



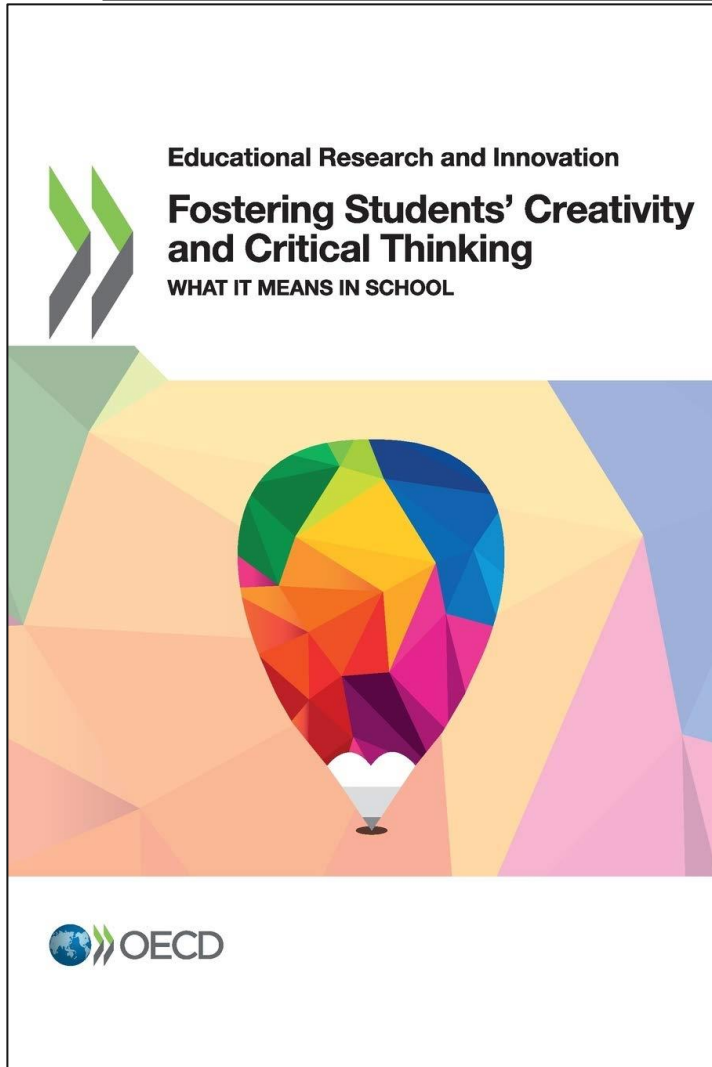
Improving teaching and learning by fostering students' creativity and critical thinking

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Outline



- How do we achieve better learning outcomes through the fostering of creativity and critical thinking?
- What does it take and look like to change teaching and learning approaches?
- What tools are available for that?

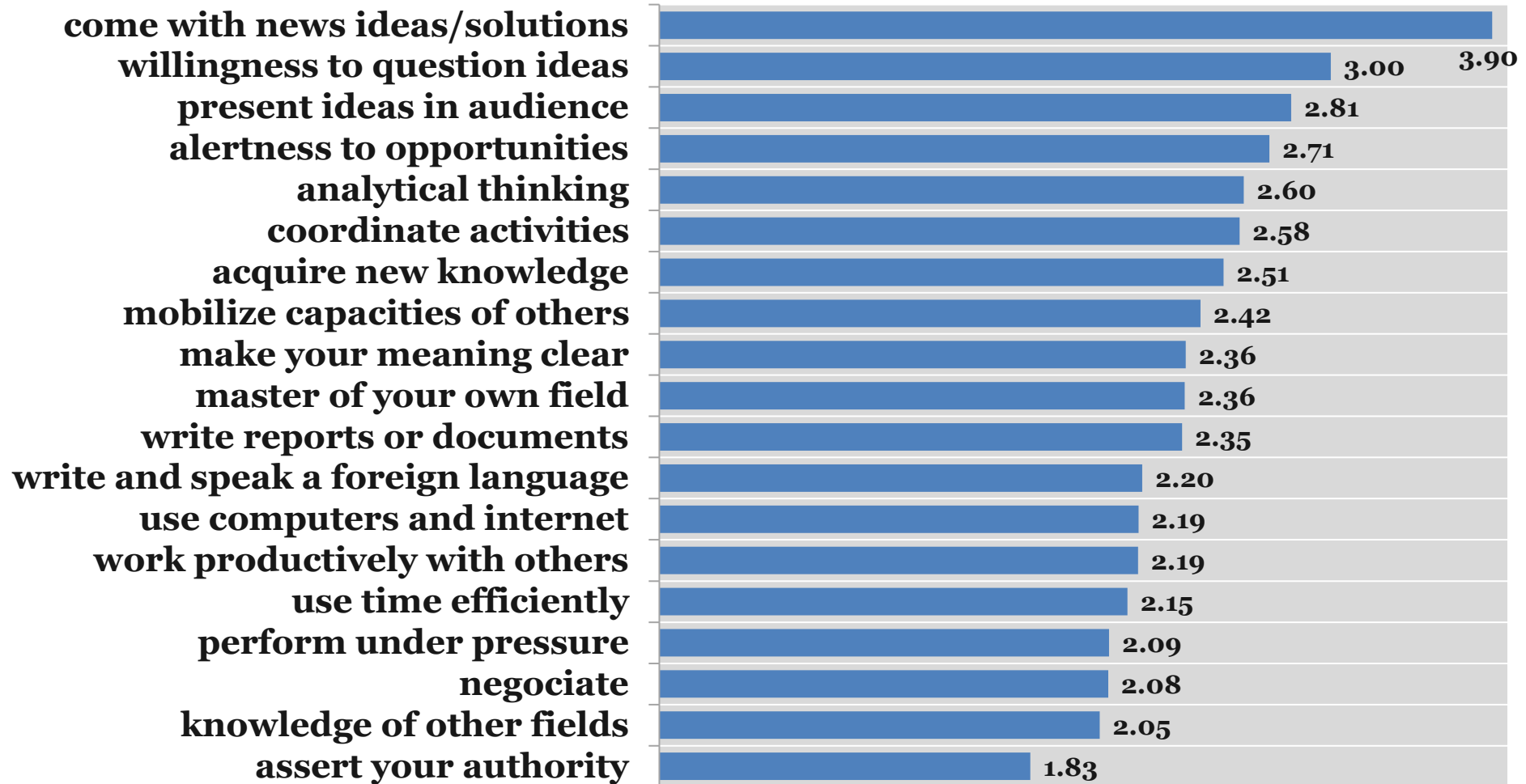


why creativity and critical thinking matter



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

Likelihood (odds ratios) of reporting the following skills: people
in the most innovative jobs vs. least innovative jobs





Survey of CEOs and HRM Directors: Creativity and Innovation in top 5 Skills Demand: 2025, 2022, 2018

Top 10 skills of 2025



Source: Future of Jobs Report 2020, World Economic Forum.

Today, 2018

Analytical thinking and innovation
Complex problem-solving
Critical thinking and analysis
Active learning and learning strategies
Creativity, originality and initiative
Attention to detail, trustworthiness
Emotional intelligence
Reasoning, problem-solving and ideation
Leadership and social influence
Coordination and time management

Trending, 2022

Analytical thinking and innovation
Active learning and learning strategies
Creativity, originality and initiative
Technology design and programming
Critical thinking and analysis
Complex problem-solving
Leadership and social influence
Emotional intelligence
Reasoning, problem-solving and ideation
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 contributes to active citizenship and tolerance

