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The Scientific Mind: An Integral Concern in the Development of Human Learning for the 21st Century

Lecture hosted by the
Egyptian Cabinet
Information and Decision Support Center (IDSC)

Jan Visser

jvisser@learndev.org

President, Learning Development Institute
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A talk in five parts

1. Learning and schooling for the 21st century.
2. Thoughtfulness as essential condition for survival of our species (and the biosphere).
3. Our home in the universe and what we made of it.
4. Reflections on the meaning of learning.
5. The (scientific) mind.

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1

Preamble about learning and schooling for the 21st century

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Learning: Not by schooling alone

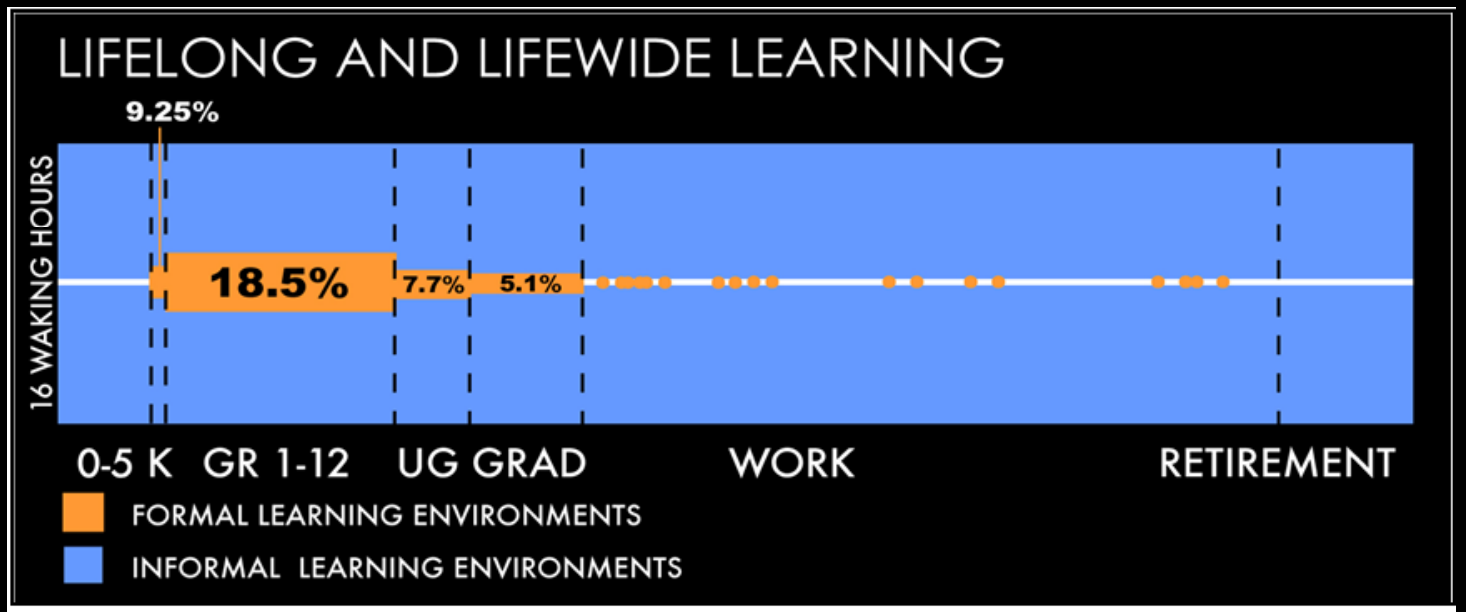

Figure 3-1. The LIFE Center's Representation of Lifelong and Lifewide Learning

Source: Bransford, J. D., Slowinski, M., Vye, N., & Mosborg, S. (2008). The learning sciences, technology and designs for educational systems: Some thoughts about change. In J. Visser & M. Visser-Valfrey (Eds.), *Learners in a changing learning landscape: Reflections from a dialogue on new roles and expectations* . Dordrecht, The Netherlands: Springer.

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A multifaceted learning landscape

- The role of schooling could be crucial only if adequately designed. ➔ Implications:
  - Conception of school as integral component of lifelong and lifewide learning journey.
  - Fundamental curriculum reform: Driven by vision of today's problems and challenges and appreciation of values.
  - Refocusing of approaches towards teaching and learning, aiming at learner autonomy.
  - Ability to acquire knowledge and wisdom more important than possession of knowledge.
- Role of informal learning spaces equally crucial, but different in terms of deliberate intervention (different players).

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Important foci for learning for the 21st century (based on ideas originated by David Christian at San Diego State University)

- Understanding our place in the universe:
  - Spatio-temporal perspective.
  - Questions of origin.
  - Planet earth as one among many products of the evolution of the universe.
  - Humans as the product (in ecological context) of physical, chemical and biological evolution.
  - History of human life on earth.
- Learning relevant skills for now, and the ability to acquire them in the future.
- Envisioning humanity's futures in a planetary perspective (see also Edgar Morin: Seven complex lessons in education for the future – http://unesdoc.unesco.org/images/0011/001177/117740eo.pdf).

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Thoughts about humans, their uniqueness and vulnerability, and why thoughtfulness is essential to their survival

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Human uniqueness (and vulnerability)

- Gerald Edelman: Higher order consciousness is a unique human feature. It is expressed in the ability to interpret the past and imagine the future.
- Blaise Pascal: Humans are *thinking reeds.*
- Stephen J Gould: “Consciousness, vouchsafed only to our species in the history of life on earth, is the most god-awfully potent evolutionary invention ever developed. Although accidental and unpredictable, it has given *Homo sapiens* unprecedented power both over the history of our own species and the life of the entire contemporary biosphere.”

In praise of thoughtfulness
(Skepticism – Gr. *Skeptic* = thoughtful)

Carl Sagan (in 1987 Pasadena lecture on *The Burden of Skepticism*): "It seems to me that what is called for is an exquisite balance between two conflicting needs: the most skeptical scrutiny of all hypotheses that are served up to us and at the same time a great openness to new ideas. If you are only skeptical, then no new ideas make it through to you….

On the other hand, if you are open to the point of gullibility…, then you cannot distinguish useful ideas from the worthless ones. If all ideas have equal validity then you are lost, because then, it seems to me, no ideas have any validity at all."

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3

Our home in the universe and what we made of it.

A reality check.

