

Re-mapping Pedagogy

A Kaupapa Māori Approach to Location-Based Learning in Iwi Landscapes

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Abstract

This article reconceptualises spatial technologies through Māori ontological foundations to support Indigenous pedagogies of place. It argues that the divergence between institutional geographic information systems (GIS) and Māori spatial ontology is pedagogical and technical, as spatial systems shape how knowledge is encountered and transmitted.

The article advances the concept of Māori spatial pedagogy as a distinct mode of learning grounded in relational engagement with whenua. Drawing on principles of whakapapa, kōrero tuku iho, and embodied interaction, it identifies key pedagogical conditions in which knowledge is encountered, including movement, co-presence, relational positioning, and the sequencing of narrative. These are contrasted with conventional GIS learning environments that privilege abstraction, visualisation, and analytical distance.

Positioning spatial technologies as pedagogical environments, the article argues that systems supporting Māori relationships with place must be designed around relational encounter rather than abstract representation. This requires an integrated approach aligning pedagogy, governance, infrastructure, and tikanga from the outset.

It concludes by establishing Māori digital spatial technologies as a distinct pedagogical domain, proposing that developing such systems requires both technical capability and fluency in Māori cosmology, whakapapa, and tikanga to inform the design of relational learning environments.

Keywords

Māori spatial ontology; Indigenous GIS; whenua kōrero; whenua-based pedagogy; co-presence; Indigenous data sovereignty

Introduction

Learning within iwi contexts is grounded in whenua, whakapapa, and relational engagement with sites of significance. Knowledge is encountered through movement, co-presence, and participation in lived landscapes. When iwi members are disconnected from these landscapes, the disruption is not only social or cultural but also pedagogical, because it alters the conditions enabling knowledge to be encountered and transmitted.

Digital and spatial technologies have increasingly been used to map, represent, and manage Indigenous knowledge. Within Indigenous geographic information systems (GIS), significant advances have been made in relation to data sovereignty, cultural protection, and spatial representation. Indigenous GIS platforms have largely focused on displaying and managing information through maps, databases, and visualisations, rather than supporting how people learn through engagement with whenua (Apiti, 2018; Harmsworth, 1997).

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Within conventional GIS, engagement is structured through viewing, querying, and editing spatial data. A system oriented towards visualisation positions the learner in front of a screen, whereas a system oriented towards learning and connection takes you to the pā. The question of how spatial systems might function as pedagogical environments grounded in kaupapa Māori remains underdeveloped.

This article addresses that gap by advancing a whenua-based pedagogical model for Māori digital spatial technologies. It argues that spatial systems grounded in Māori ontology must support learning through co-presence, movement, relational engagement, and narrative encounter, rather than through abstract representation alone. Drawing on a research-through-design approach, the article demonstrates how location-based systems can be configured as contemporary extensions of tikanga, enabling mātauranga to be encountered within the conditions its transmission requires. In doing so, it repositions Indigenous GIS as a pedagogical domain and contributes to emerging discussions on Indigenous pedagogy, spatial systems, and digital sovereignty.

Aim and Research Questions

The aim of this research is to design and prototype an iwi-led digital platform that connects authenticated iwi members to wāhi tapu and other culturally significant sites through location-based engagement, QR code verification, and narrative interaction, while supporting iwi communication and membership engagement.

The core research questions are:

1. How can location-based game mechanics be adapted within a kaupapa Māori framework to strengthen iwi relationships with culturally significant sites while upholding tikanga and Indigenous data sovereignty?
2. What governance conditions are required for such a system to operate in alignment with tikanga while supporting iwi membership, communication, and whānau economic engagement?

Kaupapa Māori and Indigenous Pedagogies of Place

Kaupapa Māori and Indigenous pedagogies of place position learning as relational, embodied, and grounded within specific landscapes and genealogical contexts. Within this framework, knowledge is not delivered, it is encountered. Whenua, whakapapa, and community are not the context for learning; they are the conditions in which learning occurs.

