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Innovating higher education by developing students' creativity and critical thinking?

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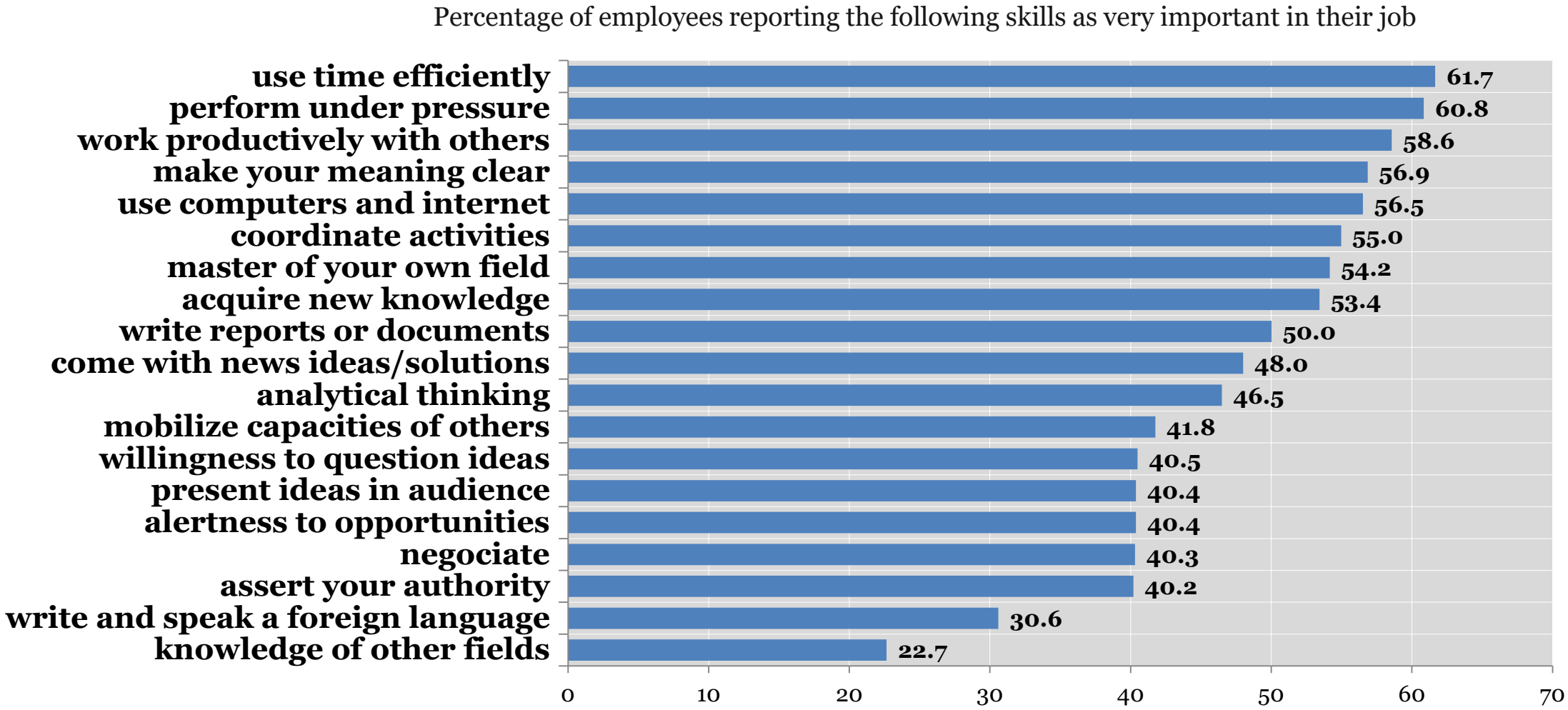
OECD
BETTER POLICIES FOR BETTER LIVES

Outline

- Skills for innovation and digitalisation
- How is higher education doing?
- Fostering critical thinking and creativity in higher education
- Examples of activities to develop creativity and critical thinking

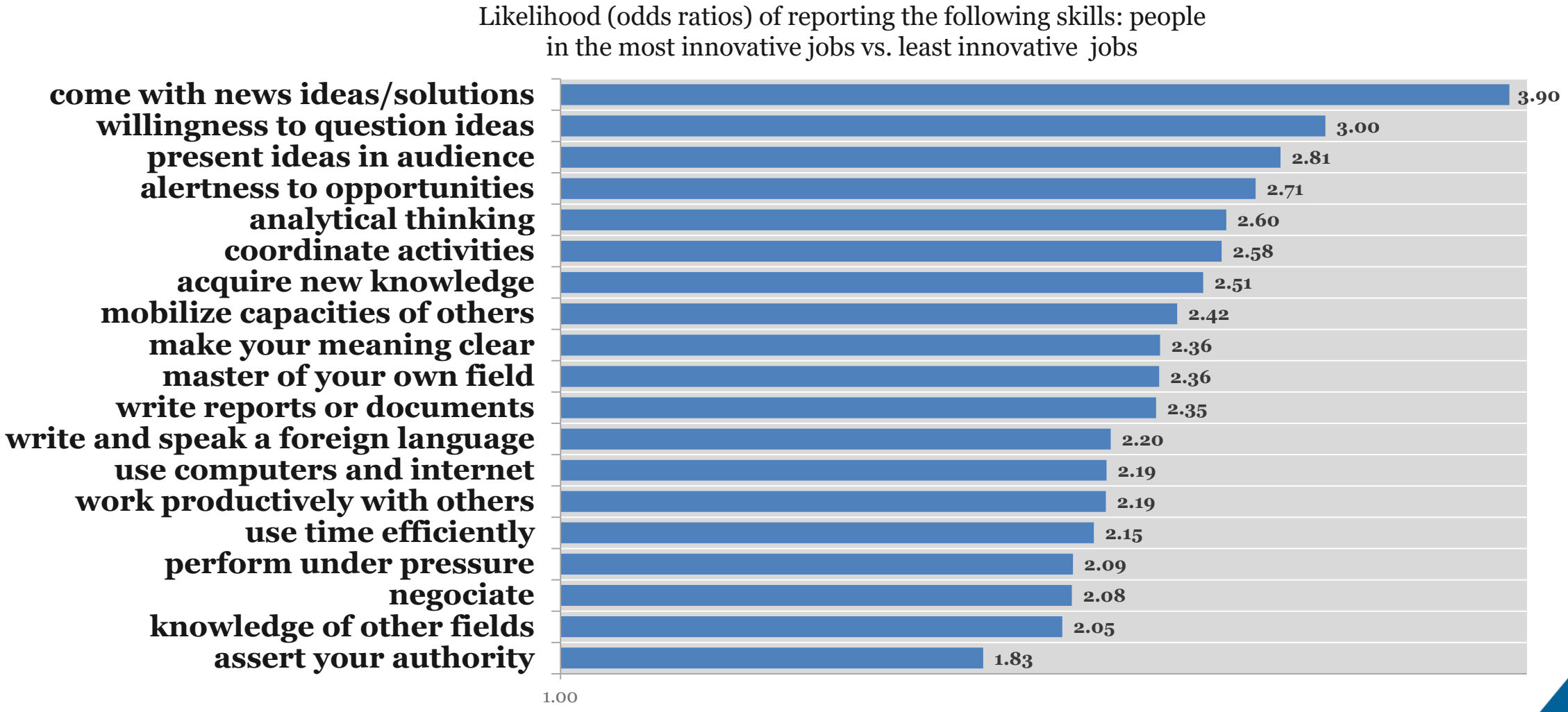
skills and education for innovation and digitalisation

Skills that tertiary-educated professionals report as very important in their job



Source: Avvisati, Jacotin and Vincent-Lancrin (2014), based on REFLEX and HEGESCO data

Critical skills for the most innovative jobs (according to tertiary-educated workers)



Source: Avvisati, Jacotin and Vincent-Lancrin (2014), based on REFLEX and HEGESCO data

Accenture: New skillsets becoming more important

The skillsets that are increasingly important across every role are acquired through practice and experience, not in classrooms.