Creativity

- Flow
- Positive emotions
- Positive impact on health

Critical thinking

- Media literacy
- Positive citizenship
- Openness to others' opinions





Creativity

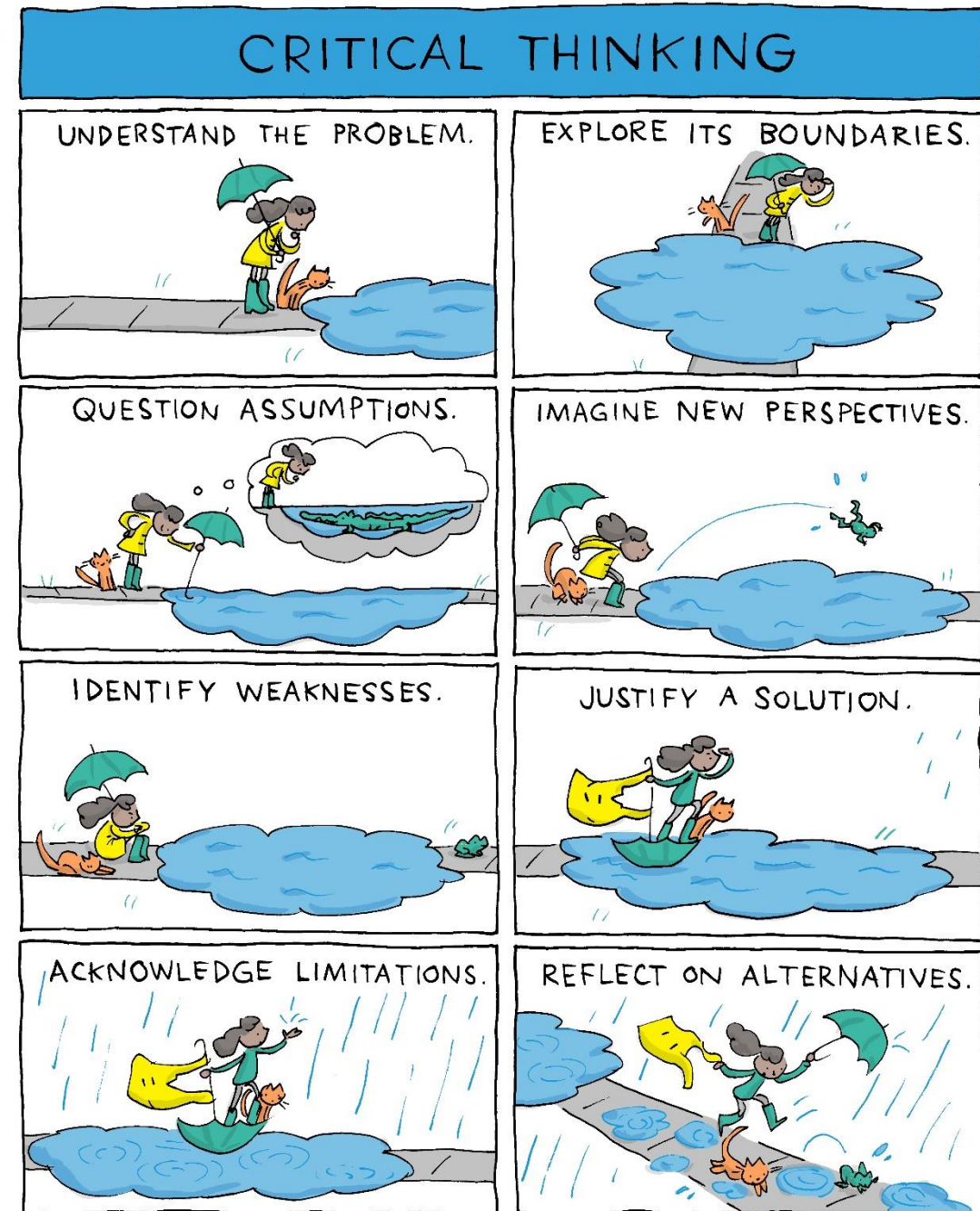
- **Creativity:** the ability to produce work that is both novel and appropriate
- It is about:
 - Ideation and exploration (divergent-exploratory)
 - New and interesting combinations (convergent-integrative)
 - Getting at ease with unusual and daring ideas
 - Not about « novel to the world » or « gifted » 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)

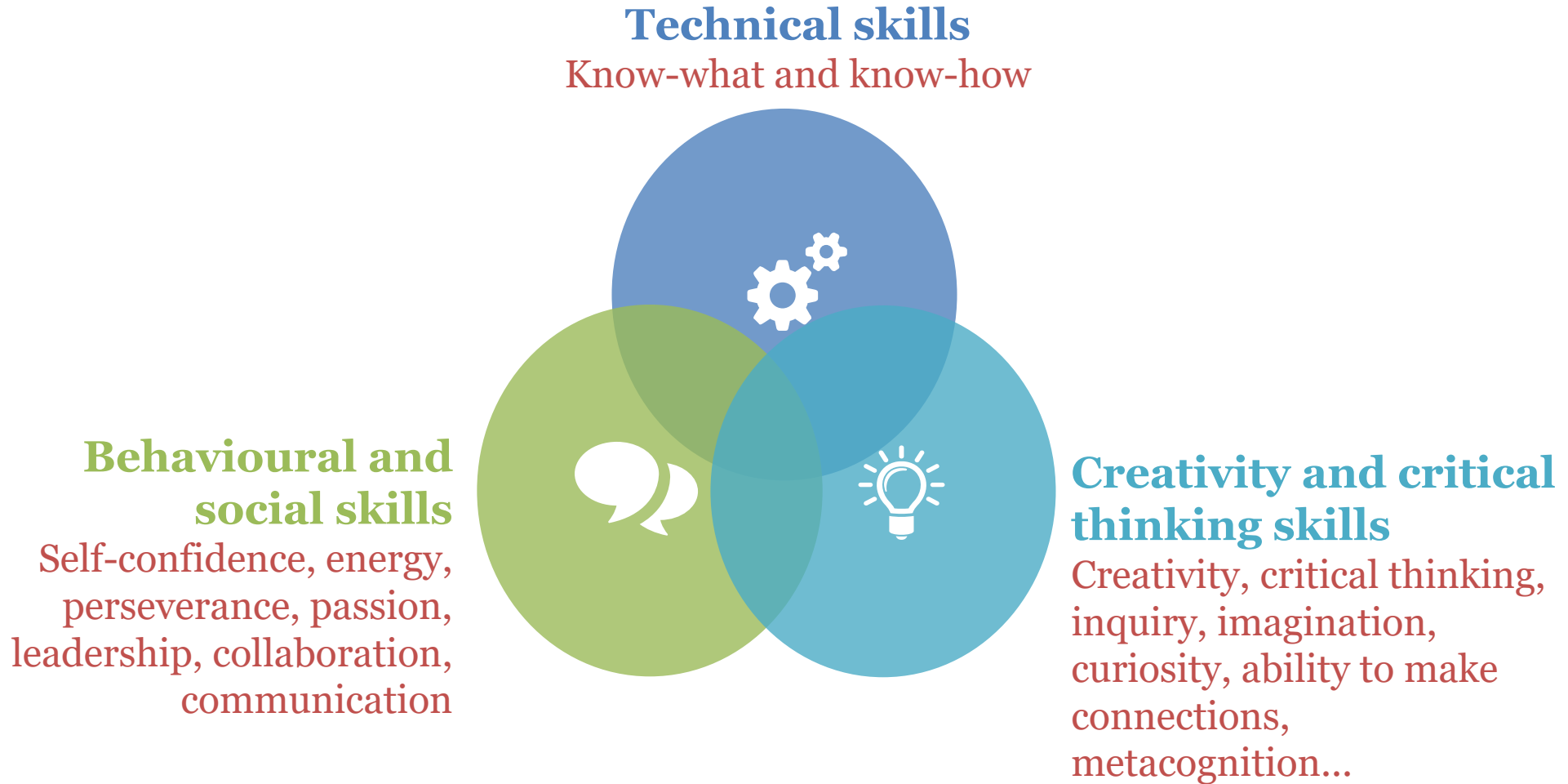




fostering and assessing creativity and critical thinking in education



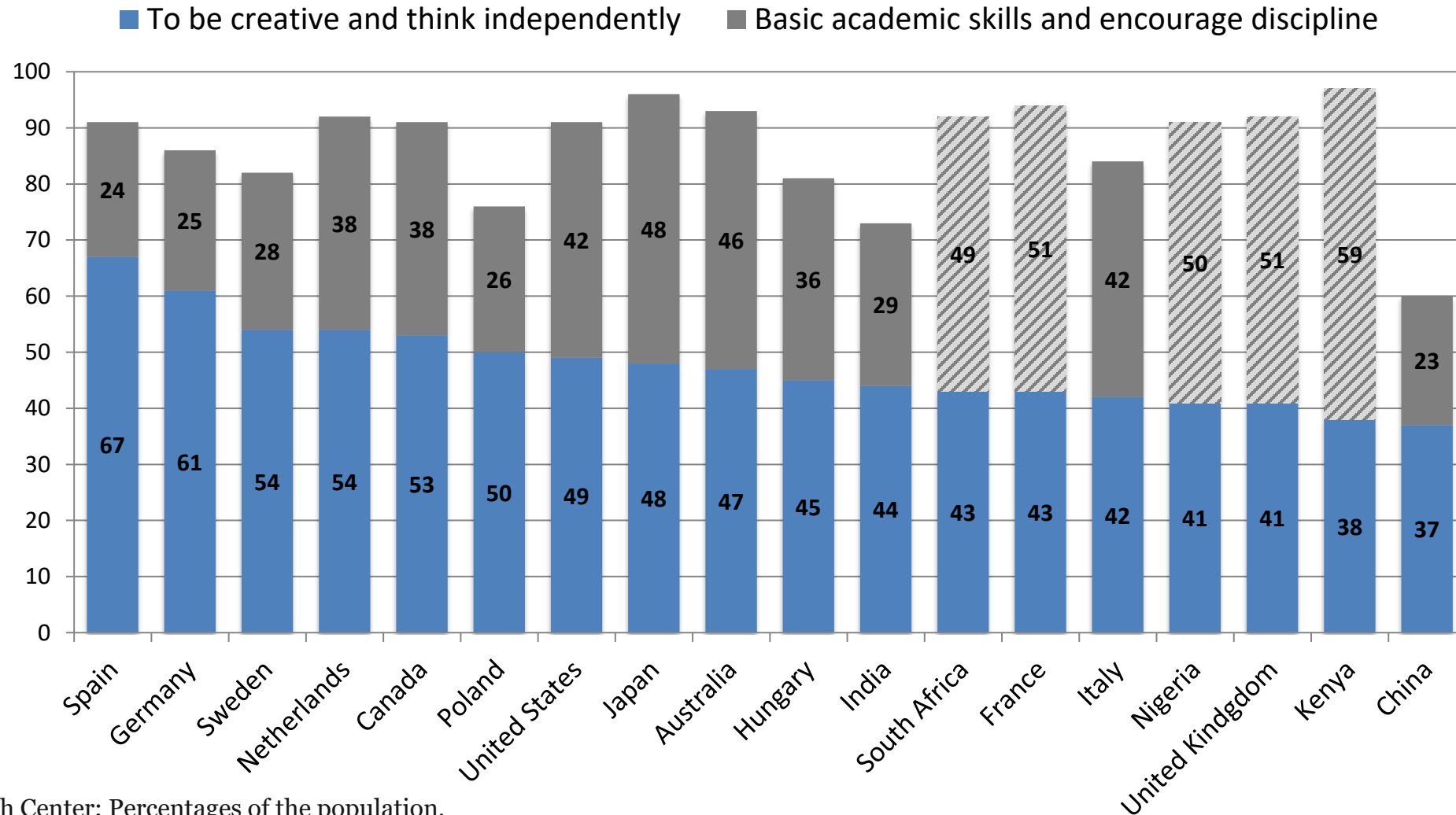
What skills should education systems foster?





