying on mathematical models.[5,6] This same logic is applied to sociology (left), where Khoo[2] argues that a true understanding of societies must be built on the "lived realities" and "local beliefs" of their participants. By contextualizing the educational challenge,[3,4] within these broader scientific and sociological principles, the figure argues that experiential learning is a robust, non-optional framework for generating applied and durable knowledge, providing a unified methodology for connecting theoretical concepts with observable reality.

A simple moment in the laboratory such as asking a student to relate one millilitre to one gram revealed to me a deeper issue: knowledge may exist, but without understanding, it cannot be applied.[1] This gap between knowing and understanding reflects a broader problem in education, where memorization is often prioritized over meaning.

In ecology, this distinction is critical. Observing a system directly whether it is a mussel accumulating heavy metals or a simple aquatic ecosystem under stress provides insights that cannot be obtained through theoretical models alone. Odum[5] and Krebs[6] both emphasized that ecological understanding must emerge from careful observation of real systems. Experiential learning, therefore, is not optional. It is the foundation upon which meaningful knowledge is built.

The wood and the trees: Revisiting the basic

Khoo[2] metaphor of "the wood and the trees" captures a fundamental epistemological challenge: the tendency to generalize without understanding the components that constitute the whole.

The conceptual framework presented in Figure 2 delineates the relationship between fundamental components ("the trees") and emergent wholes ("the wood"), addressing the epistemological challenge of over-generalization. Central to this model is the principle that "the basic is still basic," asserting that complex outcomes-whether scientific conclusions or experimental results-are invariably rooted in simple, underlying processes.[3,4] By utilizing the metaphor provided by Khoo,[2] the diagram illustrates that a failure to investigate the constituent parts of a system leads to a distorted understanding of the macro-structure. This foundational logic is visualized through the analogy of the Merdeka 118 skyscraper, where the visible height of the structure is entirely contingent upon the unseen, "basic" integrity of the foundations beneath the surface.[1]

