

Indigenous Perspectives in STEAM

Integrating Place-Based Knowledge with Scientific Principles

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March, 2025

Learning Objectives

By the end of this presentation, you will be able to:

- Describe the relationship between place-based knowledge and scientific understanding
- Identify key elements of Indigenous physics perspectives
- Recognize parallel concepts between traditional knowledge and modern physics
- Apply diverse knowledge systems to solve physics problems
- Evaluate how Indigenous perspectives can enhance scientific inquiry

Place-Based Knowledge: Foundations

- Knowledge deeply connected to specific locations
- Understanding derived from direct experience with environments
- Knowledge passed through generations of observation
- Emphasis on relationships between phenomena
- Context-dependent rather than abstract



Key Insight

Place-based knowledge recognizes that understanding is embedded in specific contexts rather than universal abstractions.

Relational Understanding in STEAM

Western Approach

- Isolates variables for study prediction
- Reduces systems to fundamental parts
- Seeks universal laws

Indigenous Approach

- Emphasizes interconnectedness of phenomena
- Studies relationships between elements
- Recognizes context-dependent variations

Example Application

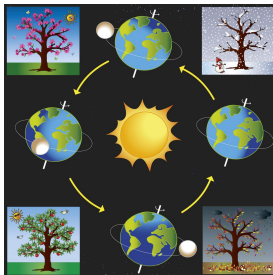
Understanding wave phenomena through observing interactions in natural water systems rather than through isolated wave equations.

Observational Expertise

- Knowledge built through generations of careful observation
- Detailed understanding of patterns and cycles
- Recognition of subtle environmental indicators
- Correlation of multiple phenomena simultaneously

Connection to Scientific Method

Both Indigenous knowledge and modern science value observation as a primary tool, but differ in recording methods and time scales.



Holistic Approaches to Physical Phenomena

Western Scientific Approach

- Studies phenomena in isolation
- Controls variables
- Seeks objective measurement
- Prioritizes quantitative data

Indigenous Approach

- Examines phenomena in context
- Observes interrelationships
- Incorporates multiple perspectives
- Values qualitative observations

Complementary Nature

These approaches can be seen as complementary rather than contradictory, offering different insights into the same phenomena.

Astronomical Knowledge

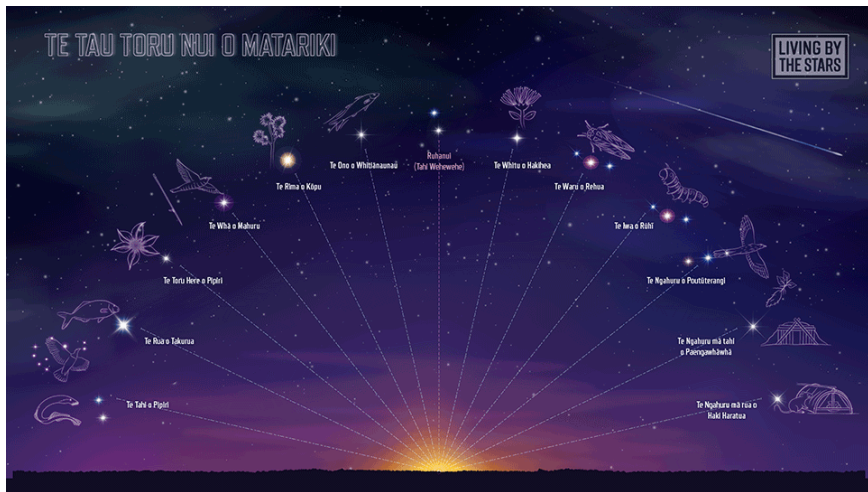
- Many Indigenous communities developed sophisticated celestial understanding
- Star positions used for navigation, timekeeping, and seasonal planning
- Recognition of planetary movements and cycles
- Correlation between celestial events and Earth-based phenomena
- Integration of astronomical knowledge into cultural practices