Creative and independent thinking vs. basic academic skills

It is more important that schools in our country teach...



Source: Pew Research Center; Percentages of the population.



What the hell do we mean?





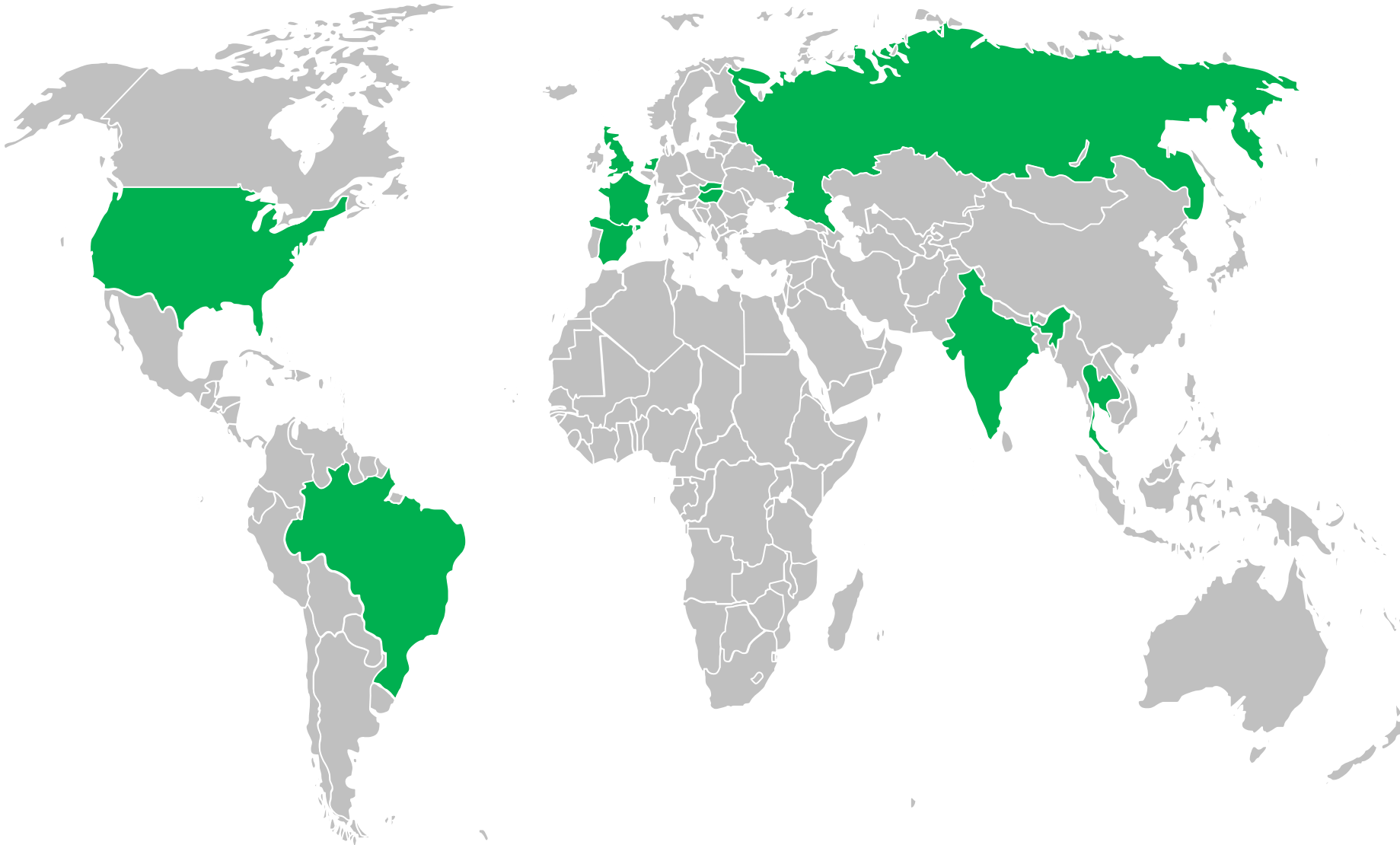
OECD practice-engaged research project on fostering and assessing students' creativity and critical thinking

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



Completed fieldwork with network of 25 higher education institutions from 13 countries (5 semesters)

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

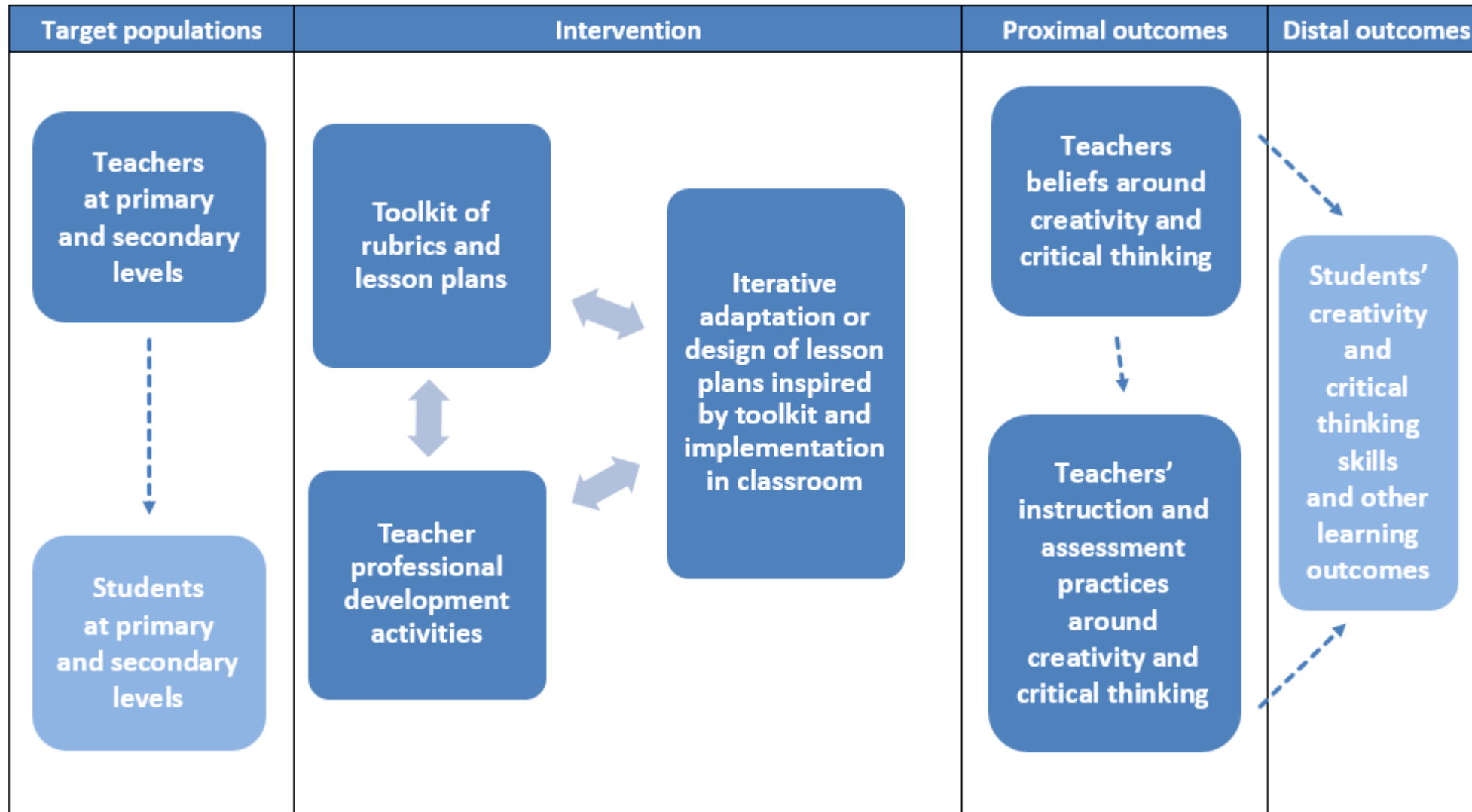
[Russian Federation: HSE Moscow]