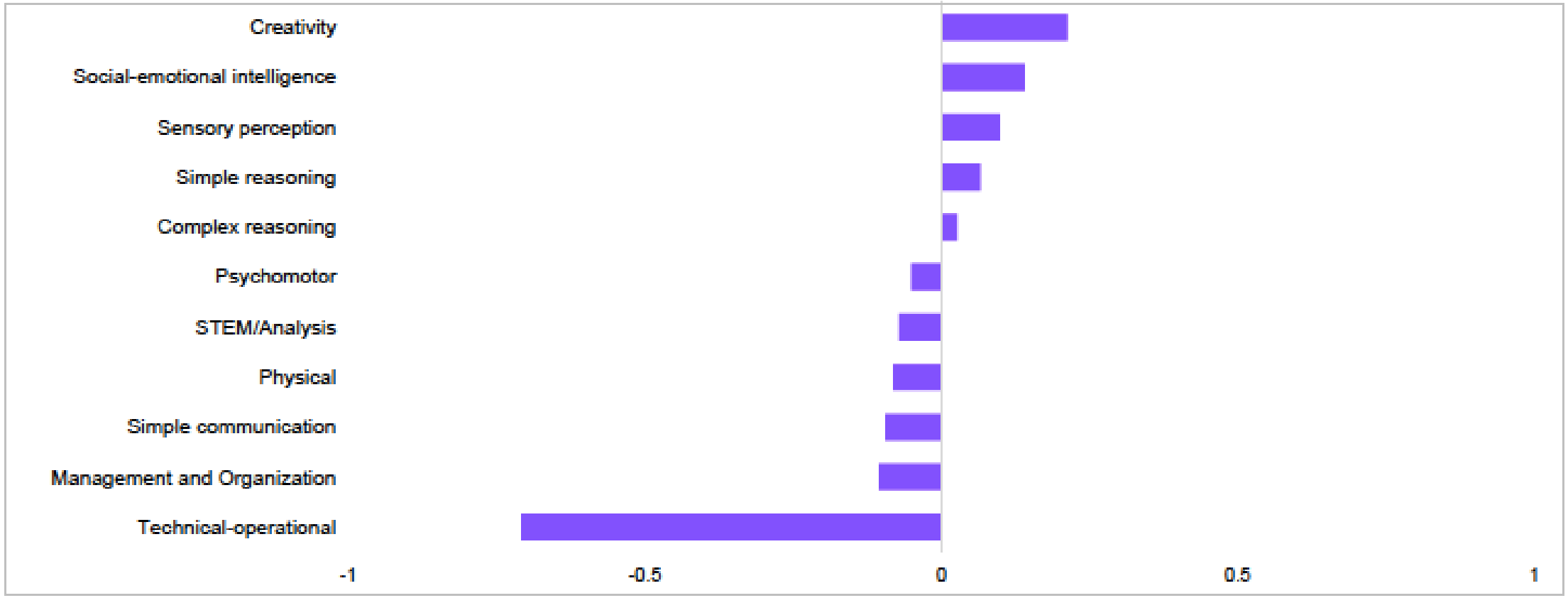
Importance: ○ High ○ Medium ○ Low	Complex Reasoning		Creativity		Socio-emotional Intelligence		Sensory Perception	
	Importance in 2017	Change since 2004	Importance in 2017	Change since 2004	Importance in 2017	Change since 2004	Importance in 2017	Change since 2004
MANAGEMENT & LEADERSHIP	○	▲	○	▲	○	▲	○	▲
EMPATHY & SUPPORT	○	▲	○	▲	○	▲	○	▲
SCIENCE & ENGINEERING	○	▲	○	▲	○	▲	○	▲
ANALYTICAL SUBJECT-MATTER EXPERTISE	○	▲	○	▲	○	▼	○	▲
RELATIONAL SUBJECT-MATTER EXPERTISE	○	▲	○	▲	○	▲	○	▲
PROCESS & ANALYSIS	○	▲	○	▲	○	▲	○	▲
PHYSICAL SERVICES	○	▲	○	▲	○	▲	○	▲
TECHNICAL EQUIPMENT MAINTENANCE	○	▲	○	▲	○	▲	○	▲
MACHINE OPERATION & MANOEUVRING	○	▲	○	▲	○	▲	○	▲
PHYSICAL MANUAL LABOR	○	▲	○	▲	○	▲	○	▲

Note:
- Complex Reasoning includes critical thinking, deductive reasoning, active learning and a set of higher-order cognitive capabilities.
- Socio-emotional Intelligence involves active listening, social perceptiveness, persuasion, negotiation and service orientation.
- Sensory Perception incorporates a wide range of sensory capabilities that have been stimulated through our increasingly intimate relationship with digital technologies.

Source: Accenture analysis of data from The Occupational Information Network (O*NET) of the US Department of Labor

Accenture: How skills in science and engineering roles have changed (2004-2017)

Science and engineering roles already require greater creativity and socio-emotional intelligence.
This trend will accelerate with human-machine collaboration.



Scale based on US Department of Labor (O*Net) measure of skill importance, 1-5 scale
Source: Accenture analysis of data from The Occupational Information (O*Net) from the US Department of Labor

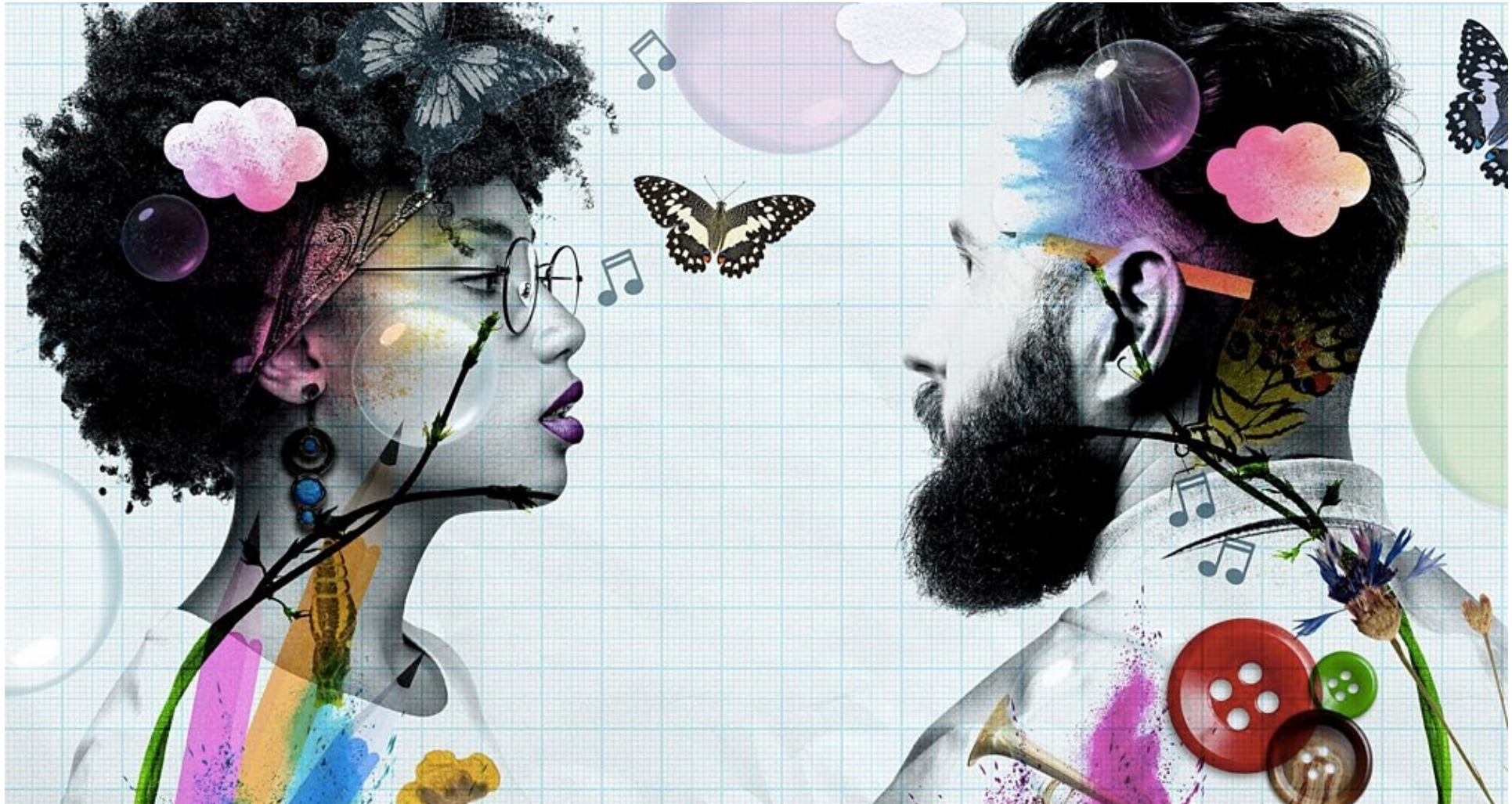
Survey of CEOs: Top 10 Skills Demand: 2018 vs. 2022

Today, 2018	Trending, 2022
Analytical thinking and innovation	Analytical thinking and innovation
Complex problem-solving	Active learning and learning strategies
Critical thinking and analysis	Creativity, originality and initiative
Active learning and learning strategies	Technology design and programming
Creativity, originality and initiative	Critical thinking and analysis
Attention to detail, trustworthiness	Complex problem-solving
Emotional intelligence	Leadership and social influence
Reasoning, problem-solving and ideation	Emotional intelligence
Leadership and social influence	Reasoning, problem-solving and ideation
Coordination and time management	Systems analysis and evaluation

Source: Future of Jobs Survey 2018, World Economic Forum.

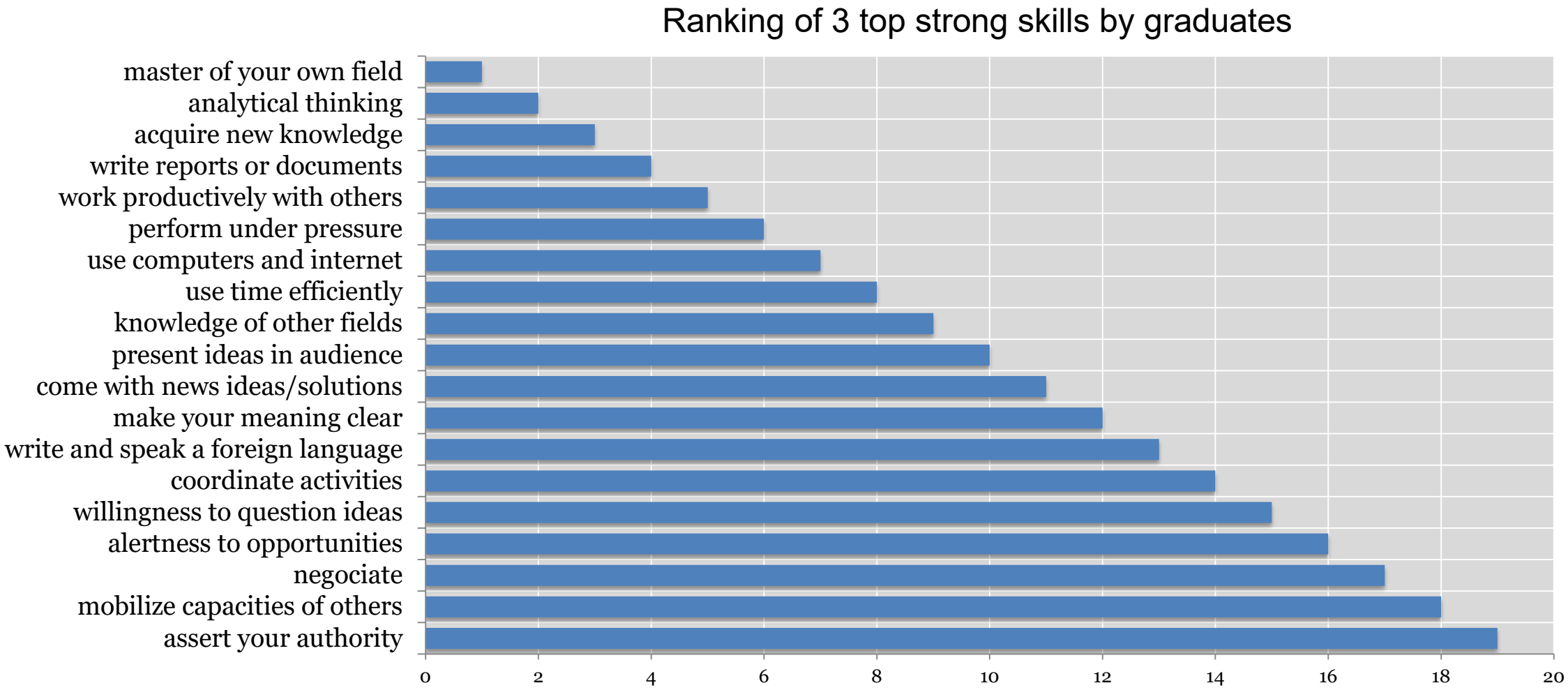
Creativity is a source of personal and social well being / Critical thinking is critical for citizenship

