Technological, social and economic trends towards 2030 - Implications for curriculum reform

Charles Fadel

December 10, 2015

Charlesfadel@gmail.com

Twitter: @CurrRedesign #4D_EDU

Source: Aaron Kobler

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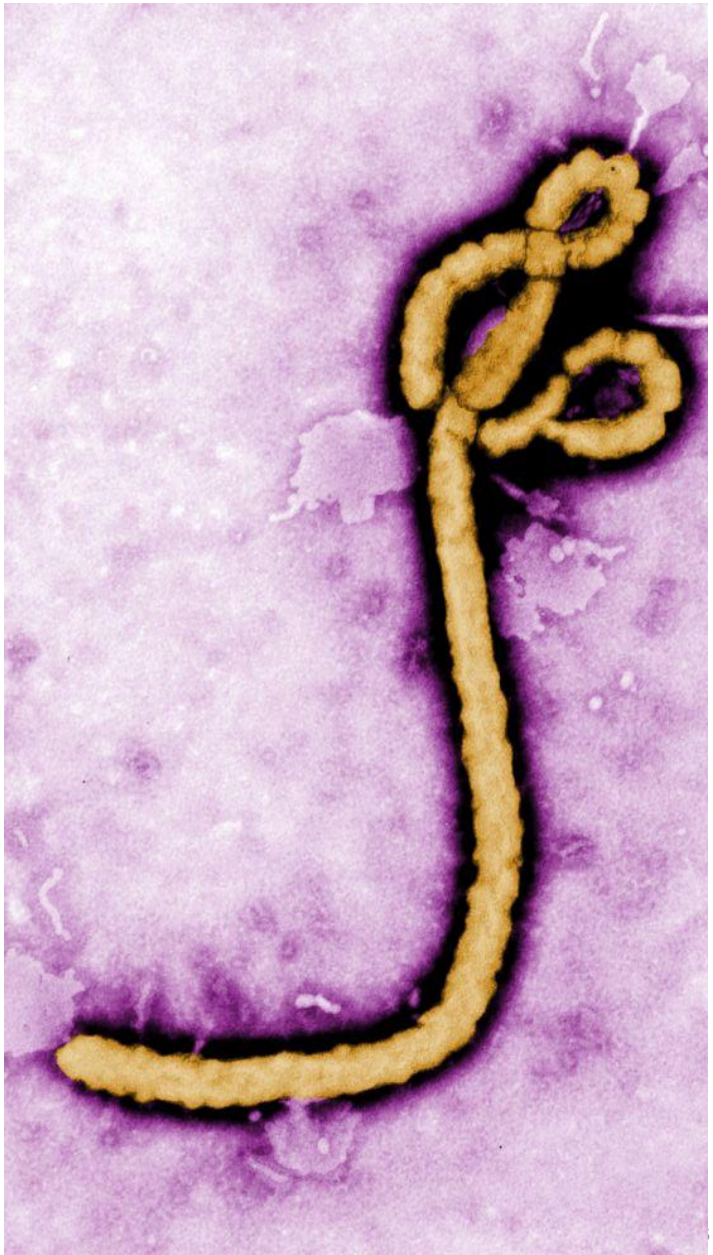
Sincere thanks to…

