Trends and Issues in Science Education

BY

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ISSUES?

Ideas, thoughts and debate centered on educational policy and practices

TRENDS?

New, up-and-coming and popular educational practices

OVERVIEW

1. What are the currents state of Teaching & Learning?

2. What cause changes in Science Education?

3. What are the current trends?

   What are the issues in implementing these trends?

4. Having a broader understanding and perspectives as participants share their country's trends and issues in Science Education.

SCIENCE

What is Science?

Why do we need Science?

Where do we use Science?

What sorts of jobs are Science related?

SCIENCE

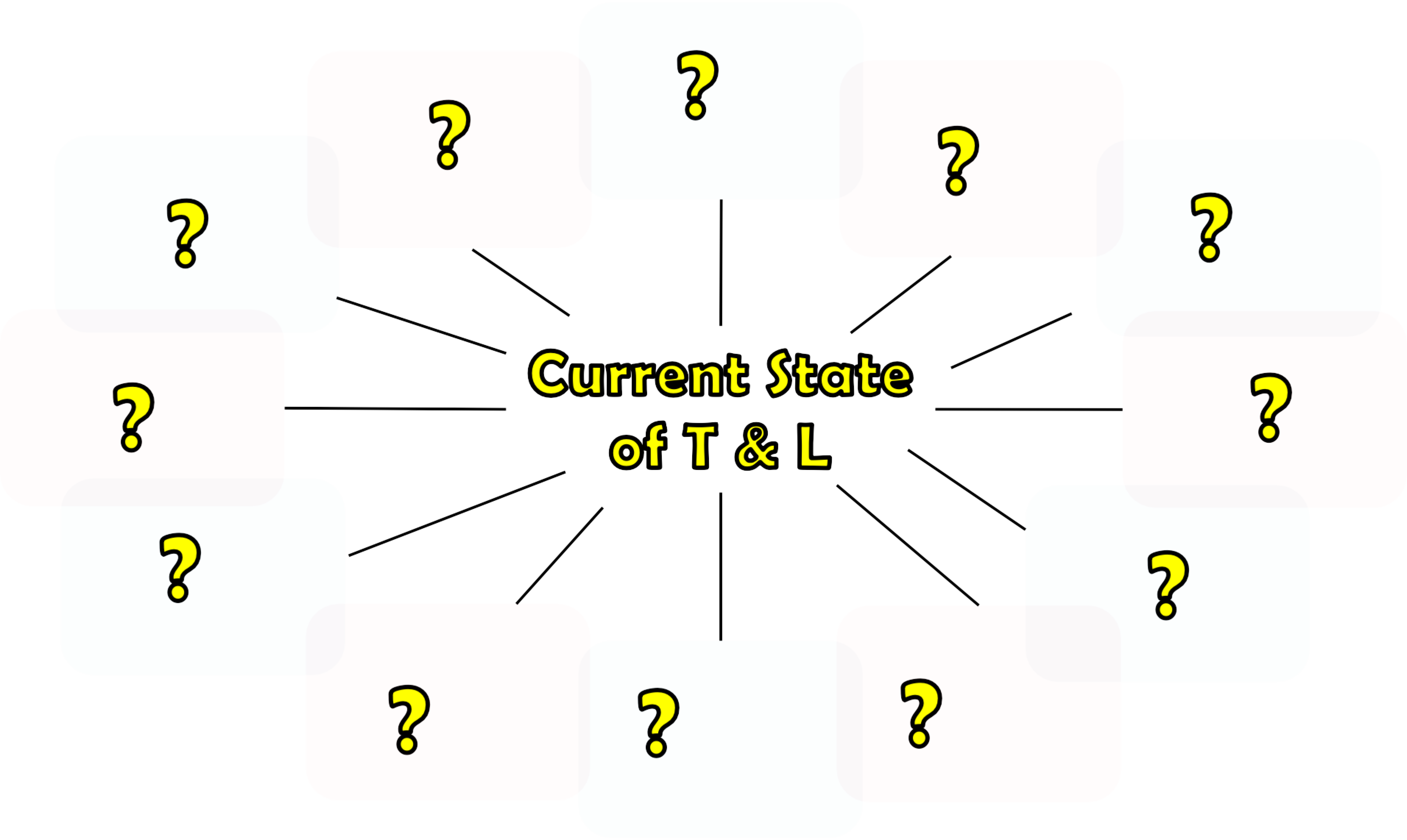
Science: The study of the natural world

Science is not just a body of knowledge that reflects current understanding of the world, it is also a **set of practices used to establish facts**, **extend** and **refine that knowledge**

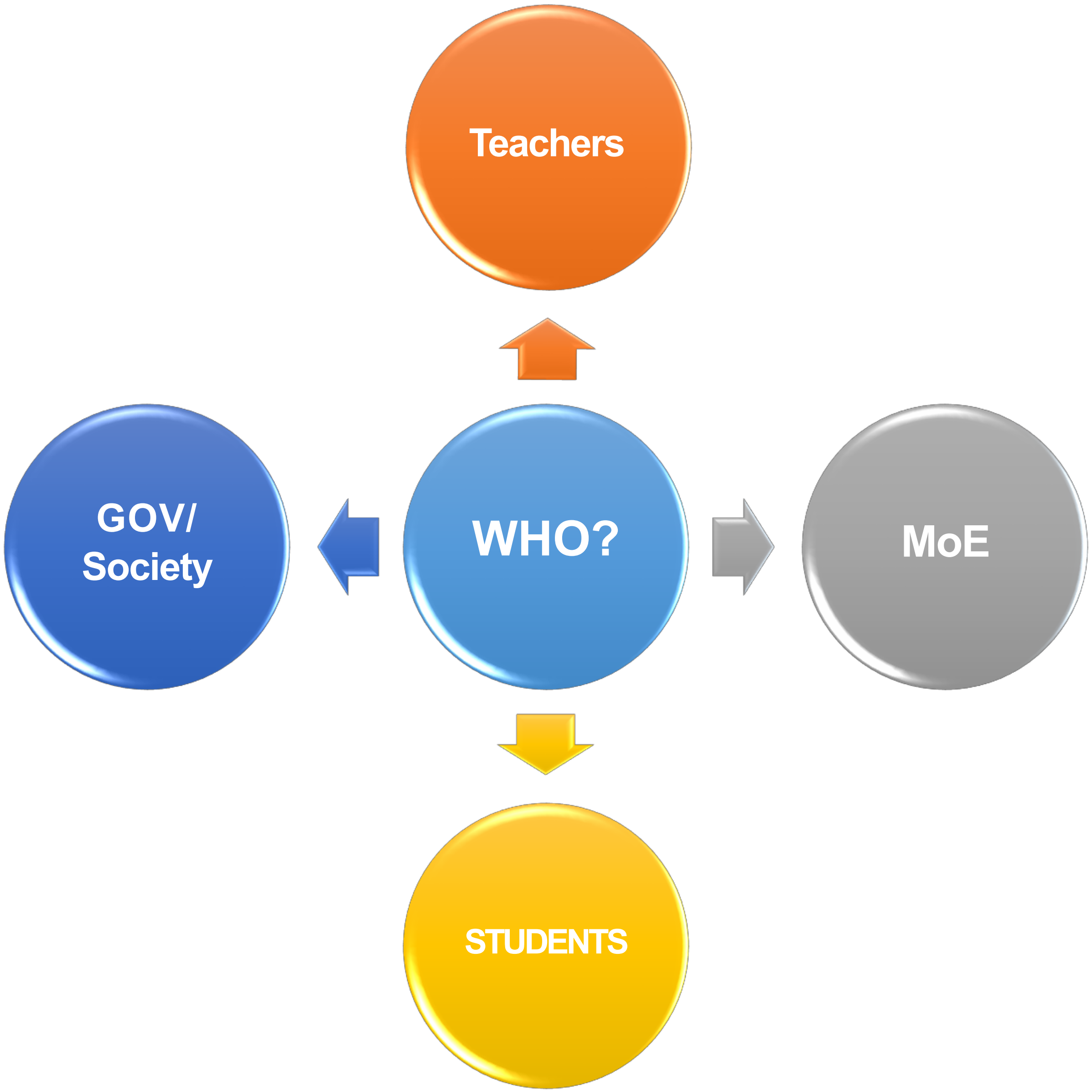
Both elemats – **KNOWLEDGE** and **PRACTICE** -

--- ARE ESSENTIAL!

-Activity 1-
Our Current State of T & L



Who decide the way we teach science?



What decide the way we teach science?