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Humanity in perspective

Event	Real time scale	1 week time scale	
Universe	13.7 billion years (WMAP, 2005)	Day 1	
Life	3.43 billion years (Allwood, Walter, Kamber, Marshall, & Burch, 2006; Awramik, 2006)	Day 6	
Hominids	From five to ten million years ago (Institute of Human Origin, 2001); i.e., ¼ to ½ million generations	Day 7	5 minutes ago
Humans	100 to 200 thousand years ago (Templeton, A.R., 2002); i.e., 5 to 10 thousand generations		6 seconds ago
Agricultural revolution	10 000 years ago; i.e. 500 generations ago		< 0.5 sec ago
Galileo	4 centuries ago; i.e. 20 generations ago		< 5.10^{-5} sec ago

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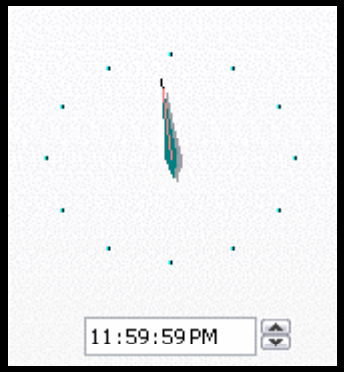
Consequences of human intervention

Agricultural revolution started half a second ago.



8000 BC	8 million
0	250 million
1600	500 million
1800	1000 million
1960	3041 million
2000	6082 million
2008	6677 million

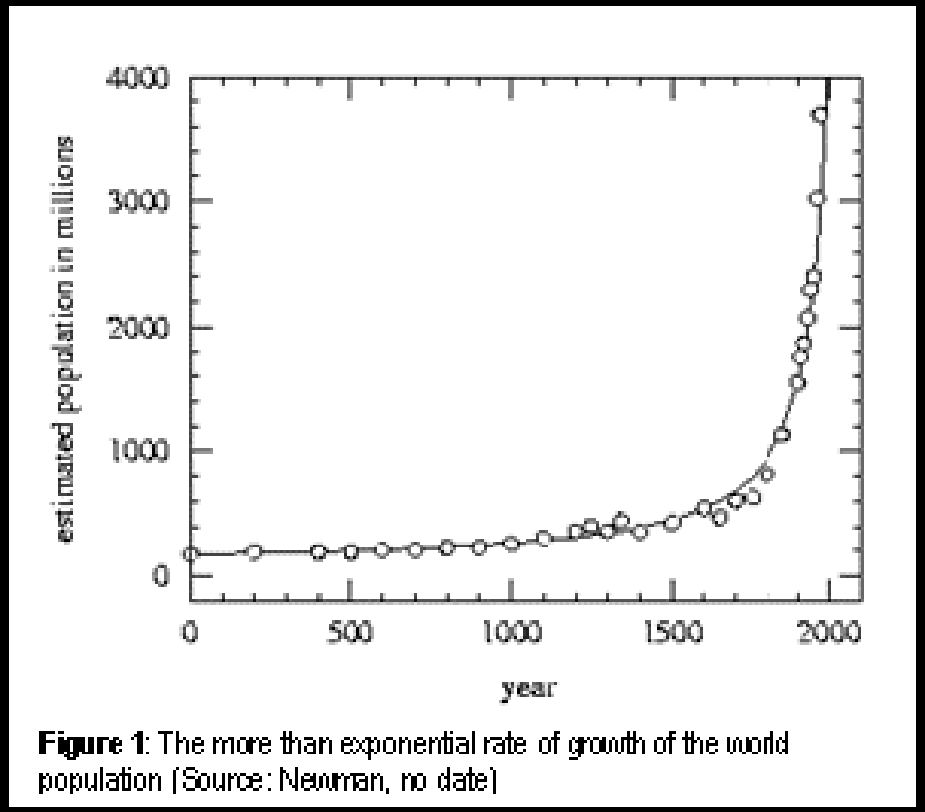
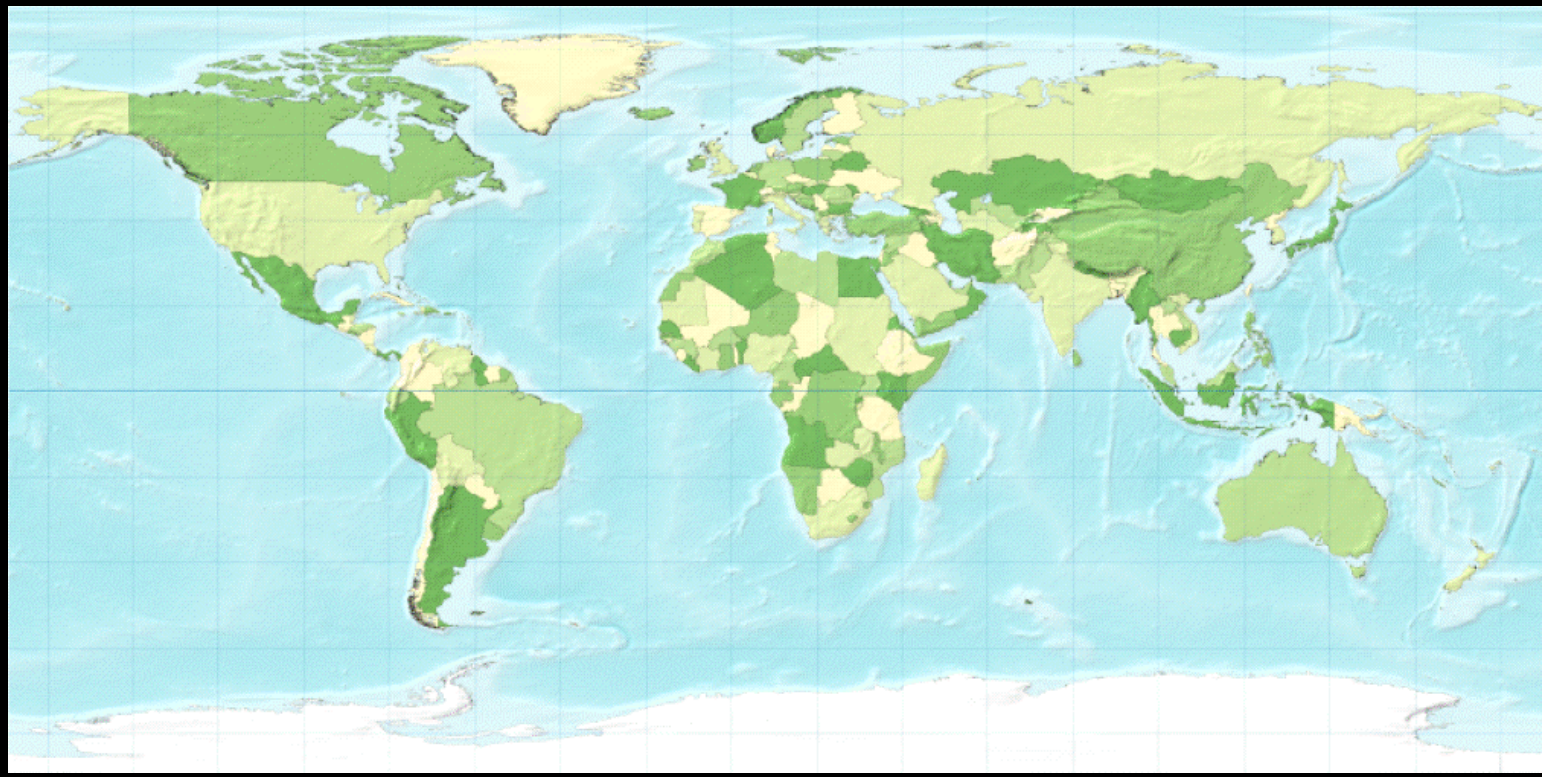