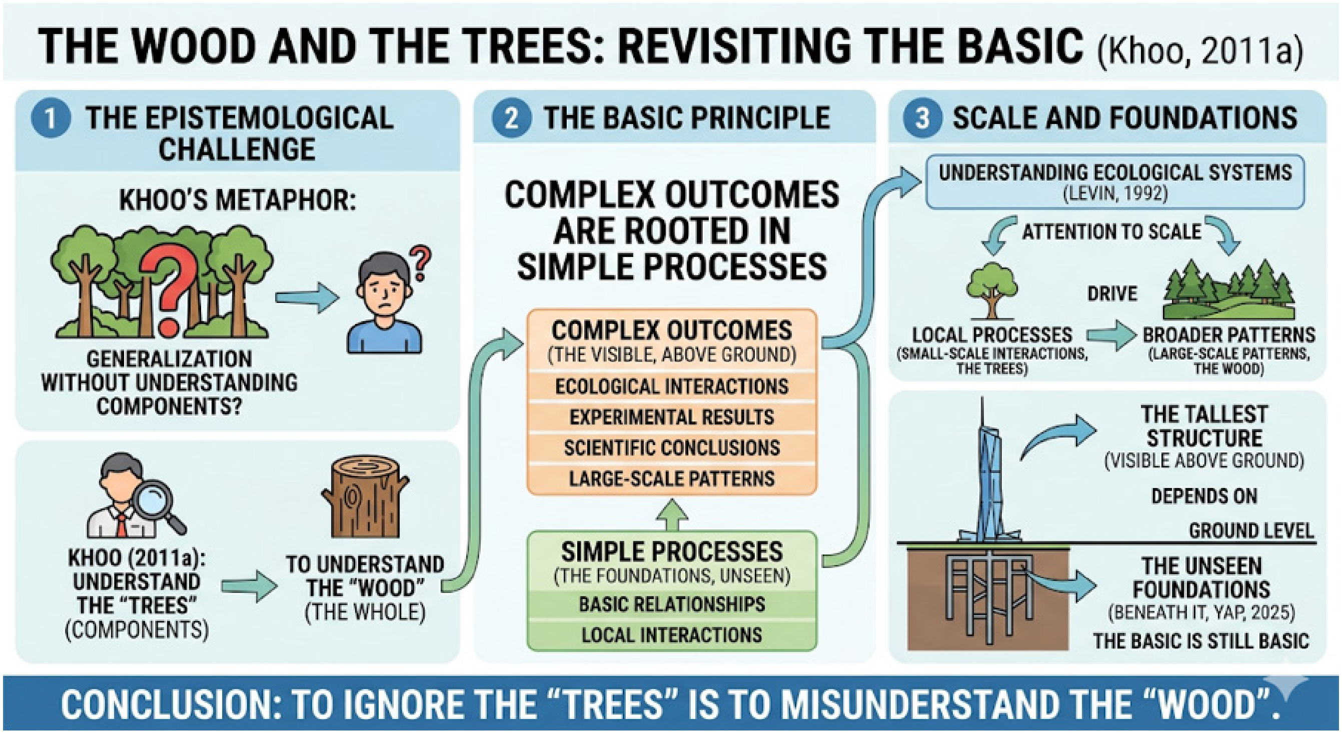

Figure 2 A multidisciplinary model of scaling: Integrating epistemological foundations with ecological and structural complexity. Note: This diagram was generated with the assistance of Gemini (Google AI).

The application of this principle is further explored through the lens of ecological scale and structural hierarchy. As depicted in the "Scale and Foundations" section in Figure 2, local-scale interactions are the primary drivers of broad-scale patterns, a concept that necessitates rigorous attention to scale in ecological modelling.[7] The diagram highlights that ignoring these small-scale "trees" renders the broader "wood" incomprehensible, as the macro-patterns are not independent entities but are built upon a series of fundamental relationships. By integrating these perspectives, Figure 2 argues that mastery of any complex system requires a return to its basic elements, reinforcing the idea that the strength of any scientific or theoretical conclusion is limited by the depth of its foundational understanding.

In my own work, this is expressed through the principle that the basic is still basic. Complex outcomes are always rooted in simple processes. Every ecological interaction, every experimental result, and every scientific conclusion is built upon fundamental relationships.

As I have reflected previously, even the tallest structure, like Merdeka 118, depends not on what is visible above ground but on the unseen foundations beneath it.[1] Similarly, in ecology, large-scale patterns emerge from small-scale interactions. Levin[7] highlighted that understanding ecological systems requires attention to scale, where local processes drive broader patterns. To ignore the "trees" is to misunderstand the "wood."

The danger of abstraction without grounding

Khoo[2] warns against imposing external frameworks on Asian societies, arguing that such approaches often distort reality. In ecological science, a similar danger exists when models are applied without sufficient empirical grounding.

The conceptual framework in Figure 3 illustrates the "Distortion Gap" that emerges when theoretical abstraction becomes decoupled from empirical grounding. As shown in the left "Theoretical Modelling" pathway, an over-reliance on simulations and statistical outputs without constant recalibration against reality creates an "illusion of understanding".[3,4] This mirrors the epistemological warning issued by Khoo,[2] who argues that imposing external, ungrounded frameworks-whether on Asian societies or biological systems-leads to a fundamental distortion of reality. The model highlights a critical "Danger Zone" where early-stage errors in observation are amplified through complex modelling, ultimately resulting in research failures and publication issues at later stages.[3,4]

Conversely, the right-hand "Empirical Observation" pathway demonstrates the necessity of anchoring knowledge in the "unexpected outcomes" of the real world (Figure 3). This approach aligns with the principle that ecosystems are inherently dynamic and cannot be fully encapsulated by static, theoretical models.[8] The diagram emphasizes a feedback loop where "Returning to Fundamentals" (the green arrow) serves as a corrective mechanism, ensuring that predictive tools are continuously anchored in observed reality. By contrasting the risks of "Error Amplification" with the stability of "Meaningful Knowledge," Figure 3 argues that grounding is not merely a scientific preference but a vital safeguard against the systemic distortion of knowledge.

Modern scientific practice increasingly relies on statistical outputs, simulations, and predictive models. While these tools are valuable, they can create an illusion of understanding if not anchored in observation. A growing concern in contemporary science education is the emergence of what may be described as a "star-chasing" culture, where the focus is placed disproportionately on achieving statistically significant results, often symbolized by the asterisk in outputs, rather than on understanding the processes that generate those results. In such situations, students may become preoccupied with producing significance rather than seeking meaning.