Our world today

- What are we lacking?
(Problems of scarcity)
- What are too much?
(Unwanted abundance)
- Trends in sc&technology
(responding to current scenarios)

Too little…

Food

Water

What else?

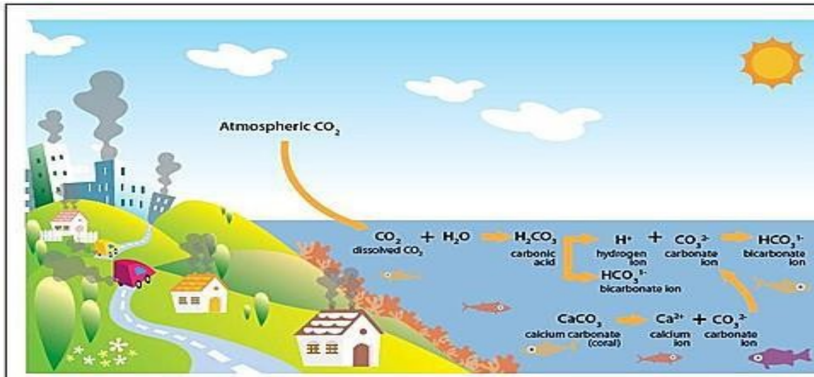
Energy

Environment

Too much…

Natural Catastrophes

Man-Made Catastrophes

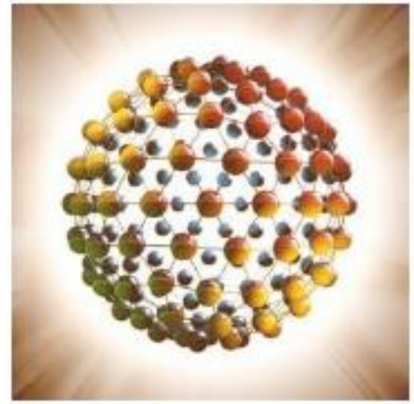


As CO_2 is absorbed by the atmosphere it bonds with sea water forming carbonic acid. This acid then releases a bicarbonate ion and a hydrogen ion. The hydrogen ion bonds with free carbonate ions in the water forming another bicarbonate ion. This free carbonate would otherwise be available to marine animals for making calcium carbonate shells and skeletons.

Trends in Science and Technology

GM food

Renewable energy



Nanotechnology

Military weapons

Nuclear power

Human Genome

Space Exploration

Construction technology

-Activity 2-
In Currents...

1) What should be the goal(s) of science education?
2) What should be taught? (or what students need to learn?)
3) How or in what ways science (preferably) should be taught?
4) How to assess learning (based on the growing trend)?
5) What is the global trend in (future) science education?
6) Your wish list, if any?

Your views on the trends of science education

Goals …

Curriculum …

Pedagogy ….

Assessment …

Globalisation…

Others …

Lets discuss on our points…

…then look at the rest of the presentation

Overview

Basic Goal(s)

Philosophy

Curriculum

Pedagogy

Assessment

Scientific and Technological Literacy

Education for Sustainable Development

Sustainable Development Goals SDGs

Goals

Four basic goals of science education:

1. **Science for meeting personal needs:**
To prepare individuals to use science for improving their own lives and for coping with an increasingly technological world.

2. **Science for resolving current societal issues:**
To produce informed citizens prepared to deal responsibly with science-related societal issues.

3. **Science for assisting with career choices:**
To increase awareness of the nature and scope of a wide variety of science and technology-related careers

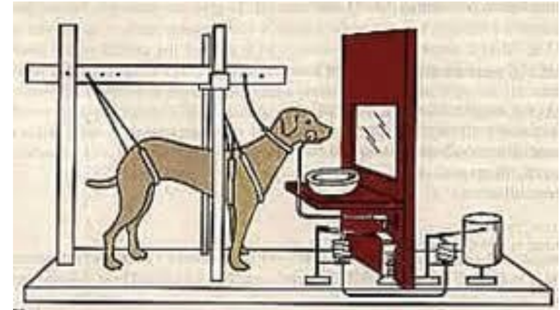
4. **Science for preparing for further study:**
To provide students with a firm foundation to pursue higher levels of study

Lets discuss…

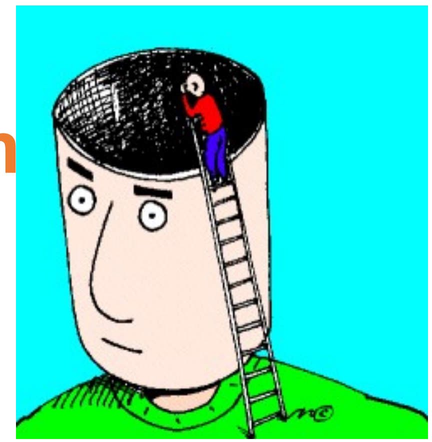
In what ways science should be taught?

- **Philosophy?**

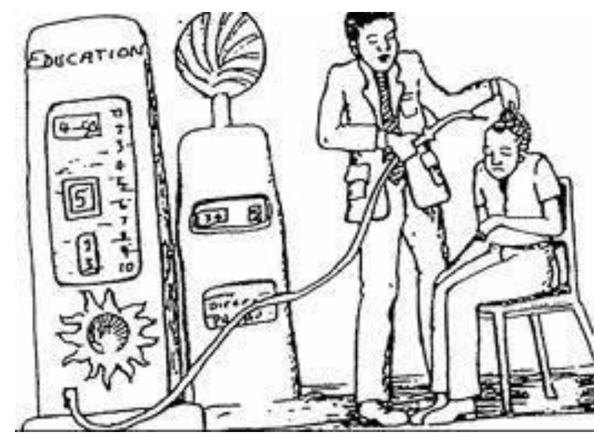
In what ways science should be taught?