Spain: University Camilo José Cela

United Kingdom (England): University of Winchester



Theory of action for a (possible) efficacy study

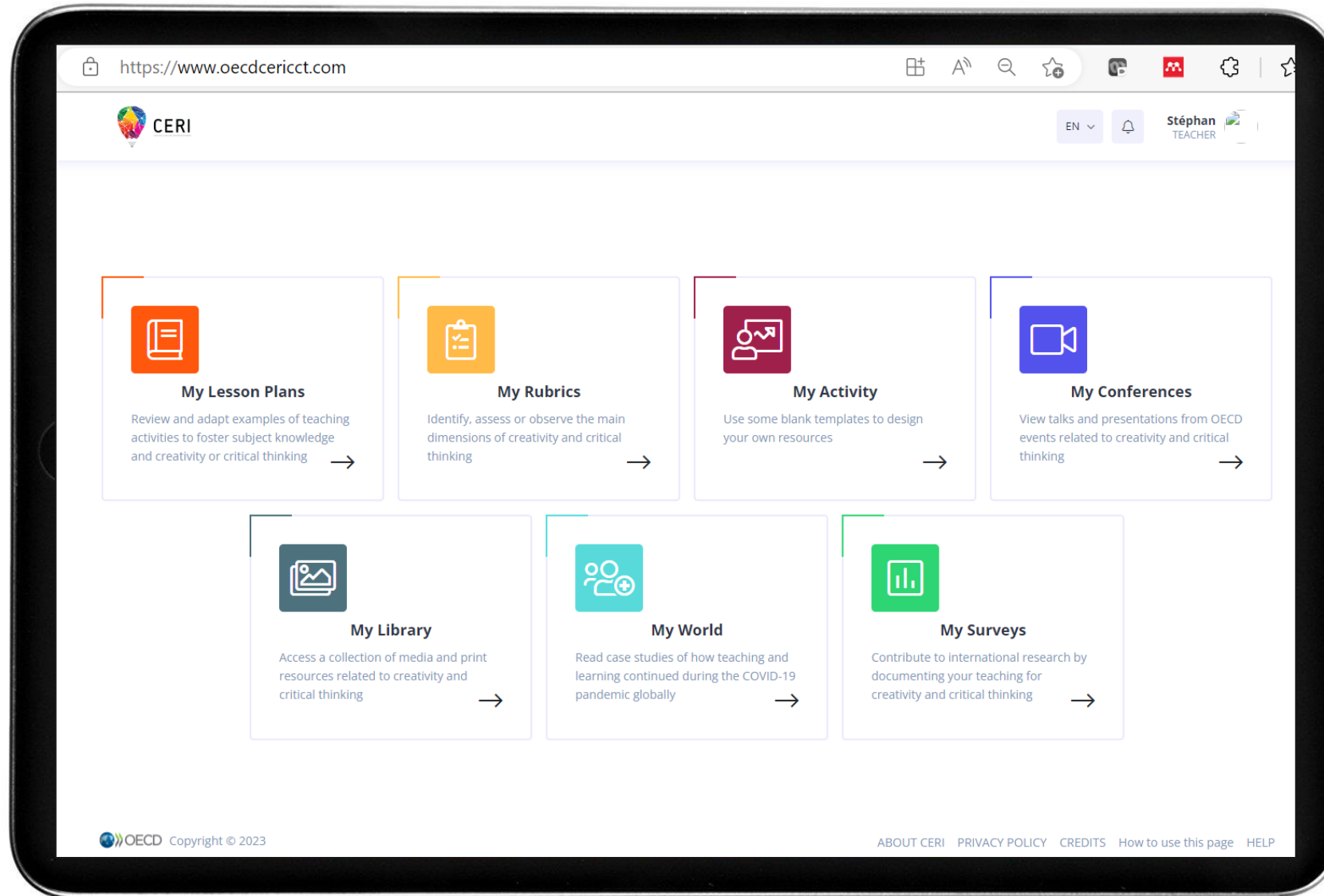




building a professional representation
through a bank of pedagogical resources



Bank of pedagogical resources by/for teachers





Bank of pedagogical resources: rubrics

- To **develop** activities
- To **improve** activities
- To **assess** student work
- To **understand** and develop awareness of creativity and critical thinking



My Rubrics

Identify, assess or observe the main dimensions of creativity and critical thinking



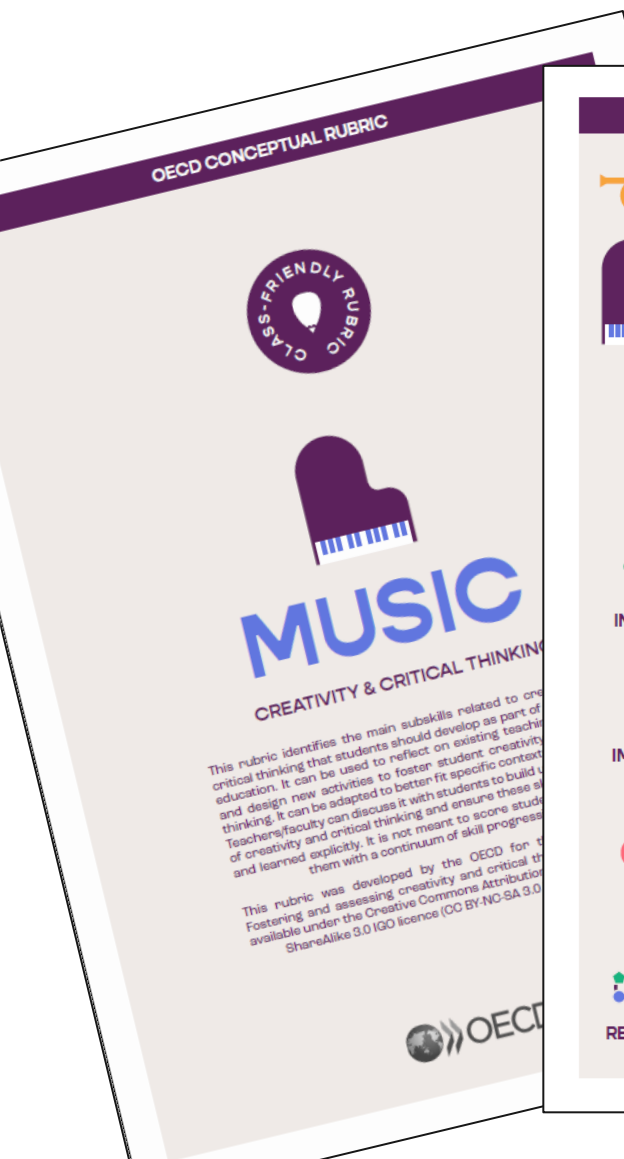


OECD rubric on creativity and critical thinking (class-friendly version)