MEXT

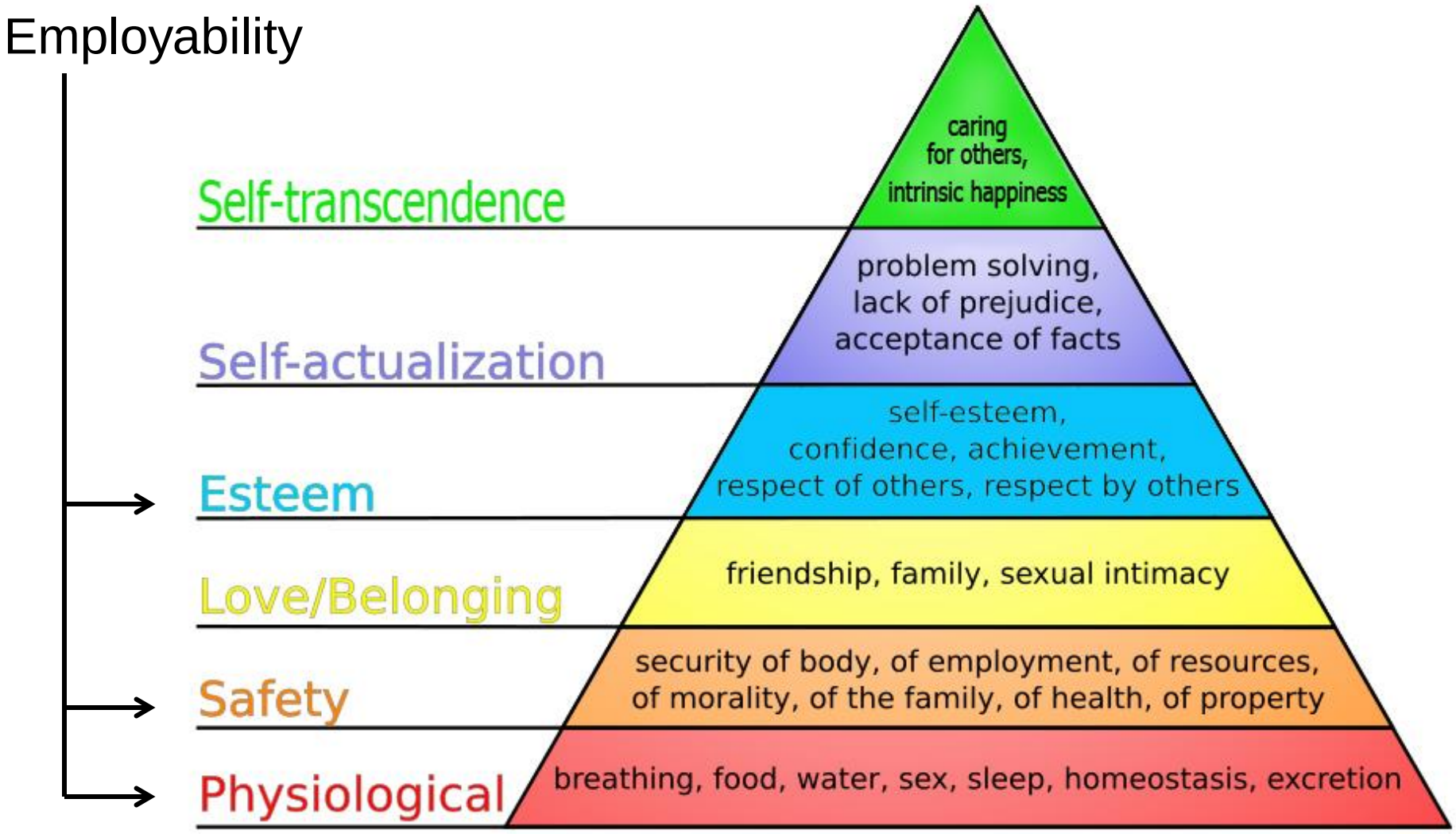
MINISTRY OF EDUCATION,
CULTURE, SPORTS,
SCIENCE AND TECHNOLOGY-JAPAN


VUCA
Volatile
Uncertain
Complex
Ambiguous

Human Interdependency…



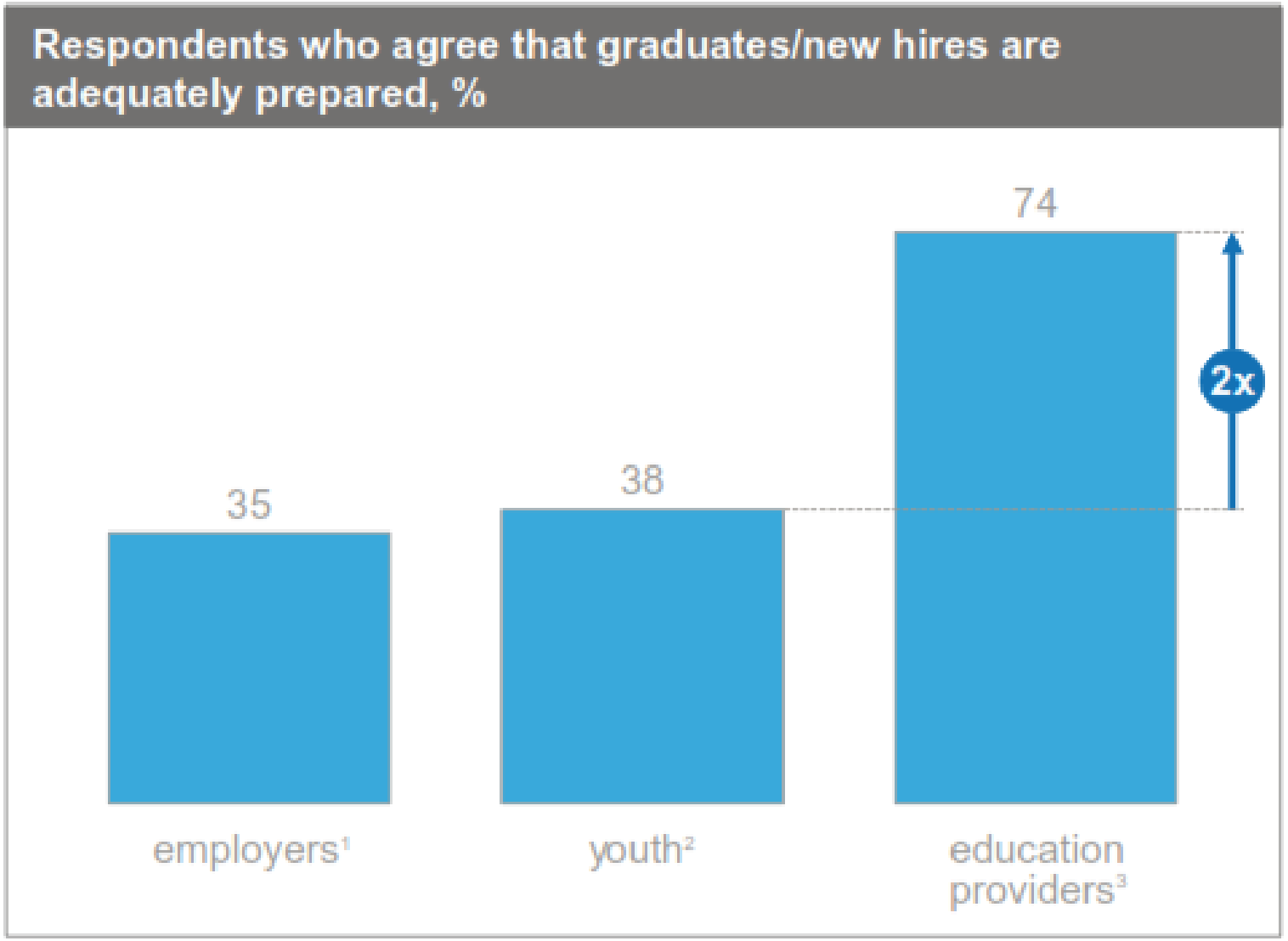
Goal of Education: Sustainable Humanity



The stakes have never been higher

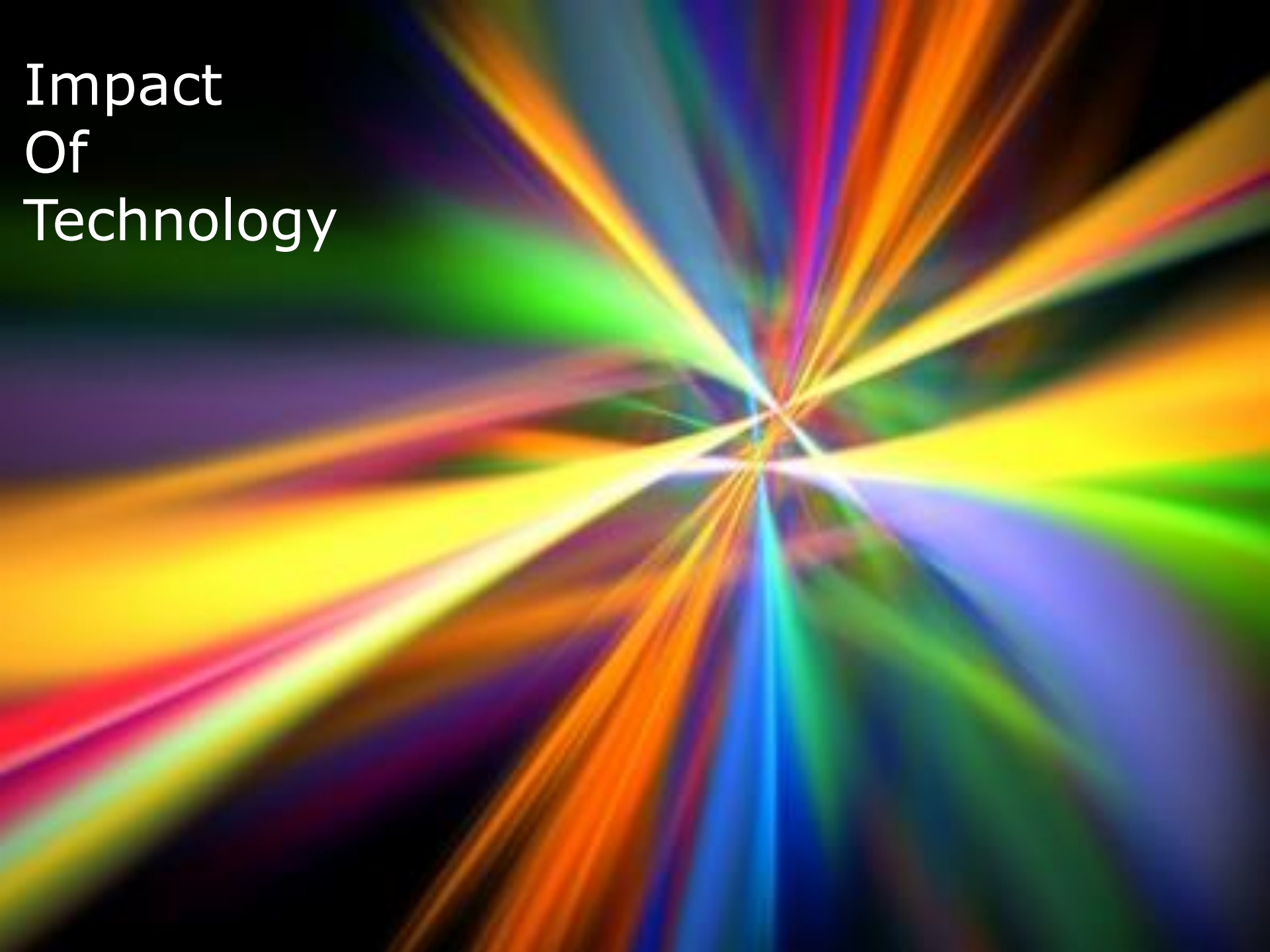
Source: Video extract from “Occupy Wall Street”