If knowledge can be transmitted abstractly, a conventional GIS screen is sufficient. If knowledge must be encountered through whenua, whakapapa, and community, then the system must take the learner somewhere, verify their presence, and situate them within the relational conditions that make knowledge accessible. Learning occurs through movement, observation, participation, and guided interaction with sites of significance, where meaning emerges through relationships between people, place, and narrative. This contrasts with dominant educational models that separate knowledge from context and prioritise cognitive acquisition over lived experience.

In a kaupapa Māori context, whenua is not a backdrop to learning but a primary source of knowledge, where histories, cosmologies, and identities are embedded and encountered through appropriate forms of engagement. A pā site, for example, does not simply mark where events occurred, it holds the genealogical logic of those events in its topography, orientation, and names. That knowledge becomes legible through presence and guidance from those who hold the authority to share it. A map of the same site can show its co-ordinates and boundaries, but it cannot reproduce the conditions that presence creates.

Kaupapa Māori also extends beyond educational philosophy to encompass a framework for knowledge governance. Access to knowledge is structured through whakapapa, tikanga, and collective responsibility. Kaumātua, tohunga, and other knowledge holders govern access to particular forms of knowledge, ensuring that transmission occurs within culturally sanctioned conditions. Learning therefore carries obligation, positioning the learner within relationships and responsibilities that extend across time and place.

When iwi members are displaced from significant landscapes through urbanisation, distance, or the absence of guided return, what is disrupted is more than access to information. The disruption affects the conditions that allow knowledge to be encountered and the continuity of *ahi kā*. Learning within kaupapa Māori requires presence, guidance, and repeated return, where each encounter deepens the learner's relationship with the site and the knowledge it holds. Within this framework, a location-based system that requires physical presence is not simply a design feature but a pedagogical necessity.

These principles are shared across Indigenous pedagogical traditions that position place, embodiment, and relational accountability as central to learning (Battiste, 2013; Brayboy & Maughan, 2009; Smith, 1999). The growing use of digital technologies within Indigenous educational and cultural contexts therefore introduces significant tensions. Platforms built on content-delivery models reproduce precisely the conditions that kaupapa Māori pedagogy challenges: the separation of knowledge from place and the reduction of situated knowledge to portable content.

Location-based systems represent a partial response to this tension by requiring physical presence as a condition of engagement. Whether such systems can support culturally governed access, embodied encounter, and the broader pedagogical conditions described above depends on the values embedded in their design (Carroll et al., 2020; Taiuru, 2025). The question is not whether spatial systems can represent Indigenous knowledge, they already do. The question is whether they can be designed to support the conditions under which that knowledge is transmitted today.

From Representation to Pedagogy in Indigenous GIS

Māori spatial pedagogy operates through a distinct set of learning conditions in which knowledge is encountered through relational engagement with *whenua* rather than transmitted as abstract information. Learning occurs through the alignment of movement, co-presence, and narrative. Movement situates the learner within the spatial field; co-presence establishes engagement with place; and narrative provides the structure by which knowledge is encountered and interpreted. Together, these elements form an integrated system that gives rise to understanding.

Indigenous GIS has developed as critical tools for asserting control over spatial data, protecting culturally sensitive knowledge, and representing Indigenous relationships to land. Significant advances have been made in establishing frameworks for data sovereignty, ensuring that Indigenous communities retain authority over how knowledge is stored, accessed, and used. Within Aotearoa, the use of GIS in Waitangi Tribunal proceedings represented one of the earliest and most consequential applications of this shift, where spatial evidence produced by and for iwi was used to document territorial relationships, resource use, and historical occupation in ways that carried direct legal and political weight. This established a precedent in which Indigenous communities could produce spatial representations on their own terms and for their own purposes.