Flow / Positive emotions / Positive impact on health / Assessing information



how is higher education doing?

Strong points of higher education



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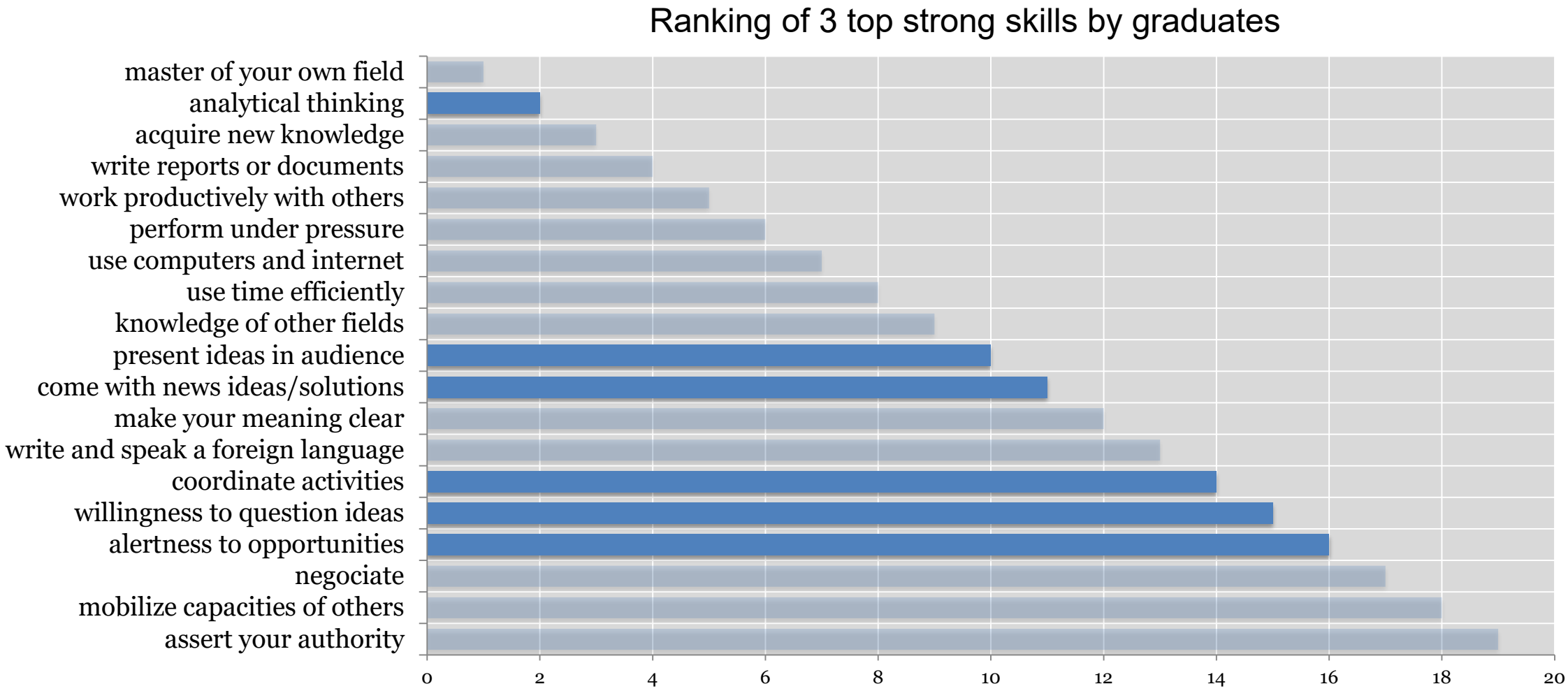
Strong points of higher education



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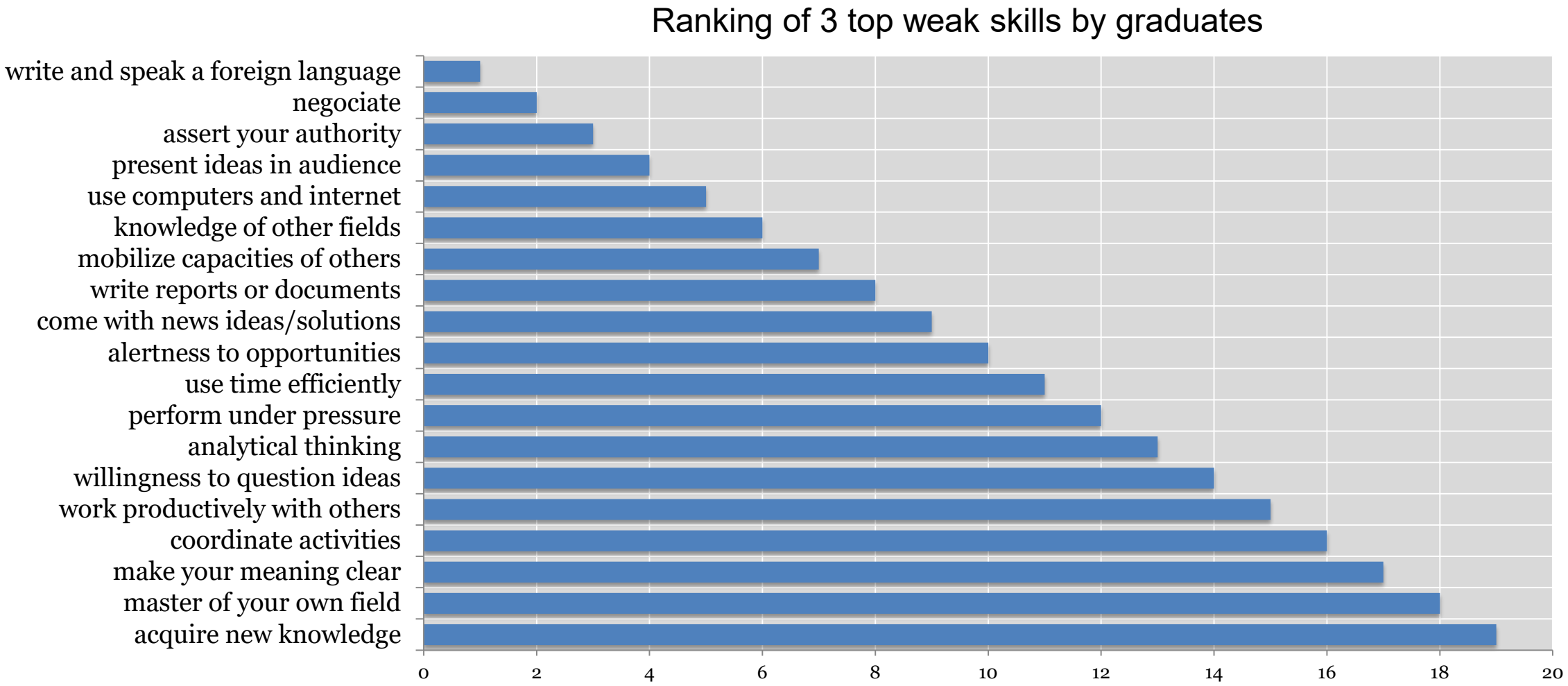
Weak points of higher education