	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

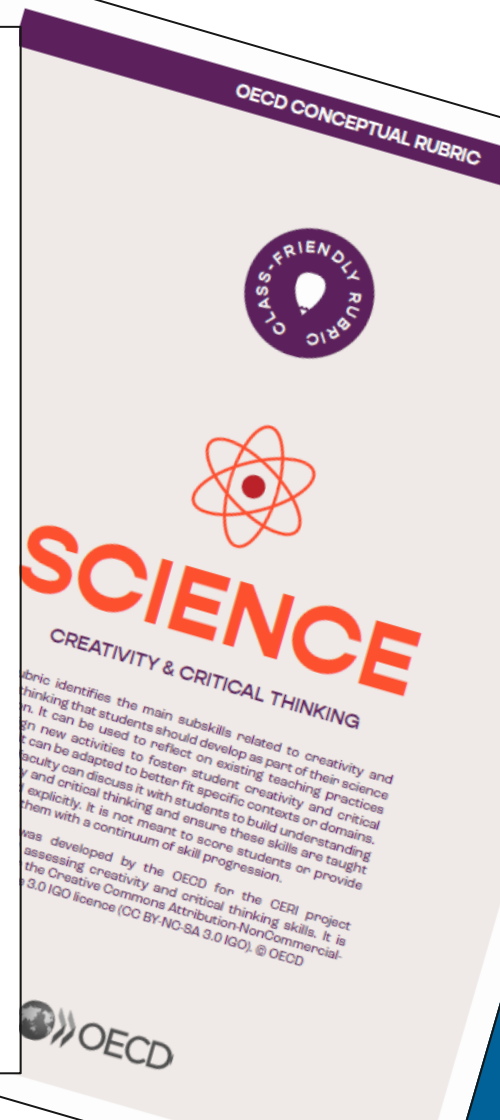


A series of domain-specific versions



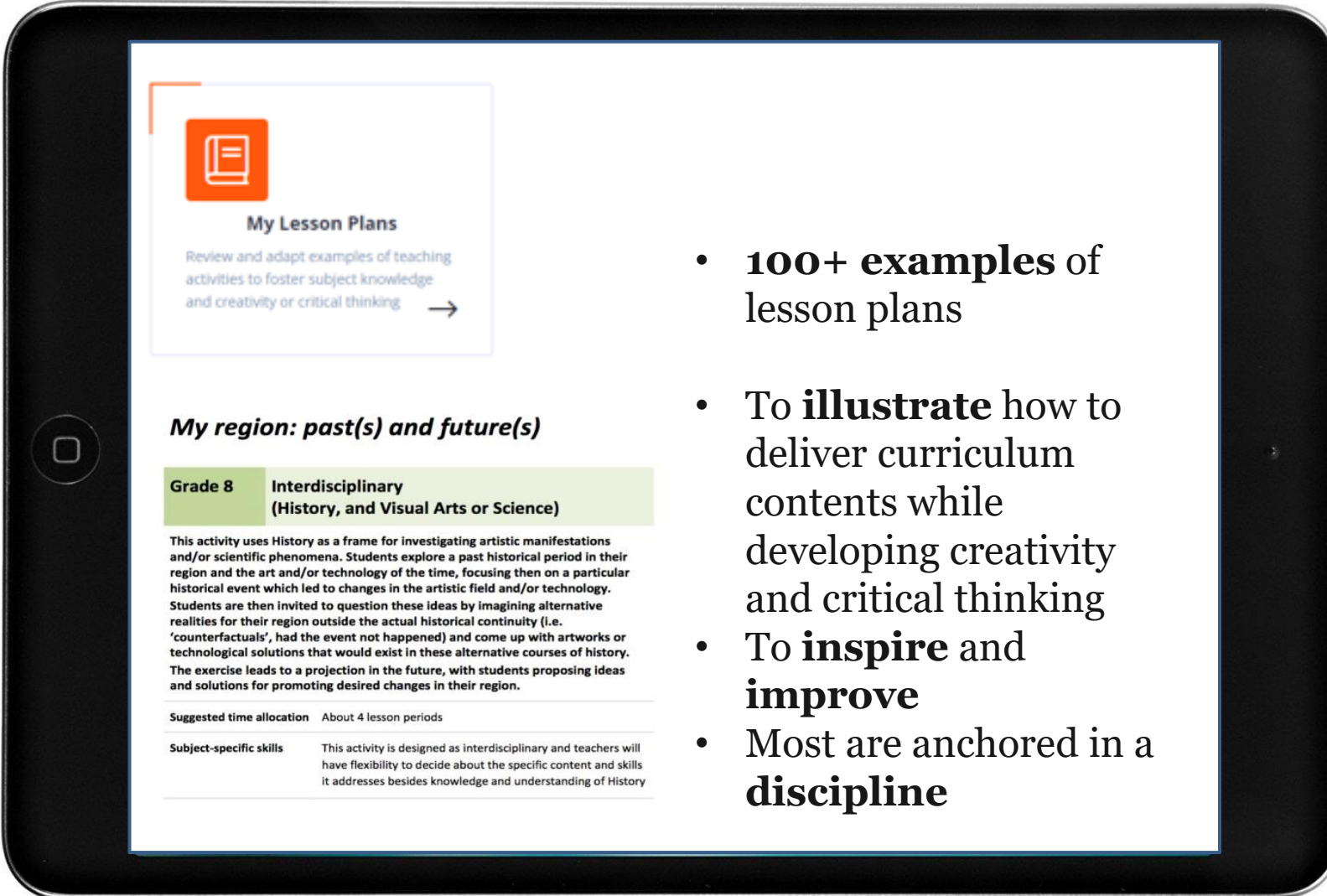
OECD CONCEPTUAL RUBRIC		
MUSIC		
CREATIVITY Coming up with new ideas and solutions		
CRITICAL THINKING Questioning and evaluating ideas and solutions		
	Make connections to other musical styles, concepts or conceptual ideas in other disciplines	Identify and question assumptions and conventional rules in a musical performance, composition or analysis
	Play with unusual and radical ideas when preparing to perform, compose, orchestrate, or analyse a music piece	Consider several perspectives on a musical performance, composition, interpretation or analysis
	Perform, compose, or analyse music with expressive qualities or relating to personally meaningful subject matter	Explain both strengths and limitations of a performance, a composition or an analysis of a music piece
	Reflect on steps taken to create performances, compositions or analyses of a music piece	Reflect on the chosen way of performing, composing or analysing a music piece relative to possible alternatives

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





Bank of pedagogical resources: examples to re-design lesson plans



The tablet screen shows a digital interface for a 'Bank of pedagogical resources'. At the top, there is a section titled 'My Lesson Plans' with an orange icon of a book and a right-pointing arrow. Below this, the text reads: 'Review and adapt examples of teaching activities to foster subject knowledge and creativity or critical thinking'. Further down, the title 'My region: past(s) and future(s)' is displayed. Below the title, there is a green header bar for 'Grade 8 Interdisciplinary (History, and Visual Arts or Science)'. The main content area describes an activity using History as a frame for investigating artistic manifestations and/or scientific phenomena. It mentions that students explore a past historical period, focus on a particular historical event, and are invited to question these ideas by imagining alternative realities. The exercise leads to a projection in the future, with students proposing ideas and solutions for promoting desired changes in their region. At the bottom, there are two sections: 'Suggested time allocation' (About 4 lesson periods) and 'Subject-specific skills' (This activity is designed as interdisciplinary and teachers will have flexibility to decide about the specific content and skills it addresses besides knowledge and understanding of History).

My Lesson Plans
Review and adapt examples of teaching activities to foster subject knowledge and creativity or critical thinking →

My region: past(s) and future(s)

Grade 8 Interdisciplinary (History, and Visual Arts or Science)

This activity uses History as a frame for investigating artistic manifestations and/or scientific phenomena. Students explore a past historical period in their region and the art and/or technology of the time, focusing then on a particular historical event which led to changes in the artistic field and/or technology. Students are then invited to question these ideas by imagining alternative realities for their region outside the actual historical continuity (i.e. 'counterfactuals', had the event not happened) and come up with artworks or technological solutions that would exist in these alternative courses of history. The exercise leads to a projection in the future, with students proposing ideas and solutions for promoting desired changes in their region.

Suggested time allocation About 4 lesson periods

Subject-specific skills This activity is designed as interdisciplinary and teachers will have flexibility to decide about the specific content and skills it addresses besides knowledge and understanding of History

- **100+ examples** of lesson plans
- To **illustrate** how to deliver curriculum contents while developing creativity and critical thinking
- To **inspire** and **improve**
- Most are anchored in a **discipline**



100+ examples of lesson plans

Discover the sounds of your school

Primary: (ages 7 – 11)

Music

Students are asked to create a composition with sounds that they find and record around their school. Students develop sensitivity to and understanding of music through observation, composition, and performance. They pay careful attention to various organic sound resources and use music to represent the character of particular spaces. Students practice using their perception, find the relevance to musicality of what they discover in their environment, and apply this to their creation. Students also explore and reflect on their composition in multiple ways to create and develop musical ideas.

Note: There is also an extended version of this activity available for use in secondary contexts

Time allocation	About 3 lesson periods
Subject content	Observe environment and use and/or reproduce found sounds for composition Expand range of musicality Analyse composition and musical factors
Creativity and critical thinking	This unit has a creativity focus: <ul style="list-style-type: none">• Make connections between environment and musical concepts• Play with unusual ideas and sounds in composing musical pieces• Compose, perform, and reflect on music with expressive qualities
Other skills	Collaboration, Communication
Key words	Sound from found objects; rhythm; tempo; composition; music performance

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Create a lesson for the year above

Primary: (ages 7 – 11)

Mathematics

Students create an arithmetic challenge for the year above, according to provided lesson structure. These arithmetic challenges/lessons are completed by the year above to see how well they work. This challenges students to explore arithmetic knowledge, play with unusual ideas, work together to create a lesson, and finally look at the result critically. The ultimate goal is creation of the lesson for the year above per se. Instead this creative process means to enable students to think about what makes a sum easy or difficult is particularly useful at the end of the year to focus on transition to the year above.

Time allocation	3 lesson periods
Subject content	Arithmetic - Can be focused on area of maths as appropriate teaching context (e.g. multiplication, division, big or negative numbers; percentages; decimals etc.)
Creativity and critical thinking	This unit has a creativity and critical thinking focus: <ul style="list-style-type: none">• Explore and generate ideas for a maths lesson• Play with unusual ideas and make connections between different levels of maths• Find alternative perspectives and challenge assumptions about easiness/difficulty of maths
Other skills	Collaboration
Key words	arithmetic; big numbers; percentages; decimals; multiplication; division; fractions

Products and processes to assess

Students work collaboratively to produce an inventive lesson plan. More importantly, their work process shows the confidence to explore and challenge their current knowledge and imagine what might come next. They are able to come up with ideas for how mathematics might become more difficult, make connections to the mathematics they have already studied, and articulate why they have made their final choices for the lesson plan.

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My region: what if?

Secondary: (ages 11 – 14)

Interdisciplinary (history, visual arts, science)

This activity uses history as a way to investigate artistic and/or scientific phenomena. Students explore a past historical period in their region and study the art and/or technology of the time, focusing then on a particular historical event from the period which led to changes in the arts and/or technology. Students are invited to question these ideas by imagining alternative histories for their region (i.e. 'counterfactuals': what if this event not happened?) and imagining artworks or technology that could have existed in these alternative courses of history. This leads to a projection into the future, with students proposing ideas and solutions to promote desired changes in their region.