This tendency reflects a deeper epistemological issue. When scientific training emphasizes outcomes over understanding, it risks producing what some educators have informally described as "superficial scientists" individuals who are technically capable of executing procedures but lack the philosophical grounding to interpret their findings or the creativity to design new inquiries. Without this deeper foundation, experimental work becomes mechanical rather than intellectual, and analysis becomes confirmation rather than exploration.

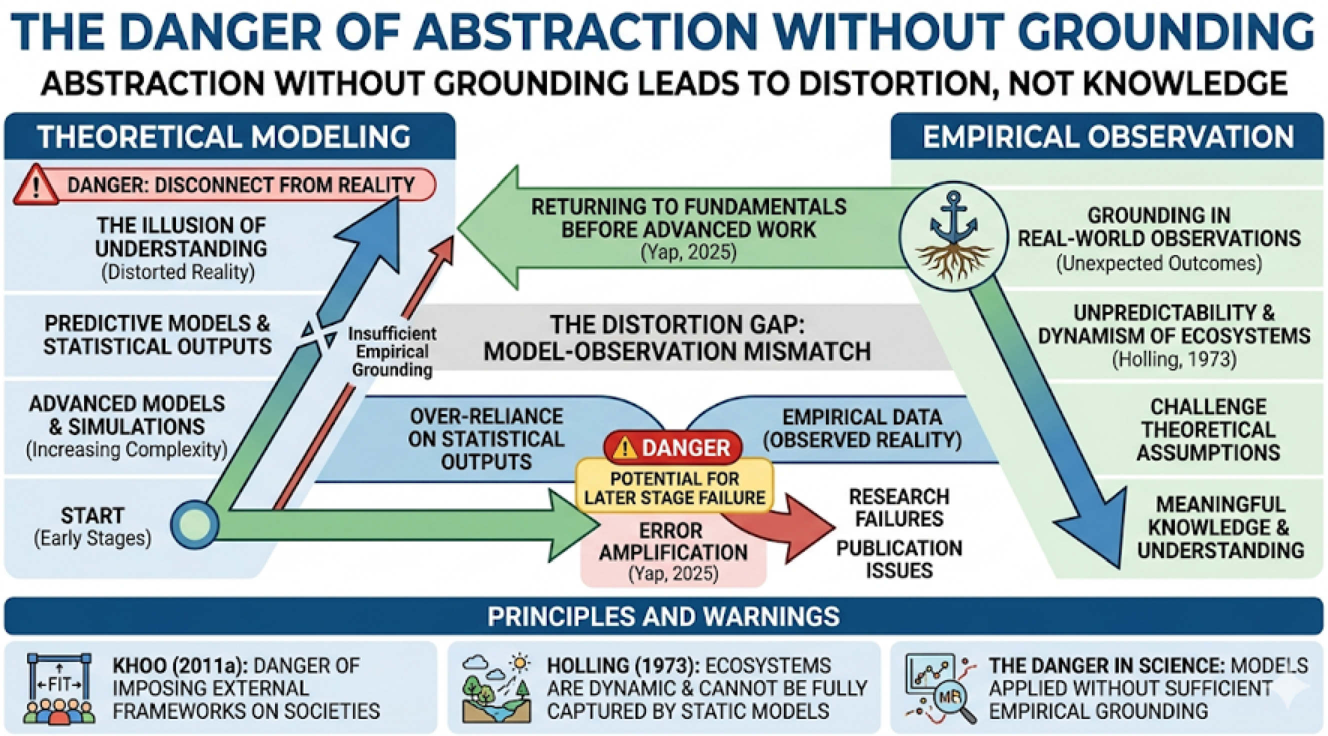

Figure 3 The distortion gap: A model of the divergence between abstract theory and grounded empirical reality. Note: This diagram was generated with the assistance of Gemini (Google AI).

In my own reflections, I have emphasized that early errors, if not corrected, can lead to failure at later stages, whether in research or publication.[1] This highlights the importance of returning to fundamentals before advancing into complexity. Holling[8] argued that ecosystems are dynamic and cannot be fully captured by static models. Similarly, real-world observations often reveal unexpected outcomes that challenge theoretical assumptions. Abstraction without grounding does not lead to knowledge. It leads to distortion.