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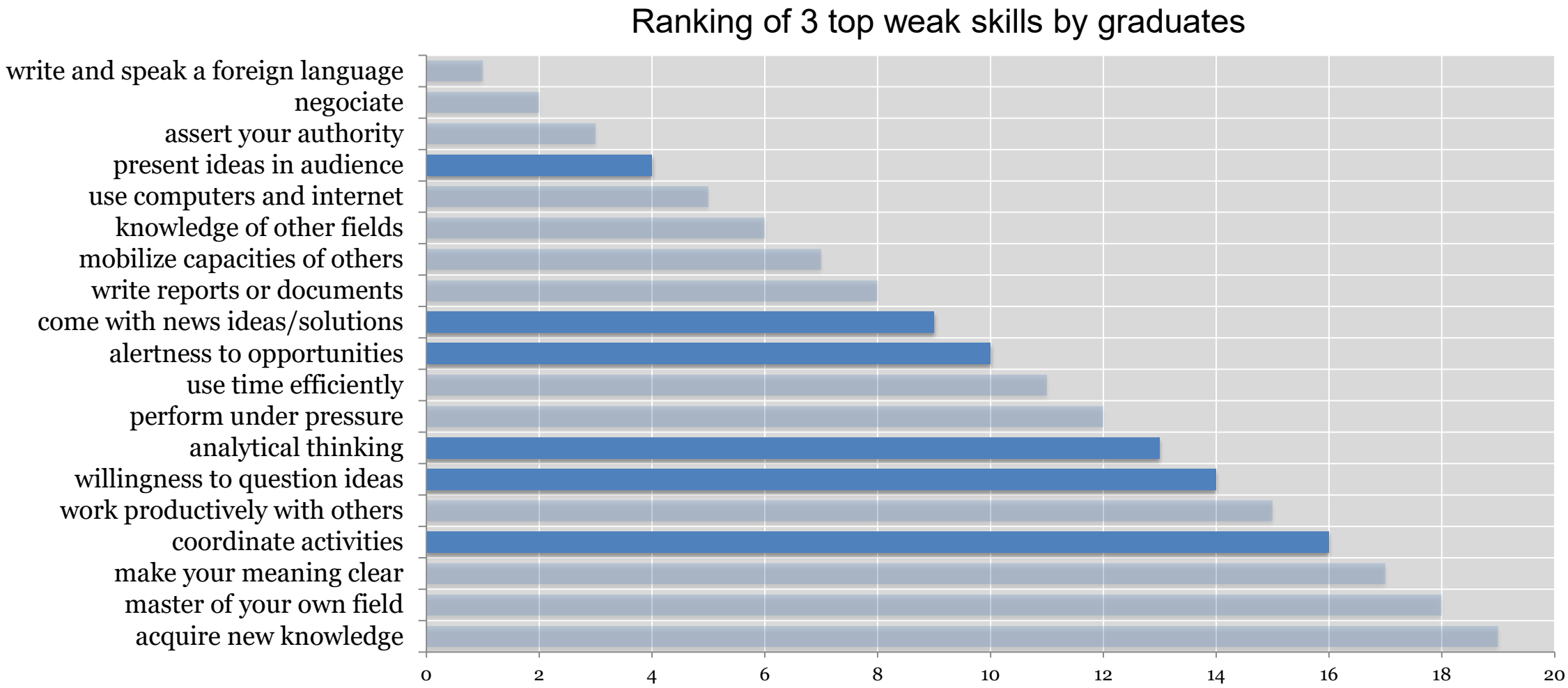
Weak points of higher education

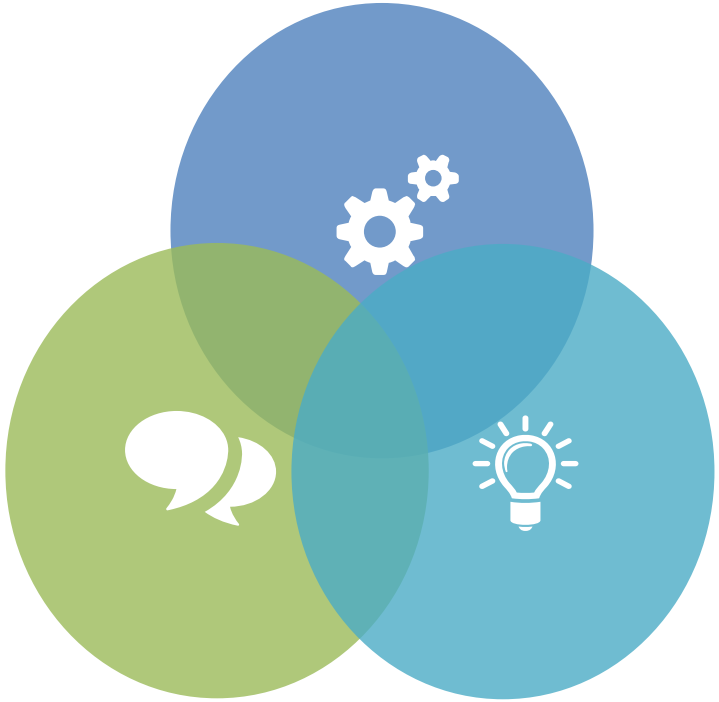


Source: Avvisati, Jacotin and Vincent-Lancrin (2014), based on REFLEX and HEGESCO data

towards competency-based curricula

What skills should education systems foster?

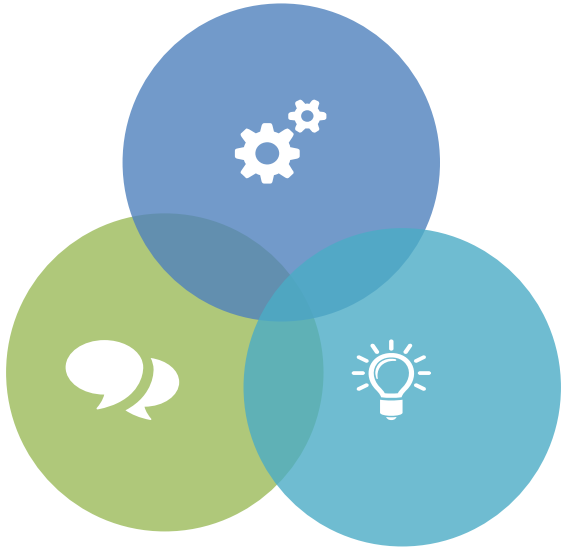
Technical skills
Know-what and know-how



Behavioural and social skills
Self-confidence, energy, perseverance, passion, leadership, collaboration, communication

Creativity and critical thinking skills
Creativity, critical thinking, inquiry, imagination, curiosity, ability to make connections, metacognition…

Some comments on these skills categories



- They overlap and may reinforce each other

But

- They are different and cannot be reduced to a single skill (or measure)

- They are domain-specific (take different forms in each domain)
  - Skills are generally domain-specific: one is creative in a field, one knows how to behave/communicate in a specific context, one has knowledge and problem-solving skills in a field

- They can become « domain-generic »
  - A skills becomes « domain-generic » when one has gained it in a number of domains or settings, so that it becomes a « habit of mind » (a disposition or a stabilised skill) that one can apply to new fields (or when one remains at a certain level of abstraction)

fostering and assessing creativity and critical thinking

What the hell do we mean?

OECD practice-engaged research project on fostering and assessing students' creativity and critical thinking

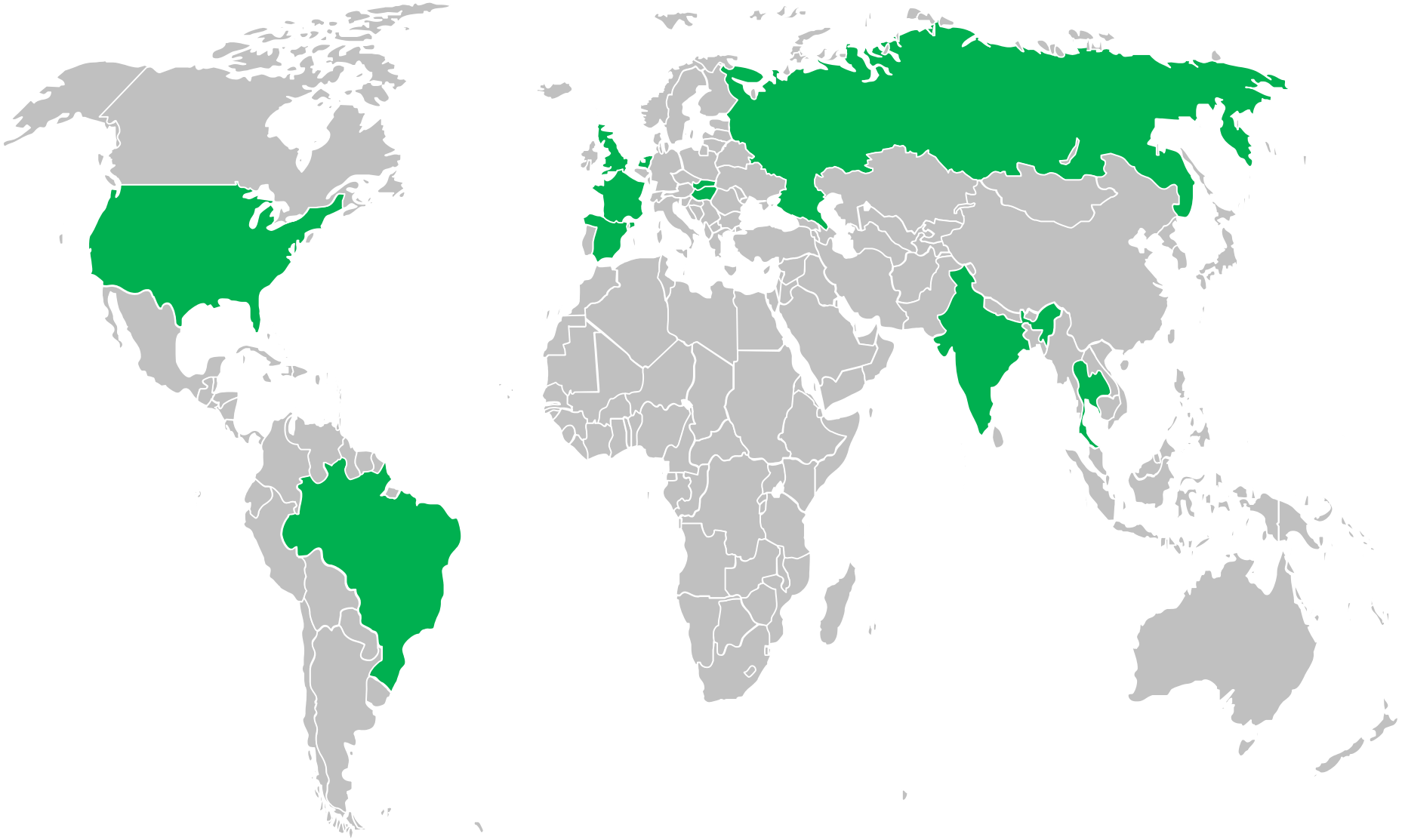
1. Articulate a common **international language** on creativity and critical thinking in education