Figure 1: The more than exponential rate of growth of the world population (Source: Newman, no date)

The world as we know it



Source: Images of the social and economic world – Mark Newman

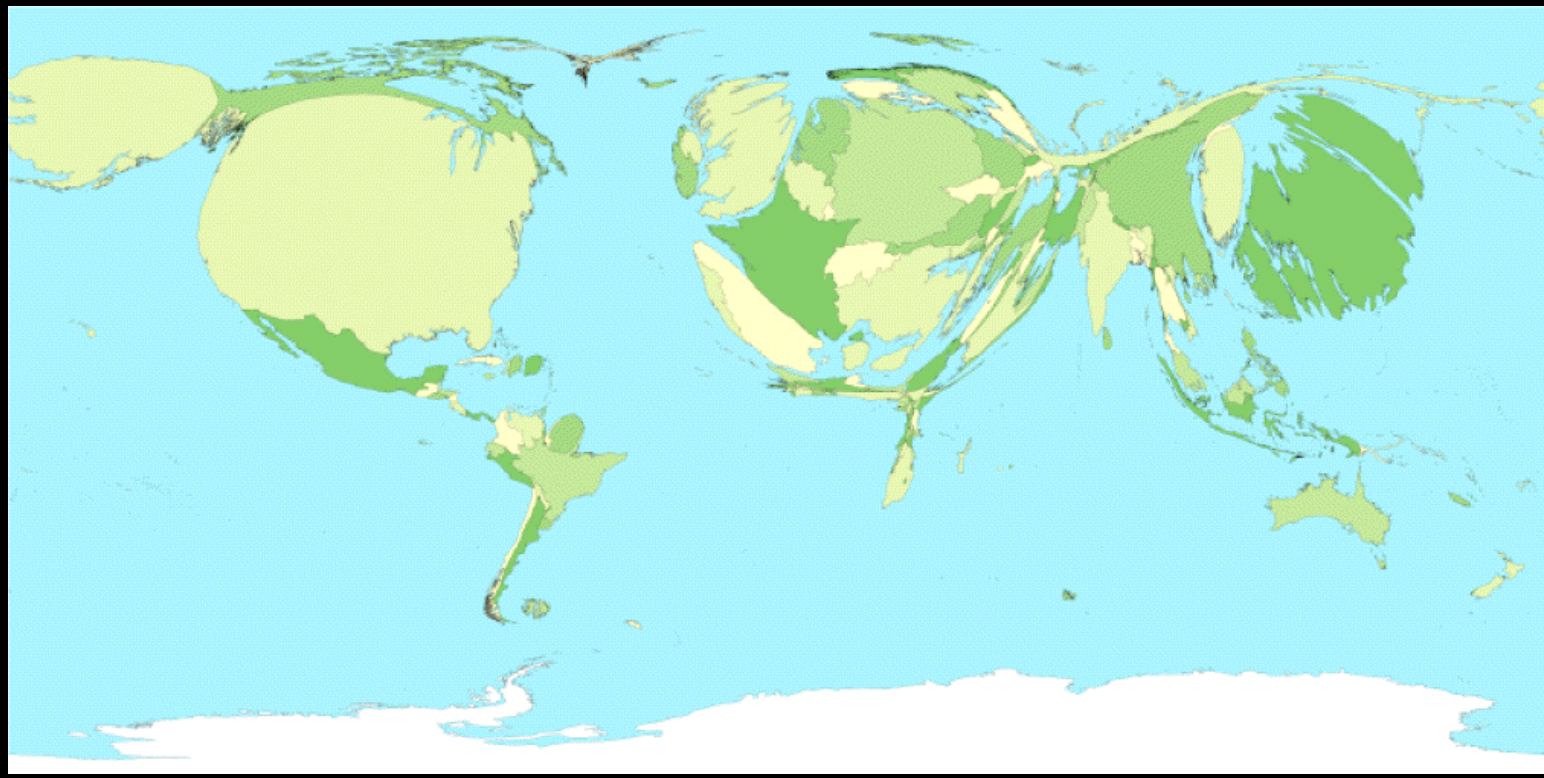
http://www-personal.umich.edu/~mejn/cartograms/