Kā Huru Manu (n.d), the Ngāi Tahu cultural mapping project, is among the clearest expressions of this development: a platform built to reassert Māori place names, narrative, and territorial knowledge within a spatial system governed entirely by the iwi. Such projects demonstrate that Indigenous GIS has moved beyond the extraction and representation of Indigenous knowledge by external agencies toward systems that are genuinely community controlled (Carroll et al., 2020; Harmsworth, 1997; Kukutai et al., 2023).

Indigenous GIS has always carried cultural and pedagogical intent. Platforms such as *Kā Huru Manu*, or those developed for Waitangi Tribunal processes, were designed to express cultural knowledge, assert relationships to land, and transmit knowledge to future generations. Delivering that intent, however, is a different problem.

Consider a *whareniui* filled with carvings carrying genealogical knowledge and story. The pedagogical intent is clear. But if the only way to encounter that *whareniui* is through a photograph on a website, the conditions that make the knowledge transmissible, the presence, guidance, and encounter, have been stripped out by the medium itself.

The knowledge remains, but the relational conditions for encountering it are absent.

What has been missing is a design logic capable of preserving the conditions knowledge requires: presence, relationship, and guided encounter. The field therefore requires a shift from GIS as an instrument of visualisation towards GIS as an environment for structuring learning. This means reconceiving the map as an interface that lets learners move, encounter knowledge, and deepen understanding through guided interaction.

Positioning Indigenous GIS as a pedagogical domain does not abandon the advances made in representation and sovereignty, but extends them by asking that the conditions that allow knowledge to be encountered be designed with the same care as the conditions that allow it to be stored and protected. If spatial systems are understood as pedagogical environments, then decisions about access, interface, and interaction carry pedagogical consequences that must be governed in alignment with tikanga.

Within Aotearoa, Māori Maps (n.d.) provides one example of this broader cultural intent. Designed to reconnect users with marae and the whakapapa relationships those places carry, the platform recognises the problem of disconnection from whenua and positions itself as a gateway toward re-engagement (Apiti, 2018; Harmsworth, 1997). What it cannot provide is the structured sequence of presence, guided encounter, and layered knowledge access that a whenua-based pedagogical model requires.

That limitation is not unique to Māori Maps. The primary function of most GIS, including those developed within Indigenous contexts, remains oriented toward display rather than learning. Users engage with information assembled for viewing rather than encountering knowledge through active participation in place. This representational function remains valuable, but it does not address the pedagogical conditions that kaupapa Māori identifies as essential: movement through landscape, co-presence with sites of significance, relational engagement with knowledge holders, and the progressive deepening of understanding through repeated encounter.

This reflects the intellectual traditions that shaped the development of GIS. Geospatial systems emerged from cartographic and information-management traditions that do not conceptualise the map as a pedagogical environment. Even where Indigenous priorities have reshaped the content and governance of these systems, the underlying design logic has often remained tied to representation rather than learning. Indigenous GIS has yet to fully develop as a field that explicitly theorises how knowledge is encountered through spatial systems and how pedagogical conditions can be structured through design.

The following section articulates a whenua-based pedagogical model that builds on these foundations, defining the principles that enable spatial systems to support Indigenous pedagogies of place. Rather than beginning with the technology, the model begins with learning: movement across landscape, co-presence with sites of significance, engagement with iwi narratives, and the relational accountability that governs what can be known, by whom, and under what conditions.

Toward a Whenua-Based Pedagogical Model

The pedagogical approach outlined in this article can be understood as a whenua-based model of learning structured through the integration of relational positioning, movement, co-presence, and narrative. Within this model, learning is not the acquisition of abstract knowledge but the outcome of situated engagement within a relational field.

Relational positioning establishes the learner's connection to whenua through whakapapa and associated responsibilities. Movement situates the learner within that field, enabling knowledge to be encountered through spatial progression. Co-presence reinforces engagement with place, while narrative provides the structure for interpreting, transmitting, and retaining knowledge. Together, these elements operate as an integrated system from which understanding emerges.