Philosophy

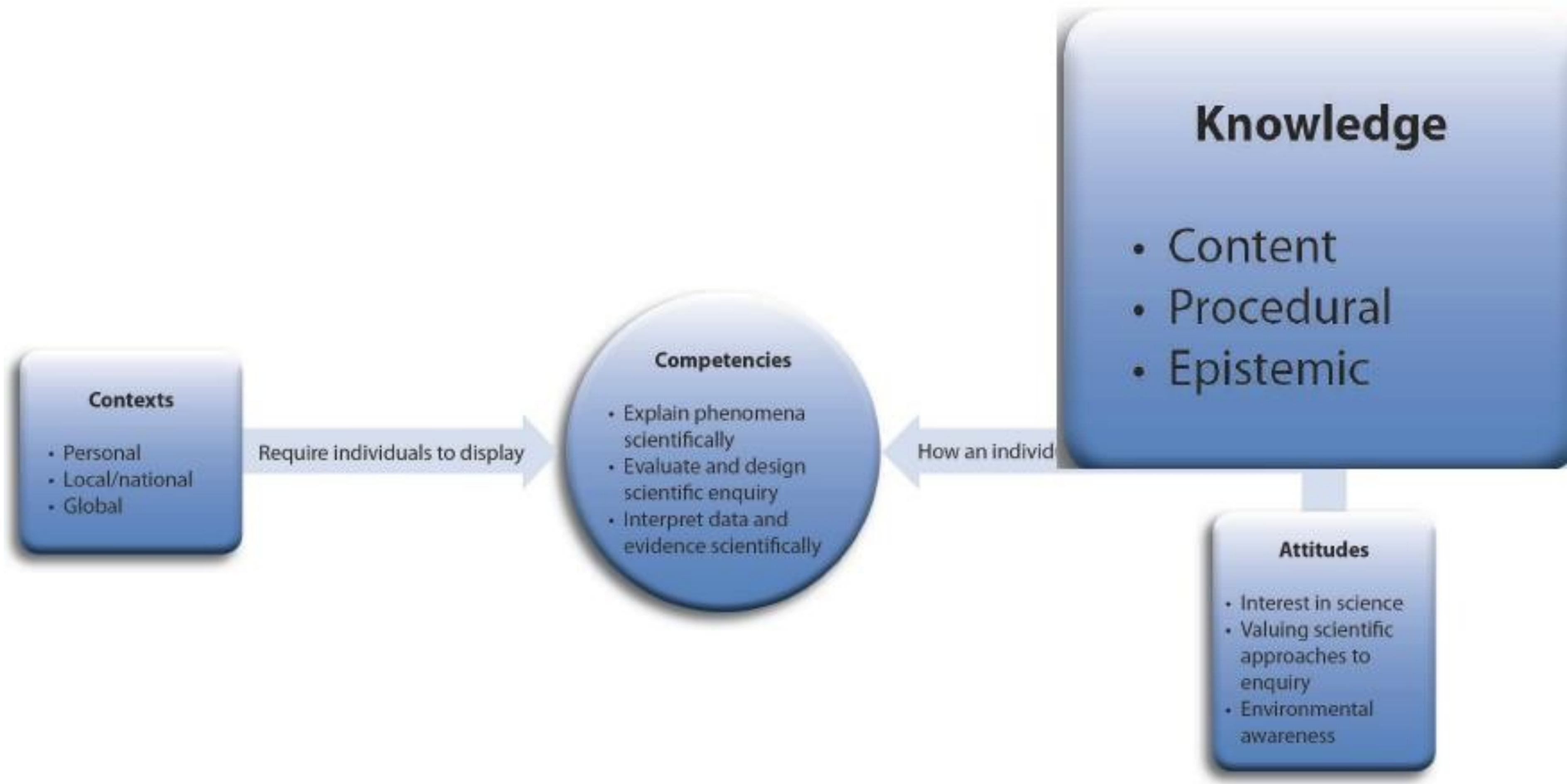


- Changed from behaviourism to cognitivism and to constructivism
- Students' minds are not like empty vessels (to be filled with knowledge)
  - -they construct ideas
- They need to be guided to learn

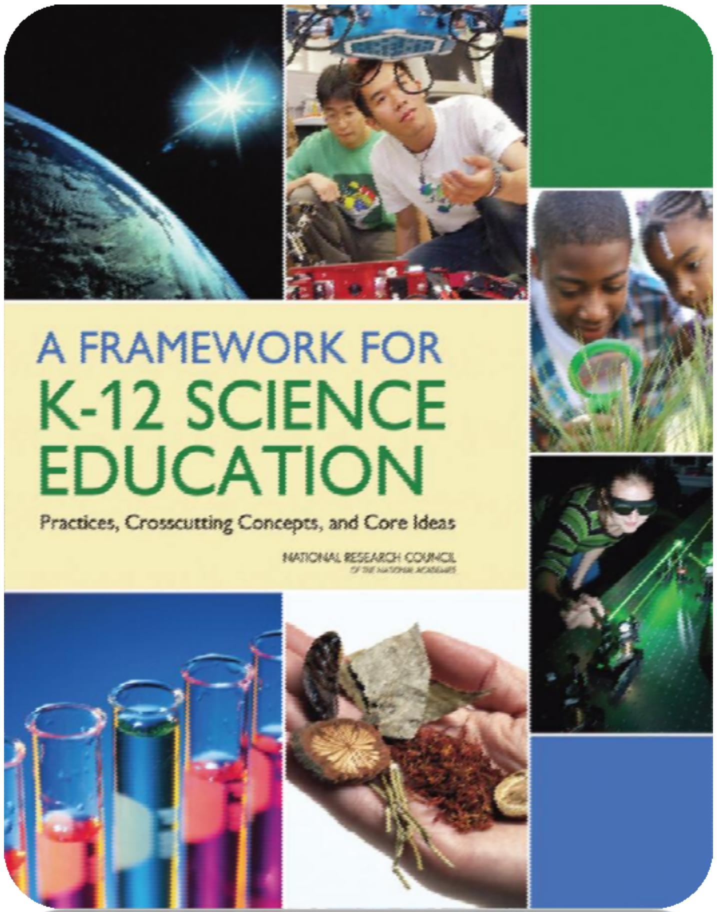


PISA 2015 SCIENTIFIC LITERACY FRAMEWORK

Programme for International Student Assessment (PISA)



Science as a Set of 8 Practices



1. Asking questions and defining problems

2. Developing and using models

3. Planning and carrying out investigations

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations and designing solutions

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

Science Curriculum

- **Providing hands-on/doing approach to learning**
  to observe, explore and test hypotheses…
- **Promoting higher order thinking skills**
  encourages students' imagination, logic and open-mindedness
- **Making Interdisciplinary connections**
  links science lesson to other areas of study
- **Linking science education to the real world**
  link to the student's own world through contextual learning
- **Incorporating information from new sciences/technology**
  information from technology, biotechnology and nanotechnology
- **Using information & communication technology**
  harnessing its potentials to enhance teaching-learning processes
- **Scientific attitude and values**
  caring heart for the humanity

Pedagogy
(constructivist model of learning)

Recognises that

- Learning is dependent on:

•the preconceptions of the learners
•the context in which it occurs

- Learner must construct his own meaning

Pedagogy (2)
(constructivist model of teaching/learning)

1)Hands-on:

- Doing science to construct meaning & acquire understanding.

2)Minds-on:

- Promoting thinking skills
- Encouraging questioning & interactions

3)Authentic problem-solving activities:

- Real-life questions and issues
- Dialogue with informed expert sources
- Acquire generalization of ideas & application

4)Inquiry-based lessons/studies

- Explore/ discover/ carry out investigations or experiments
- Solve problems and answer questions,
- Develop communication skills, critical and logical thinking

(5) Learning through ICT / Internet?

Assessment

- Using a variety of alternative assessment tools
- Learning assessment is built into the process of instruction
- On-line assessment
- PISA, TIMMS standards?

Scientific and Technological Literacy (STL)

Everybody should have sufficient knowledge and understanding to follow science and scientific debates with interest,

and

to engage with the issues science and technology poses – both for them individually, and for our society as a whole.

Scientific and Technological Literacy
(Teaching/Learning Approach)

- **Science in schools must be relevant to the students (not just learning facts, theories and laws…) such as how to solve problems in their daily lives.**

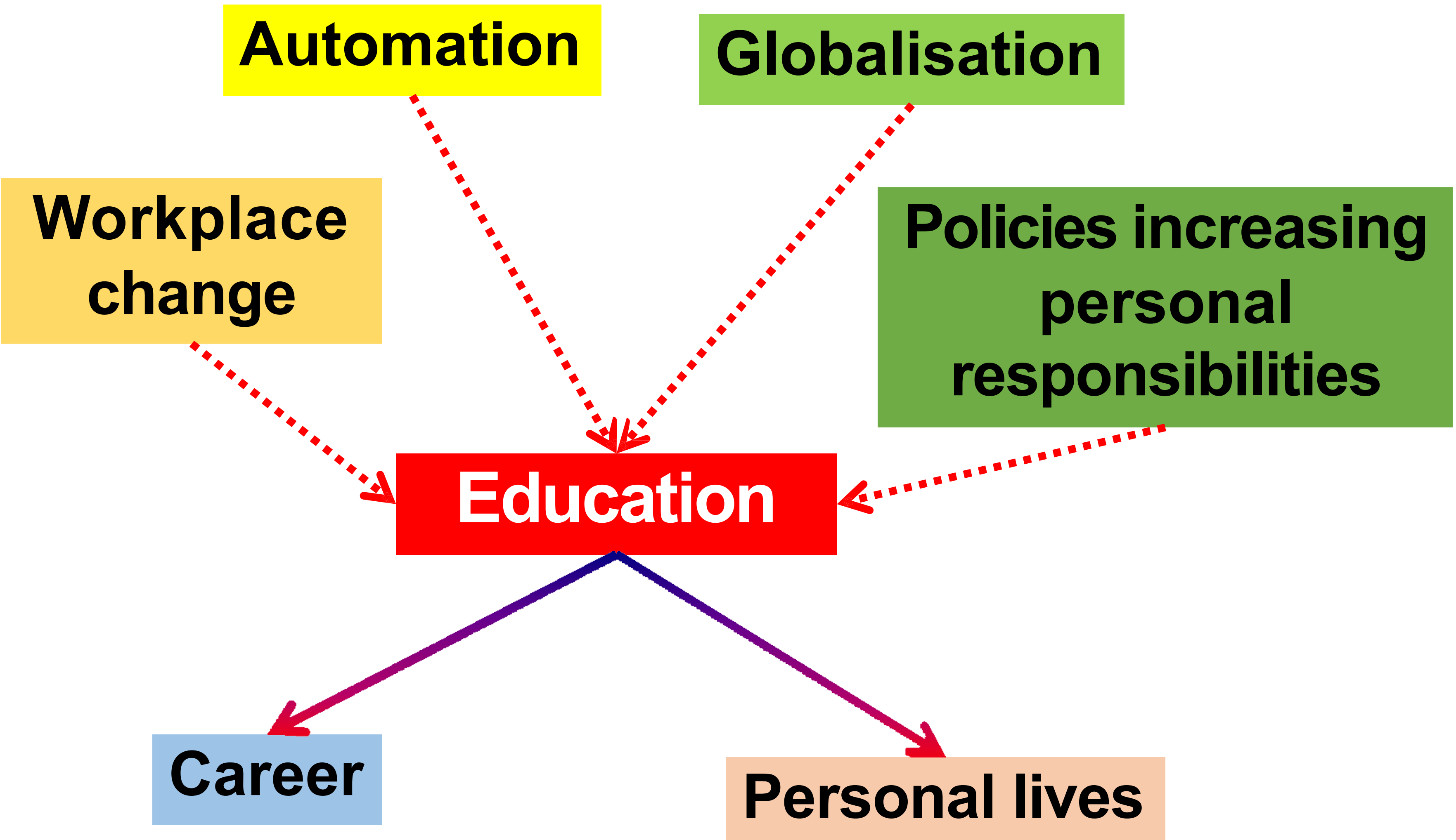
- **STL for developing the ability to utilize science knowledge creatively in everyday life (to solve problems, make decisions and hence improve the quality of life).**

Education that seeks to empower people of all ages to assume responsibility for creating and enjoying a sustainable future.