Mentorship, integrity, and the ecology of learning

Beyond scientific inquiry, my philosophy extends into teaching and mentorship. I do not measure success by publications or metrics alone. Instead, I focus on cultivating integrity, humility, and clarity in my students. The concern raised by the reviewer regarding "star chasers" resonates strongly with my own experience in supervising students. There is an increasing tendency among some learners to equate success with statistically significant outcomes, without fully understanding the biological, ecological, or methodological foundations of their work.

This is not merely a technical issue. It is a philosophical one. When students are trained to prioritize results over reasoning, they may lose the capacity to ask meaningful questions, to challenge assumptions, or to design experiments beyond standard protocols. In such cases, science risks becoming procedural rather than creative, and analytical rather than reflective. True scientific development, however, requires more than technical competence. It requires the ability to think, to question, and to connect observations with broader conceptual understanding.

As I have written, the most meaningful legacy of an academic lies not in citations but in the values instilled in students.[1] This aligns with Khoo[2] concern that education in many Asian contexts prioritizes memorization over understanding, limiting the development of broader perspectives. Mentorship, like ecology, is a process. It requires patience, observation, and continuous adjustment. Just as ecosystems are shaped by interactions over time, students develop through guidance, reflection, and experience. This is, in essence, an ecology of learning.

The conceptual framework visualized in Figure 4 illustrates a holistic pedagogy where the primary focus is not on quantitative metrics, but on the cultivation of intrinsic values and robust understanding. Central to this approach is the concept that the most enduring academic legacy is found in the values instilled within students, rather than in citation indices or publication counts.[3,4] As depicted in the "Mentorship Philosophy" section, true success is rooted in the soil of 'Integrity', 'Humility', and 'Clarity'. By explicitly contrasting this prioritized value-centric model against superficial metrics (indicated by crossed-out elements), the figure presents a philosophy that seeks to bridge the gap between mere technological skill and the broader intellectual and ethical perspective that defines a true scholar.[2]

This developmental journey is modelled as "The Ecology of Learning," a continuous and interactive process analogous to the slow, adaptive formation of an ecosystem. The central pathway in Figure 4 shows that true development emerges from a repeating cycle of 'Guidance (Observation & Patience)', 'Reflection (Experience & Thought)', and 'Continuous Adjustment'. Just as ecosystems are shaped by interactions over time, students develop through persistent feedback loops and lived experiences. This model contrasts a process of 'Growth over Time' against the common educational concern that prioritizes rote memorization over genuine understanding.[2] By defining mentorship explicitly as an iterative process (Bottom), Figure 4 argues that durable knowledge and character are not instant outputs but emergent properties of a nurtured learning ecosystem.