The model therefore redefines spatial learning as a relational and embodied process grounded in Māori ontological understandings of whenua, whakapapa, and engagement. In doing so, it establishes the pedagogical foundation for Māori digital spatial technologies.

A Whenua-Based Pedagogical Model

The whenua-based pedagogical model proposed in this article centres whenua as the primary site of learning and organises the learning encounter around four elements: movement, co-presence, narrative engagement, and reflection. These elements operate interdependently within the learning encounter.

Consider a player who opens the system and sees a pā site marked on the map of their rohe. To unlock its content, they must travel there physically. That journey forms the beginning of the learning encounter itself. Arriving at the site and scanning the QR marker establishes co-presence, and only in that moment of verified presence does the kōrero held by the site become accessible.

The narrative that follows, curated by iwi knowledge holders and tied to that specific place, carries meaning through the whenua in which it is encountered. The reflective questions that follow ask the player to consider the site's meaning, history, and relationships while standing within the landscape to which the story belongs.

Each element activates the next. Without movement there is no co-presence. Without co-presence the narrative becomes detached from place. Without narrative engagement reflection loses its grounding. The model therefore describes a set of interdependent pedagogical conditions that gives rise to spatial learning.

The model operates through iwi authority at every level of the learning encounter. The sites that appear on the map, the kōrero that unlocks at each location, the questions that follow, and the answers that are accepted are designed and curated by iwi knowledge holders who determine what can be shared, with whom, and under what conditions. Sites are nominated by those who hold responsibility for them, while narratives are contributed by kaumātua and knowledge holders who have agreed to their inclusion.

The questions embedded within the system are designed to reflect the ethical and cultural dimensions of each site rather than functioning as generic comprehension exercises. Overseeing this process is a body of kaumātua and knowledge holders whose role is cultural rather than technical. They determine what knowledge enters the system, how it is represented, what visual language and symbology are appropriate, and what knowledge remains protected. The system itself does not determine these conditions; it operationalises the authority and decisions of iwi governance structures (Doherty, 2014; Kukutai et al., 2023).

Movement within the whenua-based pedagogical model is where learning begins. The requirement that learners travel physically to sites of significance reimplements a fundamental condition of Indigenous pedagogy: that knowledge is encountered in place rather than abstracted from it. Movement is purposeful, directed towards sites whose significance is defined by iwi, and structured so that progression through the landscape mirrors progression in understanding.

The learner does not simply visit locations but moves through a pedagogical environment in which each site represents an encounter with a dimension of iwi knowledge, history, or identity. The landscape itself becomes curriculum, where the order, direction, and pace of movement are pedagogically significant.

Co-presence with sites of significance establishes the threshold condition for learning within the model. The requirement for physical presence before knowledge can be accessed reflects tikanga-based principles in which access is contingent on appropriate engagement, and in which the conditions required to encounter [for encountering?] knowledge are as significant as the knowledge itself.

The threshold is tikanga in digital form: you arrive before you receive. This ensures that learning remains grounded in embodied encounter and that the digital system maintains the conditions that have long governed Indigenous knowledge transmission. By making presence a prerequisite for access, the model positions the body in place as the starting point for learning.

The questions within the system are designed to deepen understanding and connection to the site in question. Early in an encounter, a user may be asked to recall names, relationships, or events connected to the kōrero they have just encountered. As engagement deepens, the questions shift from recall towards interpretation, reflection, and connection. Initial recognition gives way to comprehension, and comprehension gives way to obligation and responsibility.

Within kaupapa Māori, learning is never simply about acquiring knowledge. Knowledge carries obligation. When you know something, you become responsible for carrying it correctly, using it appropriately, and passing it on. The questioning sequence is therefore designed to make responsibility visible. By the end of an encounter with a significant site, the player should understand not only the site itself but also their relationship to it (Smith, 1999).