What are 21st Century Skills?

1. Ways of thinking: Creativity, critical thinking, problem-solving, decision-making and learning
2. Ways of working: Communication and collaboration
3. Tools for working: Information and communications technology (ICT) and information literacy
4. Skills for living in the world: Citizenship, life and career, and personal and social responsibility

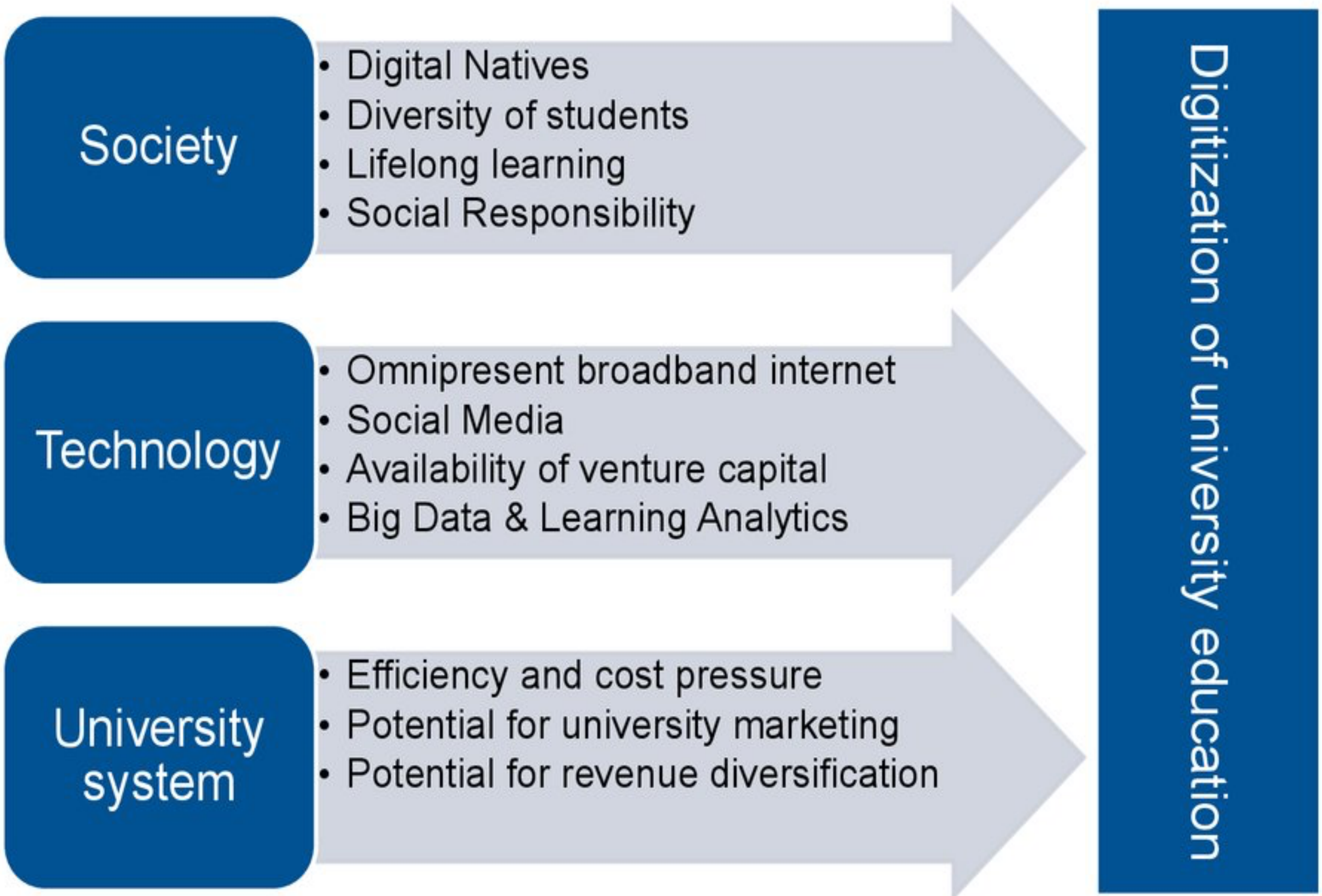
Why 21st Century Learning?

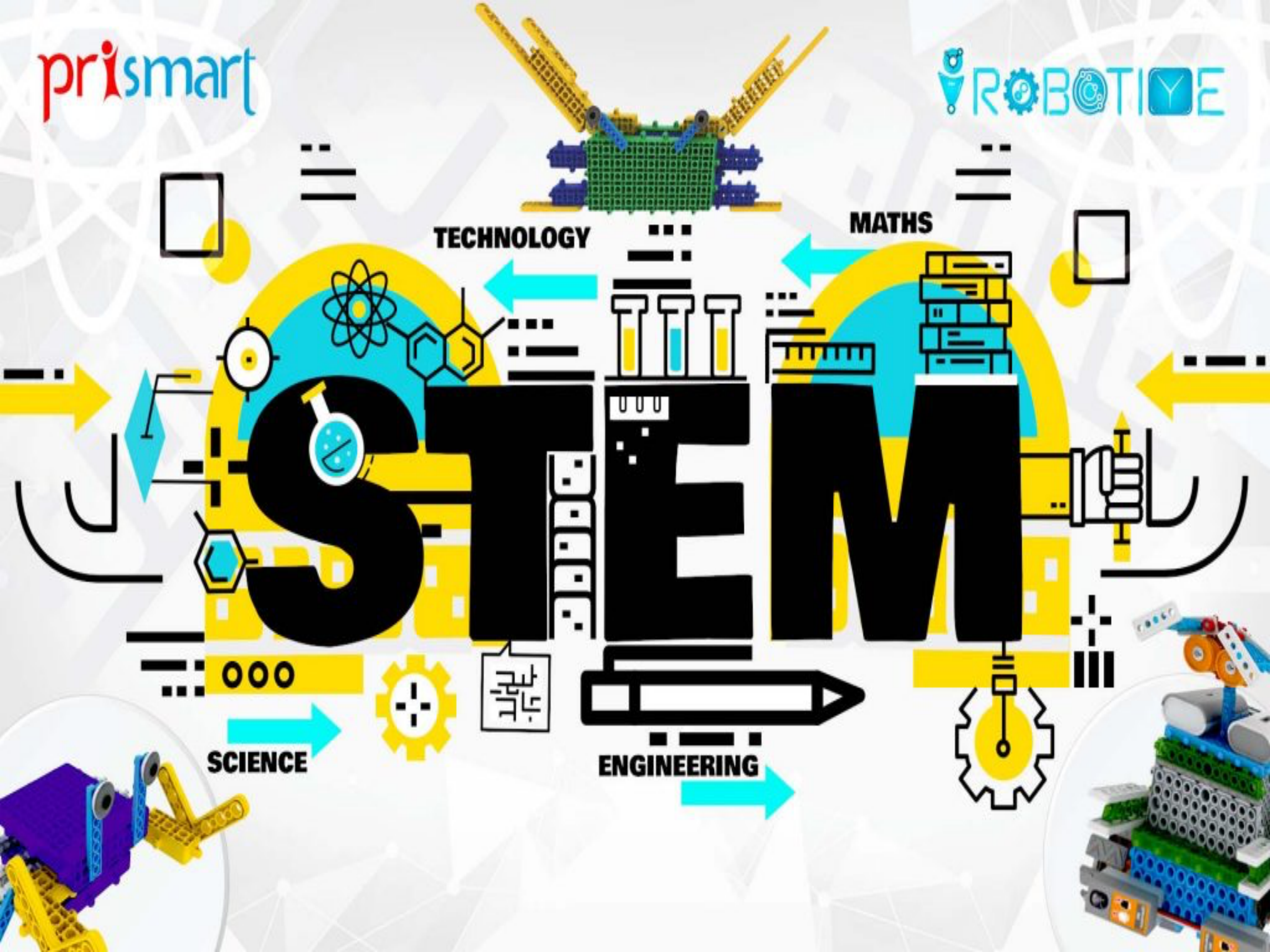



1 NO POVERTY
2 NO HUNGER
3 GOOD HEALTH
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 RENEWABLE ENERGY
8 GOOD JOBS AND ECONOMIC GROWTH
9 INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS
For Sustainable Development

