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Cultivating Innovation for One Health: From Curiosity-Driven Learning to Sustainable Solutions

FIDELIS KILONZO, PhD, PE
KENYATTA UNIVERSITY





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The Innovation Paradox



Picture courtesy of Sheila Brown



<https://www.dvidshub.net/>





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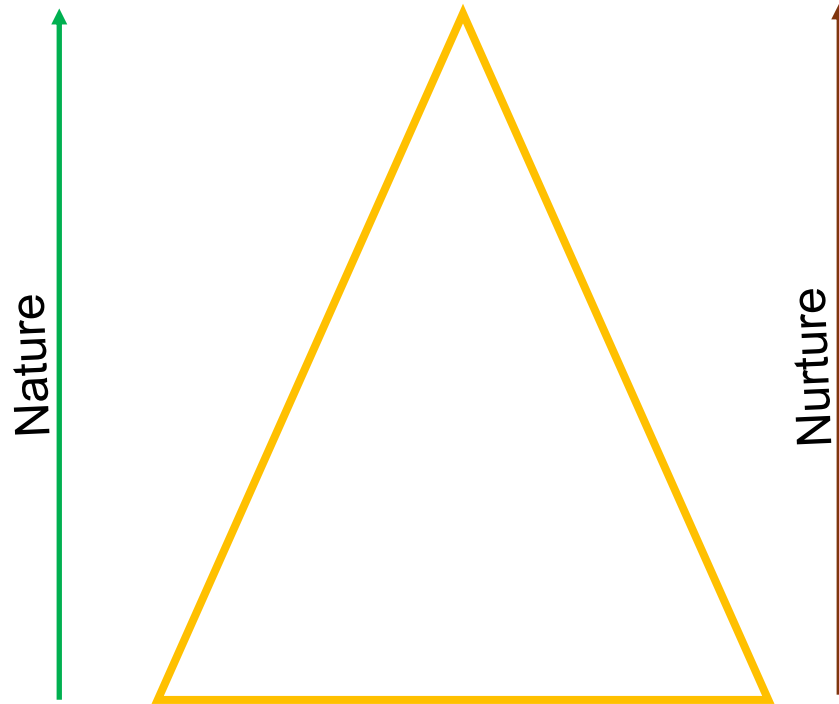


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The Innovation Paradox



“curiosity is nearly universal in babies and continues to propel children throughout early childhood”.

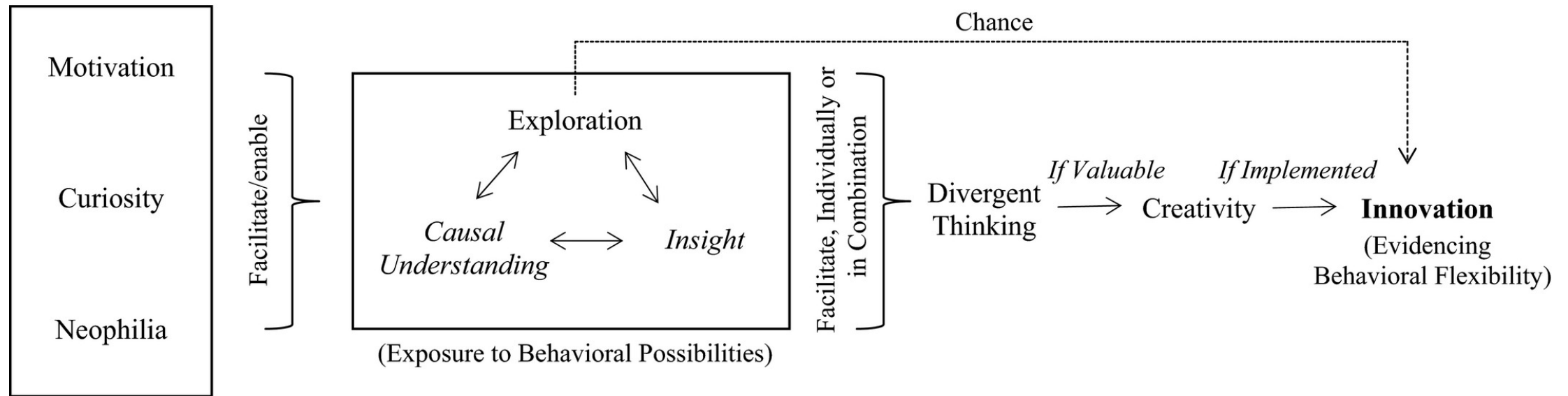
Susan Engel -The Hungry Mind





The Innovation Paradox

A hypothetical individual-level pathway to innovation



Innovation constrained by: Low Motivation, Neophobia, Functional Fixedness, Pedagogy