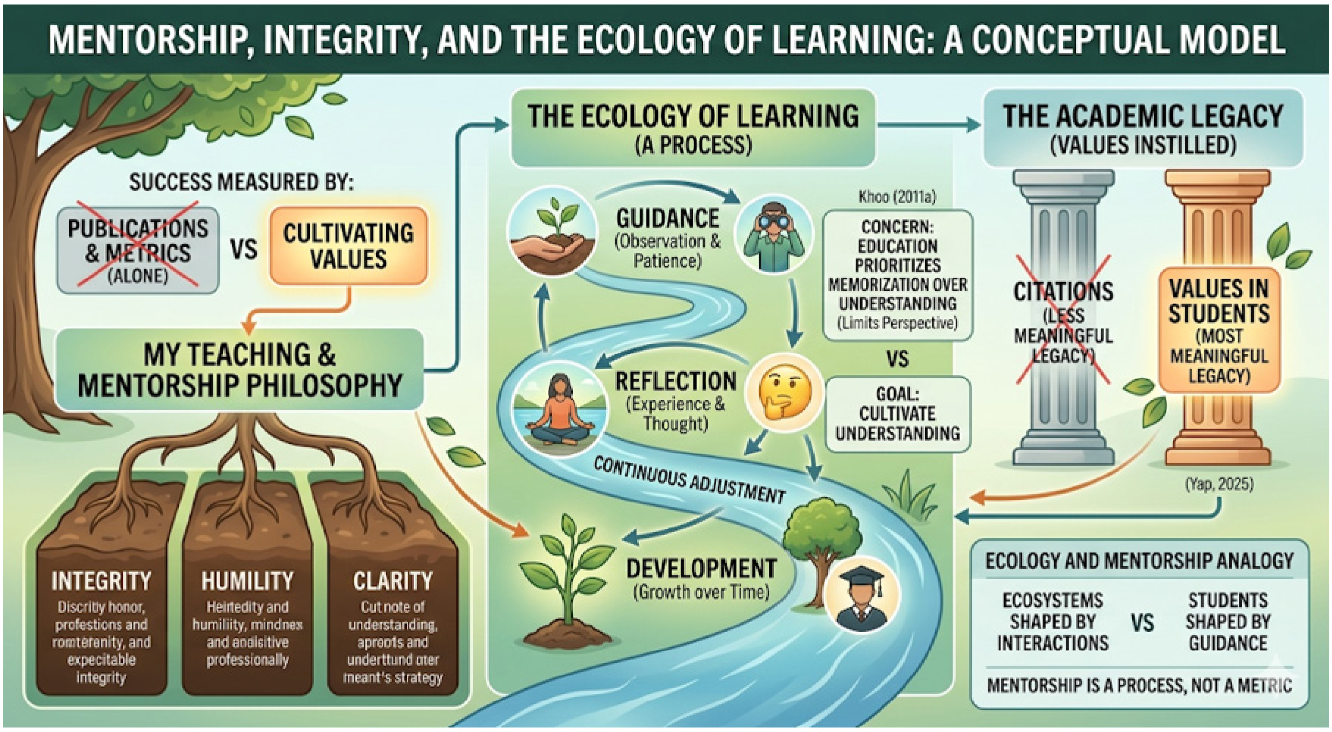

Figure 4 The ecology of learning: A model of mentorship, integrity, and academic legacy. Note: This diagram was generated with the assistance of Gemini (Google AI).

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Returning to fundamentals in a complex world

In an age dominated by artificial intelligence, rapid data processing, and increasing complexity, the temptation to move away from basics is strong. Yet, it is precisely in such times that returning to fundamentals becomes most important.

The conceptual framework visualized in Figure 5 depicts "The Starting Point of Truth: Simplicity" as the critical base supporting three major pillars of knowledge construction: Scientific Research, Ecological Understanding, and Intellectual Inquiry. The central pillar, "Ecological Understanding," explicitly diagrams how true insight is built through observing local interactions, which subsequently grounds modern computational tools in empirical reality.[2] This bottom-up approach contrasts sharply with the "Increasing Complexity" (visualized on the left with gears and AI symbols). An arrow labelled "Temptation to Move Away from Basics" indicates the strong pull of complexity, which this model seeks to counteract. A large arcing arrow from the base explicitly shows that the most sophisticated "Modern Approaches" (AI and rapid data processing) are only valid when firmly grounded in these observed realities and foundational principles.[2]

Figure 5 also illustrates the cyclical nature of knowledge refinement through an iterative loop labelled "Knowledge Construction." Within this cycle, the "Scientific Research" pillar visualizes the principle from Van Wyk et al.[4] which mandates an attentive start: "roots attended to" and "small errors corrected early." This meticulous process (Figure 5, top left) leads to "Reliable Findings," which then feed into a larger "Paradigm Shift" (top right, compass). This shift is not a rejection of complexity but a re-cantering of knowledge construction, ensuring that "Basic Assumptions" are continuously questioned and "Fundamental Principles" are revisited within all three domains.[3,4] The overall model argues that true intellectual growth and reliable insights are emergent properties that develop over time when complexity is built upon, and continuously refined by, simple, observed truths.