Current Trends in Education 4.0

Education 4.0: Push and Pull Factors




prismart
ROBOTIME
TECHNOLOGY
MATHS
STEM
SCIENCE
ENGINEERING

STEM

SCIENCE, TECHNOLOGY, ENGINEERING AND MATH

CABLE TELECOMMUNICATIONS NEED STEM

SCTE

2x

5 YRS — 21.4% STEM JOBS

10.4% JOBS IN OTHER FIELDS

TODAY

JOB GROWTH RATE [2]

20% / 80%

JOBS REQUIRING TECHNICAL SKILLS IN THE NEXT DECADE [2]

25

U.S. RANK INTERNATIONAL ASSESSMENT OF HIGH SCHOOLERS MATH PERFORMANCE [6]

3.8

MILLION NUMBER OF 9TH GRADERS IN THE U.S.

6%

233,000 NUMBER CHOOSING A STEM DEGREE [4]

15 OF 20

PROJECTED TO 2014, NUMBER OF FASTEST GROWING U.S. JOBS THAT REQUIRE SIGNIFICANT MATH OR SCIENCE SKILLS [5]

$4.3 BILLION ANNUALLY [3]

FEDERAL GOVERNMENT SPENDING ON STEM EDUCATION AND TRAINING

THERE ARE TWO STEM ECONOMIES: GRADUATE AND HIGH SCHOOLS, WORKSHOPS, VOCATIONAL SCHOOLS AND COMMUNITY COLLEGES, WHICH RECEIVE INSUFFICIENT FUNDING

4/5 GRADUATE: BACHELOR LEVEL STEM FUNDING

1/5 SUB-BACHELOR LEVEL STEM FUNDING [3]

10%

$53,000 ON AVERAGE

$47,700 ON AVERAGE

NON 4-YR DEGREE STEM JOBS PAY MORE THAN THOSE WITH THE SAME EDUCATION LEVEL [3]

50%

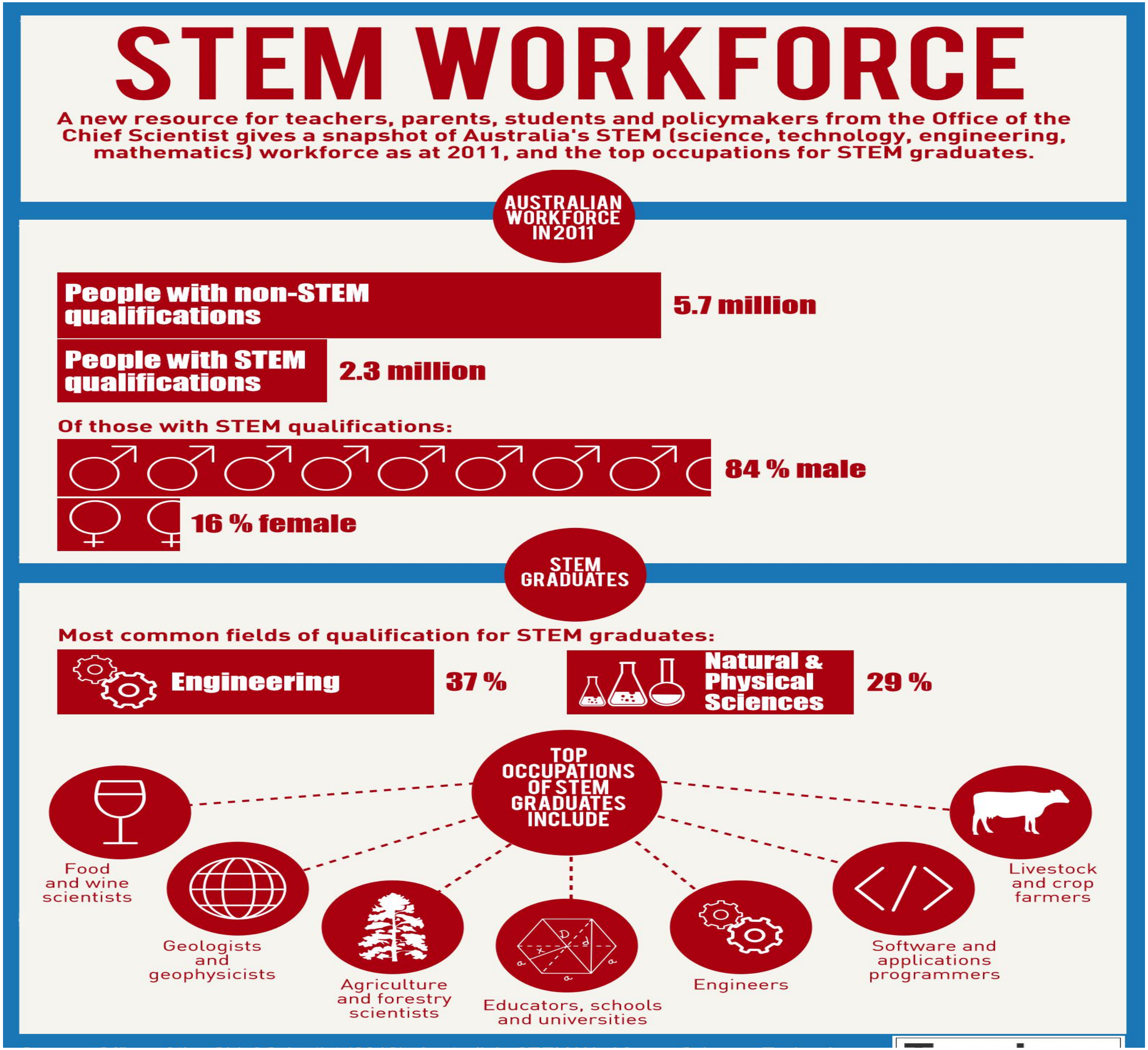
STEM JOBS NOT REQUIRING A 4-YR DEGREE: [3] TECHNICAL TRAINING FUNDS ARE NEEDED

16%

U.S. BACHELOR'S DEGREES IN BY 2020 THAT WILL FOCUS ON STEM RELATED FIELD [1]

+ www.scte.org/stem

1. "Help wanted; Projections of jobs and education requirements through 2018," U.S. Bureau of Labor Statistics; 2010
2. U.S. Bureau of Statistics
3. "Study: Half of STEM Jobs Don't Require Bachelor's Degree," www.US News.com; Brookings Institution Report, "The Hidden STEM Economy," 2013
4. National Center for Education Statistics
5. US Department of Labor
6. "PISA 2006: Science Competencies for Tomorrow's World, OECD briefing note for te United States," Organizations for Economic Co-operation and Development 2007


STEM WORKFORCE
A new resource for teachers, parents, students and policymakers from the Office of the Chief Scientist gives a snapshot of Australia's STEM (science, technology, engineering, mathematics) workforce as at 2011, and the top occupations for STEM graduates.
AUSTRALIAN WORKFORCE IN 2011
People with non-STEM qualifications
5.7 million
People with STEM qualifications
2.3 million
Of those with STEM qualifications:
84 % male
16 % female
STEM GRADUATES
Most common fields of qualification for STEM graduates:
Engineering
37 %
Natural & Physical Sciences
29 %
TOP OCCUPATIONS OF STEM GRADUATES INCLUDE
Food and wine scientists
Geologists and geophysicists
Agriculture and forestry scientists
Educators, schools and universities
Engineers
Software and applications programmers
Livestock and crop farmers