The world in population perspective

Source: Images of the social and economic world – Mark Newman

http://www-personal.umich.edu/~mejn/cartograms/

The world by gross domestic product



Source: Images of the social and economic world – Mark Newman

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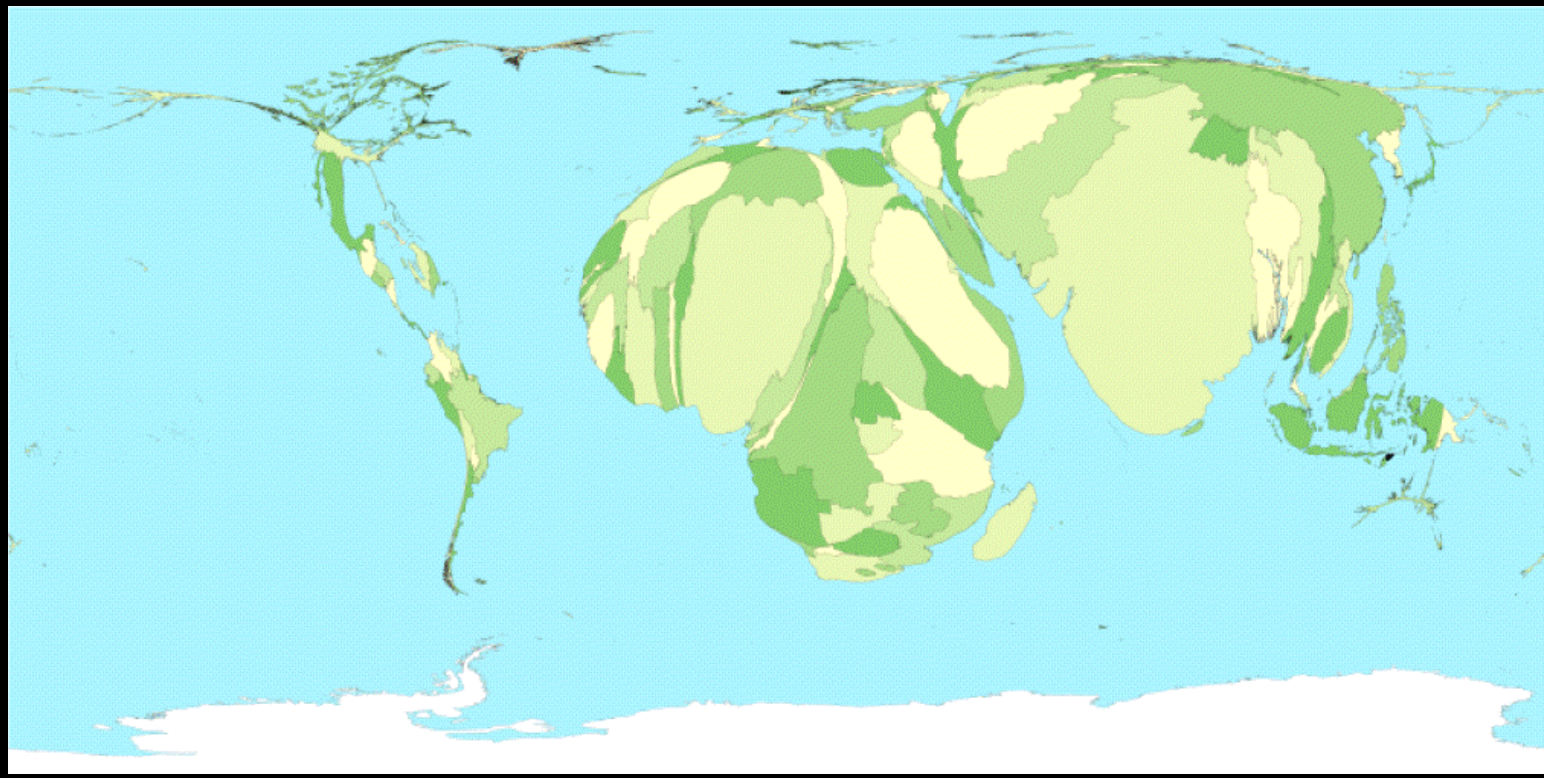
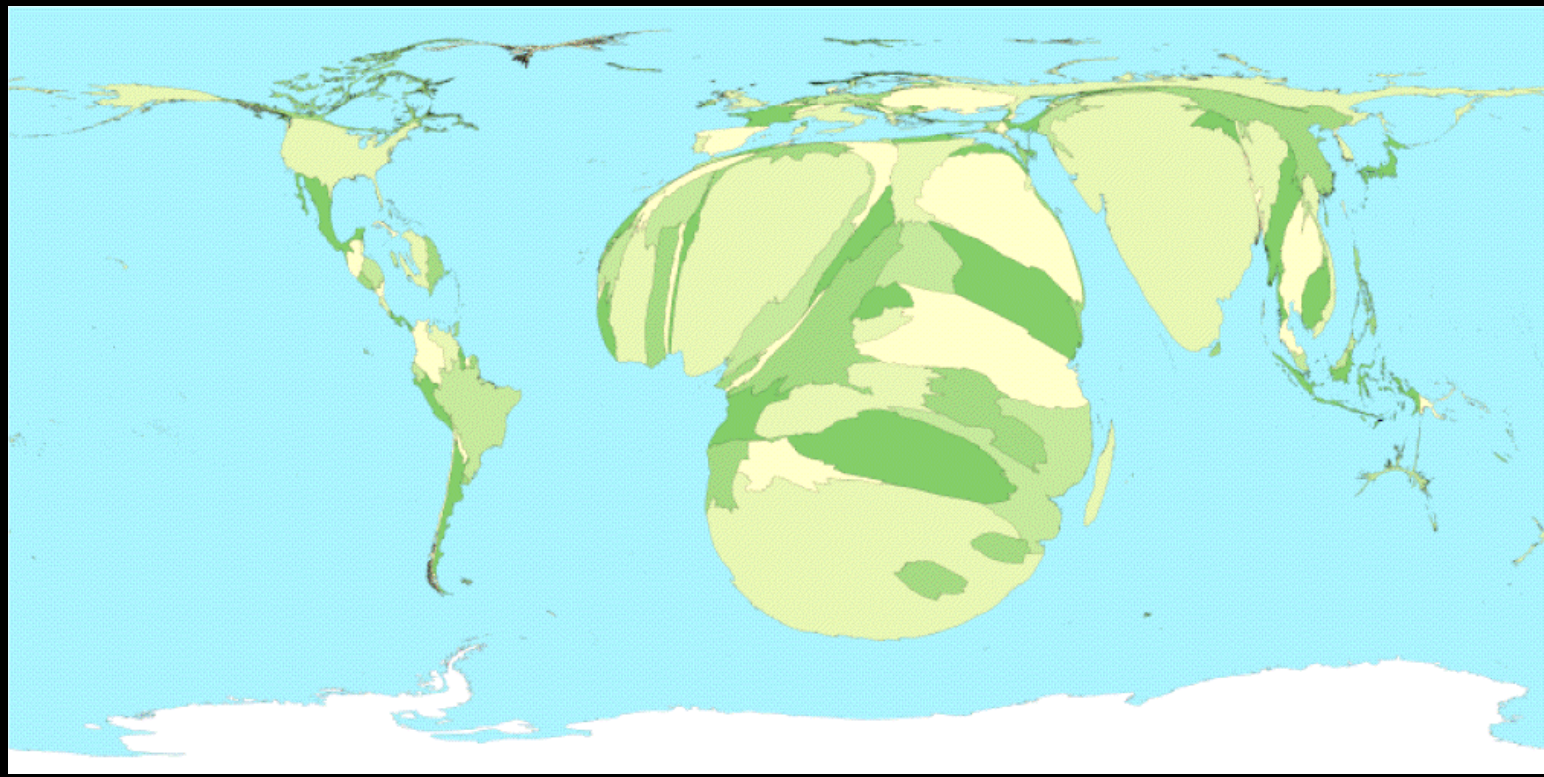
The world in child mortality perspective