Disconnect between employers and educators



Source: McKinsey 2013

Impact Of Technology

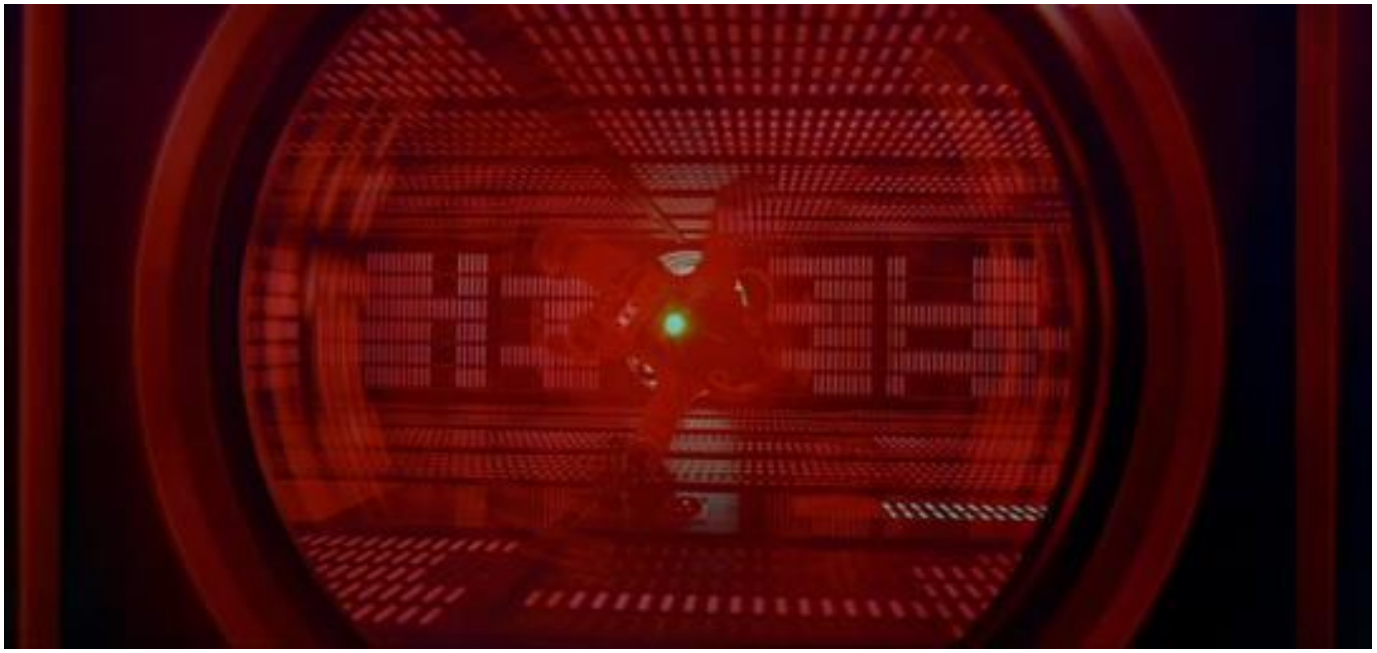


More to come… Bioengineering

Gene Sequencing (PCR)
Gene Editing (CRISPR)
Proteomics
Synthetic Biology
STEM cells
Cloning
Etc.

More to come… Virtual Reality - Video

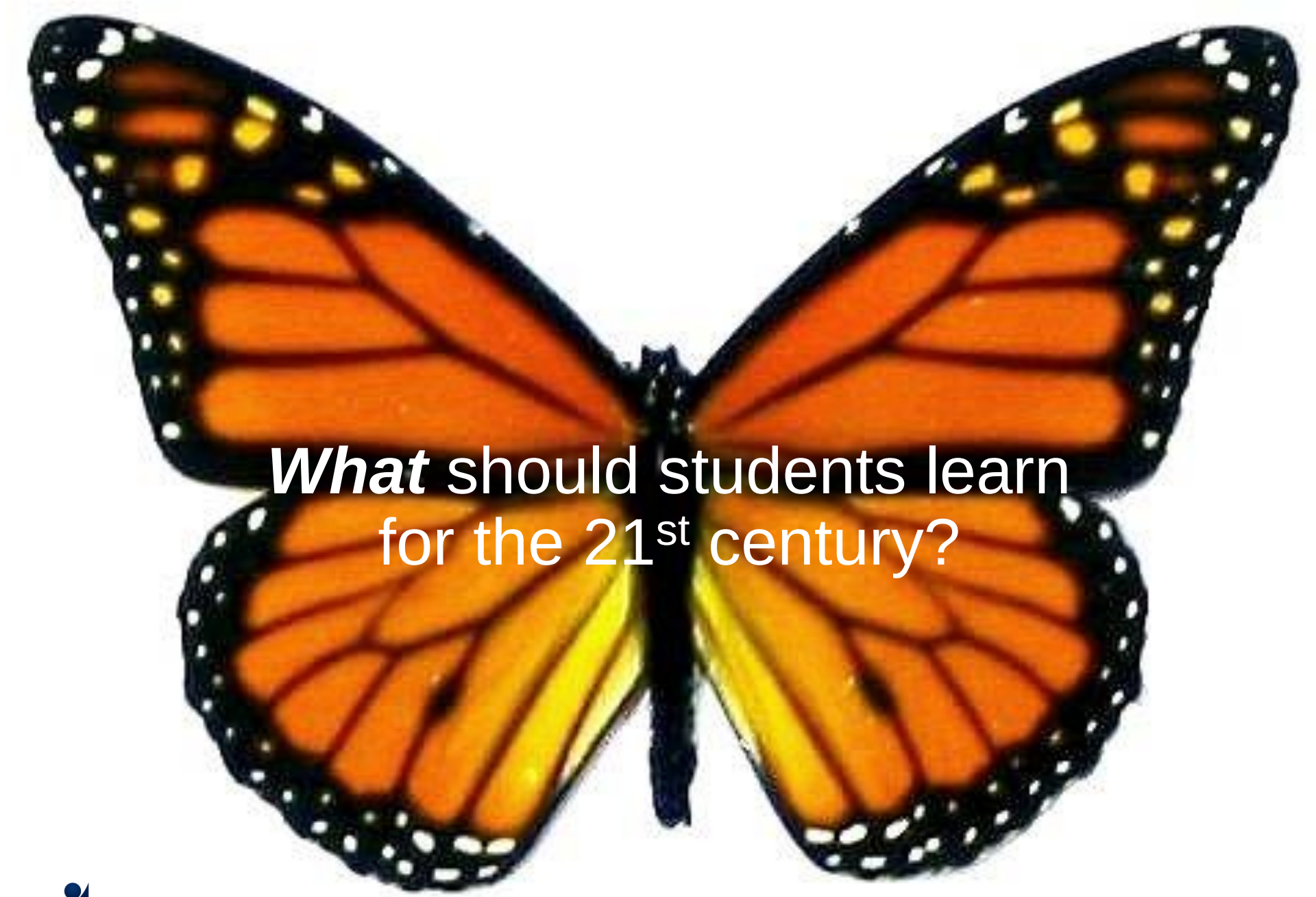
Artificial Intelligence



- Financial trading algorithms
- Autonomous vehicles
- Medical diagnostic systems
- Wikipedia bots
- Automatic translation - demo
- Personal assistants
- Etc.