Incorporating 3D Printing into **Robotics for Education**

Teq®

STRATEGY	PROJECT-BASED ACTION LEARNING			
	1.0	2.0	3.0	4.0
Process	Implement	Integrate	Innovate	Improve Continuously
People	Junior Manageme nt	Middle & Junior Management	Senior, Middle, & Junior Management	Key Stakeholders (Internal & External)
Tool/Technology	Faster	Better	Faster, Better, Cheaper	Faster, Better, Smarter
Management Approach	Left Brain	Right Brain	Whole Brain	Accelerated Learning
Purpose	Process-Driven	Customer-Driven	Agile-Driven	Human Capital-Driven
Era	1970s	1990s	2000s	2020s

EDUCATION 3.0

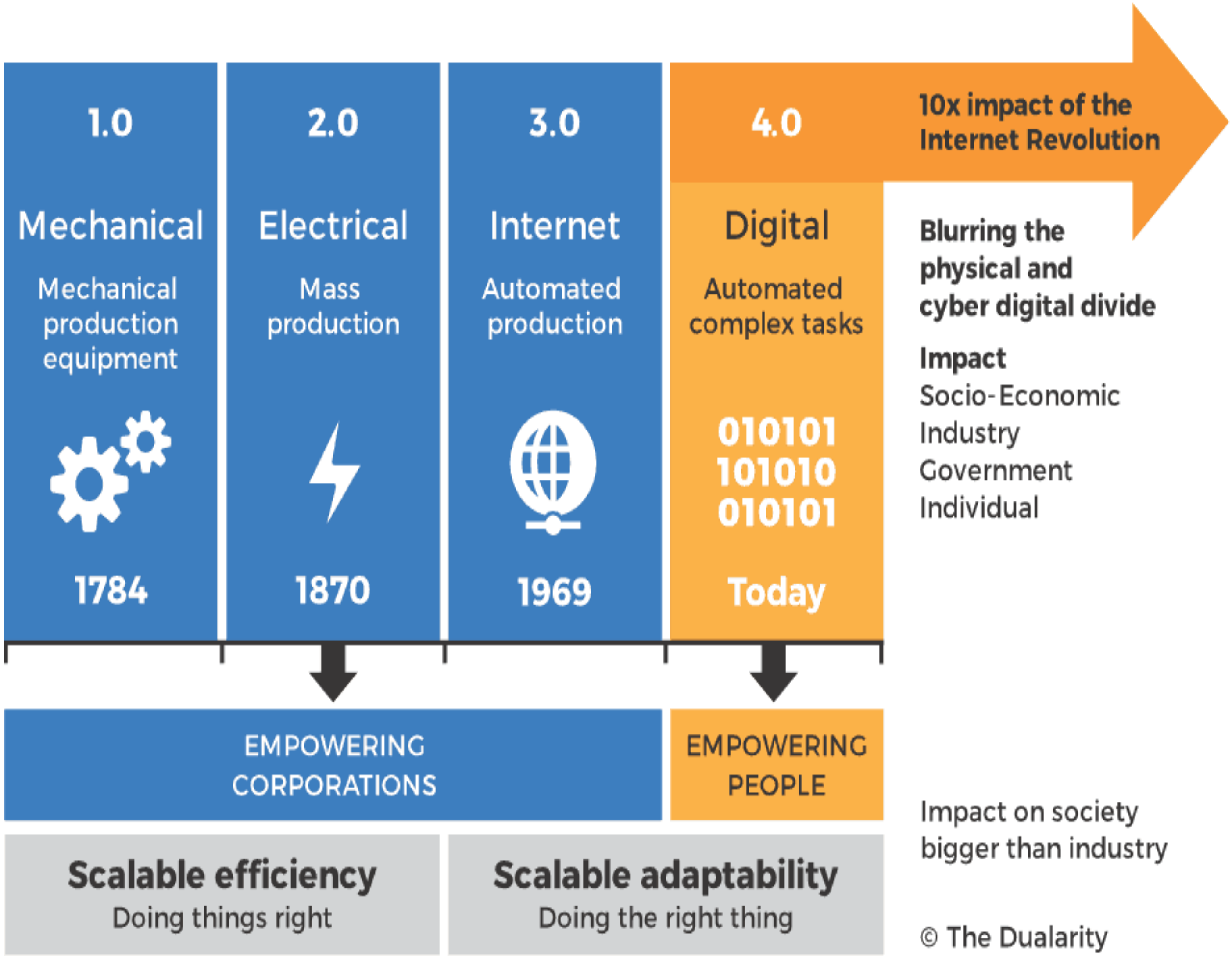
	Education 1.0	Education 2.0	Education 3.0
Learners	Apprentice, Acolyte	Clients	Co-developers & Co-researchers
Learning	Received	Formal & Informal	Lifelong
Knowledge	Transmitted	Socially Constructed	Open Free Contextual Reinvented Applied
Academics	Authoritative Expert	Supported by Facilitators & Assistants	Learning Designers & Leaders
Teaching	Teacher to student	Peer Encouragment	Co-constructed & created
Graduate-ness	Degree Qualified	License to Start Practicing	Prepared for Uncertain Multiple Careers
Technology	Fixed	Cautiously Applied	Digital Mobile
Learning Locations	Static Sustainable	Blended, Flexible	Enabling Chosen Everywhere

Source: Salmon, G. 2017. Higher Education 1.0 to 3.0; and Fisk, P. 2017. Education 4.0. Cited by Vincent Gaspersz, Lean Six Sigma Master Black Belt and Certified Management System Lead Specialist.