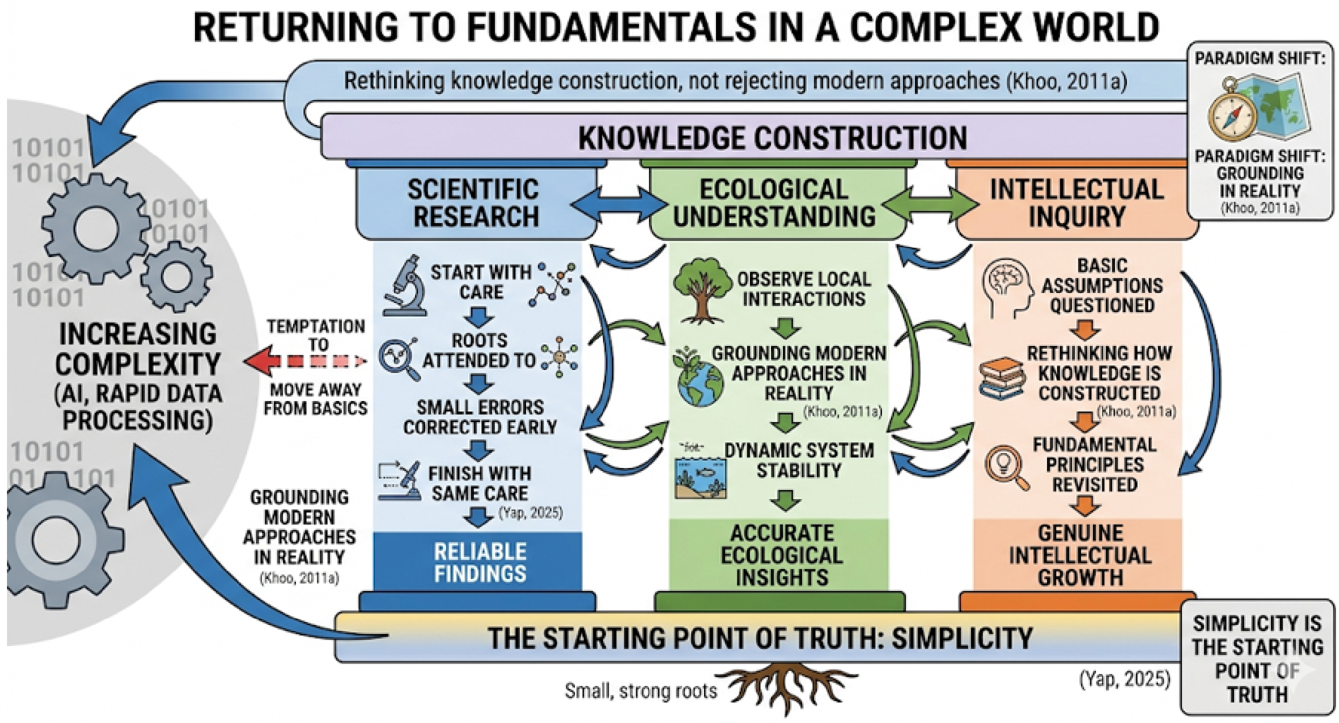

Figure 5 The epistemic foundation: A model for grounding knowledge construction in simplicity and fundamental principles. Note: This diagram was generated with the assistance of Gemini (Google AI).

As I have emphasized, "attend to roots, correct while errors are still small, and finish with the same care as at the start".[1] This principle applies equally to scientific research, ecological understanding, and intellectual inquiry.

Khoo[2] call for a paradigm shift in Asian studies is, at its core, a call to rethink how knowledge is constructed. It is not about rejecting modern approaches, but about grounding them in reality. Therefore, simplicity is not a weakness. It is the starting point of truth.

Conclusion

This reflection demonstrates that despite differences in discipline, there is a profound similarity between the thinking of a historian like Prof Khoo Kay Kim and a biologist engaged in ecological research. Both perspectives emphasize observation, context, and the importance of fundamentals. The study of ecosystems and the study of societies share a common challenge: understanding complexity without losing sight of the basic elements that constitute it. In my own journey, I remain committed to this principle. I will continue to ask simple questions, to observe carefully, and to return to fundamentals. Because in both science and life, one truth remains clear: the basic is still basic.

Declaration on the use of artificial intelligence

The author declares that generative artificial intelligence tools were used in a supportive capacity during the preparation of this manuscript. These tools assisted with language refinement, structural organisation, and stylistic clarity of the text. All ideas, interpretations, reflections, and conclusions presented in this paper are the author's own and are grounded in personal experience and scholarly judgment. The author retains full responsibility for the content, accuracy, originality, and integrity of the manuscript.

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None.

Conflicts of interest

The author declare that there are not conflict of interest.

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