Music exercise – Audio

Even human creativity is challenged by Artificial Intelligence



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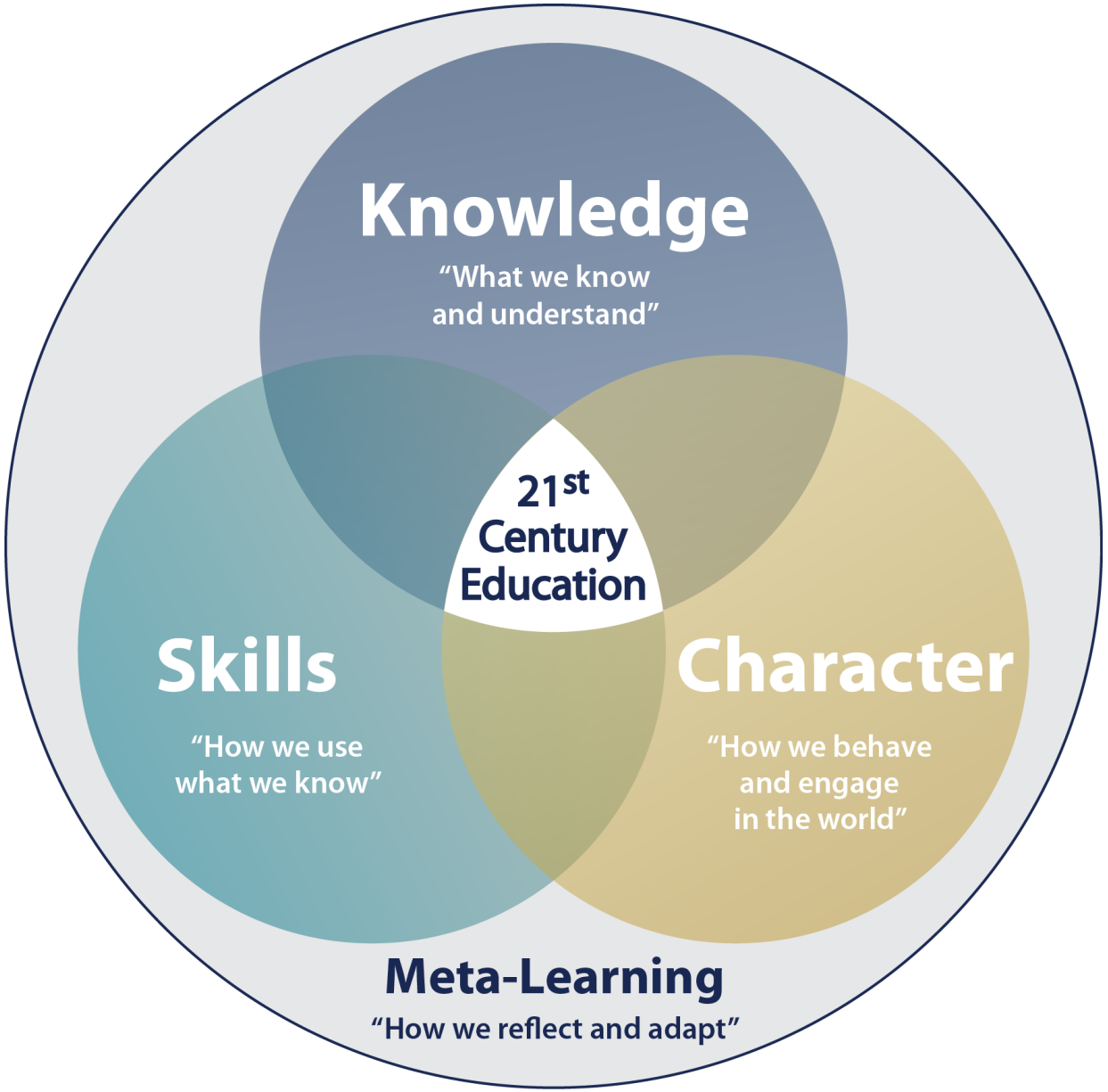
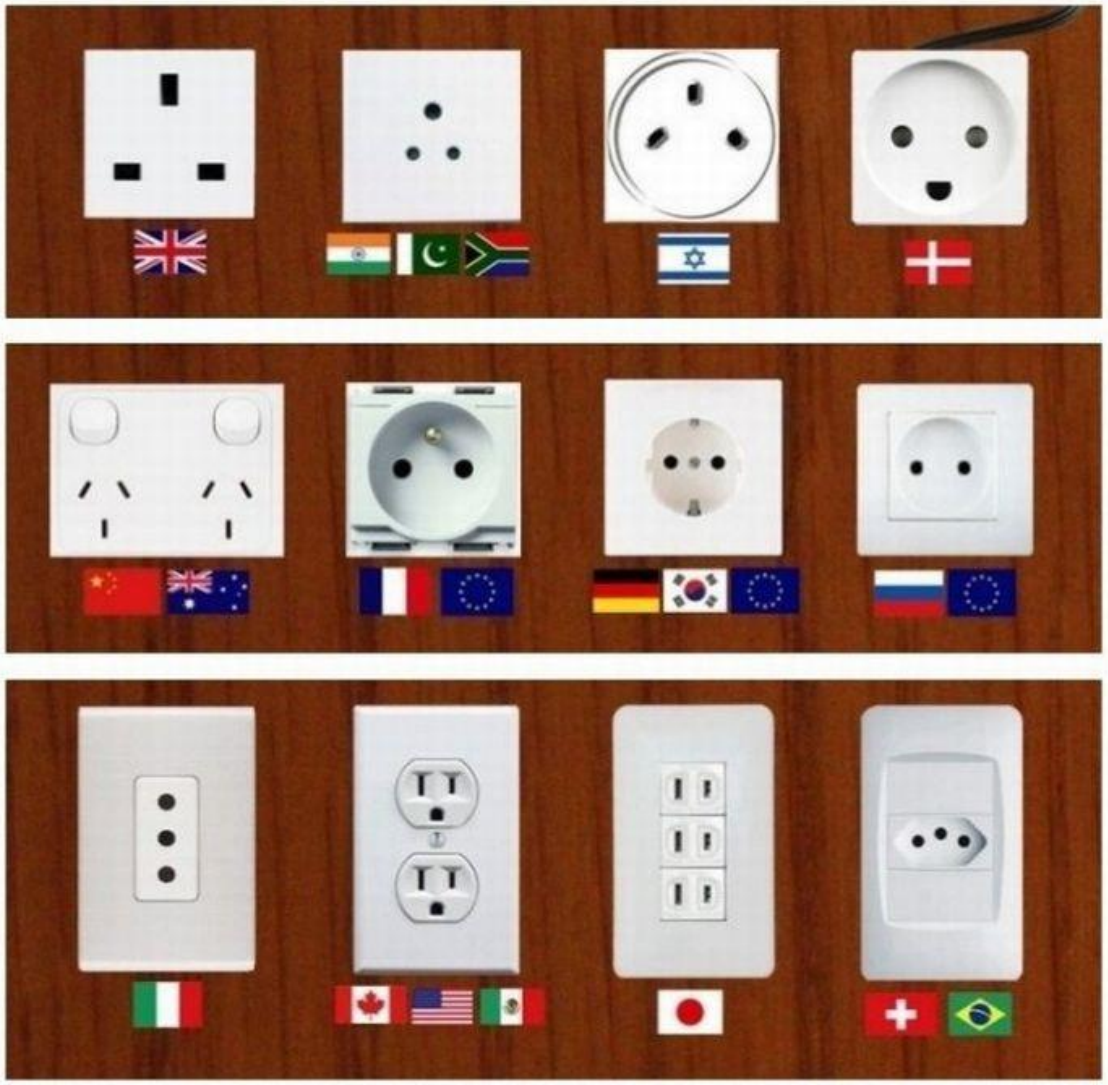
with key global players

VUCA world → Versatility as key strategy

Implying *All* Dimensions of Education

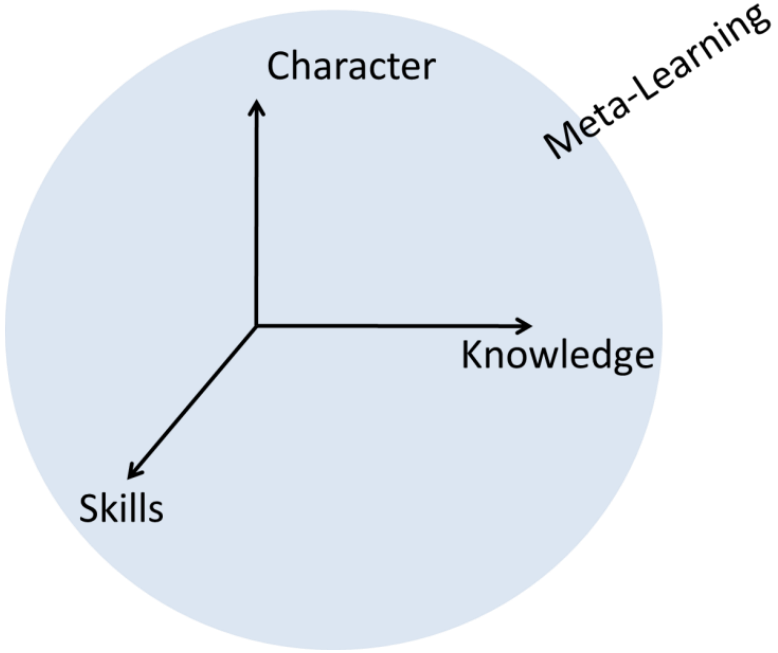


Analogy



All share 4 attributes:

