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PANEL BIONATURE/BIOTECHNO

Environmental Modeling: Challenges on Biocomputation

Today's Panelists

Moderator:
Vladimir Strezov, Macquarie University - Sydney, Australia

Panelists:

- **Kevin O'Connor, Mount Royal University, Canada**
- **Vladimir Strezov, Macquarie University - Sydney, Australia**
- **Petre Dini (last Mohican)**

Measuring Sustainable Development

- **First time discussed in the Agenda 21:**

  "Countries could develop systems for monitoring and evaluation of progress towards achieving sustainable development by adopting indicators that measure changes across economic, social and environmental dimensions"

- **Multiple sustainability indexes**
- **Criticism towards "lack of a clear direction at the global level in how best to approach sustainable development" (Wilson et al., 2007)**

Sustainability indexes

- Nine indexes (some of the many):
  - Change in Wealth Index (CWI)
  - Ecological Footprint (EF)
  - Environmental Performance Index (EPI)
  - Environmental Sustainability Index (ESI)
  - Genuine Savings Index (GSI)
  - Global Wellbeing Index (GWI)
  - Happy Planet Index (HPI)
  - Human Development Index (HDI)
  - Sustainable Society Index (SSI).

Indicators for calculation of each index

Index	Economic	Environmental	Social
CWI	Intangible capital Produced capital Natural capital		
EF		Cropland footprint Grazing footprint Forest footprint Fishing ground footprint Carbon footprint Built-up land	
GSI	Gross national savings Consumption of fixed capital	Energy depletion Metals depletion Minerals depletion Net forest depletion Damage from CO_2 Damage from PM_{10}	Expenditures on education

Indicators for calculation of each index

Index	Economic	Environmental	Social
EPI		Air Pollution - Average Exposure to $PM_{2.5}$ Air Pollution - $PM_{2.5}$ Exceedance Household Air Quality Access to Drinking Water Access to Sanitation Wastewater treatment Agricultural Subsidies Pesticide Regulation Change in Forest Cover Fish Stocks Coastal Shelf Fishing Pressure Critical Habitat Protection Terrestrial Protected Areas Marine Protected Areas Trend in Carbon Intensity Change of Trend in Carbon Intensity Trend in CO_2 per kWh	Child mortality Access to Electricity

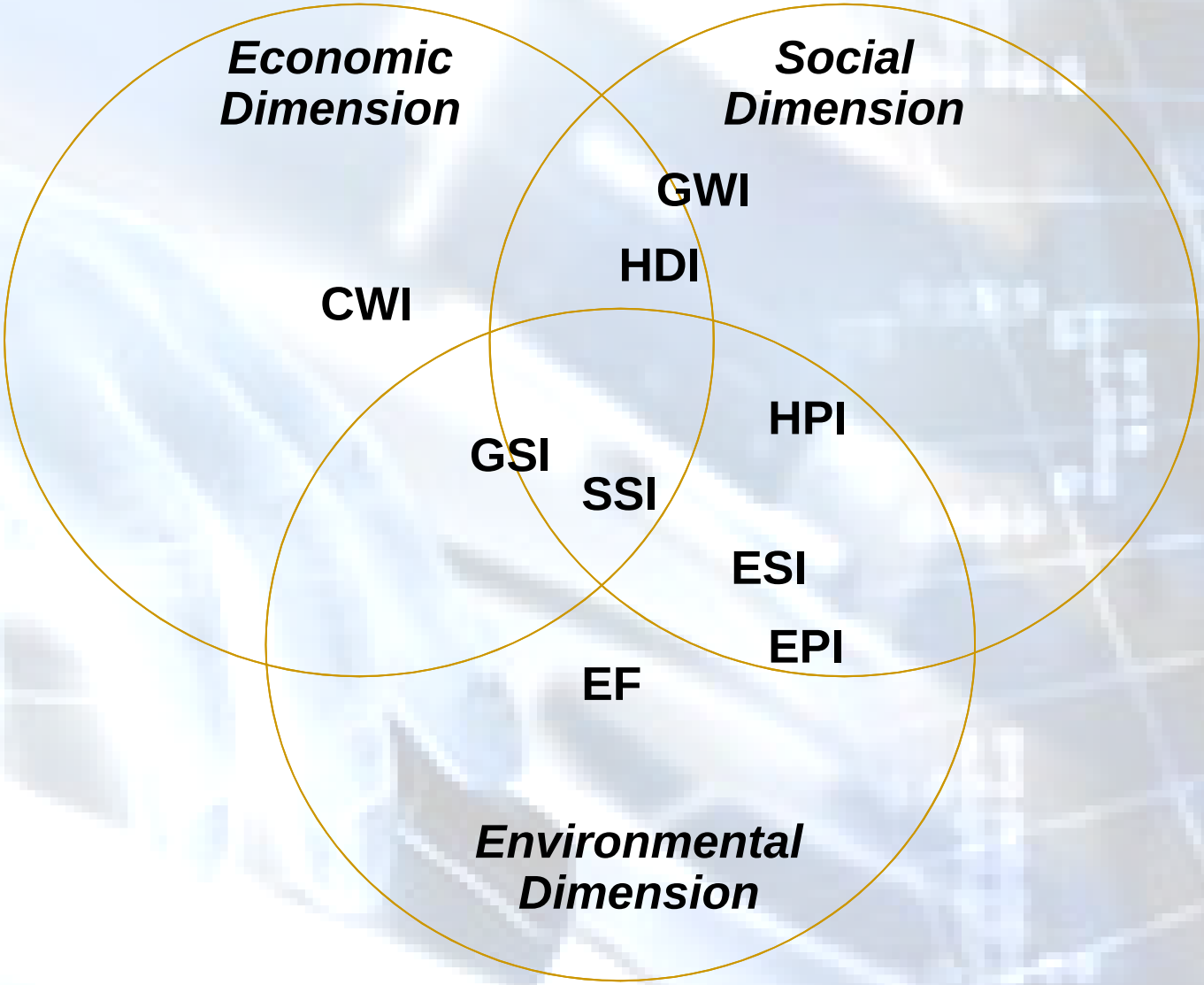
Indicators for calculation of each index