Source: Images of the social and economic world – Mark Newman

http://www-personal.umich.edu/~mejn/cartograms/

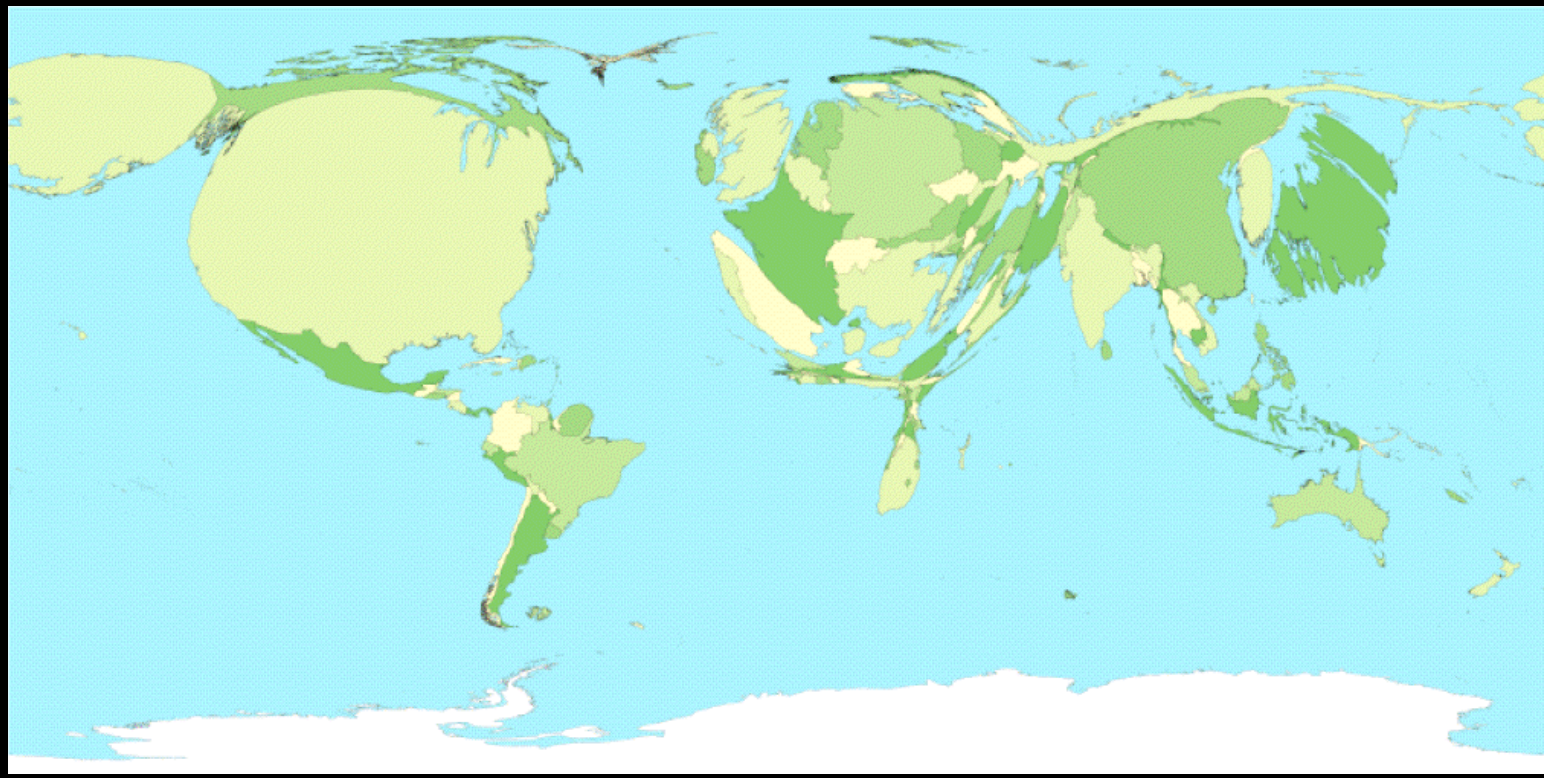
The world in HIV/AIDS perspective



Source: Images of the social and economic world – Mark Newman

http://www-personal.umich.edu/~mejn/cartograms/

The world by spending on healthcare



Source: Images of the social and economic world – Mark Newman