This is not a new pedagogy. It is the formalisation of a logic long present within kaupapa Māori: that learning requires presence, that knowledge carries obligation, and that authority over what is shared belongs to those who hold it. What this article proposes is a design logic capable of making those conditions structurally enforceable within a contemporary spatial system, enabling the pedagogical intent long present within Indigenous GIS to be enacted through infrastructure aligned with it (Smith, 1999).

Enacting Pedagogy Through Location-Based Systems

The system takes familiar location-based mechanics and reconfigures them as a structured learning environment in which the primary rewards are embodied knowledge of place and strengthened connections with iwi life. Logged-in iwi members navigate a map of their rohe, travel physically to designated sites, scan QR codes to verify their presence, and unlock stories, media, and question sets curated by iwi knowledge holders. Membership engagement, iwi communication, and whānau economic participation are integrated into the learning environment through systems governed by iwi entities.

Key Features

1. Map-Based Interface and Indigenous Cartographies.

The primary interface is a custom cartographic view that places Māori place names at the centre of the map, not as a secondary layer beneath English names but as the primary identity of the landscape. The names that appear are those that iwi use: names that carry genealogical, historical, and cosmological meaning, including the specific names of awa, pā, urupā, and wāhi tapu that would not appear on any commercial map. Māori place names often encode the ancestor who resided there, the event that occurred, or the natural feature that defines it. The map itself becomes a pedagogical surface before the player has travelled anywhere or scanned anything.

Beyond place names, the interface makes visible the rohe, showing whose territory the player is in according to iwi and hapū boundaries rather than local government districts or suburb names. For someone who has grown up knowing they are Ngāti Hikairo but has never seen that represented on a map they use every day, this is significant. The landscape is returned to its Indigenous spatial logic.

The system then organises that landscape into thematically grouped trails that give the player a structured pathway through it. Rather than presenting all sites as an undifferentiated collection of pins with no obvious relationship to each other, a player might choose to follow an awa journey, travelling a river and encountering the sites and narratives connected to it from source to sea. They might follow a mōteatea, visiting sites that are sung through that mōteatea. Or a hekenga

that their tūpuna needed to do, to survive. Or for that matter a mahinga kai trail connecting the player to places where food was gathered, to practices of sustainability, seasonal knowledge, and kaitiakitanga.

Each trail is a curriculum in itself. The player is not collecting locations; they are being taken through a particular dimension of iwi knowledge and identity, one site at a time, in an order that makes the connections between them visible.

2. On-Site Verification via QR Codes and Location.

Each participating site of significance is associated with a physical QR marker and a digital geo-reference, requiring players to be physically present at the site to unlock its content. QR codes may be embedded into pou, signage, or other culturally appropriate markers to minimise visual intrusion while enabling robust verification to prevent remote or automated spoofing. The coupling of QR and GPS ensures that learning and engagement remain grounded in embodied encounter. You cannot unlock a site from your couch; you need to be there. This reflects tikanga-based principles where access is contingent on appropriate engagement.

3. Storytelling, Questions, and Reflective Play.

Upon verification, players access a curated bundle of media, such as audio kōrero from kaumātua, images from whānau archives, waiata excerpts, or textual narratives, that frame the site within iwi histories, cosmologies, and contemporary realities. Each story segment is followed by a short sequence of interactive questions, for example multiple choice, ordering timelines, kupu matching, or interpretive prompts, that test recall but also invite relational and ethical reflection about the site and its ongoing significance.

Higher level players are increasingly asked to engage with “why” and “so what” questions and may be prompted to record short, optional reflections that contribute to a growing, moderated corpus of community perspectives. These narratives function as the primary mode of knowledge transmission, situating the learner within whakapapa and historical continuity, rather than presenting information as isolated or decontextualised content.

4. Progression System and Culturally Grounded Ranks.

Progression is articulated through a tiered-rank system that tracks the number, diversity, and depth of sites engaged with, moving players from novice roles towards positions symbolising responsibility and guardianship. While drawing inspiration from level-based structures in mainstream role-playing and location-based games, the rank names and thresholds are co-designed with iwi to respect tikanga and avoid trivialising chiefly titles. In-game badges and titles emphasise kaitiakitanga, such as guardians of the awa or of whenua kōrero, reinforcing the game’s orientation towards service and responsibility (Burnett, 2023).