The Innovation Paradox

Pedagogy

Creativity changes over the life course, finding interesting **slumps** that **coincide** with the start of **formal schooling** and the transition from **primary to secondary schooling** (Hui et al., 2019)

“Many teachers [...] **discourage uncertainty**, emphasizing instead what they know, or feel the students should know. They are more comfortable encouraging students to learn trustworthy information than to explore questions to which they themselves do not know the answer.

Instead of using school as a place to formalize and extend the power of a young child's zest for tackling the unknown or uncertain, **teachers tend to squelch curiosity**. [...] -Sarah Hughes





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The Innovation Paradox

“Writing between the lines or coloring outside the line...what if by coloring the background the zebra actually stands out better....i tried that once...**never again**”





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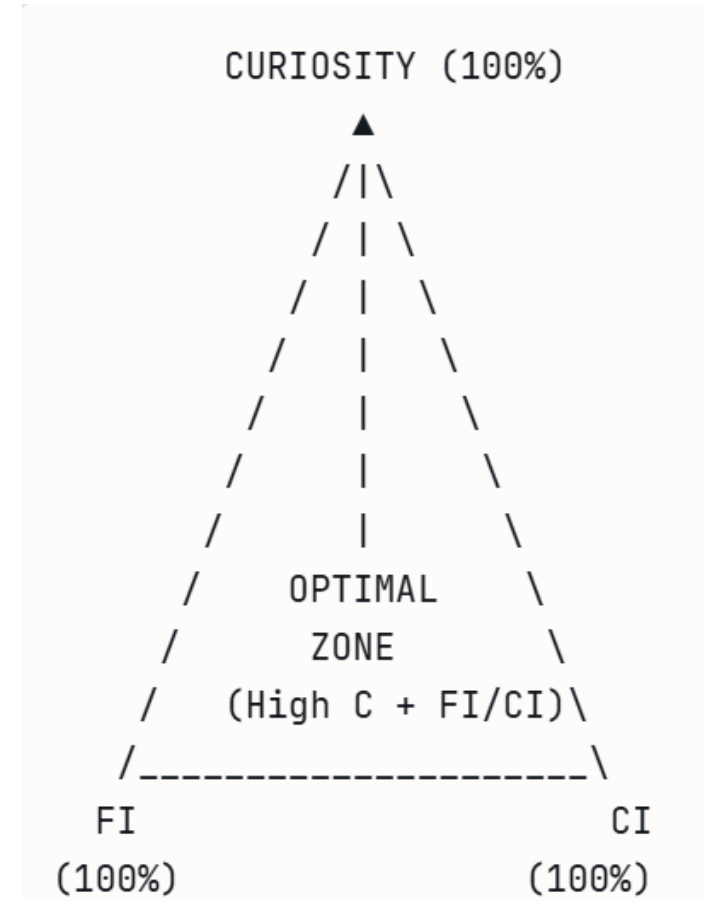
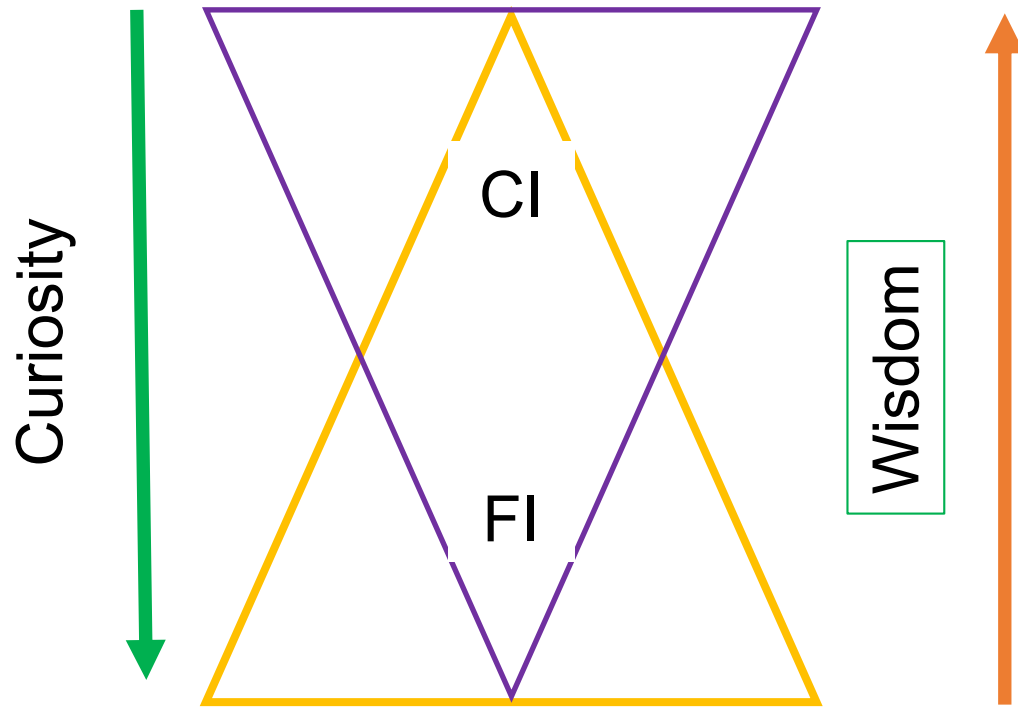
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Innovation Framework for One Health