INDUSTRY 4.0

Welcome to the Industrial Revolution 4.0

010101
101010
010101



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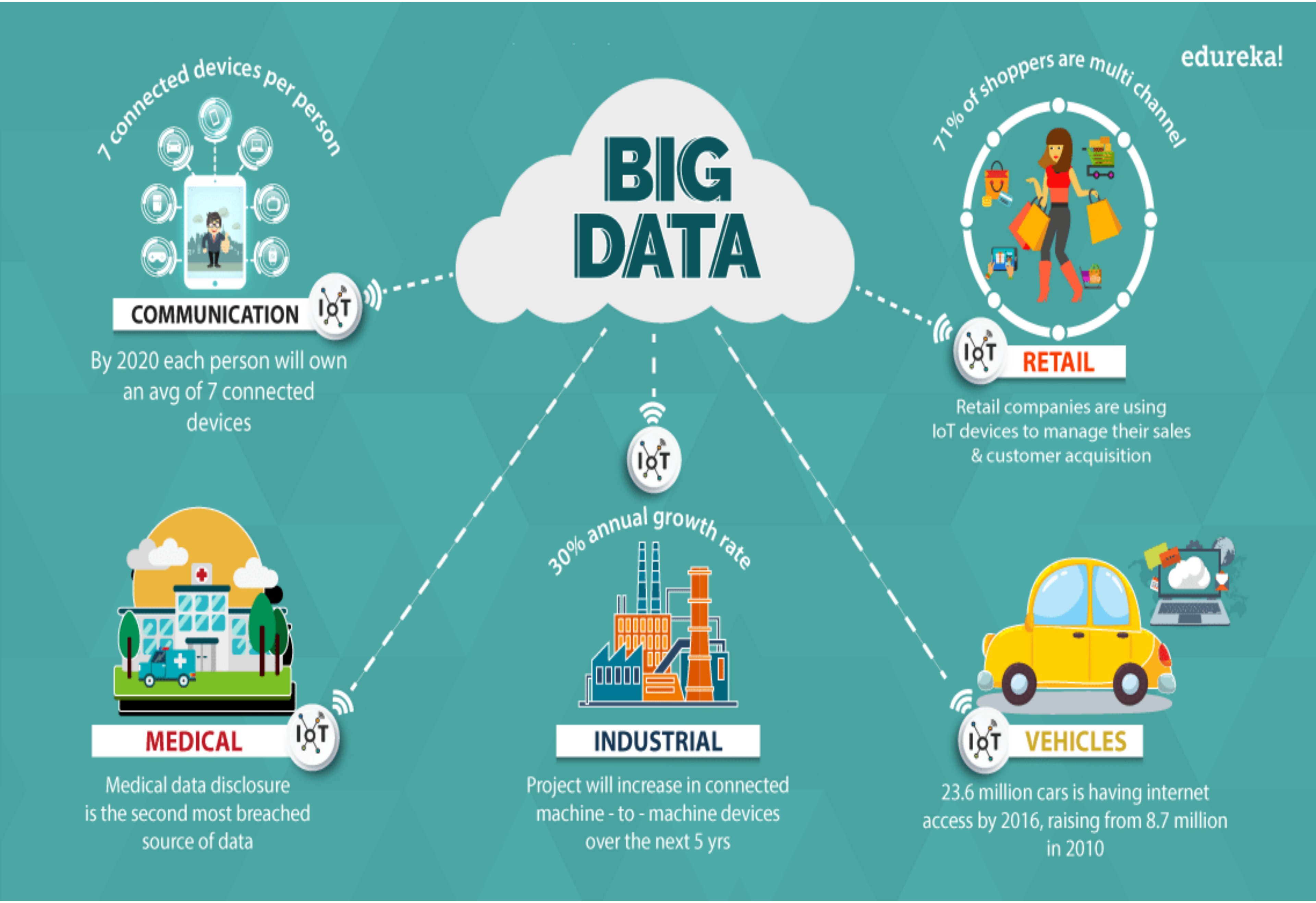
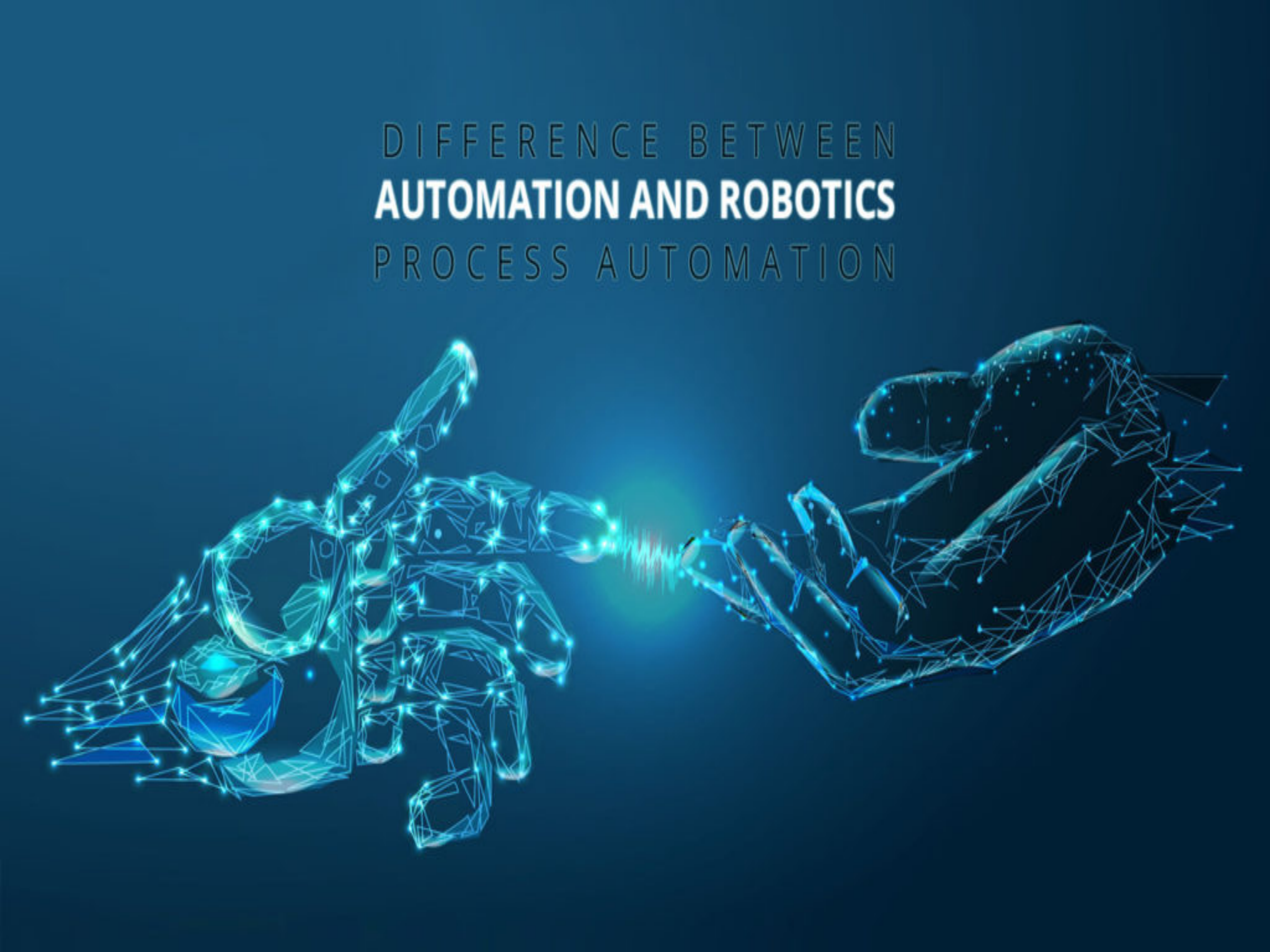

edureka!
BIG DATA
7 connected devices per person
COMMUNICATION
By 2020 each person will own an avg of 7 connected devices
71% of shoppers are multi channel
RETAIL
Retail companies are using IoT devices to manage their sales & customer acquisition
IoT
30% annual growth rate
MEDICAL
Medical data disclosure is the second most breached source of data
INDUSTRIAL
Project will increase in connected machine - to - machine devices over the next 5 yrs
VEHICLES
23.6 million cars is having internet access by 2016, raising from 8.7 million in 2010


DIFFERENCE BETWEEN
AUTOMATION AND ROBOTICS
PROCESS AUTOMATION


ARTIFICIAL
INTELLIGENCE

ARTIFICIAL INTELLIGENCE—THE NEXT BIG REVOLUTION IN COMPUTING

Computer scientists have been pursuing artificial intelligence (AI) since the 1950s.
Here's why the age of artificial intelligence may finally be here.

THE DEFINITION OF AI IS EVOLVING

How People Used to See AI

The Turing Test
AI scientist Alan Turing's 1950 test required a computer to trick a human into thinking it is human. No AI program has passed the Turing test.

Video Game Non-player Characters
Enemies appear to act intelligently in response to algorithms created for the game world.

HAL 9000
Author Arthur C. Clarke's fictional sentient computer ran the Discovery One spacecraft.

Deep Blue
IBM's* real computer defeated world chess champ Garry Kasparov using brute force computing power.

Spam Filters
Once a programmed set of rules, today's spam filters use neural networks that learn to recognize junk mail.

How Intel® Defines AI Today

Machine learning that can...

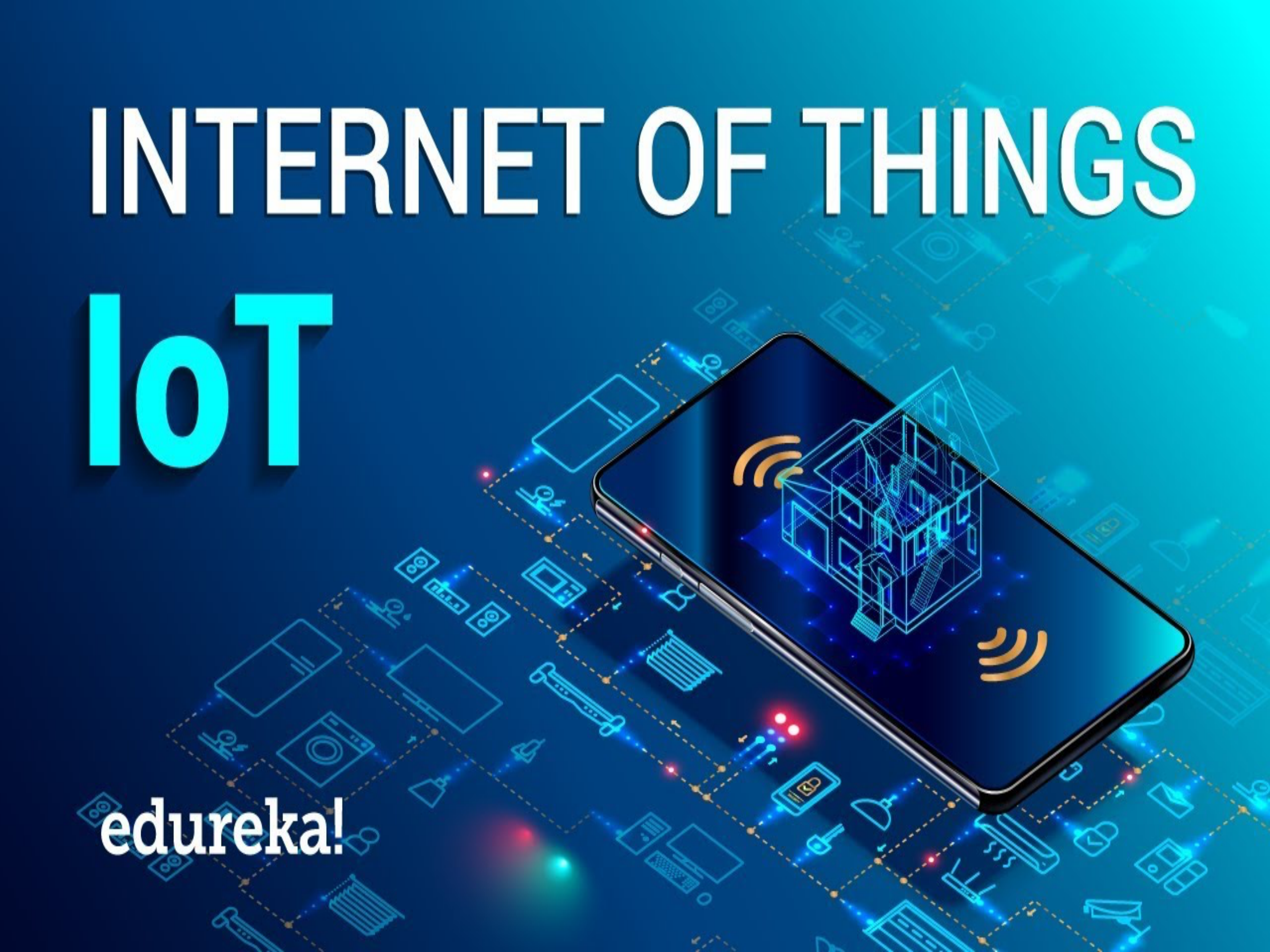
- **Sense**
- **Reason**
- **Act**
- **Adapt** based on experience