5. Iwi Engagement, Membership, and Communication.

A core feature of the platform is its function as an iwi-engagement infrastructure. Player profiles double as membership profiles, with clear consent and messaging that the data they provide support iwi planning, representation, and service delivery. Within the game, access to certain features, such as members-only kōrero, special trails, or participatory design votes on new content, can be tied to verified membership status, creating positive incentives for members to keep their details current. Routine touchpoints in the game, for example rank progression or new quest unlocks, prompt members to confirm or update contact details, marae affiliations, or location, helping iwi organisations maintain accurate and current rolls.

The platform also serves as a targeted communication channel for iwi events and activities. Iwi entities can push notifications about hui, wānanga, sports events, cultural festivals, or consultation

processes to members based on their location, which trails they have engaged with, and their expressed interests, rather than issuing one-size-fits-all pānui. Event-specific quests can make attending hui, participating in wānanga, or visiting new pou part of the game's progression, rewarding participation with unique stories, badges, or in-game recognition.

6. Iwi Businesses and Circular Economy.

An integrated business layer connects site engagement and membership data with iwi and whānau enterprises, including food, accommodation, tours, and services located near or thematically linked to specific sites. Business owners maintain profiles within the platform, update offers, and optionally sponsor trails or events, while players encounter these offerings contextually.

For example, after completing a river trail, they may discover nearby iwi-owned cafés, accommodation, or waka experiences. Rewards such as discounts or special experiences can be tied to in-game achievements or ranks, creating a circular economy in which digital play supports local iwi and whānau businesses.

Whenua-Based Pedagogy and the Design of Location-Based Learning Systems

What the preceding sections establish is that each design feature carries a pedagogical justification that precedes its technical specification. The map is structured the way it is because of how kaupapa Māori understands landscape. The QR threshold exists because of how tikanga governs access to knowledge. The questioning sequence is structured according to what learning within iwi contexts requires, including relational and whenua-based forms of inquiry. The technology enacts the pedagogy; it does not define it.

Governance, Ethics, and Data Sovereignty

Content, site selection, and visibility settings are governed by iwi entities, with differentiated layers for public, members-only, and restricted content to ensure that sensitive kōrero and sites are protected. Player data, including location traces, answer histories, progression metrics, and membership details, are treated as taonga, housed within iwi-controlled infrastructures and subject to clear, transparent data governance that prohibits commercial resale or secondary exploitation. Aggregated analytics, such as patterns of engagement by age group, time of day, region of residence, or trail popularity, are made available to iwi decision makers to inform cultural, educational, economic, and engagement strategies, while individual identities remain protected.

This aligns with Indigenous data sovereignty principles that position iwi as the primary decision makers over data lifecycles, access, and use. Governance, within this system, is the pedagogy. The conditions under which knowledge is accessed, shared, and protected are not administrative constraints layered over the learning experience. They are what makes the learning experience possible (Carroll et al., 2020; Hudson et al., 2016; Kukutai et al., 2023; Taiuru, 2025).

Contribution to Theory and Practice

The central contribution of this article is a reframing. Indigenous GIS is not only a tool of sovereignty, a means of asserting control over spatial data and protecting culturally sensitive knowledge. It is a medium of transmission, a domain through which mātauranga can be encountered, enacted, and deepened through structured engagement with whenua. That reframing shifts the question the field asks of its own systems: not only who controls the map, but what the map can be designed to do for the person standing in the landscape it represents.

For Indigenous pedagogy specifically, the whenua-based model demonstrates that digital mediation does not require abstraction from place. Technology can be designed to return the learner to whenua, structuring access to knowledge through appropriate forms of engagement rather than unrestricted consumption and doing so in ways that maintain rather than displace the authority of those who hold it (Black, 2014; Doherty, 2014; Harmsworth, 1997).