- Line
- Neutral
- Ground
- Socket



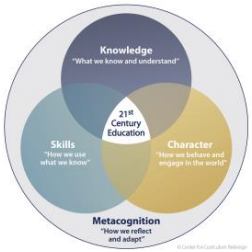
CCR's research- & evidence-based Process

SYNTHESIZE:

- prior & existing frameworks
- input from employers
- research from the learning sciences
- future studies and global trends

ANALYZE:

- surveys from teachers
- feedback from global conferences
- social media
- literature reviews + expert panels



ORGANIZE:

- comprehensive: no major elements missing
- compact: actionable and deployable
- uncorrelated: no duplication or confusion
- appropriate layer of abstraction: sensical
- globally relevant: for broad acceptability

“Clear and actionable first-of-its-kind organizing framework of competencies needed”

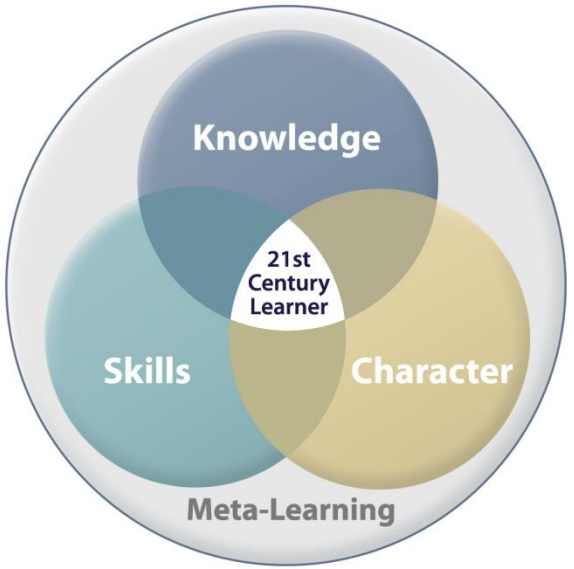
Andreas Schleicher,
OECD

“Educators worldwide [need] to rapidly operationalize these dimensions”

Todd Rose,
Harvard University

From the authors* of best-seller *21st Century Skills*

CHARLES FADEL*, MAYA BIALIK, AND BERNIE TRILLING*



FOUR-DIMENSIONAL EDUCATION

THE COMPETENCIES LEARNERS NEED TO SUCCEED

Prologue by **Andreas Schleicher, OECD**

“A very thoughtful treatment of the competencies our students need to thrive in today’s (and tomorrow’s) world. This book will help educators understand and navigate the critical choices we are facing.”

-Carol Dweck, Stanford University

http://curriculumredesign.org/

Matrix between Knowledge and other Dimensions

© 2014 Center for Curriculum Redesign – All Rights Reserved		Skills				Character						Meta-Learning	
		Creativity	Critical thinking	Communication	Collaboration	Mindfulness	Curiosity	Courage	Resilience	Ethics	Leadership	Growth	Metacognition
Themes - embedded throughout: Global literacy, Environmental Literacy, Etc.	Traditional Knowledge (Interdisciplinary)												
	Mathematics												
	Science												
	Language												
	Etc.												
	Modern Knowledge (Interdisciplinary)												
	Robotics												
	Entrepreneurship												
	Wellness												
	Etc.												

Competencies are expressed through Knowledge domain

CCR Knowledge Framework

CCR Knowledge Framework

- **Concepts & Meta-concepts**
- **Processes, Methods & Tools**
- **Branches, Subjects, and Topics**

Themes - Embedded everywhere across Knowledge, to the appropriate extent

- Global literacy
- Environmental literacy
- Information literacy
- Digital literacy
- Systems thinking
- Design thinking
- Etc.

Traditional Knowledge (+ Interdisciplinarity)

- Maths
- Science
- Languages – domestic
- Languages - foreign
- Social Studies (History, geography, civics, economics, etc.)
- Arts (Dance, drama, media arts, music, visual arts, etc.)
- Etc. (country-dependent)

Modern Knowledge (+ Interdisciplinarity)

- Technology & Engineering, including:
  - Computer science, in particular: Coding; Robotics & Artificial Intelligence
  - Bioengineering, in particular: Genome editing; Synthetic Biology
- Media, including:
  - Journalism (digital)
  - Cinema
- Entrepreneurship & business
- Personal finance
- Wellness:
  - Physical
  - Mental
- Social systems (sociology, anthropology, etc.)
- Etc.

How does this all work together ?