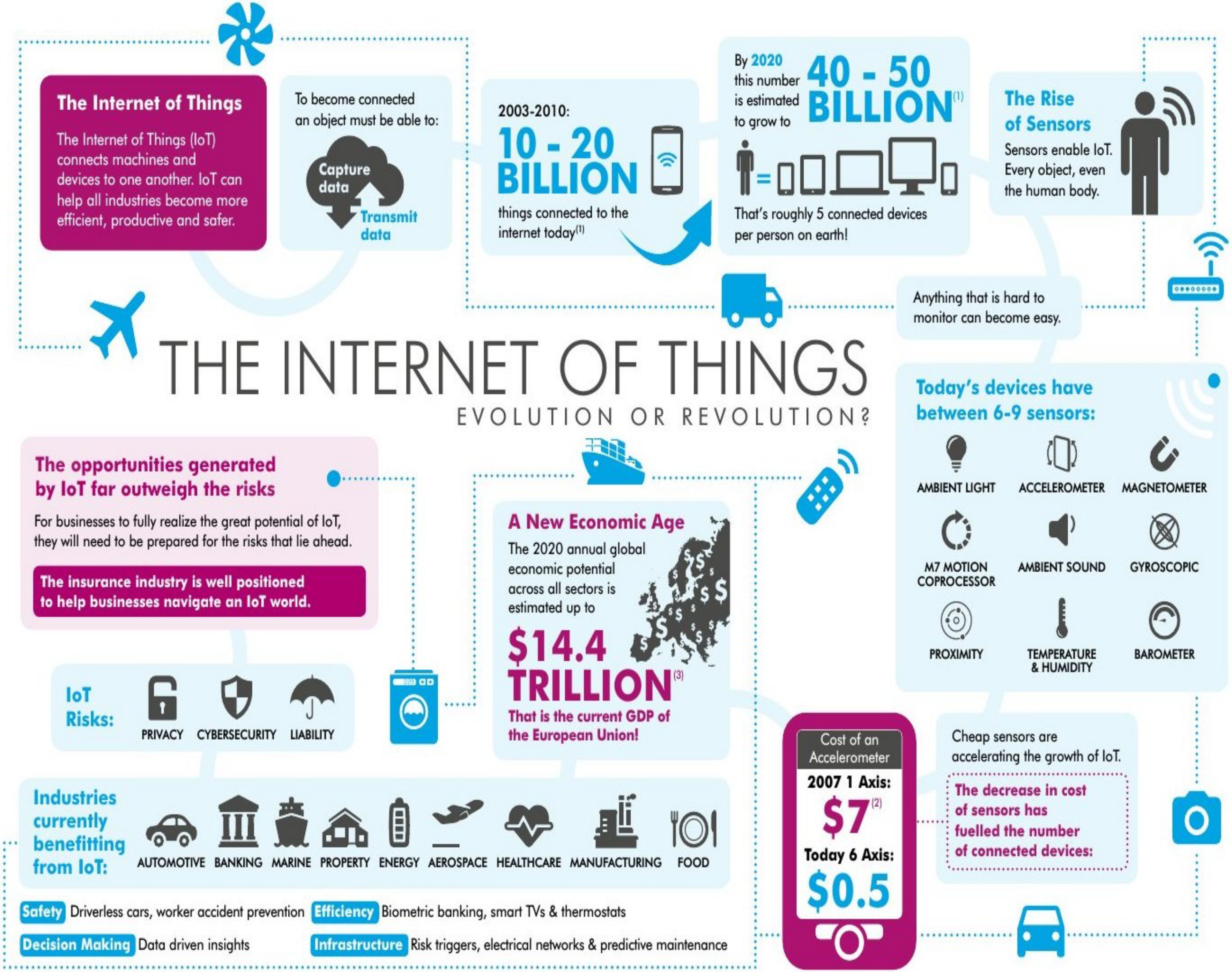
TECHNOLOGICAL ADVANCES THAT HAVE CHANGED THE AI LANDSCAPE

Modern Computer Architecture
Small, cheap multi-chip processors and modern code algorithms help programs solve big problems quickly.

Big Data
Today's intelligent programs learn by studying huge stores of digital data amassed in the Internet age.

Neural Networks
Neural nets organized in layers that process increasingly complex data learn abstract concepts more like our brains do.


INTERNET OF THINGS
IoT
edureka!



THE INTERNET OF THINGS
EVOLUTION OR REVOLUTION?
The Internet of Things
The Internet of Things (IoT) connects machines and devices to one another. IoT can help all industries become more efficient, productive and safer.
To become connected an object must be able to:
Capture data
Transmit data
2003-2010:
10 - 20 BILLION
things connected to the internet today(1)
By 2020 this number is estimated to grow to
40 - 50 BILLION(1)
That's roughly 5 connected devices per person on earth!
The Rise of Sensors
Sensors enable IoT. Every object, even the human body.
Anything that is hard to monitor can become easy.
Today's devices have between 6-9 sensors:
AMBIENT LIGHT
ACCELEROMETER
MAGNETOMETER
M7 MOTION COPROCESSOR
AMBIENT SOUND
GYROSCOPIC
PROXIMITY
TEMPERATURE & HUMIDITY
BAROMETER
The opportunities generated by IoT far outweigh the risks
For businesses to fully realize the great potential of IoT, they will need to be prepared for the risks that lie ahead.
The insurance industry is well positioned to help businesses navigate an IoT world.
IoT Risks:
PRIVACY
CYBERSECURITY
LIABILITY
A New Economic Age
The 2020 annual global economic potential across all sectors is estimated up to
$14.4 TRILLION(3)
That is the current GDP of the European Union!
Cost of an Accelerometer
2007 1 Axis:
$7(2)
Today 6 Axis:
$0.5
Cheap sensors are accelerating the growth of IoT.
The decrease in cost of sensors has fuelled the number of connected devices:
Industries currently benefitting from IoT:
AUTOMOTIVE
BANKING
MARINE
PROPERTY
ENERGY
AEROSPACE
HEALTHCARE
MANUFACTURING
FOOD
Safety Driverless cars, worker accident prevention
Efficiency Biometric banking, smart TVs & thermostats
Decision Making Data driven insights
Infrastructure Risk triggers, electrical networks & predictive maintenance


WEB 2.0
APPS
WEB 3.0
DAPPS
BROWSER
STORAGE
VIDEO AND
AUDIO CALLS
OPERATING
SYSTEM
SOCIAL
NETWORK
MESSAGING
REMOTE JOB
Brave
Storj
IPFS
Experty
Essentia.one
EOS
Steemit
Akasha
Status
Ethlance


AR Anatomy
Right lung
AUGMENTED REALITY
FOR EDUCATION

REGULAR COURSE RC-PS-144-1
5 - 30 August 2019

Inquiry Based Learning in Primary Science Education

Mr. Liman Anthony
Science Specialist,
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