The broader implication is for how Indigenous digital systems are conceived. Pedagogy, governance, and infrastructure cannot be designed in sequence, with one layered on top of another. Each shapes what the others can do.

Consider how access to a site of significance is handled within this system. The infrastructure decision is what technology verifies that a player is physically present. The governance decision is who can access the site at all, under what conditions, and what level of membership or progression is required before content unlocks. That decision belongs to the kaumātua and knowledge holders who hold responsibility for the site. The pedagogical decision is what the player encounters when access is granted, in what sequence, and what questions follow.

In a system where these three things are designed separately, the result is a technically functional platform that delivers content to whoever reaches a GPS co-ordinate, governed by terms and conditions written by a developer, with questions generated by a content team. The infrastructure works; the governance is nominal; the pedagogy is generic.

In this system, the three cannot be separated. The governance decision, for example that a particular site is restricted to verified members of a specific hapū who have completed the preceding trail, directly shapes what the infrastructure must do, which in turn shapes what the pedagogical encounter looks like when it occurs. The kaumātua who determines that a particular piece of kōrero can only be shared with someone who has demonstrated a certain level of engagement has made a pedagogical decision and a governance decision simultaneously. The infrastructure enacts both.

Technology designed separately from tikanga carries the assumptions and decision-making structures embedded within its architecture from the outset. A system developed through the integration of pedagogy, governance, infrastructure, and tikanga becomes something fundamentally different: a mechanism by which tikanga shapes both the storage of knowledge and the conditions in which that knowledge is encountered.

Implications for Iwi Engagement and Digital Sovereignty

The implications of this work extend beyond the design of a location-based system. Iwi engagement, within this framework, means reestablishing relationships between iwi members and whenua through structured forms of learning. The model shifts the focus from increasing user activity to deepening relational connections, where returning to a significant site, hearing the kōrero held there, and reflecting on what it asks of you becomes the measure of engagement rather than time spent on a platform.

Learning within this system is woven into iwi life rather than sitting alongside it. Within this model, updating a contact detail, attending a wānanga, and visiting a pā are all expressions of the same relational process through which identity and belonging are affirmed and renewed. Knowledge, identity, and participation are not separate domains to be managed independently. They are dimensions of a single ongoing relationship between an iwi member and their whenua, their whakapapa, and their community.

Digital sovereignty, within this framework, is a condition of learning. Who controls the system, the data, and access to knowledge directly shapes how learning occurs (Kukutai et al., 2023; Mutu, 2020).

Consider two versions of the same system, with the same sites, the same kōrero, and the same questions, but with different sovereignty arrangements. In the first, the system is hosted on a commercial cloud platform, data are stored on servers outside iwi control, and access protocols are determined by a developer's terms of service. A player arrives at a wāhi tapu site and unlocks the kōrero. The content appears. Technically, the learning encounter has occurred, but the data generated by that encounter, where the player went, how long they stayed, what questions they answered, their membership details and location, flow into an infrastructure that iwi do not control. The developer can change the terms. The platform can be sold. The data can be used in ways that were not agreed to. The learning encounter happened, but the conditions surrounding it were governed by a commercial agreement, not by tikanga.

In the second version, the same player arrives at the same site. The same kōrero unlocks, but the data generated by that encounter are housed within iwi-controlled infrastructure, governed by protocols that kaumātua and knowledge holders designed, subject to data governance that prohibits any use beyond what iwi have sanctioned. The kaumātua who contributed the kōrero knows exactly who has heard it, under what conditions, and retains the authority to withdraw it if those conditions change.