2. Develop an exemplary **bank of pedagogical resources** to teach and assess creativity and critical thinking as part of countries' (current) curriculum

3. Develop **professional development plans**

4. Develop and pilot **evaluation instruments** to measure the effects of pedagogical practices on pedagogies, beliefs, social and behavioural skills, and standardised measures of creativity and academic achievement

Fieldwork over 2 school years in 11 countries with 800 teachers and 20 000 students in 320 primary and secondary schools



Round 1 (2015-16): Brazil, France, India, Hungary, Netherlands, Russia, Slovakia, Thailand, United States

Round 2 (2016-17): Brazil, France, India, Hungary, Russia, Spain, Thailand, Wales (UK), United States

Ongoing fieldwork with network of 26 higher education institutions from 14 countries (ongoing)

Building an international community of practice of institutions around teaching, learning and assessing creativity and critical thinking

Australia: Monash University

Canada: McGill University, Ontario Tech University

China: Central China Normal University, North East Normal University, Shanghai Normal University

Denmark: University College Copenhagen

Finland: Aalto University

Italy: Politecnico di Torino

Ireland: University of Limerick (NISE)

Japan: International Christian University, Sophia University

Korea: 2 institutions

Mexico: University of Guadalajara, National Pedagogical University

Portugal: ESSSM, IPVC, U. Aveiro, U. Lisbon (IST), U. Porto, ULHT, UTAD

Russian Federation: HSE Moscow

Spain: University Camilo José Cela

United Kingdom (England): University of Winchester

building a professional representation through a bank of pedagogical resources

Creativity

- **Creativity**: the ability to produce work that is both novel and appropriate

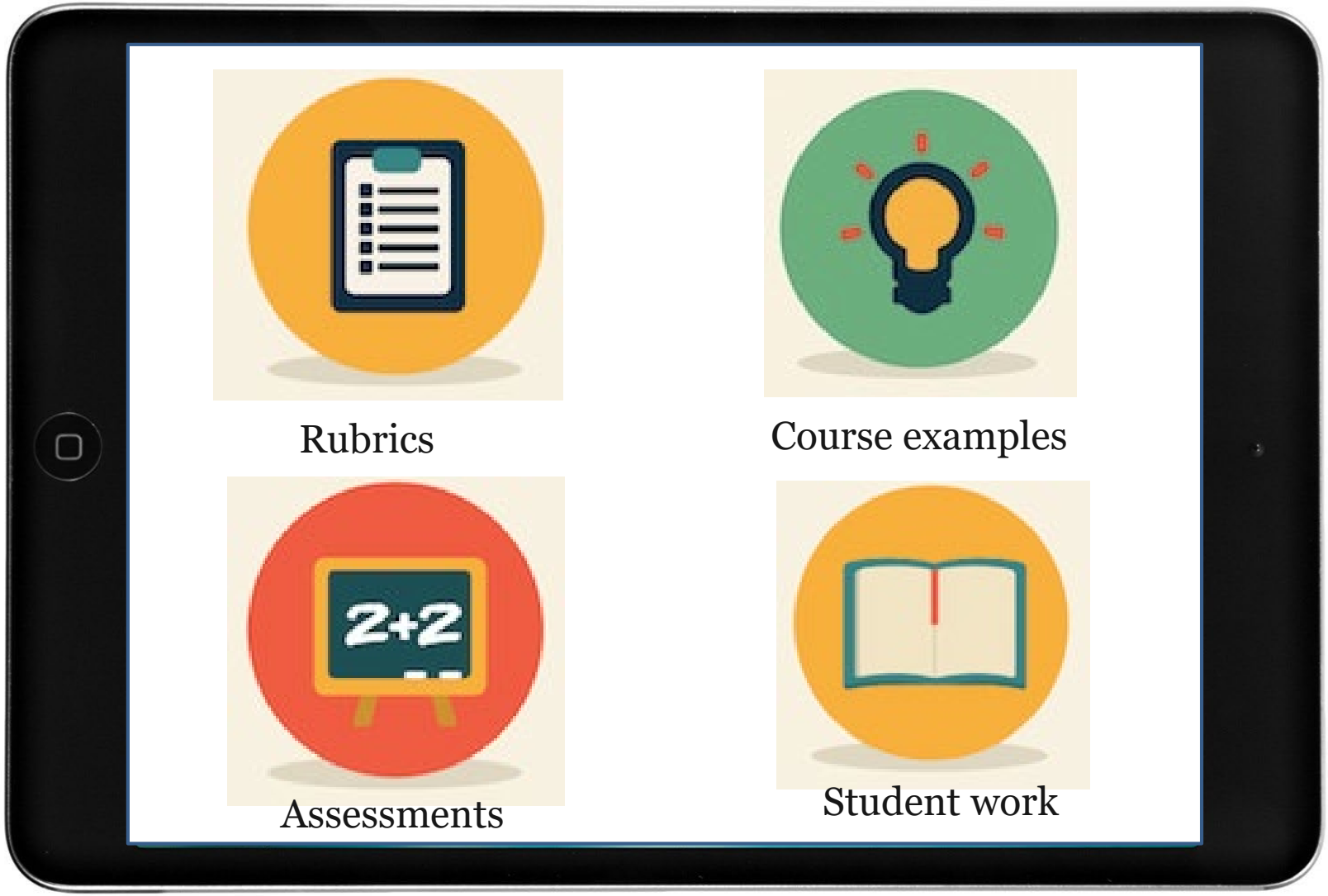
- It is about:
  - Ideation and exploration (divergent-exploratory)
  - New and interesting combinations (convergent-integrative)
  - Getting at ease with unusual and daring ideas
  - Not about « novel to the world » or « gifted » or « successful »

Critical thinking

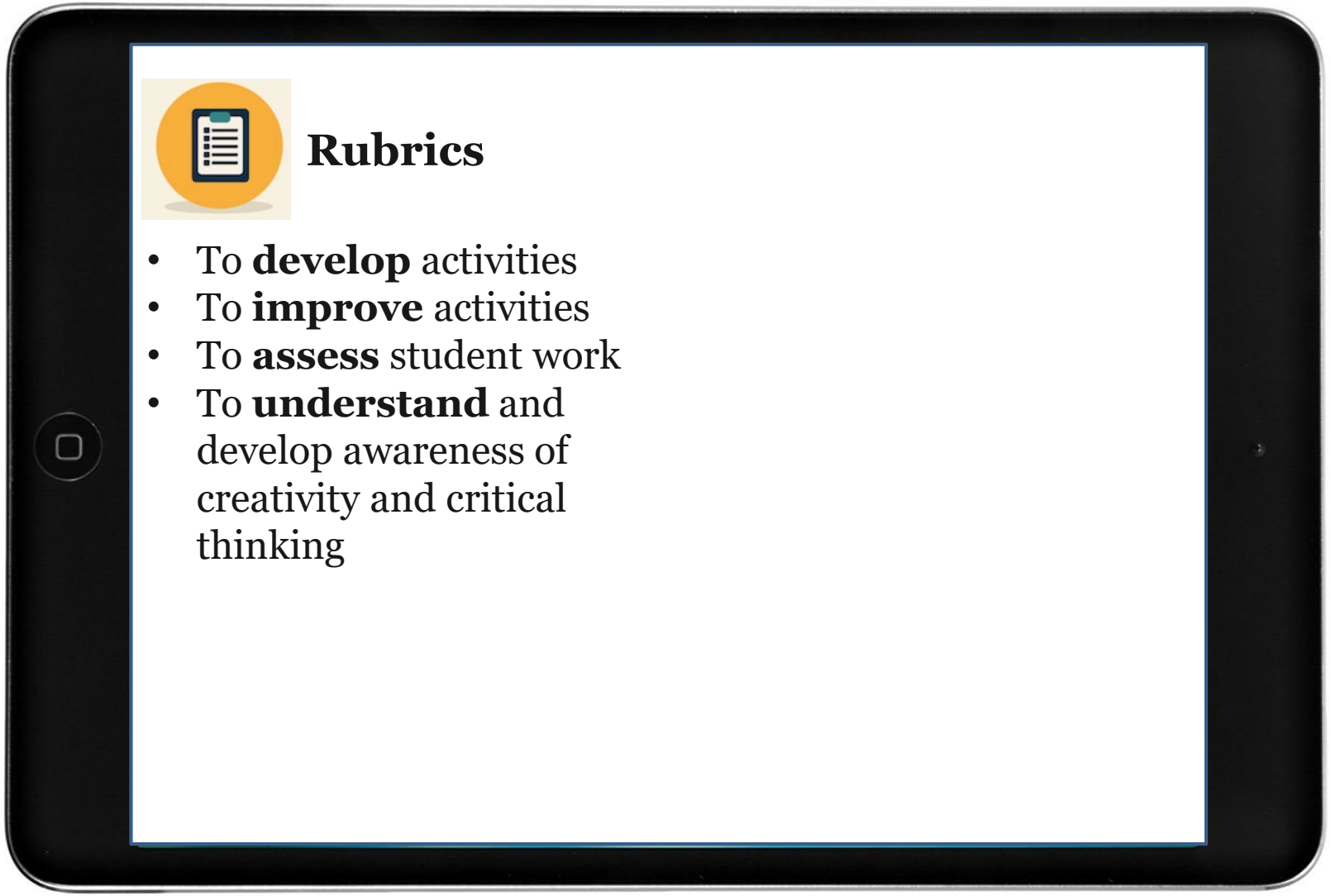
- **Critical thinking**: the ability to carefully evaluate and judge statements, ideas and theories relative to alternative explanations or solutions so as to reach a competent, independent position

- It is about:
  - Thinking rationally (slow) and in a certain disciplinary frame
  - Understanding the limitations of theories and conventions (including ours)
  - Challenging assumptions
  - Considering other theories and perspectives (possibly to then discard them)