- Curiosity-Wisdom-Intelligence mix



Innovation for One Health

DREAM framework

Discovery - Finding problems at human-animal-environment interfaces

Reasoning - Systems thinking across disciplines

Exploration - Hands-on, practice-based learning

Mastery - Building genuine competence





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One-health and the sustainable development goals

Examples

- Example 1 - Finding problems at human-animal-environment interfaces and Systems thinking
- Example 2 - Systems thinking across disciplines
- Example 3 - Hands-on, practice-based learning and Building genuine competence





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<p>1 NO POVERTY</p>	<p>2 ZERO HUNGER</p>	<p>3 GOOD HEALTH AND WELL-BEING</p>	<p>4 QUALITY EDUCATION</p>	<p>5 GENDER EQUALITY</p>
<p>6 CLEAN WATER AND SANITATION</p>	<p>7 AFFORDABLE AND CLEAN ENERGY</p>	<p>8 DECENT WORK AND ECONOMIC GROWTH</p>	<p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	<p>10 REDUCED INEQUALITIES</p>
<p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>	<p>THE GLOBAL GOALS For Sustainable Development</p>			<p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p>
<p>13 CLIMATE ACTION</p>	<p>14 LIFE BELOW WATER</p>	<p>15 LIFE ON LAND</p>	<p>16 PEACE AND JUSTICE STRONG INSTITUTIONS</p>	<p>17 PARTNERSHIPS FOR THE GOALS</p>



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EXAMPLE 1 AVERMECTIN - IVERMECTIN

Wonder drug that won Nobel Prize
in Physiology or Medicine

Treats parasitic diseases in
humans (river blindness,
lymphatic filariasis - SDG 3)

Widely used in livestock for
parasite control (animal health,
SDG 2)