Time allocation	5 lesson periods
Subject content	This activity is designed to be interdisciplinary; teachers have flexibility to decide on the specific content and skills it addresses in addition to: <ul style="list-style-type: none">• Learn about the evolution of a region, from historical and cultural perspectives• Understand how a past historical period or episode shapes the present time• Understand artistic manifestations and/or scientific phenomena in their historical context
Creativity and critical thinking	This unit has a creativity and critical thinking focus: <ul style="list-style-type: none">• Generate, play with, and stretch unusual ideas• Make connections and imagine alternative courses of history• Appraise and justify opinions and arguments
Other skills	Collaboration, Communication
Key words	counterfactuals; speculative history; local area; arts; architecture; inventions; wars; historical events; revolutions; discoveries

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What controls my health?

Secondary: (ages 11 – 14)

Science

This 25-lesson unit engages students in investigations to understand the importance of both genetic and environmental factors in their risk for disease. Students start the unit by experiencing the phenomenon of Type 2 diabetes through the eyes of a peer recently diagnosed with the disease. They develop an initial model to answer the question, "What caused Monique's diabetes?". Students discover that diabetes, like many common diseases, is caused by a combination of both genetic and environmental factors. Students also investigate how lifestyle options like healthy foods and exercise help prevent or reduce diabetes. The unit includes several opportunities for students to construct, test, revise and share their models to explain the investigated phenomena, while performing experiments and using computer simulations. For their final assignment, students conduct an action research project to improve their school or neighbourhood to help prevent or reduce diabetes.

NB: This unit includes an annex with adaptations for remote learning

Time allocation	About 25 lesson periods; 9-11 weeks (plus a 20 hour action research project; approximately 3-4 weeks)
Subject content	Develop inquiry and modelling skills to be able to construct a scientific explanation based on evidence for how environmental and genetic factors influence health.
Creative and critical thinking	This unit has a creativity and critical thinking focus: <ul style="list-style-type: none">• Consider several perspectives on what controls health• Reflect on the limits of an endorsed position• Propose, plan, and carry out an inquiry/action research project
Other skills	Persistence/Perseverance, Respect/Tolerance of difference

Authors: L. Adler, L. Beyer, I. (rbeyer@msu.edu), Peck-Brown, D., Morales, C.J., Lee, J., Krajcik, J. (2017). Michigan State University: CREATE for STEM Institute. This work was supported by a Science Education Partnership Award (SEPA) from the National Institute of Health and National Science Foundation (NSF) and was adapted for the OECD for the CERI project Fostering and assessing creativity and critical thinking skills. It is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO license (CC BY-NC-SA 3.0 IGO). © OECD



The sounds of my school

1. Students have the mission to choose an area of the school, find its sounds and use those sounds to compose music that represents that area of the school.
 2. Students start to plan and compose a three-minute piece in groups of four using various sound resources: bodies, voices, instruments and objects. The piece should reflect the area of the school.
 3. Each group performs for the whole class and records their performance. The class guesses what the location is.
 4. Each group appraises another group's work in terms of how well the location was captured and the quality of composition and musical elements.
-
- Develops mainly creativity but also critical thinking to a small extent
 - Develops music skills (composition, performance, group work, instruments, etc.)



My region: what if?

- Students focus on a particular historical event from a historical period of their region which led to changes in the arts and/or technology
 - Students imagine alternative histories for their region (i.e. ‘counterfactuals’: what if this event had not happened?) and artworks or technology that could have existed in these alternative courses of history
 - They invent and play a drama scene based from the perspective of a social group and how the event affected them
 - This leads to a projection into the future, with students proposing ideas and solutions to promote desired changes in their region
-
- Develops both creativity and critical thinking – and good subject for cultural education
 - Develops language skills, history – and either cultural/art or technology education



Using generative AI to support creativity

- Ask GPT to draft a story about what a specific group would have become if a certain historical event had not happened
- Specify the story to customise it to your context and the group's interests – possibly asking further ideas to GPT
- With the help of GPT, write a short play showcasing characters from different social groups and what the different society could have looked like
- Once the short play is written, work in groups to direct, rehearse and perform it
- Discuss the strengths and weaknesses of generative AI for creativity



Using generative AI to support critical thinking

- Provide students with a theme (not a full prompt so they don't all ask the same questions – eg information about the historical event) and ask them to use GPT to illustrate one aspect of the issue
- Ask them to verify the information provided by GPT and correct whatever is wrong (and find some sources saying similar things)
- Ask students to share their GPT-based texts/verified info with the rest of the class: moderate a group discussion about the assumptions, similar and different perspectives provided by the tool give the different prompts (or lack thereof)
- Have a discussion about the significance of the historical event
- Discuss the strengths and weaknesses of generative AI



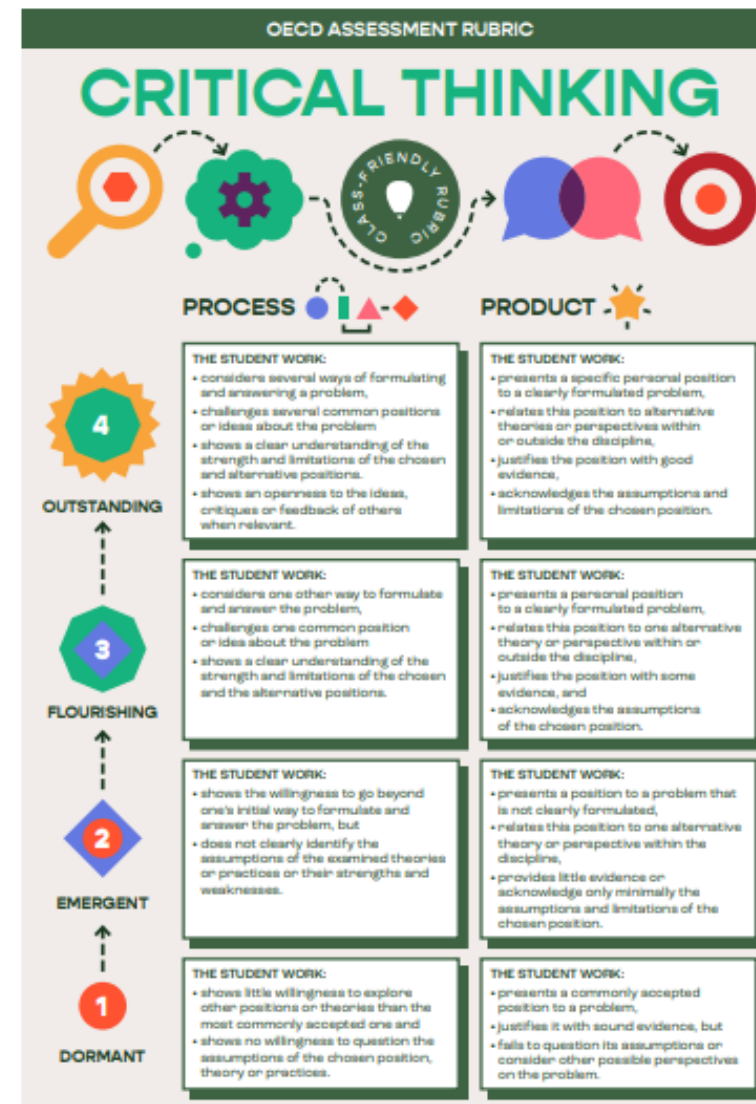
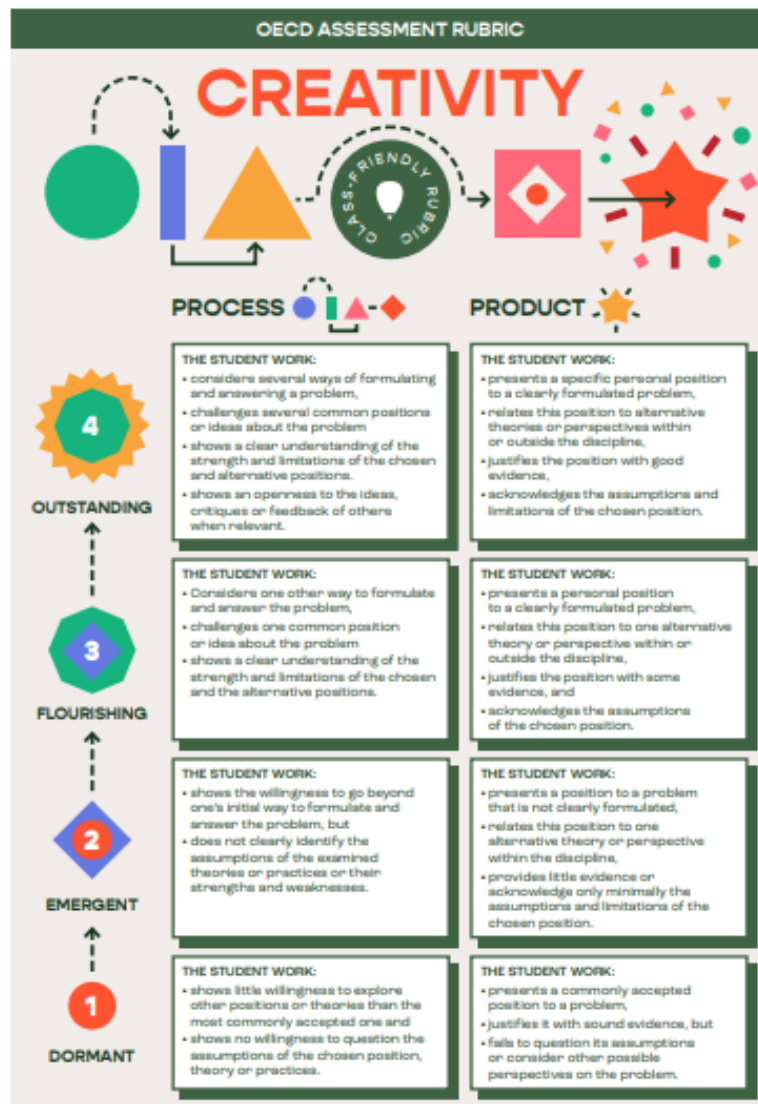
OECD assessment rubric on creativity

