From STEM to STEAM:
Toward a Human-Centered Education, Creativity & Learning Thinking

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Montaigne
we are better to have
a “well-made rather than a well-filled head”
knowledge vs. understanding
training for exams
not enough time to learn (too much to absorb)
takes time to understand
links between things?
quantity vs. quality
abstraction and action
knowledge is designed, built and refined (design thinking)
learning thinking ➔ love of learning
Learning to learn
Knowledge retention
Learning efficiency
Making errors
Having fun
What Space Can Contribute to Global STEM Education
Lecturers and other contributors

Leland Melvin, Astronaut, AA Education (NASA)
Jacques Arnould, Philosopher (CNES)
NASA KSC Education Specialists
Caroline Hardman, Educator (NNDS)
Bill Nye, The Science Guy (The Planetary Society)
Remy Bourganel, Artist and Designer (ENSAD)
Carlos Niederstrasser, Aerospace Engineer (Orbital Sciences)
Jean-Jacques Favier, Astronaut and Engineer (CNES)
Chiaki Mukai, Astronaut and Physician (JAXA)

HCD PhD students (FIT)
Master students (Ecole Polytechnique, Paris)
STEM?

21st century...

Society changes...

Critical age?

Literacy and maths?

Space is about cognition, innovation and risk taking

Space technologies...
Technology provides us with concrete trivial answers to theoretical fundamental questions.
understanding

situated knowledge design

learning thinking
\[ B(t) = \sum_{i=0}^{n} \binom{n}{i} (1 - t)^{n-i} t^i P_i \]

\[ = (1 - t)^{n} P_0 + \binom{n}{1} (1 - t)^{n-1} t P_1 + \cdots \]

\[ \cdots + \binom{n}{n-1} (1 - t)^{1} t^{n-1} P_{n-1} + t^n P_n, \quad t \in [0, 1] \]
\[ v = \frac{dx}{dt} \]
Young people engagement...

Technology = substitute for effort?

Education depth?

Rol →

Business management

Creativity and problem solving?
Meaning and Creativity
Lunabotics
Contest
Space Inspires
Arts
Video Games
Online learning

Traditional Classroom

STEM TODAY

STEM TOMORROW
Lunabotics
Hyper-connectivity, complexity, emergence...

Interaction...

Multi-disciplinarity

Cooperative work

Learning by doing...

The TOP Model
Human Centered Design

People

Technology Organizations
The best way to predict the future is to invent it.

Alan Kay

Possible futures...

Goal-driven vs. event-driven...
STEM to STEAM

Einstein Pop Art by OverSurge
From STEM to STEAM

Science, Technology, Engineering & Math

Reductionism →
linear/local → non-linear/global

Human-machine systems
Human-computer interaction

Human-system integration
From STEM to STEAM

from Technology-Centered Engineering...

... to Human-Centered Design

positivism
objectivity
linear systems
context-free
control
reductionism

phenomenology
subjectivity
non-linear systems
context-dependent
management
complexity science
knowledge vs. understanding
use technology...
... to improve understanding
Wolfgang Amadeus Mozart

The Marriage of Figaro (overture)
Nothing happens without a little excitement

*Rien ne se fait sans un peu d'enthousiasme*
Voltaire, *Extrait d’une Lettre*