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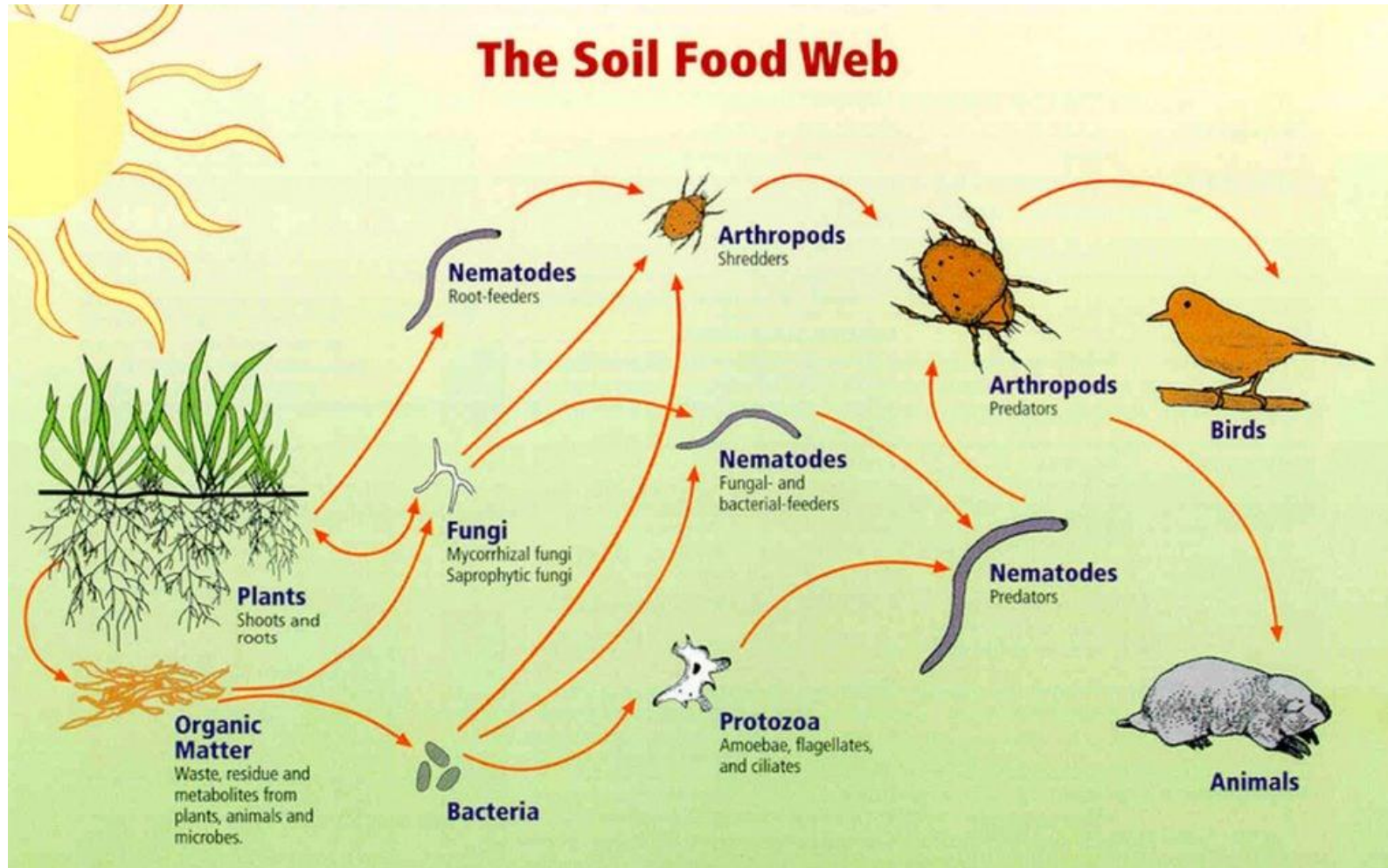