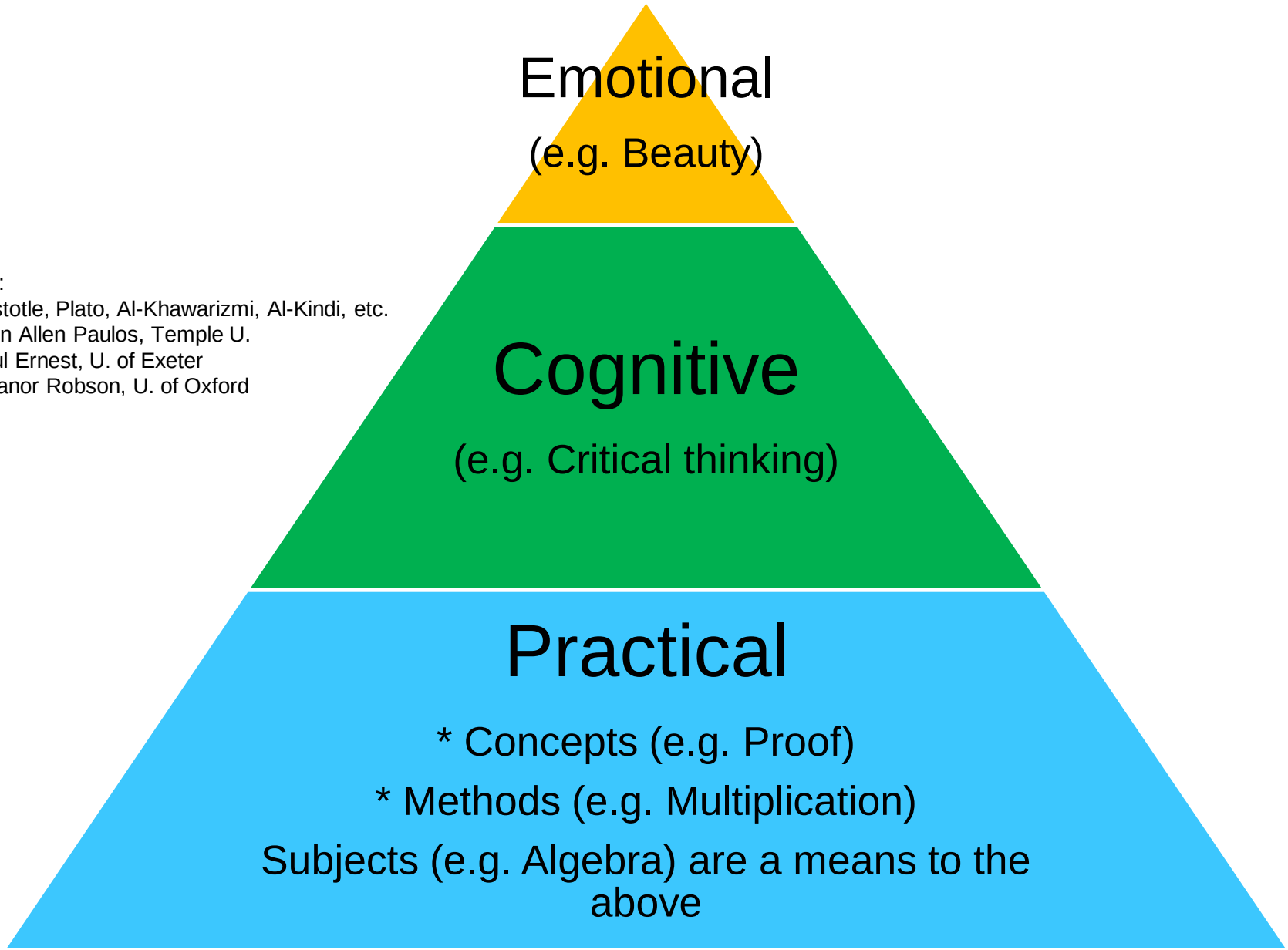
Example: Mathematics

Note: CCR is redesigning all disciplines not just Maths

What are the reasons to learn Mathematics?

Sources:

- Aristotle, Plato, Al-Khawarizmi, Al-Kindi, etc.
- John Allen Paulos, Temple U.
- Paul Ernest, U. of Exeter
- Eleanor Robson, U. of Oxford

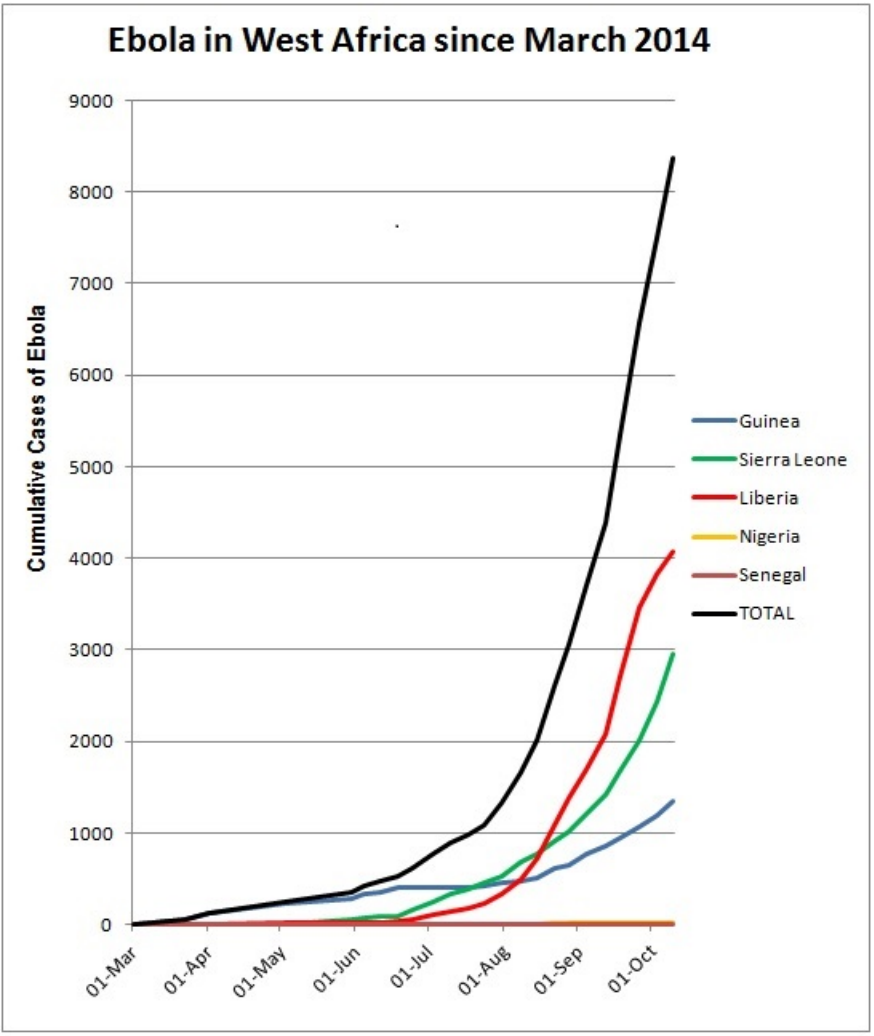


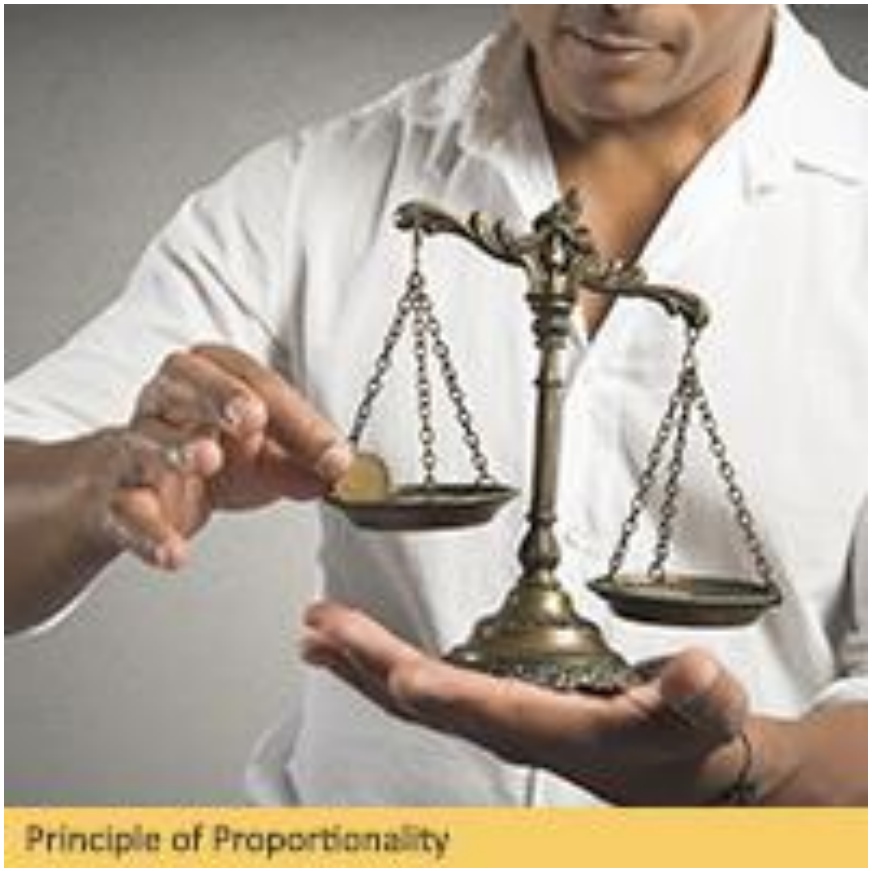
Modern industry needs different Maths

Themes	Responses
	Knowledge
Complexity	Complex systems
Uncertainty	Statistics & probabilities
Multiple scales	Complex systems
Simulations & Modeling	Computational maths (algorithms)
Data & Information	Statistics & probabilities
	Skills
Multidisciplinarity	Collaboration
Transfer of knowledge	Communication