Example: Celestial Navigation

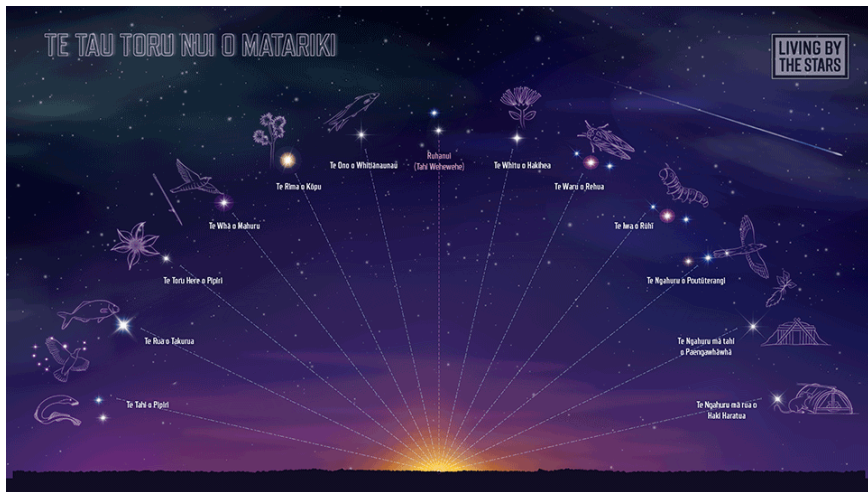
Pacific Islander wayfinding techniques incorporate detailed knowledge of star positions, ocean currents, and wave patterns to navigate vast distances.



TE TAU TORU NUI O MATARIKI

LIVING BY
THE STARS

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Physics Principles in Traditional Technologies

- Canoe design: Hydrodynamics, buoyancy, stability
- Architecture: Thermodynamics, material properties, structural mechanics
- Hunting tools: Projectile motion, energy transfer, aerodynamics
- Navigation techniques: Astronomy, wave dynamics, wind patterns
- Agricultural practices: Soil physics, hydrology, seasonal energy cycles

Key Insight

Indigenous technologies often optimize for sustainability rather than maximizing immediate output.

Pattern Recognition and Algorithmic Thinking

- Indigenous beadwork, weaving, and quillwork incorporate complex patterns
- These patterns follow systematic algorithms
- Pattern recognition central to both traditions
- Both require precise sequence of operations
- Both involve error detection and correction

Example Connection

The iterative patterns in traditional weaving can be represented as recursive algorithms in computer science.

Indigenous Approaches to Knowledge Management

- Knowledge access determined by appropriate use and relationship
- Consideration of impacts across generations
- Protocols for information sharing and protection
- Recognition of knowledge as living rather than static
- Emphasis on responsible use of information

Relevance to Modern Data Ethics

These principles offer valuable perspectives for addressing contemporary challenges in data privacy, ownership, and algorithmic bias.

Systems Thinking

- Understanding the world as interconnected systems
- Recognition of feedback loops and emergent properties
- Awareness of cascading effects across system boundaries
- Consideration of multiple timescales simultaneously
- Focus on relationships between components

Connection to Computer Science

Systems thinking provides valuable perspectives for complex systems design, network architecture, and software ecosystems.

Complementary Approaches

Strengths of Western Science

- Precise quantitative measurement
- Controlled experimentation
- Mathematical modeling
- Replicability across contexts
- Rapid hypothesis testing

Strengths of Indigenous Knowledge

- Long-term observation
- Contextual understanding
- Holistic perspectives
- Ethical frameworks
- Practical applications

Integration Benefits

Combining these approaches can lead to more comprehensive understanding and more effective, sustainable solutions.

Research Opportunities

Potential Research Projects

- Comparing traditional weather prediction methods with meteorological models
- Analyzing the physics principles in traditional technologies
- Developing educational approaches that integrate multiple knowledge systems
- Examining how traditional ecological knowledge can inform climate science
- Exploring how Indigenous astronomy correlates with modern astrophysics

Methodological Considerations

Effective research requires respectful collaboration, recognition of knowledge ownership, and appropriate protocols for information sharing.

Key Takeaways

Summary Points

- Indigenous knowledge systems offer valuable perspectives on physical phenomena
- Place-based knowledge emphasizes context and relationships
- Traditional technologies demonstrate sophisticated understanding of physics principles
- Indigenous and Western approaches can complement each other
- Integrating diverse knowledge systems can enrich science education and research

Call to Action

As STEAM students, consider how incorporating diverse perspectives might enhance your understanding of natural phenomena and lead to more creative problem-solving.

Questions for Discussion

- ① How might observation-based knowledge complement equation-based knowledge?
- ② What advantages might come from considering physical phenomena in their broader context?
- ③ How could traditional technological solutions inform modern sustainability challenges?
- ④ What ethical considerations from Indigenous knowledge systems might benefit modern scientific practice?
- ⑤ How can we respectfully integrate diverse knowledge systems while acknowledging their distinct origins and purposes?

Thank You

Questions and Discussion