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The Soil Food Web



Systems thinking

Connect veterinary medicine
→ soil ecology
→ food security

Innovation for One Health

- **SDG Connections**

SDG 3 (Good Health)- Maintaining access to essential treatment

SDG 2 (Zero Hunger)- Protecting soil fertility and livestock productivity

SDG 15 (Life on Land)- Preserving soil biodiversity

SDG 12 (Responsible Consumption)-Sustainable pharmaceutical use

SDG 13 (Climate Action)- Healthy soils sequester carbon





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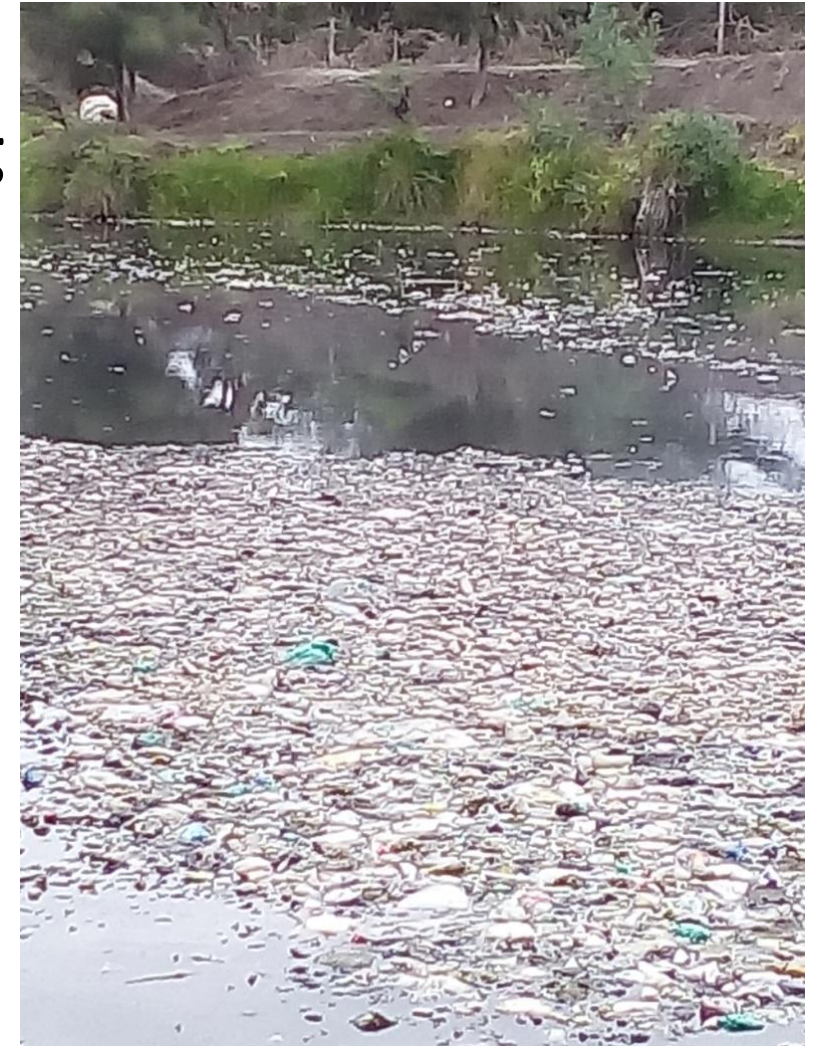


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EXAMPLE 2 Water Quality Monitoring





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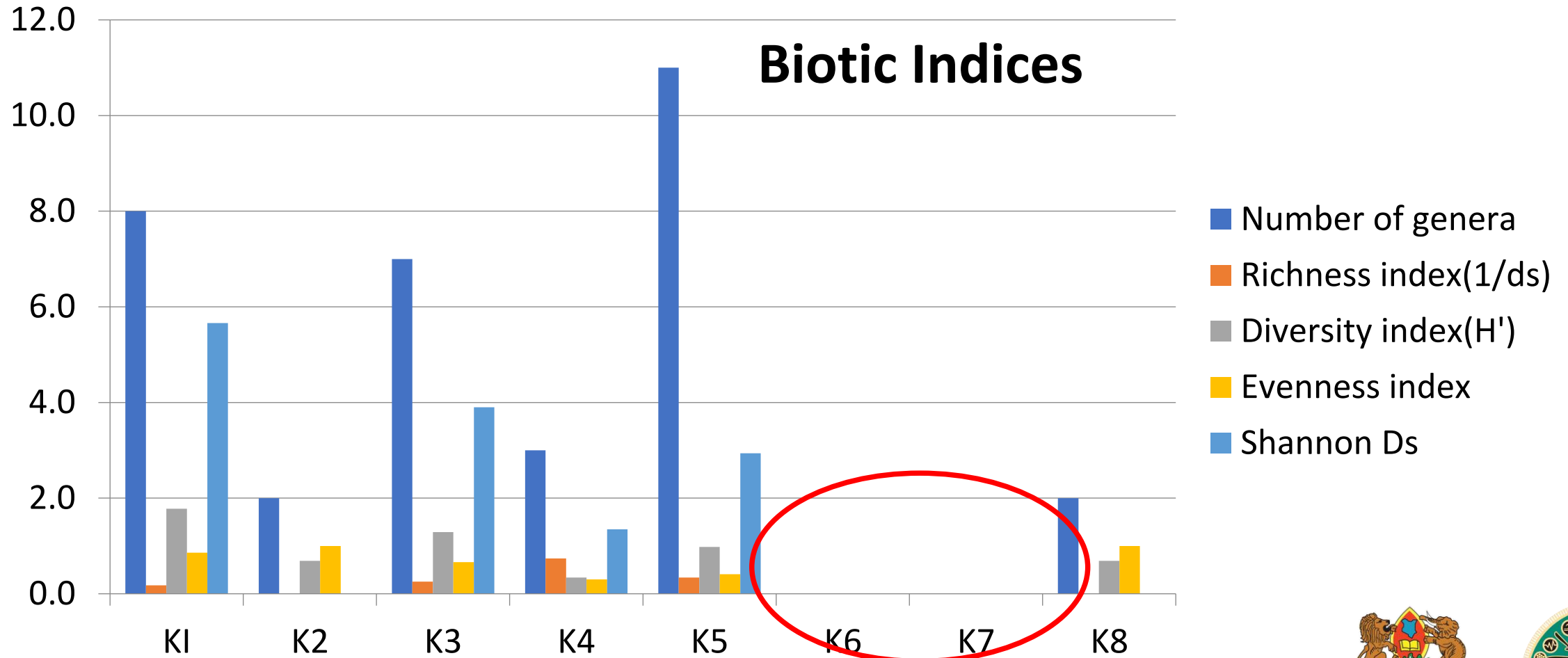
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Kilonzo et al., 2017