Source: OECD Global Science Forum Report on Mathematics in Industry - July 2008

Modern world needs deeper understanding





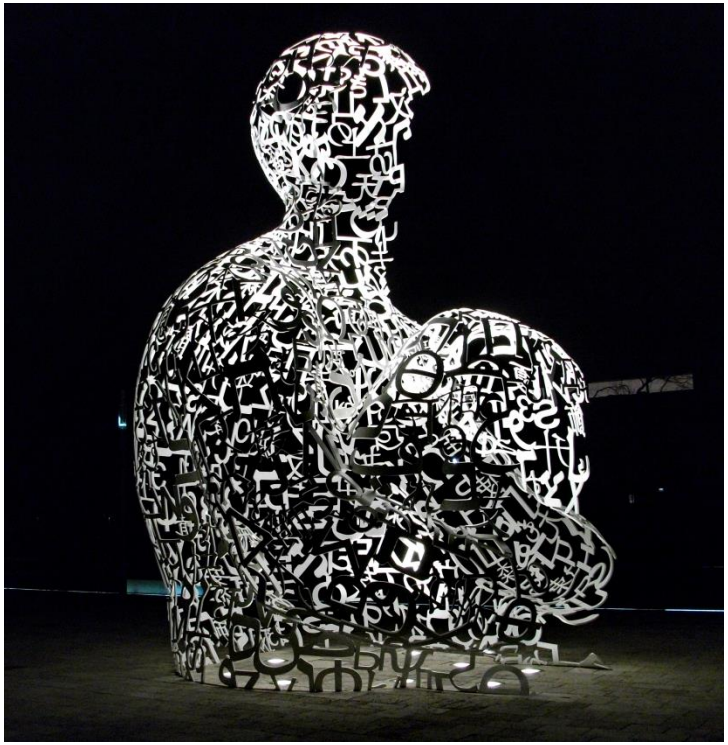
The Challenge

De-emphasize less relevant areas to save time and space for:

- More emphasis on important traditional areas
- Adding new, more relevant areas
- Interdisciplinarity, for real-world connection
- Deeper dives to develop Skills, Character, Meta-Learning

What needs to be more deeply understood?

- Number sense
- Proportionality
- Exponentials
- etc



What should be *emphasized or added ?*

Branches/topics:

- Recreational maths (younger grades – for love of Maths)
- Statistics & probabilities (including visualization & big data)
- Discrete/algorithmic mathematics (including modelling)
- Applied Maths (Complex systems, game theory, etc.)

Tools/Methods:

- Estimation
- Logic and argumentation
- Use of computer-based computation
- *Linkages to the real-world*
- *Progression from concrete to abstract*

What should be *emphasized or added* ? (2)

Interdisciplinarity:

- Large scale: Just-in-time (for Robotics etc.)
- Small scale: systematically link to real-world examples:
  - e.g. Exponentials in finance, biology, environment, etc.

What should be *emphasized or added ?* (3)

Concepts, Processes: (see CCR reports)

- Variable, rate, dimension, etc.
- Proving, representing, modelling etc.

Other Dimensions of Education: (relevant to Maths)

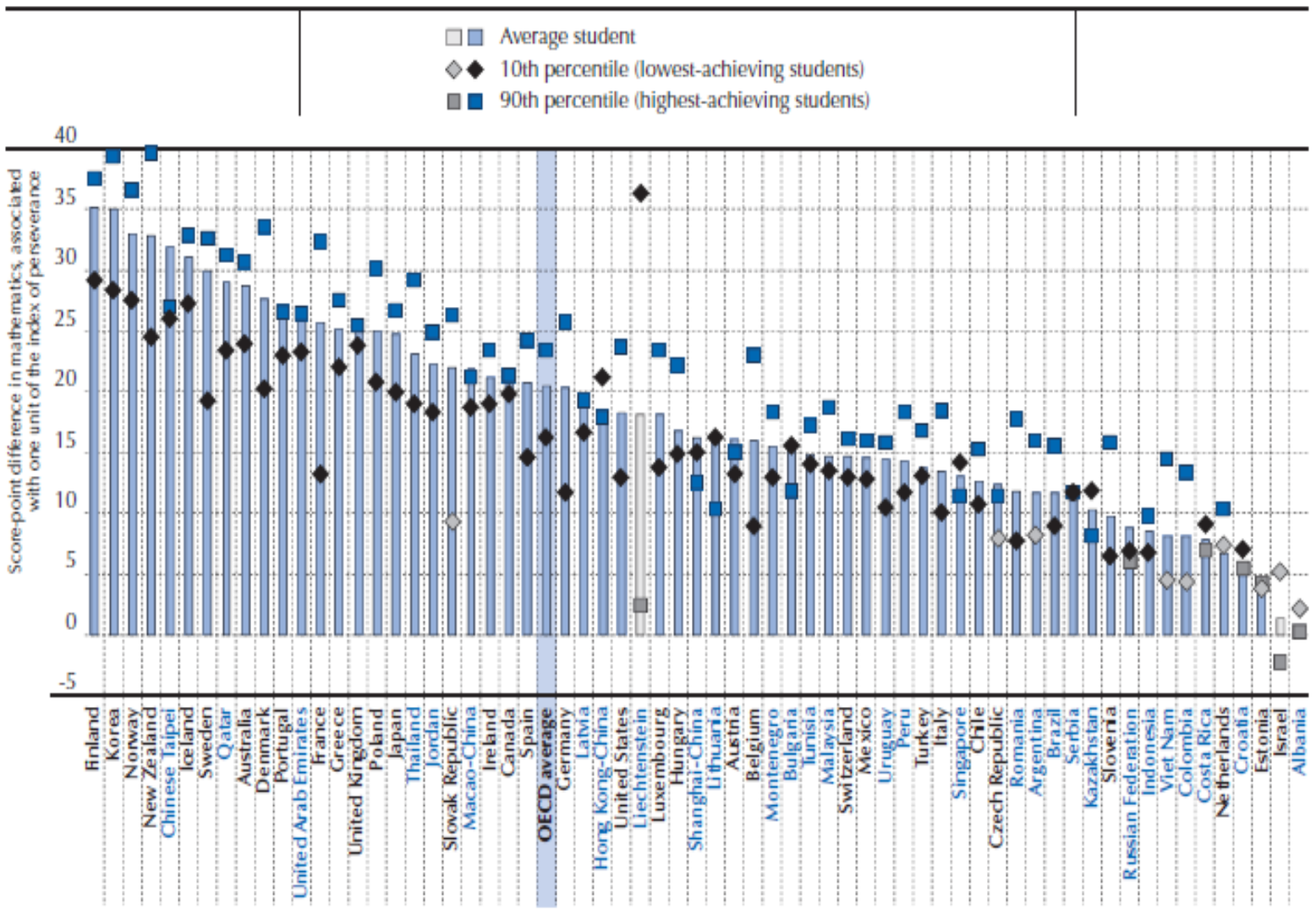
- Skills: Creativity; Critical thinking, Communication, Collaboration
- Character: Curiosity; Resilience
- Meta-Learning (self- and group-reflexion on Processes etc.)

Example: Creativity, Meta-Learning

1. Solve exercises (standard solutions)
2. Solve problems (standard solutions)
3. Solve problems using non-standard solutions (creative stretch)
4. Find new real-world problems, and solve using both standard and non-standard solutions
5. Create new problems, and solve using both standard and non-standard solutions
6. Create new *classes* of problems (metacognitive stretch) and explore solvability
7. Solve a *class* of problems

Character matters

Relationship between perseverance and mathematics performance



Note: Differences that are statistically significant at the 5% level ($p < 0.05$) are marked in a darker tone.

Countries and economies are ranked in descending order of the average score-point difference in mathematics associated with one unit of the index of perseverance.

Source: OECD, PISA 2012 Database, Table III.3.1e.

StatLink http://dx.doi.org/10.1787/888932963825

What should be *de-emphasized* ?

Branches/topics to ***curate, and make *partially* optional***:

- Algebra
- Calculus
- Geometry/Trigonometry

Tools/Methods:

By-hand algebraic computation

What are the impediments to change?

- Politics (acceptability, churn)
- Dogma (confirmation bias)
- “GroupThink” (conformance)
- Assessments (complexity)
- College entrance requirements (inertia)

CCR's Value Proposition

"CCR's work is critical in the unique value it adds to curriculum redesign via:

- Freedom from local constraints.
- Working with experts from a broader range than typical."