product and process dimensions

	Level 4 Outstanding	Level 3 Excellent	Level 2 Emergent	Level 1 Dormant
Product	<p>The student work</p> <ul style="list-style-type: none">• 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.	<p>The student work</p> <ul style="list-style-type: none">• 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.	<p>The student work</p> <ul style="list-style-type: none">• 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	<p>The student work:</p> <ul style="list-style-type: none">• meets the requirement of the task but• reproduces existing examples, with little personal perspective on formulation, content, technique or composition.
Process	<p>The work process:</p> <ul style="list-style-type: none">• 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.	<p>The work process:</p> <ul style="list-style-type: none">• 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.	<p>The work process:</p> <ul style="list-style-type: none">• 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.	<p>The work process:</p> <ul style="list-style-type: none">• is limited to the exploration of imitative patterns or to the examples presented by the teacher or expected to be familiar.

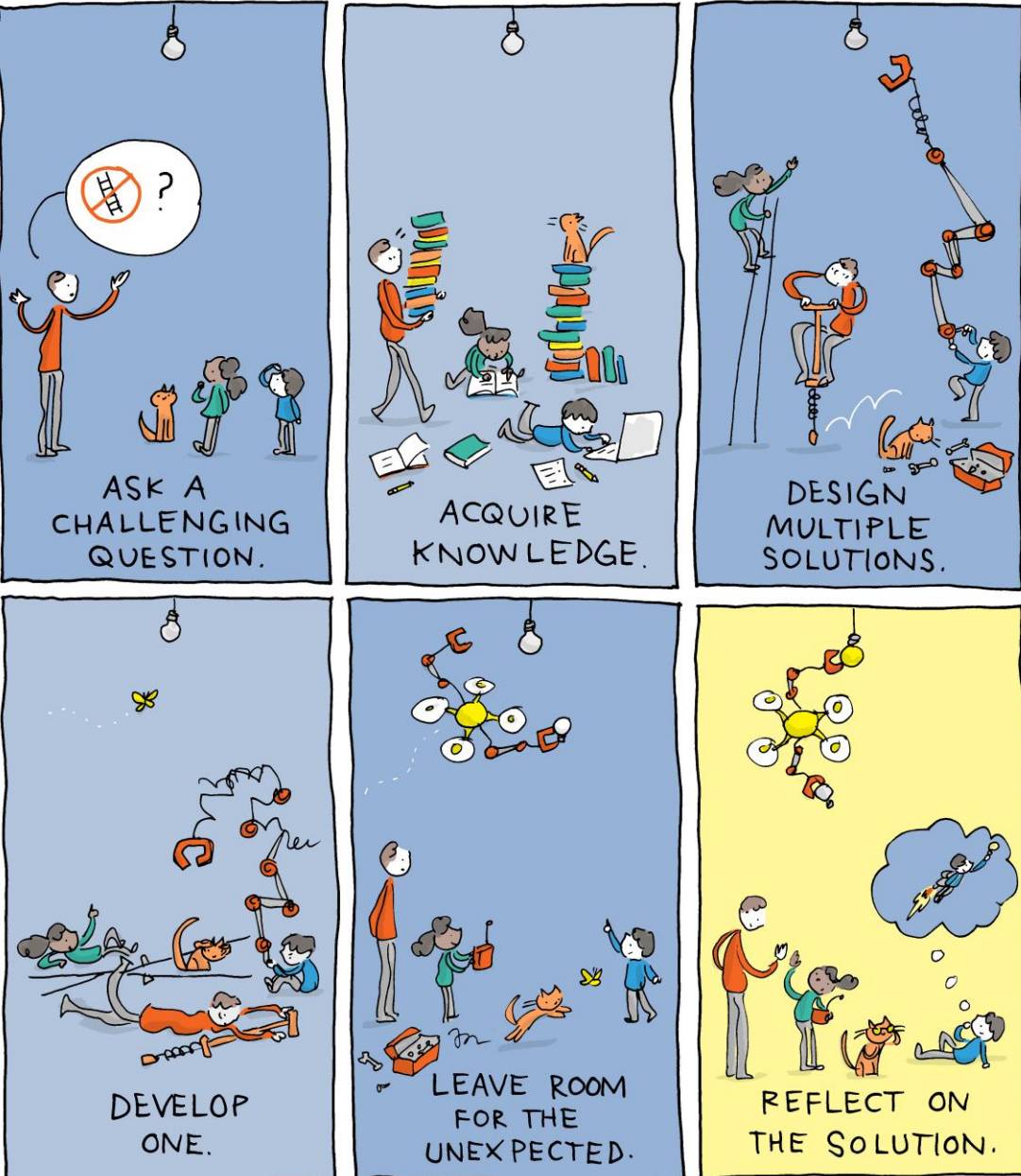


Assessment rubrics that articulate levels of progression

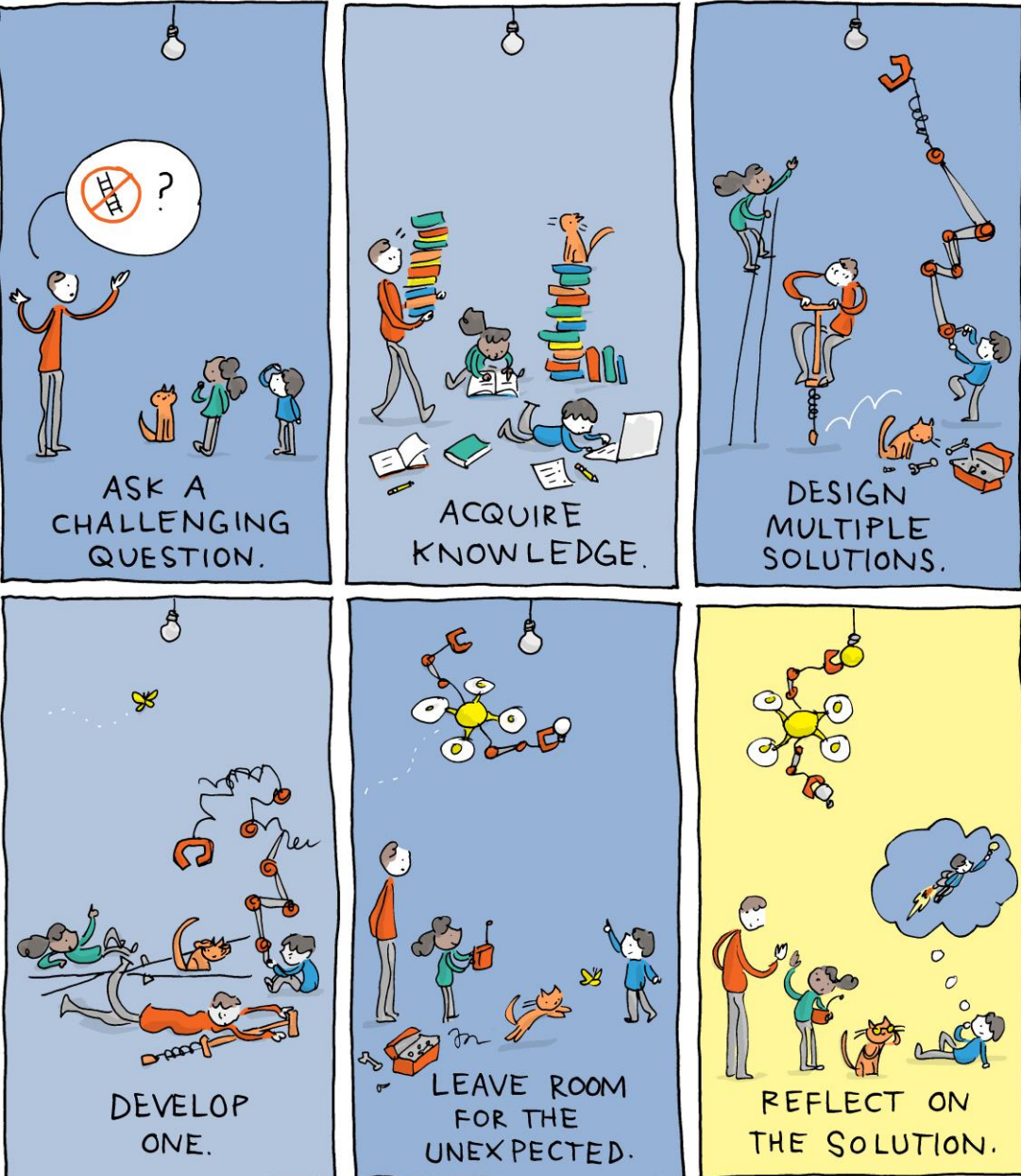


8 Design criteria for good lessons

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



GRANT SNIDER FOR OECD/CERI

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**



Balancing structure and openness



- Fostering creativity or critical thinking requires appropriate tasks and assignments
- It can be learnt in any discipline alongside technical skills
- Teachers have to prepare a courses with a strong structure and learning architecture but allow for some student agency