Bank of pedagogical resources by/for teachers



Bank of pedagogical resources: rubrics



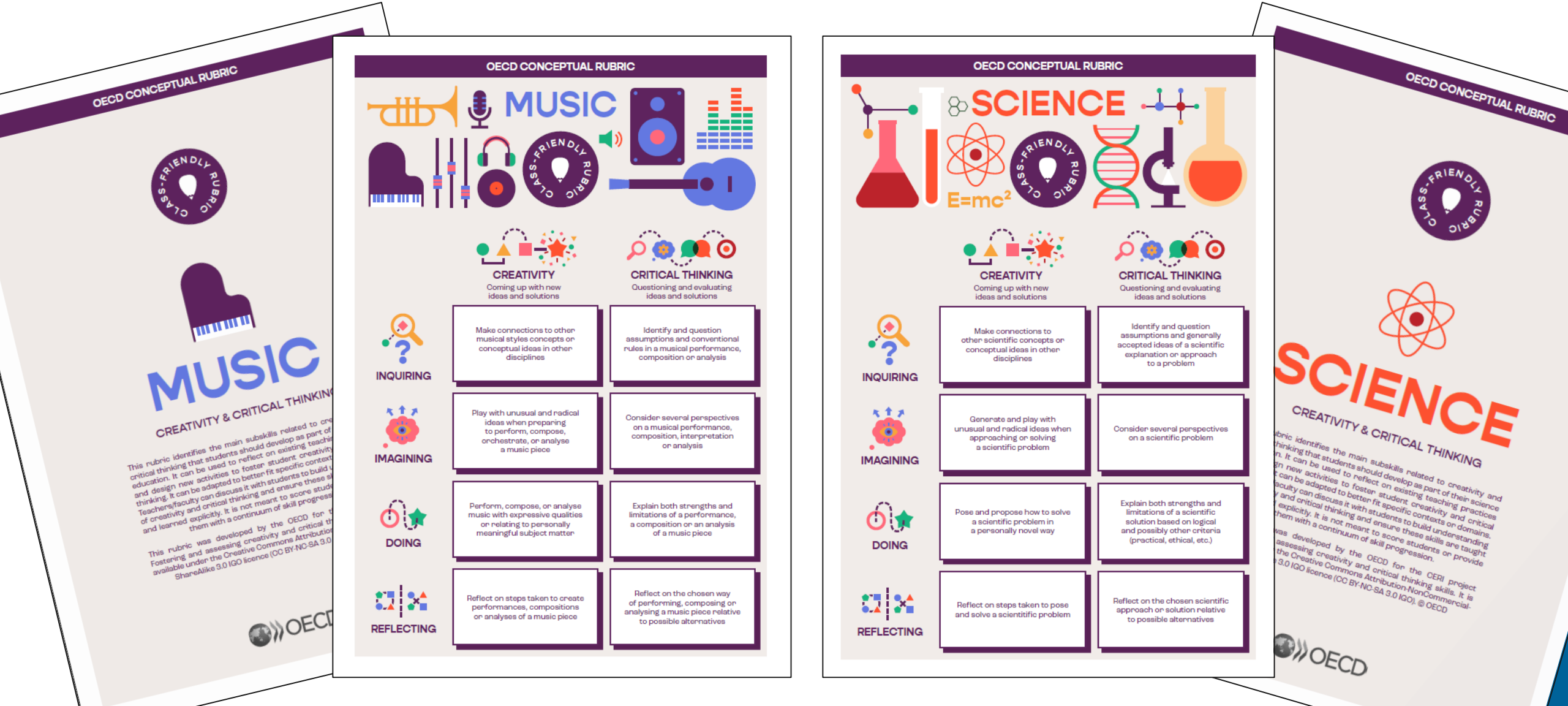
OECD (conceptual) rubric on creativity and critical thinking
(class-friendly version)

	CREATIVITY Coming up with ideas and solutions	CRITICAL THINKING Questionning and evaluating ideas and solutions
INQUIRING	Make connections to other concepts and knowledge from the same or from other disciplines	Identify and question assumptions and generally accepted ideas or practices
IMAGINING	Generate and play with unusual and radical ideas	Consider several perspectives on a problem based on different assumptions
DOING	Produce, perform or envision a meaningful output that is personally novel	Explain both strengths and limitations of a product, a solution or a theory justified on logical, ethical or aesthetic criteria
REFLECTING	Reflect on the novelty of solution and of its possible consequences	Reflect on the chosen solution/position relative to possible alternatives

OECD rubric on creativity and critical thinking
(comprehensive version)

	CREATIVITY Coming up with ideas and solutions	CRITICAL THINKING Questionning and evaluating ideas and solutions
INQUIRING	• Feel, empathise, observe, describe relevant experience and information • Make connections, integrate other disciplinary perspectives	• Understand context/frame and boundaries of the problem • Challenge assumptions, check accuracy, analyse gaps in knowledge
IMAGINING	• Explore, seek and generate ideas • Stretch and play with unusual/risky/radical ideas	• Review alternative theories and opinions and compare/find perspectives on the problem • Identify strengths and weaknesses of evidence, arguments, claims and beliefs
DOING	• Envision, Express, Produce, Prototype new product / solution / performance	• Appraise / Base / Justify opinion/products on logical, ethical or aesthetic criteria/reasoning
REFLECTING	• Assess the novelty of solution and/or possible consequences	• Acknowledge uncertainty/limits of endorsed opinion/solution and reflect on own perspective / bias

A series of domain-specific versions



teaching intentionally develop creativity and critical thinking

Animal Welfare and Society: Example of course unit

WEEK 9: Farm/zoo trip and producing animal welfare indicators

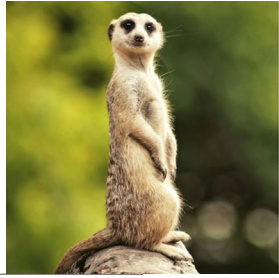
Learning objectives:
Technical skills

- To practice application of animal welfare assessment frameworks.
- To apply knowledge and develop frameworks of welfare assessment in a given species.
- To explore and evaluate real world applications of welfare assessment
- To collect data for Assignment 2 (an individual field observation and welfare assessment).

Learning objectives:
Creativity and/or Critical thinking

- Critical thinking:
  - Identify and analyse gaps in knowledge before designing a welfare assessment.
  - Understand the limitations of theories and assessment frameworks in detail.
  - Justify the inclusion and exclusion of particular welfare indicators in assessment frameworks.
  - Reflect on own perception and that of others
- Creativity:
  - Design and prototype new assessment frameworks.
  - Generate and play with ideas regarding what indicators to include/exclude and make connections between inclusion/exclusion and overall validity of the assessment framework.

Animal Welfare and Society: Example



1. Students prepare for the trip by independently researching the natural history of meerkats and reminding themselves of the work of previous weeks on animal welfare assessment frameworks and the bases on which indicators can be created, including stress, pain, suffering, and positive welfare states.

2. Each group works together to develop a welfare assessment of meerkats, starting from one of three assessment frameworks studied previously (the Five Freedoms, Five Domains, QBA) as the skeleton. They have to come up with a set of indicators that are novel but appropriate in addressing potential limitations of the frameworks they know. They generate and decide on ideas for alternative welfare indicators and scoring methods.

3. All three groups meet to review and explain their choice of indicators and compare/contrast welfare outcomes across different assessment methods.

4. Students provide peer feedback on where the novelty lies in each group's indicators and the implications for assessment outcomes. Each group's application and any inconsistencies are discussed to determine likely causes of variation and to acknowledge limitations.

Using the rubric to give students opportunities to develop creativity or critical thinking sub-skills

Example: Mapping of a lesson plan to the OECD rubric

	CREATIVITY Coming up with new ideas and solutions	Steps	CRITICAL THINKING Questioning and evaluating ideas and solutions	Steps
INQUIRING	Make connections to other scientific concepts or conceptual ideas in other disciplines	2,5	Identify and question assumptions and generally accepted ideas of a scientific explanation or approach to a problem	1,7
IMAGINING	Generate and play with unusual and radical ideas when approaching or solving a scientific problem	1,4,7	Consider several perspectives on a scientific problem	3-6
DOING	Pose and propose how to solve a scientific problem in a personally novel way	1,7	Explain both strengths and limitations of a scientific solution based on logical and possibly other criteria (practical, ethical, etc.)	6,7
REFLECTING	Reflect on steps taken to pose and solve a scientific problem	7	Reflect on the chosen scientific approach or solution relative to possible alternatives	2,3,4,7