Kinuthia et al., 2020



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Mwanzu et. al., 2023

Humans, Animals & Environment Share Water

Student-Led Innovation

- Students map water sources in their community
- Interview families about water collection patterns
- Observed Animals drink from same sources as humans collect water
- Observe irrigation with unclean water and connect with disease incidences



CITIZEN SCIENCE INITIATIVES

Quantify and gain insights into the dynamics of

- Water
- Waste
- Sediment
- Emissions



DREAM Principles

- Discovery: Community problem identification through observation
- Reasoning: Understanding multiple contamination sources
- Exploration: Prototyping with available materials (makerspace access)
- Mastery: From "I can sense the water is polluted " to "I can monitor and report on water pollution episodes"





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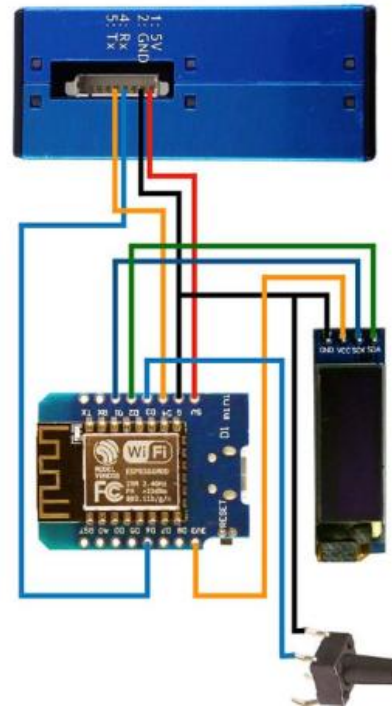
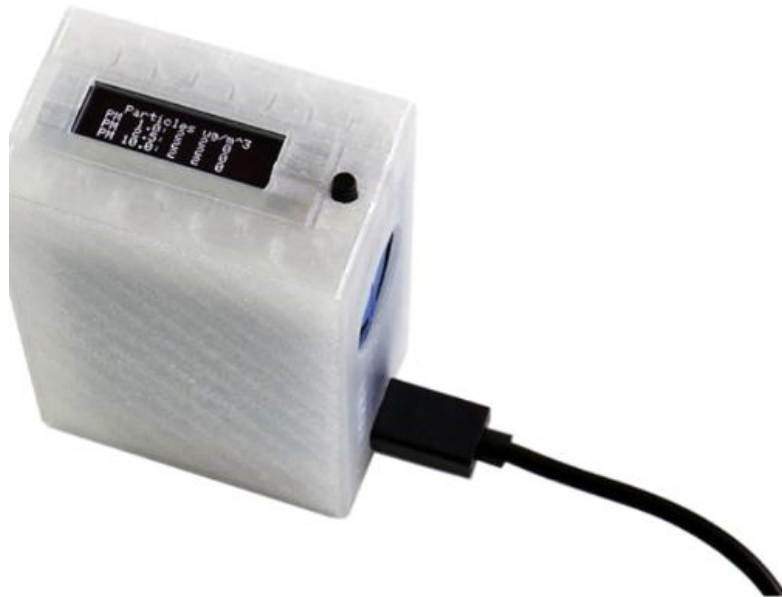