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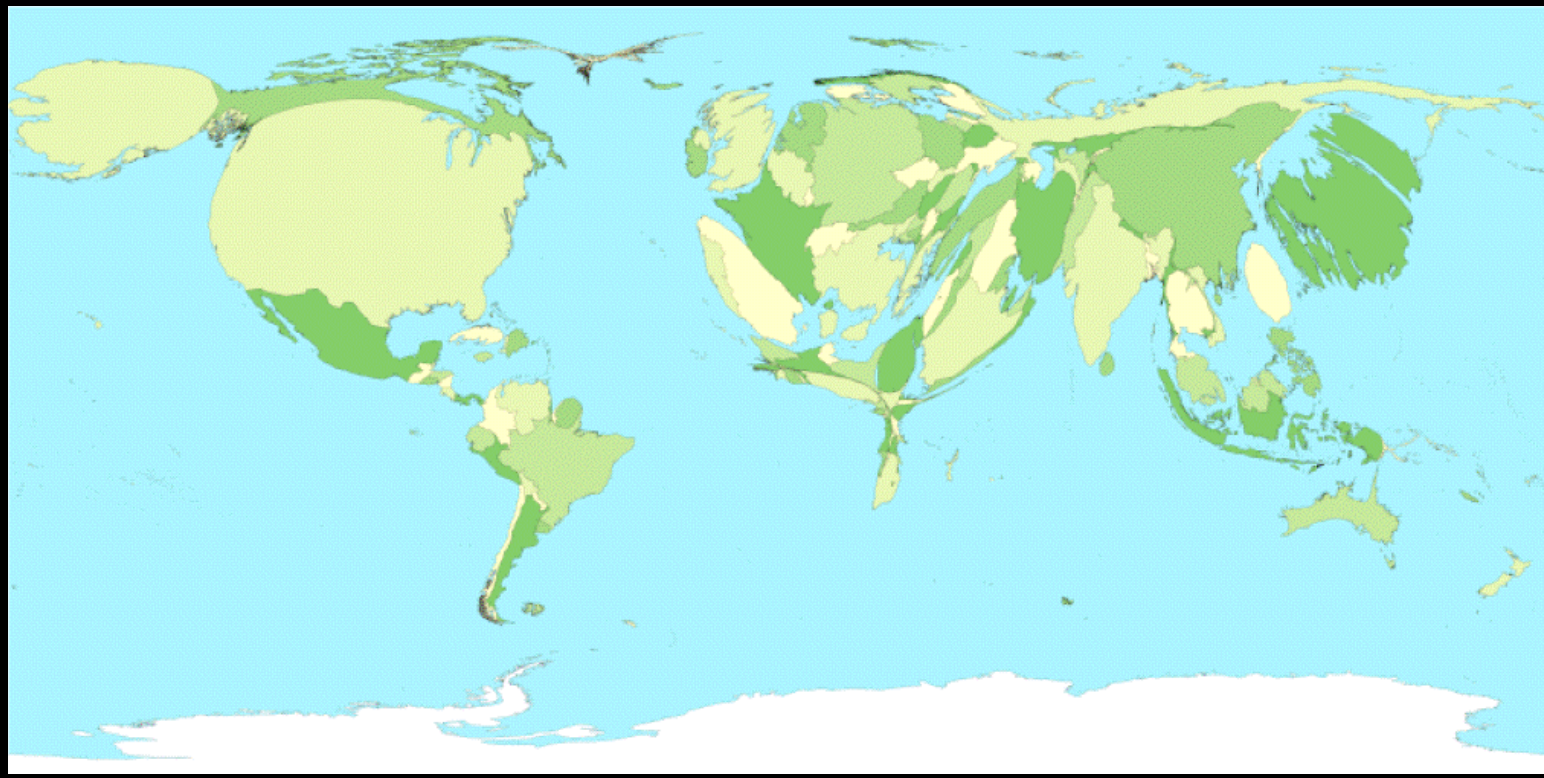
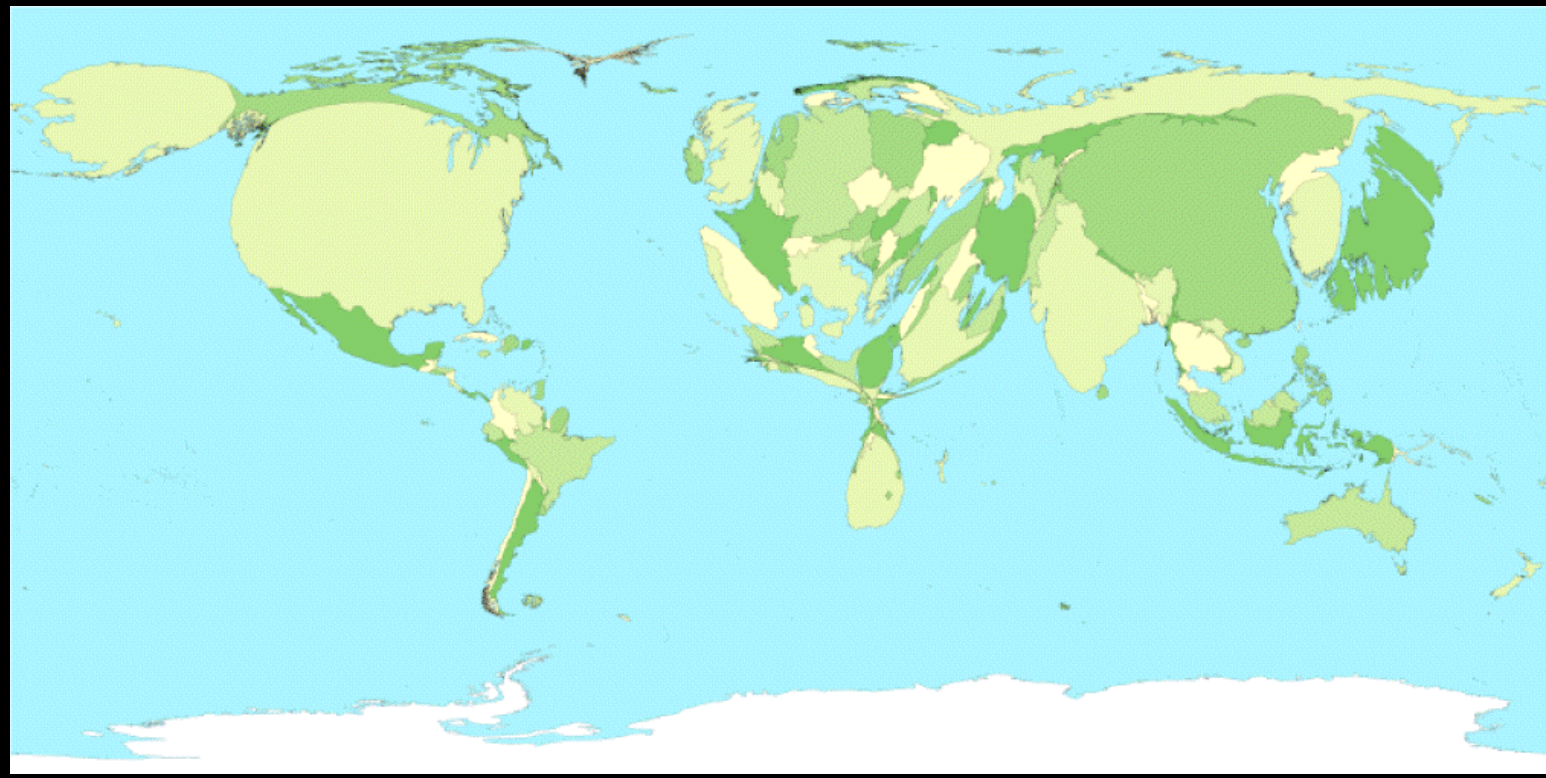
The world by energy consumption



Source: Images of the social and economic world – Mark Newman

http://www-personal.umich.edu/~mejn/cartograms/

The world by greenhouse gas emission



Source: Images of the social and economic world – Mark Newman

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Should we be concerned?