assessing creativity and critical thinking

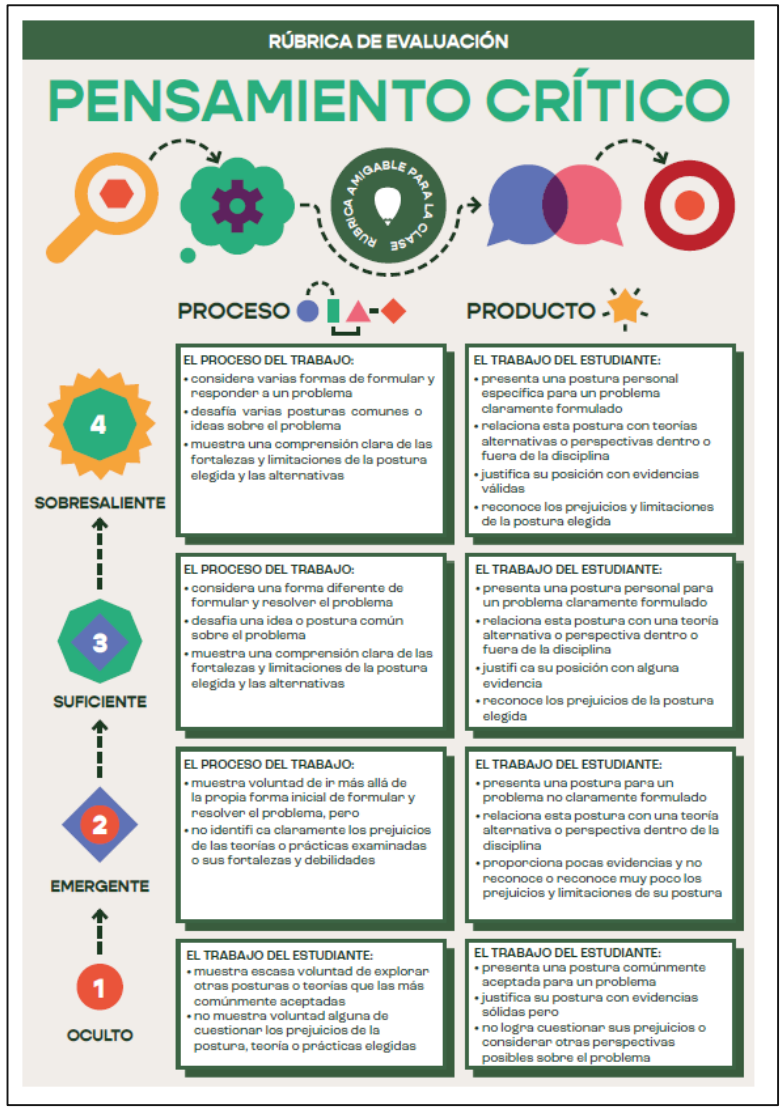
Example of assignment/assessment task: create an original exhibition

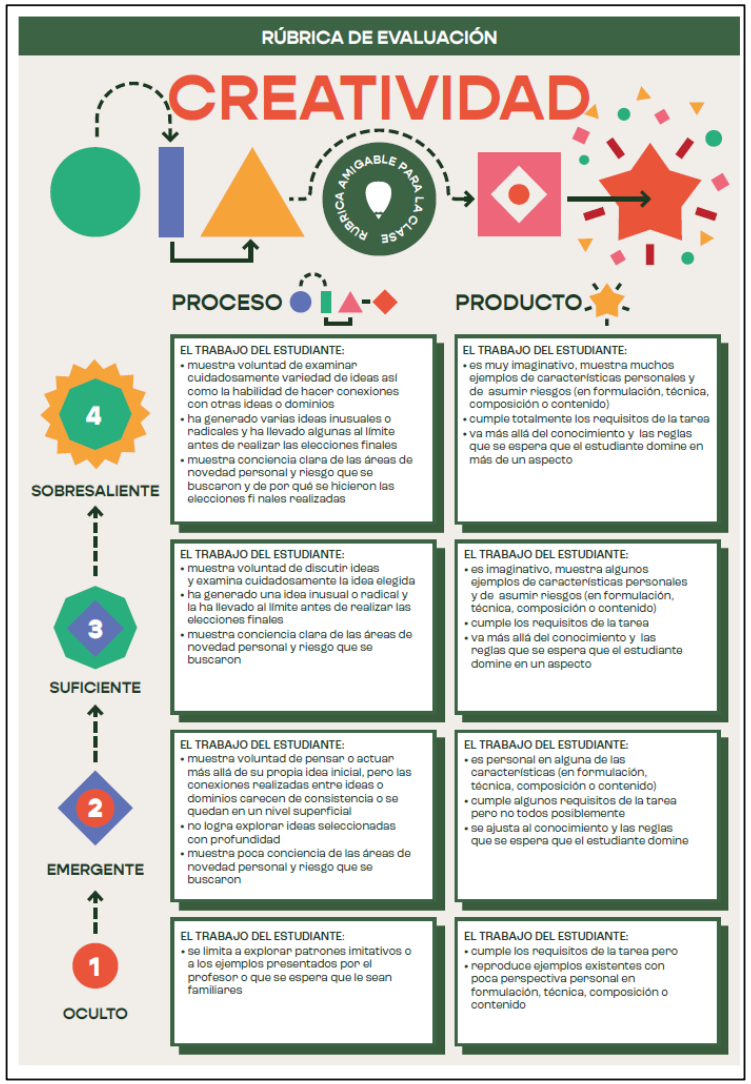
- Students are given a theme, a process, and concept, theory related to the discipline (or they have to choose one themselves: the philosophy of science or logical empiricism in the philosophy of science). Their aim is to create an original exhibition that helps the audience see new connections related to the subject.
- The exhibition can be created either in a physical space or in a digital space
- Choose a way of organising the exhibition (e.g. time periods, discoveries, concepts, thinkers, applicationsn etc.)
- Create an overall concept note for the exhibition. Choose some artefacts/photos/art pieces and create explanations of them and how they fit into the theme.
- Present and justify your choices in relation to possible alternatives

OECD assessment rubric on creativity: *product and process dimensions*

	Level 4 Outstanding	Level 3 Excellent	Level 2 Emergent	Level 1 Dormant
Product	The student work • is highly imaginative, showing many instances of personal features and risk taking (formulation, technique, composition or content), • fully meets the requirements of the task, • goes beyond the knowledge and rules expected to be mastered by the student in more than one aspect.	The student work • is imaginative, showing some examples of personal features (formulation, technique, composition or content), • meets the requirements of the task • goes beyond the knowledge and rules expected to be mastered by the student in one aspect.	The student work • is personal in some of its features (formulation, technique, composition or content), • meets some but possibly not all the requirements of the task • is in line with the knowledge and rules expected to be mastered by the student	The student work: • meets the requirement of the task but • reproduces existing examples, with little personal perspective on formulation, content, technique or composition.
Process	The work process: • shows a willingness to examine carefully a variety of ideas as well the ability to make meaningful connections with other ideas or domains. • generated several unusual or radical ideas and pushed some to their limits before making the final choices. • shows a clear awareness of the areas of personal novelty and risk that were pursued, and of why the final choices were made.	The work process: • shows a willingness to brainstorm ideas and examines carefully the chosen idea. • generated one unusual or radical idea and pushed it to its limit before making the final choices. • shows a clear awareness of the areas of personal novelty or risk that were pursued.	The work process: • shows a willingness to think or act beyond one's first idea, but connections made between ideas or domains lack consistency or remain superficial. • fails to explore selected ideas with depth. • shows little awareness of the areas of personal novelty or risk that were pursued.	The work process: • is limited to the exploration of imitative patterns or to the examples presented by the teacher or expected to be familiar.

Spanish versions on the assessment rubrics available on our website



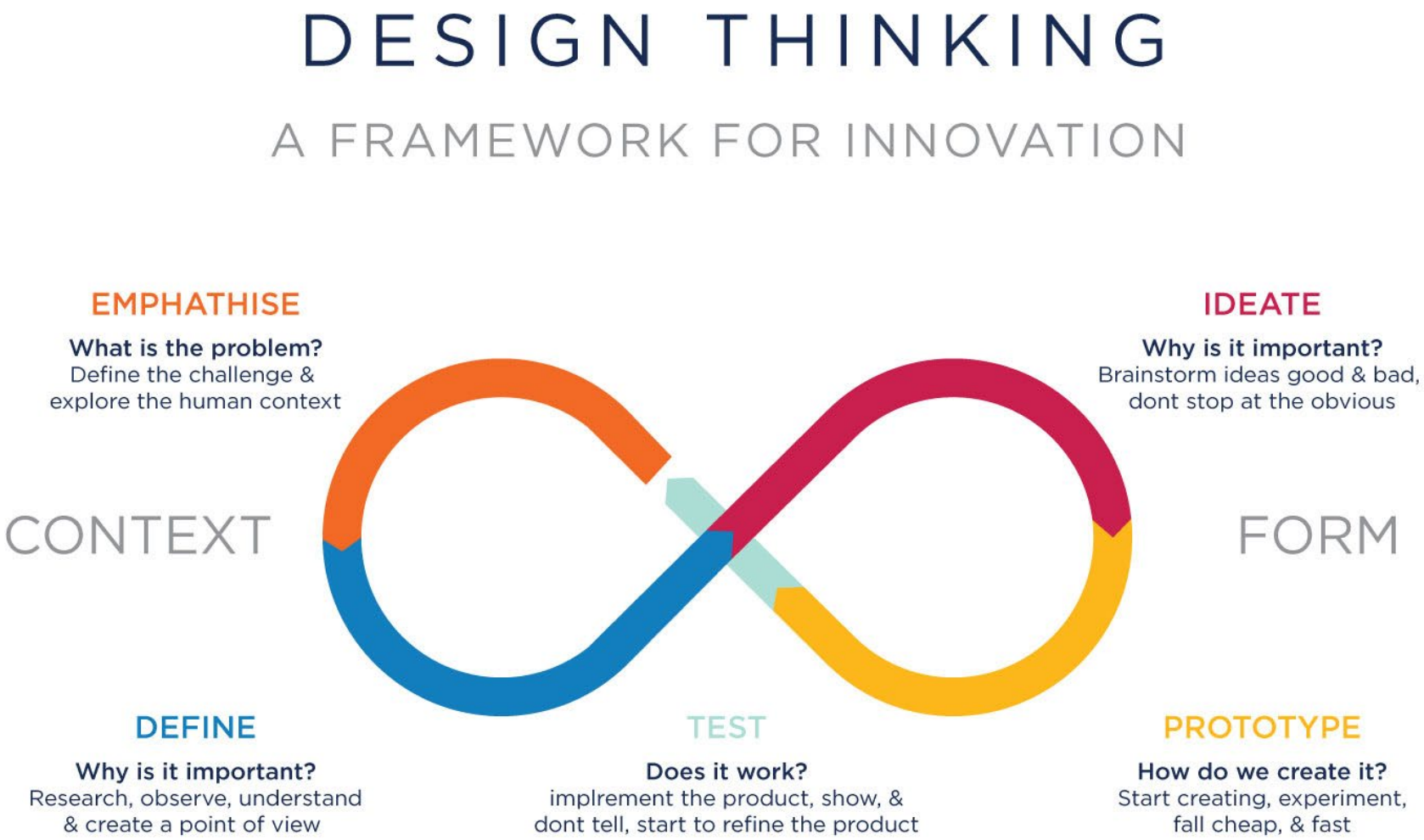


Combined version of assessment rubric for formative/summative purposes

	4 Outstanding	3 Flourishing	2 Emergent	1 Dormant
Content knowledge				
Procedural knowledge				
Critical Thinking				
Creativity				
Communication				

creativity and critical thinking courses?