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Prototyping



Sensor for PM2.5 designed at Tika
Cezeri Lab Kenyatta University





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EXAMPLE 3 Smart Brick

“50-80% of Kenyan residents in the Coast, Eastern, Rift Valley, Western and Nyanza regions live in houses built from mud and dung” – Kenya Times, 2023

Electricity access rates in Kenya rose from 37% in 2013 to 79% in 2023 –IEA, 2025





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Smart brick

- Collaborative work between Kenyatta University (KU) students and Students at the NYIT, ETIC
- Teams agreed after consultations on the smart brick and worked in Parallel and independently of each other.
- Weekly meetings to discuss progress, discuss challenges and map way forward



Smart brick

Jenga Initiative Members

- Electrical engineering
- Civil engineering
- Energy technology
- Architecture
- Mechanical engineering
- 7 Male & 3 Female

Jenga sub teams

- Studied interlocking block technology
- Designed molds and made molds using local materials
- Tested different soil/stabilizer ratios
- Tried different panels sizes
- Tested different circuit architecture



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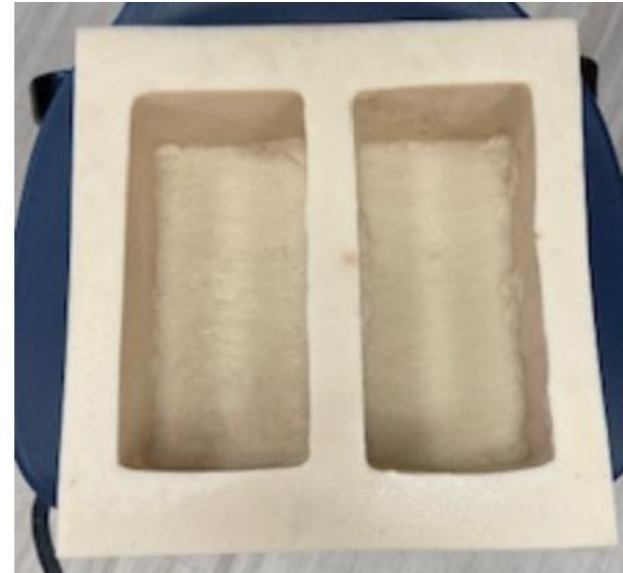
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Local resources

metallic mold – KU student



Silicone mold – NYIT student





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ITERATIONS





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One Health Reality:

- Problems are wickedly complex - no single discipline has answers
- Your expertise is essential BUT insufficient alone
- Coach-ability multiplies your impact: You + collaborators = solutions
- **The willingness to learn is more valuable than what you already know**



Parting shot

- One challenge touches multiple SDGs - Ivermectin connects SDG 3, 2, 12, 13, 15
- Technologies are tools, not solutions – Apps/software enable behavior change, they don't replace critical thinking
- Student agency is essential -These aren't top-down interventions - students identify problem and co-created solution
- Mastery enables impact -Surface knowledge can't produce these outcomes





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One Health Challenge

- Identify ONE One Health problem in your community
- Map the interdisciplinary connections-three overlapping circles (Human-Animal-Environment)- concentrate on intersection
- leverage local resources
- Commit to mastery in ONE relevant skill - Build solid foundations before adding complexity (10000hrs???)
- Form One Health team - No individual has all competencies - collaboration multiplies impact



Conclusion

- **Invert the curiosity pyramid**
- Curiosity over conformity
- Pursue mastery instead of skating over gaps
- Collaborate instead of competing
- Apply knowledge to community problems – Human Centered ethical designs





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THANK YOU

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