- No apparent pre-ordained purpose.
- No certainty regarding our uniqueness.
- A potentially harmful species that could easily squander its heritage. Would it matter? Does it matter if we care?
- No answers from science about why we are here.
- Yet we evolved, and so did our nervous system, to feel concerned (ethically and aesthetically).
- It is only natural to be led by those concerns and interact with the world accordingly.

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The conscious expression of concerns

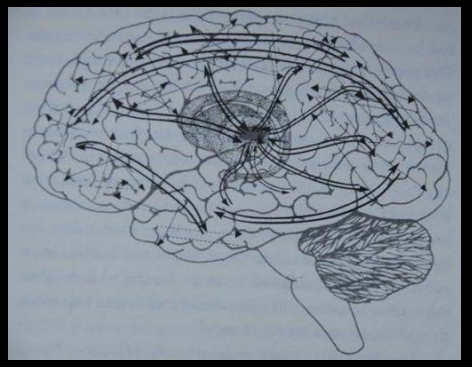
- We give conscious expression to these concerns through science and art.
- Both art and science are fed by the power of imagination
  - Van ‘t Hoff, 1878 [De Verbeeldingskracht in de Wetenschap (Imagination in Science)];
  - Edelman, 2006 [“Science is imagination in the service of verifiable truth”]).
- And what about religion?


De Verbeeldingskracht in de Wetenschap.

REDEVOERING,

Universiteit te Amsterdam,

Dr. J. H. VAN 'T HOFF.



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Religion

My view: Religions provide frameworks of metaphors of origin, purpose and destiny, within and through which generic patterns of human behavior evolved and became consolidated.

Awe may be at the roots of both science and religion; less so of art. Consolation may be found in both art (particularly music) and religion; less so in science.

Edgar Morin: Science gets us a long way, but it "opens onto undecidables where philosophical options and religious beliefs come into play through cultures and civilizations" (Seven complex lessons in education for the future [UNESCO] - http://unesdoc.unesco.org/images/0011/001177/117740eo.pdf)

Paul Tillich: God is indefinable and thus not confined by the mind or by words. Religion is direction or movement toward the ultimate or the unconditional. Faith/religion is thus expression of 'ultimate concern.'

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Reflections on the meaning of learning

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Essential problem at this juncture of evolutionary history:

We are ahead in our capacity to invent and intervene in comparison to our ability to reflect responsibly and timely on the consequences of what we do.

…there is a need to reinstate in our thinking about learning a concern with ultimate values.

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Implications for learning

…develop meta-learning abilities that allow us to ask pertinent questions, to set responsible goals and to use technology wisely in the pursuit of those goals.

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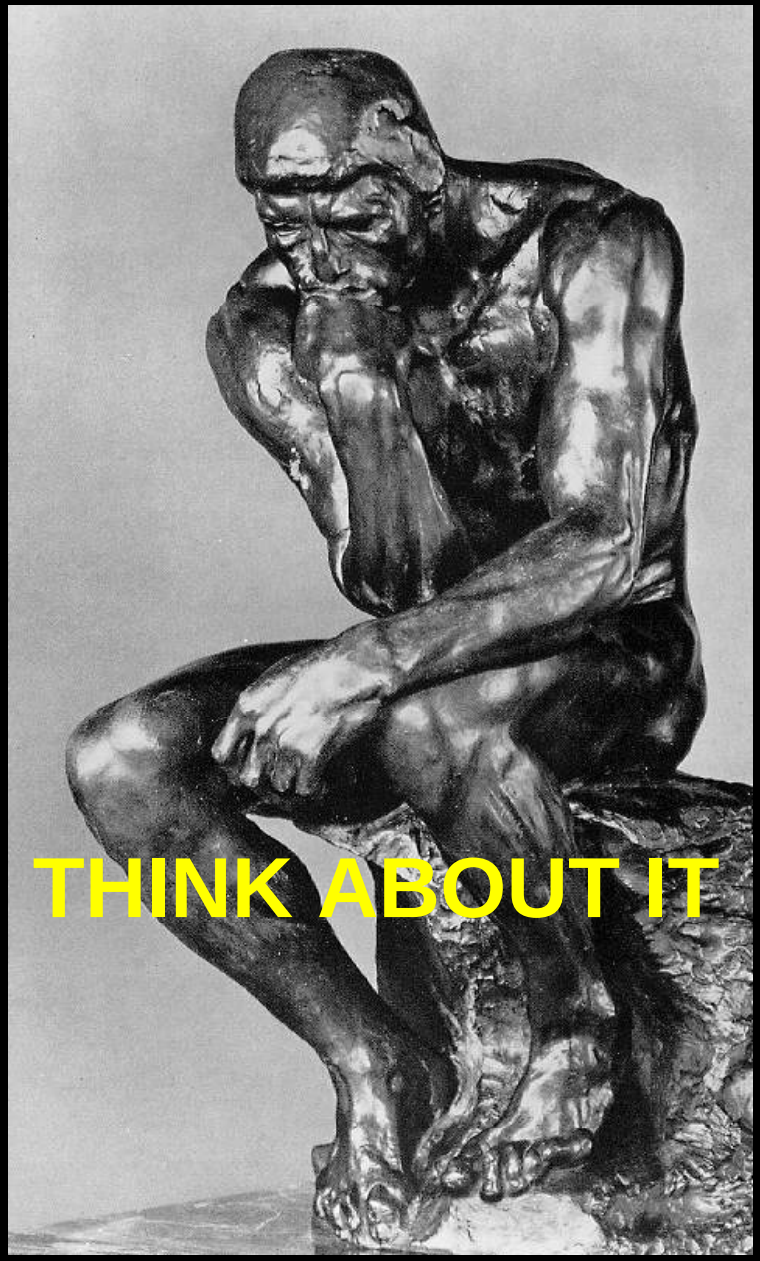
So,

What is learning?