Design thinking as an « innovation art »



An example: the i.school in Tokyo

- Created in 2009 by Professor Hideyuki Horii, faculty of engineering

- Course-workshops of 20-30 people:
  - 5-day workshops during academic breaks
  - 12 sessions of 3 hours a week during academic year

- 3 objectives:
  1. Teach students to developg an innovation workshop
  2. Teach students to develop objects and ideas that have novel impacts
  3. Develop an innovation science (including its learning) and document the processes and effects of creativity workshops

THE UNIVERSITY OF TOKYO school

How teaching and learning is organised

- Cooperative work with a heterogeneous group of 5-6 people (sex, discipline), including non-students

- Projects about identifying and solving a social problem:
  - Communication between child and working parent
  - Interaction between humans and robots

- Exploration of 1 to more of the 3 steps of the innovation process:
  - Understanding (observation, empathy, analysis)
  - Creation (product, service, idea)
  - Production (business plan)

Example of output

- How to improve parent-child communication when there is little time? The play-kitchen

Figure 1. A child looking up at his mother, spending as much time as she can with the child. (Illustrations by Arata Hayato)

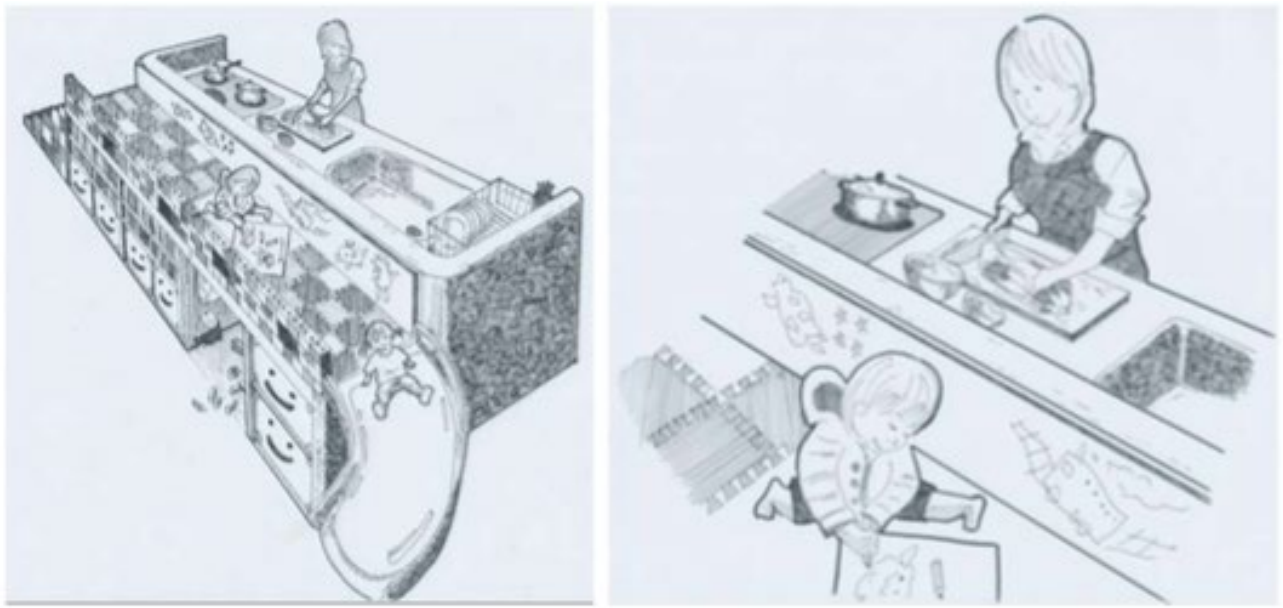


Figure 2. Mother and child dialogue in the play-kitchen. (Illustrations by Arata Hayato)

Increasing number of « critical thinking » courses in universities

- National University of Singapore (NUS)
  - Several courses on critical thinking in disciplines

- New « General Education » curriculum for all undergraduates students from Y2021-22 includes 6 pillars (the first 4 with critical thinking elements and some aspects of creativity):

1. Cultures and Connections
2. Critique and Expression
3. Data Literacy
4. Digital Literacy
5. Singapore Studies
6. Communities and Engagement

concluding remarks

8 Design criteria for good lessons

1. Create students' **need/interest to learn**
2. Be **challenging**
3. **Develop clear technical knowledge** in one domain or more
4. Include the **development of a "product"**

8 Design criteria for good lessons

5. Have **students co-design part of** the product/solution or problem

6. Deal with **problems that can be looked at from different perspectives**

7. Leave **room for the unexpected**

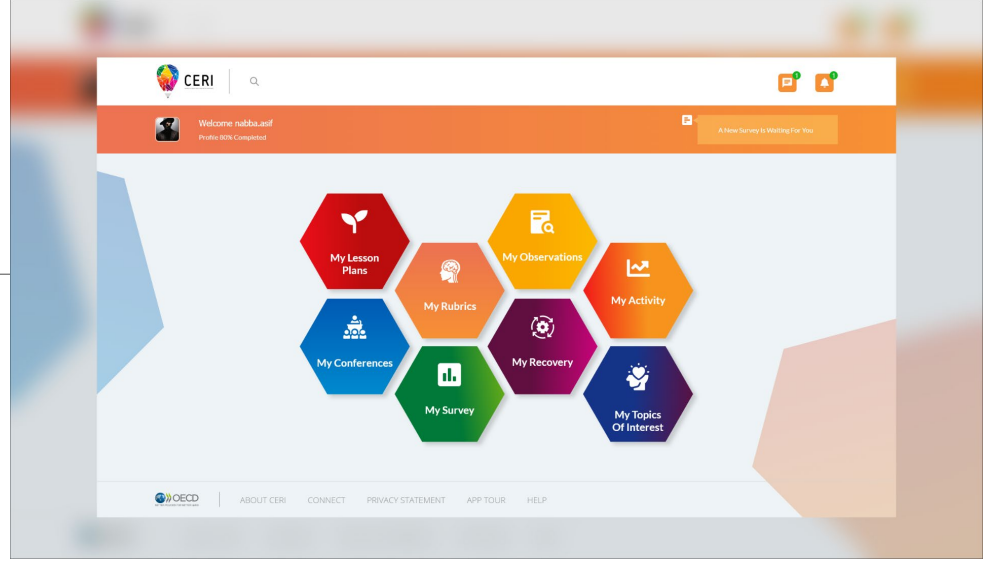
8. Include **space and time for students to reflect** and give/receive feedback

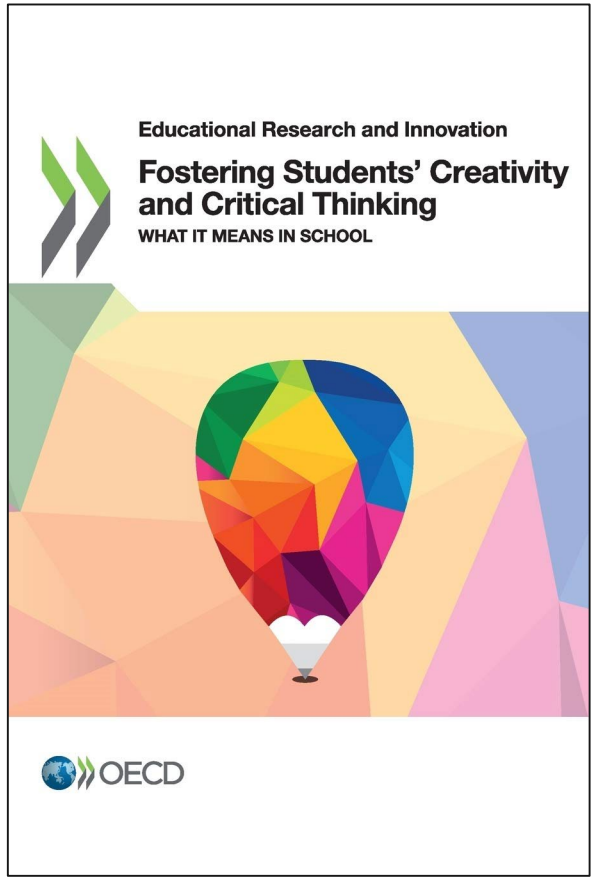
10 pointers to support change and improvement towards creative higher education

1. Be explicit in your education strategy
2. Define what you are talking about
3. Create alignment and incentives at all levels of education (admission)
4. Integrate it in the regular disciplinary teaching
5. Make it part of formal assessments and evaluations
6. Make sure faculty leadership support it and instructors feel authorised
7. Provide faculty members with professional learning opportunities
8. Provide faculty members with scaffolding tools and exemplars
9. Create and support international and domestic communities of practice
10. Monitor and evaluate the effects and impacts

Next steps

- Project is ongoing in higher education (with 26 institutions from 14 countries involved)
- Series of webinars on the topic with education stakeholders (and more)
- Piloting of a mobile app with all our rubrics, 100 examples of lesson plans, and other related materials (Fall 2021)
- Work on a standardised assessment of creativity and critical thinking for undergraduate students
- Opportunities for collaboration?





Stephan.Vincent-Lancrin@oecd.org

THANK YOU

https://oe.cd/educationceriinnovationstrategy