Index	Economic	Environmental	Social	Political
ESI		Air quality Biodiversity Land Water quality Water quantity Reducing air pollution Reducing ecosystem stress Reducing population pressure Reducing Waste & Consumption Pressures Reducing water stress Natural resource management Environmental health Eco-Efficiency Greenhouse gas emissions Reducing Transboundary Environmental Pressures	Basic human sustenance Reducing Environment-Related Natural Disaster Vulnerability Private Sector Responsiveness Science and Technology	Participation in International Collaborative Efforts Environmental Governance

Indicators for calculation of each index

Index	Economic	Environmental	Social	Political
GWI	Economic life to reduce stress and increase security		Motivation for life Relationship and love Feeling safe Good health and enough energy	
HDI	Income		Life expectancy Education	
HPI		Ecological footprint	Experienced well being Life expectancy	
SSI	Income distribution Genuine savings Gross domestic product Public debt	Clean air Clean water Air quality Biodiversity Renewable water resources Consumption Renewable energy Greenhouse gases Organic farming	Sufficient food Sufficient water to drink Safe sanitation Healthy life Education Gender equality Employment	Good governance

Distribution of indexes



THE CONVENTIONAL DIDACTIC STYLE OF TEACHING SCIENCE DOES NOT ENGAGE THE LARGER POPULATION

EXPERIENTIAL PLACE-BASED SCIENCE PEDAGOGY BETTER DEVELOPS RESPONSIBLE CITIZENSHIP

RESPONSIBLE CITIZENSHIP IS ESSENTIAL TO EMERGING ENVIRONMENTAL CONCERNS

BIONATURE 2015

Dr. Kevin O'Connor, Mount Royal University

The conventional didactic style of Teaching science does not engage the larger population

- Educational institutions tend to be large complex organizations and structures. Schools are often governed by an institutional inertia that makes operative change difficult requiring sustained energy and focus (Fine & Somerville, 1998).
- These educational systems, often secondary schools, are typically organized about specific subjects where teachers may teach a single subject within repeated blocks of time.
- Teachers typically have extensive experience in teaching a narrow range of subjects using traditional didactic instructional practices.
- The timetabling tends to be inflexible and students are thrown together in different groups each timetable rotation.
- A teacher may encounter more than 100 students each day and after the semester may not see the cohort of students again throughout their secondary school career.

Experiential Place-based science pedagogy better develops responsible citizenship

A survey of the literature on PBE reveals characteristic patterns to this still-evolving approach that make it distinctive:

- It emerges from the particular attributes of a place. The content is specific to the geography, ecology, sociology, politics, and other dynamics of that place. This fundamental characteristic establishes the foundation of the concept.
- It is inherently multidisciplinary.
- It is inherently experiential. In many programs this includes a participatory action or service-learning component; in fact, some advocates insist that action must be a component if ecological and cultural sustainability are to result.
- It is reflective of an educational philosophy that is broader than 'learn to earn'. Economics of place can be an area of study as a curriculum explores local industry and sustainability; however, all curricula and programs are designed for broader objectives.
- It connects place with self and community. Because of the ecological lens through which place-based curricula are envisioned, these connections are pervasive. These curricula include multigenerational and multicultural dimensions as they interface with community resources.

Responsible citizenship is essential to emerging environmental concerns

- We posit that the conditions that give rise to responsible environmental and social behaviors are a major focus of place-based educational initiatives
- These place-based educational initiatives focus on the development of citizenship focusing on a critical knowledge of social, environmental and political issues and associated action strategies, locus of control, attitudes, verbal commitments and an individuals sense of responsibility within a community.
- The development of citizens who internalize community and global challenges related to social and environmental goals appears to be an essential aspect of addressing phenomena related to climate change.
- educational processes involving place-based activities that encourage data collection, refection and action are important antecedents to responsible citizenship.

Critical Pedagogy and Citizenship

- Glaser's definition of citizenship: "*Good citizenship calls for the ability to think critically about issues concerning which there may be a difference of opinion and apply democratic values to the issues. Critical thinking has three components: an attitude of carefully considering problems, knowledge of logical inquiry methods, and skill in applying those methods*"
- In the examination of the educational processes and social actions that lead to good citizenship, we posit that critical thinking is the central foundation
- A crucial condition to critical pedagogy is it needs a context to be relevant and therefore be sustainable.
- Community issues in which frame place-based learning provide the context for critical thinking, situational conditions, and for attributes such as locus of control.
- Place-based educational activities focus on environmental and social values, situational characteristics and psychological variables; as community action is open to a range of varying and competing interests.