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The little we know

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Putting the picture together

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Placing things in context

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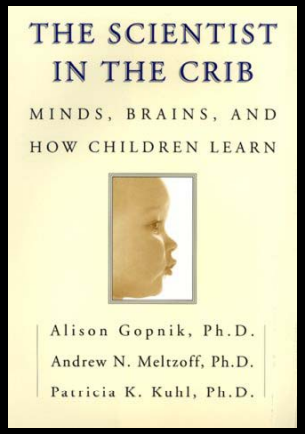
This is how it begins:

Walk upstairs, open the door gently, and look in the crib. What do you see? Most of us see a picture of innocence and helplessness, a clean slate. But, in fact, what we see in the crib is the greatest mind that has ever existed, the most powerful learning machine in the universe. The tiny fingers and mouth are exploration devices that probe the alien world around them with more precision than any Mars rover. The crumpled ears take a buzz of incomprehensible noise and flawlessly turn it into meaningful language. The wide eyes that sometimes seem to peer into your very soul actually do just that, deciphering your deepest feelings. The downy head surrounds a brain that is forming millions of new connections every day. That, at least, is what thirty years of scientific research have told us.



Gopnik, A., Meltzoff, A. N., & Kuhl, P. K. (1999). *The Scientist in the Crib*. New York: William Morrow and Company, Inc. (p. 1)

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However, confusion often sets in at the school age.

Three problems:

1. Learning often confounded with schooling.
2. Need to move from a culture of instruction to a culture of learning.
3. Wrong preconceptions about learning.

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Consider the following:

Human learning:

- Starts nine months before we are born and continues until we die (and it extends beyond our physical existence to the extent that we are all part of the social and historical process of the continual development of thought)
- Occurs in multiple contexts
- Has multiple dimensions
- Is engaged in by individuals and social entities (collectives of people who share a purpose).

The kind of learning we need

- *If there is such a thing as "preparation for life," then it must be a preparation that allows us to cope with the unpredictable.*
- *Need to learn beyond disciplines; to enhance our ability to problematize; to work on problems creatively and collaboratively.*
- *Need to perceive of learning as an ecological phenomenon: Learning is generative; no learning stands on its own.*

At a societal level we must be aware of the need to develop "policies for the learning environment at large" that can ensure that learning becomes mutually reinforcing in the different, though interconnected, parts of the learning ecology.

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The (scientific) mind

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An essential resource: **THE MIND**

- Anglo-Saxon origin: *"gemynd"*= memory
- Two perspectives on memory:
  - memory as static concept (stored retrievable information)
  - memory as dynamic concept, i.e. giving meaning, intentionality.
- While we live, we are all "memories in the making"(Yusra Laila Visser, 1997).
- Susan Greenfield (2000): *"Mind . . . is the seething morass of cell circuitry that has been configured by personal experiences and is constantly being updated as we live out each moment"(p. 13).* In other words, it is, according to Greenfield, *"the personalization of the physical brain"(p.14)* through our experience.

Visser, Y. L. (1997). Personal communication.
Greenfield, S (2000). Private life of the brain. Harmondsworth, UK: Penguin.

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An essential mindset:
THE SCIENTIFIC MIND

The spirit of science is alive in us at birth and during our earliest childhood years. In fact, evolution has set us op from before birth to display the kinds of behavior that can be associated with having a scientific mind.

Having a scientific mind is fundamental to our becoming aware of ourselves in relation to all that surrounds us, our universe. The extent of that universe is only limited by our unfolding capacity to comprehend it, emotionally and cognitively. Such comprehension is vital to our ability to play a consciously constructive role as an integral part of that same universe.

Nurturing the spirit of science is key to expanding the boundaries of our comprehension. *One can't begin soon enough!*

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The scientific mind: A multidimensional mindset

The scientific mind is a complex mindset. The following suggestions are offered as a starting point for the description of its multidimensional character:

- The spirit of inquiry
- The spirit of collaboration
- The quest for beauty (harmony, parsimony, wholeness)
- The desire to understand and do so profoundly
- The creative spirit
- The urge to be critical
- The spirit to transcend
- The spirit of building on prior knowledge
- The search for unity
- The building of the story of human knowledge and ability
- The spirit of construction

From: ***The Scientific Mind in Context*** concept paper.
http://www.learndev.org/dl/TSM-ConceptPaper.pdf

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The scientific mind at seven

Listen to Yasmina Ahmed:

I am seven years old. I liked the conference because it was about science. I like science. But I also like to draw. When I draw I can transform things. I can for instance change guys into girls simply by changing a few lines. On the first day I talked with Ron about molecules and about my microscope. I like doing experiments. I often put things inside water to find out what happens. I've also made a drawing of the inside of a tomato. At the conference I was listening to what people were saying and then I decided to make a drawing of the universe wrapped around the world. I don't know if I want to be a scientist or an artist. I like drawing, but as a scientist I would like to make potions. I already have a lot of chemicals.

Yasmina Ahmed at Building the Scientific Mind colloquium, The Hague, The Netherlands, 2005
http://www.learndev.org/ColloquiumBuildingTSM2005.html

Why stop at seven?

The traditional schooling practice, with its emphasis on the acquisition of factual knowledge and lack of encouragement to explore and comprehend deeply, is possibly a major cause of the disappearance of curiosity. If so, it may be the single most important inhibitor of the development of the scientific mind.

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Opportunities in early childhood: Opportunities for life.

The opportunities we take in early childhood, and subsequently throughout life, ultimately determine whether the child that was alive in us at birth will still live inside us as we fulfill our lives.

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The scientific mind throughout life

Keeping the scientific mind alive and fostering its growth throughout life requires creating multiple conditions in diverse learning spaces.

Join the Building the Scientific Mind (BtSM) colloquia to help:

- identify the above conditions
- invent relevant action
- build awareness
- influence research agendas
- contribute to policy development that fosters relevant change.

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Third Advanced International Colloquium on Building the Scientific Mind

Cairo, Egypt

May 10/11-14, 2009

With:

- Information and Decision Support Center (ISDC)
- Friends of the Environment and Development Association
- Foundation for a Culture of Peace
- UNESCO
- Universe Awareness (UNAWE)
- AND YOU

THANK YOU

JAN VISSER

JVISSER @ LEARNDEV.ORG

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