Michele Bruniges

New South Wales

Department of Education

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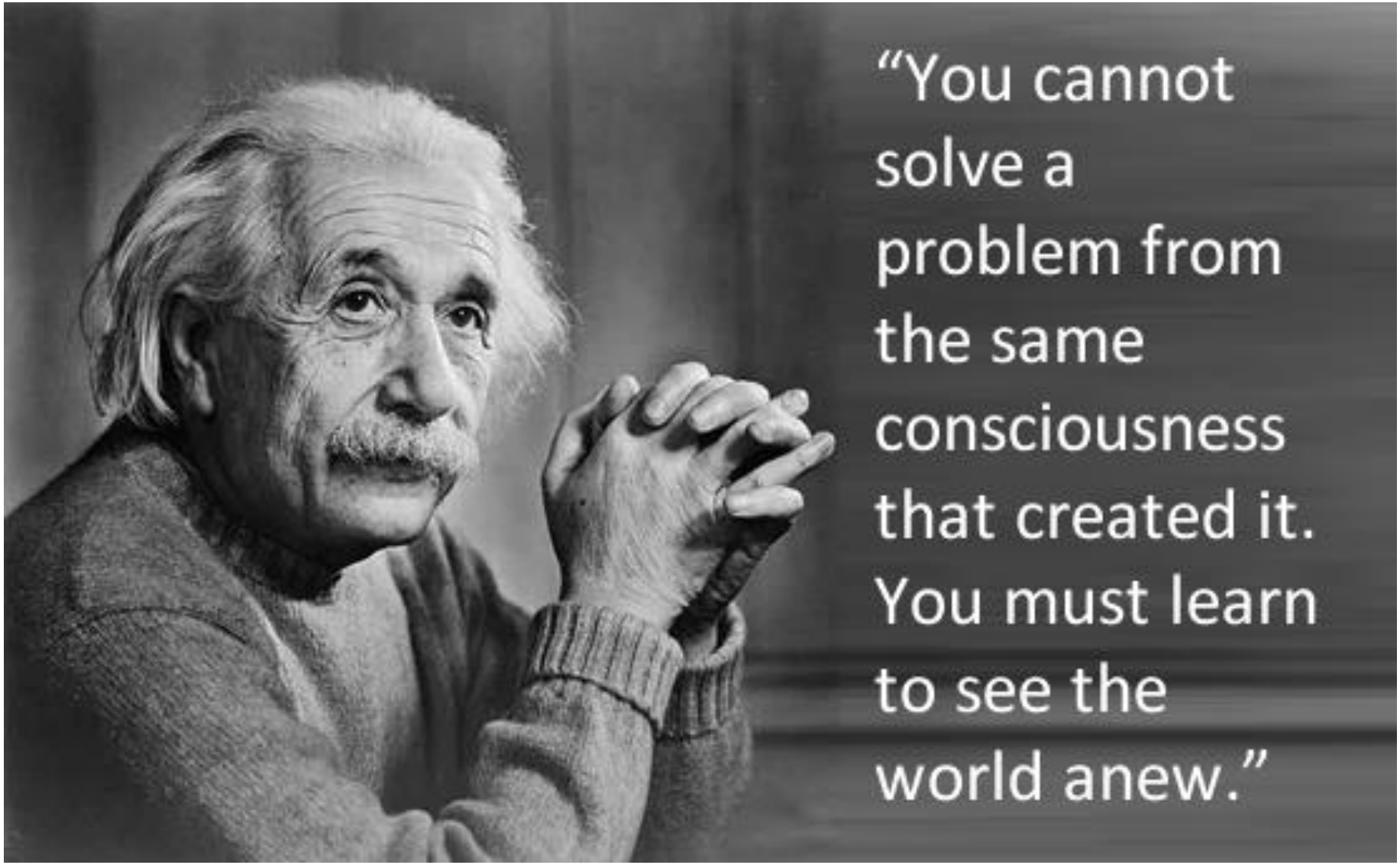
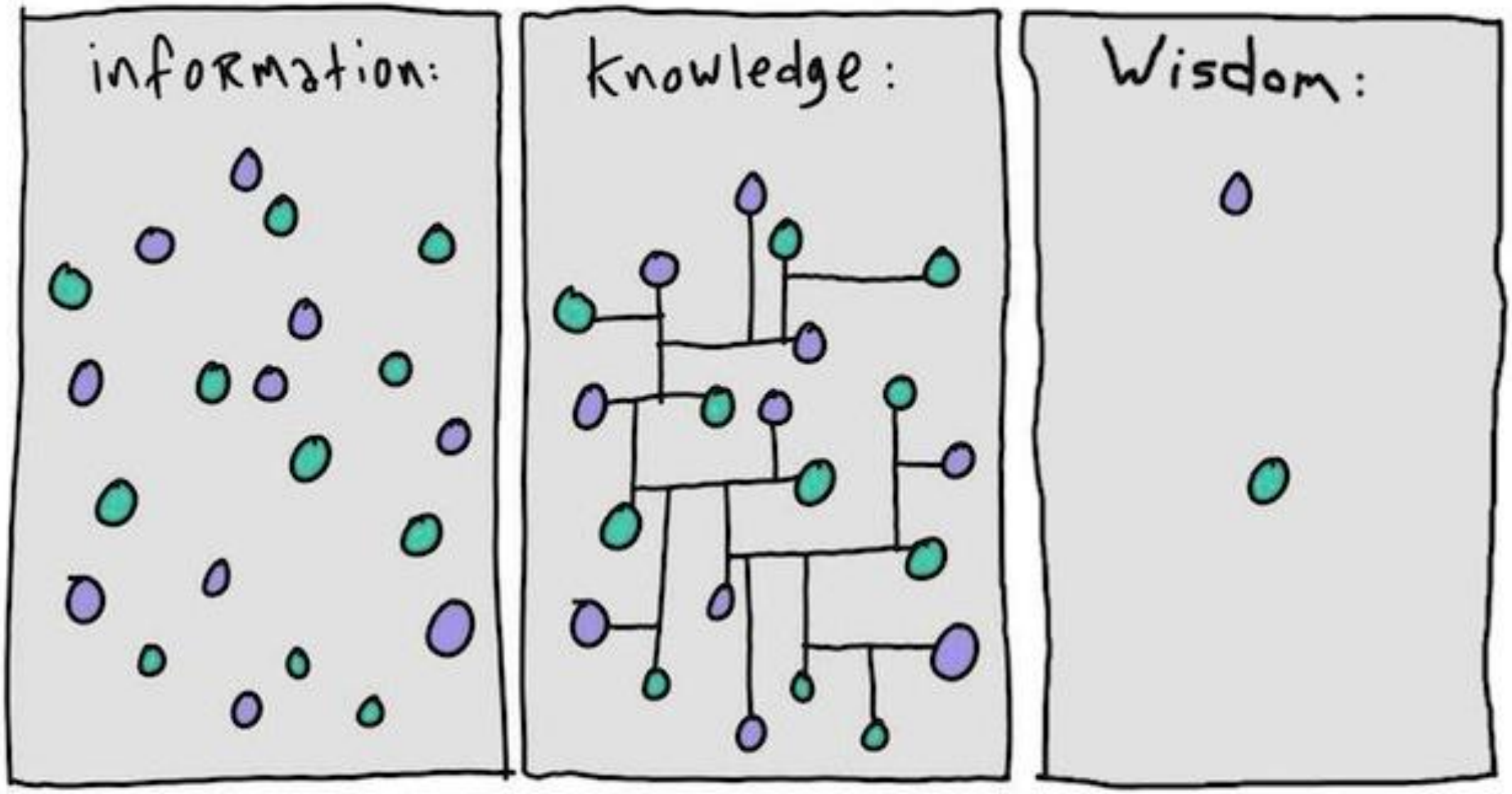
Making Education *More* Relevant

We agree



What we wish to all



Thank You !

"***What*** should students learn for the 21st century?"

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