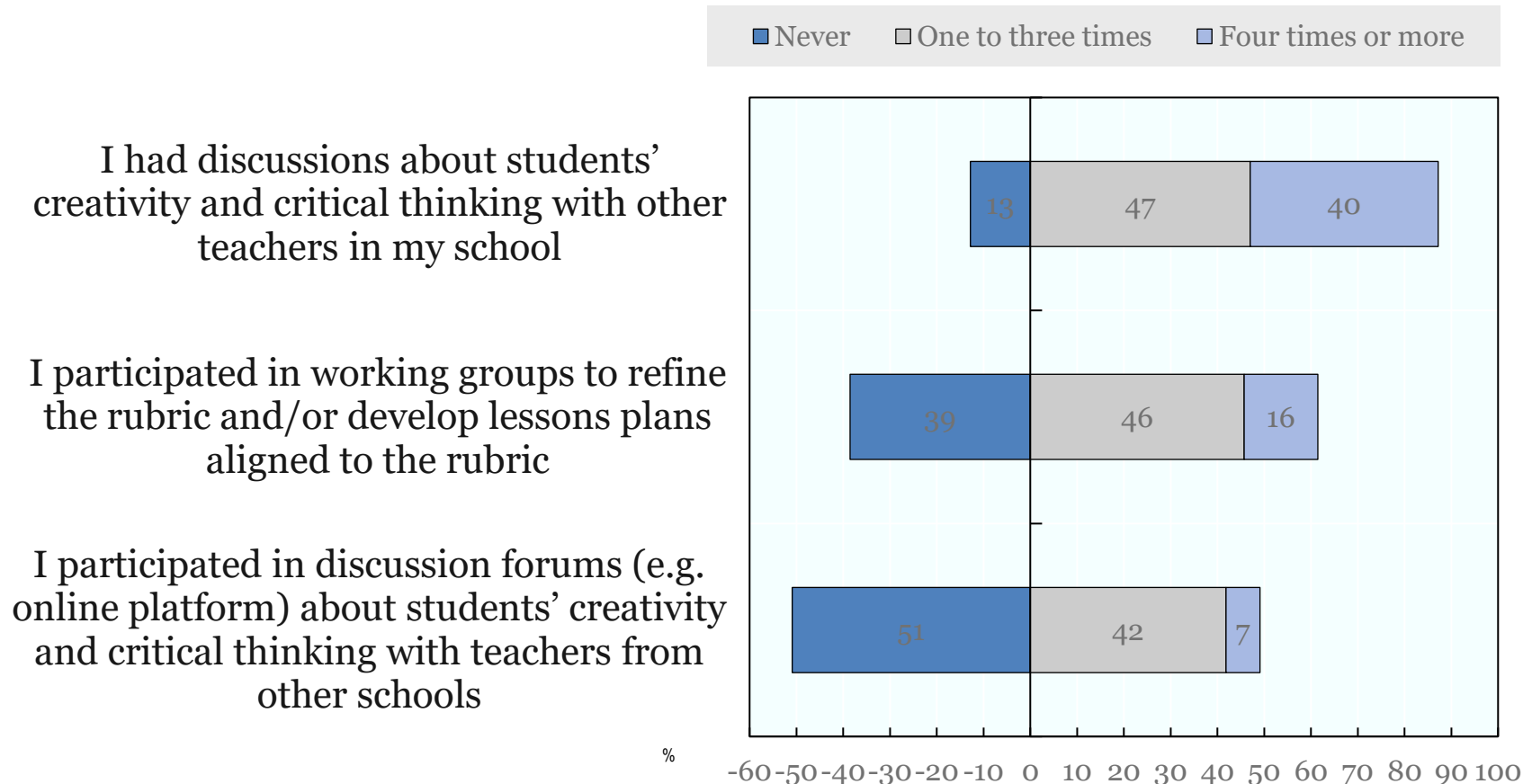


some lessons from the development
of evaluation instruments



Professional learning communities among intervention teachers

Percentage of teachers reporting collaboration with peers in relation to the project over previous 6 months



For 75% of school principals:

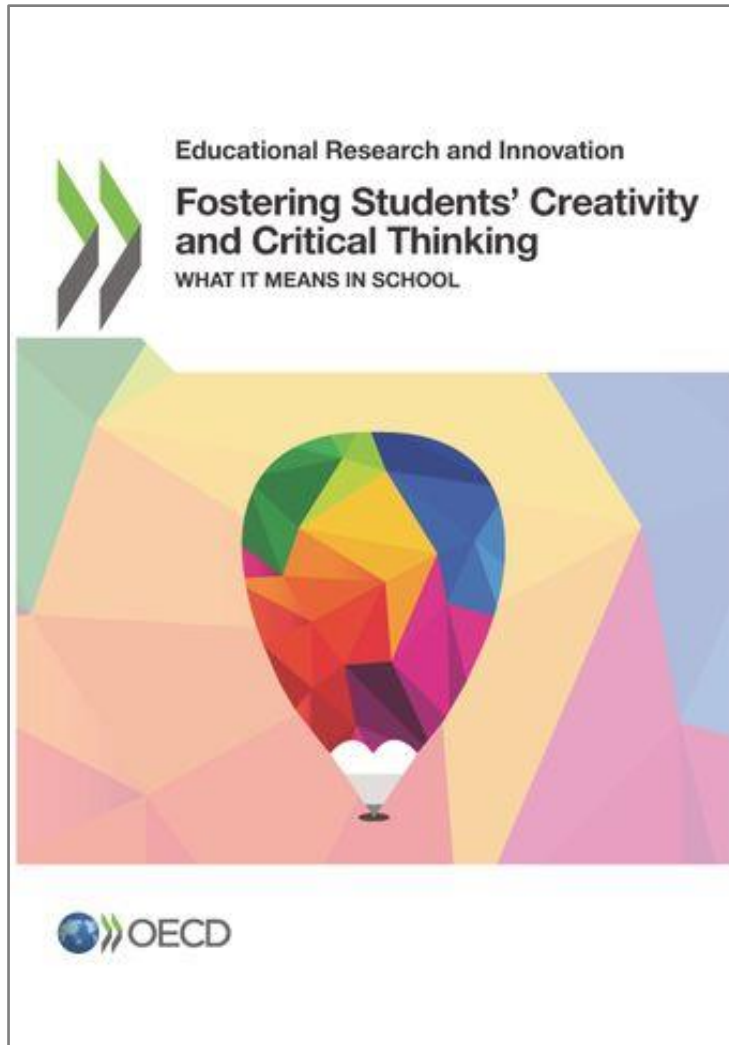
- the project led to collaboration between teachers in unusual and positive ways
- the project provided professional development opportunities that teaching staff would not have had otherwise



final reflections



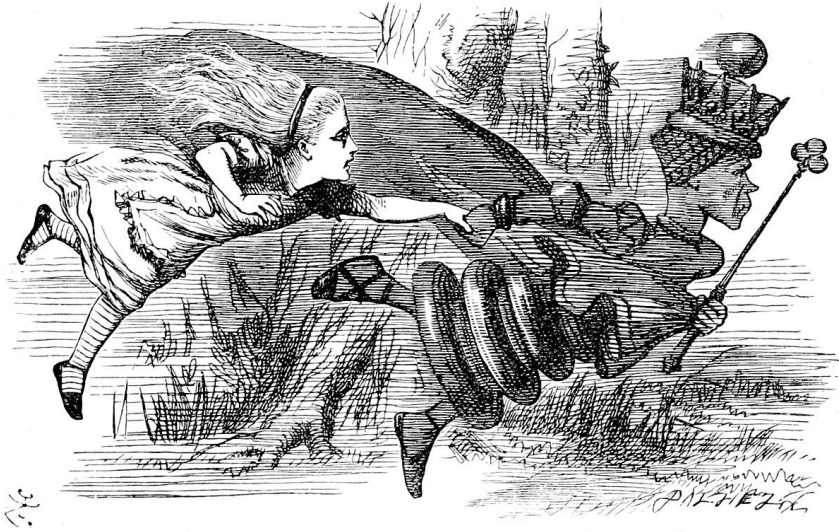
Innovating education to foster students' creativity: what does it take?



- Clarity on learning outcomes (what they mean and when they are supposed to be developed)
- Good examples of lesson plans (curriculum materials) and other pedagogical resources (e.g. rubrics, etc.)
- Good professional learning opportunities to design and deliver good lessons (or expert teachers)
- Structure and challenge BUT leaving opportunities to students to develop their critical thinking and creativity
- Appropriate tasks, assignments and assessment criteria



Changing is not so easy...



"Well, in OUR country," said Alice, still panting a little, "you'd generally get to somewhere else — if you run very fast for a long time, as we've been doing."

"A slow sort of country!" said the Queen.

"Now, HERE, you see, it takes all the running YOU can do, to keep in the same place.

If you want to get somewhere else, you must run at least twice as fast as that!"



... but it is possible



Alice: This is impossible.

The Mad Hatter: Only if you believe it is.



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THANK YOU

<https://oe.cd/educationceriinnovationstrategy>