In the first version, the learning encounter is real but the sovereignty is nominal. In the second, sovereignty is not a layer added over the top of the system; it is what makes the learning encounter legitimate. By ensuring that iwi retain authority over data lifecycles, access protocols, and content governance, the model aligns technological infrastructure with tikanga, reinforcing that knowledge is relational, protected, and context dependent. Digital sovereignty is the ground upon which the pedagogical design stands. Without it, the conditions that make the learning encounter possible cannot be guaranteed (Carroll et al., 2020; Kukutai et al., 2023).

The approach demonstrated here offers a model for designing technologies that return users to whenua, reinforcing Indigenous knowledge systems in contemporary environments. Digital platforms developed for Indigenous contexts must be conceived as integrated systems in which pedagogy, governance, and infrastructure are designed together from the outset. This integration ensures that technological development serves iwi aspirations. The system creates the conditions that allow Indigenous knowledge to be encountered according to its own relational and cultural terms.

The pedagogical model outlined here establishes the conditions that enable Māori digital spatial technologies to function as environments for learning, not simply tools for representation.

Conclusion

This article set out to examine whether digital systems can support the conditions through which Indigenous knowledge is transmitted. It argues that they can, provided the design begins with pedagogy. By grounding the whenua-based pedagogical model in kaupapa Māori and Indigenous pedagogies of place, and demonstrating how it can be enacted through a location-based spatial system, the article repositions Indigenous GIS as a pedagogical domain capable of supporting structured, place-based learning within iwi contexts. Its contribution lies in reframing spatial systems as environments shaped by the conditions knowledge requires rather than by the capabilities technology provides.

The significance of this reframing lies in what it demands of future design. If spatial systems are understood as pedagogical environments, then design decisions carry consequences for how learning occurs, how knowledge is governed, and how relationships between people and place are mediated. Pedagogy, tikanga, and digital sovereignty must therefore be integrated from the outset, because architecture inevitably embeds assumptions about access, authority, and control.

This has direct implications for Indigenous technology development. When digital systems are designed before governance conditions are established, iwi may retain authority over content while remaining excluded from decisions about infrastructure, access, and data control. The result is often a platform that carries Māori content while operating according to external logics (Carroll et al., 2020).

An alternative approach begins with kaumātua, knowledge holders, and iwi governance structures. Questions of what knowledge can be shared, with whom, under what conditions, and on whose authority become the starting point for design. Infrastructure is then developed in response to tikanga rather than the reverse.

This article defines the pedagogical conditions required to support Māori digital spatial technologies. It demonstrates that spatial learning, when grounded in Māori ontology, operates through engagement with whenua rather than through abstraction or representation. On this

basis, the development of Māori digital spatial technologies requires pedagogical foundations aligned with whakapapa, movement, co-presence, and narrative. These conditions reposition spatial technologies as environments where knowledge is encountered, enacted, and transmitted within relationships to place.

The implications extend beyond system design to the training of future practitioners. Māori digital spatial technologies require technical capability integrated with cultural and relational grounding, including fluency in whakapapa, tikanga, and Indigenous approaches to knowledge governance. In this way, Māori digital spatial technologies emerge not simply as extensions of GIS but as a distinct domain grounded in Māori ontological and pedagogical principles.

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GLOSSARY

Ahi kā	Burning fires
Awa	River
Hapū	Subtribe
Hekenga	Migration
Iwi	Tribe
Kaitiakitanga	Guardianship
Kaumātua	Elder
Kaupapa Māori	Māori customary practice
Kōrero	Talk/speech
Kōrero tuku iho	Oral tradition
Kupu	Word
Mahinga kai	Cultivated garden/area
Mātauranga	Māori knowledge
Mōteatea	Lament
Ngāti Hikairo	Tribal group of the area between Pirongia mountain and Kāwhia Harbour
Ngāi Tahu	Tribal group of much of the South Island
Pā	Fortified village
Pānui	Announcement
Pou	Pillar
Rohe	Boundary
Tikanga	Protocol
Tohunga	Proficient/expert
Urupā	Cemetery
Wāhi tapu	Sacred place
Waiata	Song
Whakapapa	Lineage
Whenua	Land

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