SKILLS FOR LIFE

Fostering Critical Thinking

IDB Inter-American Development Bank

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The policy brief draws on the work from a CERI project on Fostering and Assessing Creativity and Critical Thinking in Education (Vincent-Lancrin et al., 2019).

Abstract

Critical thinking has become key to the skill set that people should develop not only to have better prospects in the labor market, but also a better personal and civic life. This brief shows how policymakers and teachers can help students develop their critical thinking skills. First, this brief defines critical thinking skills. Then, the brief shows how the concept can be translated into teacher-friendly rubrics to support them to design or redesign better lessons but also to assess their students. Lastly, the brief highlights 10 concrete steps for policymakers, school principals, and teachers to better prepare students for the future with critical thinking skills and improve the quality of their education. While applied to the fostering and assessing of students' critical thinking skills, those 10 steps can be generalized to the implementation of other forms of educational innovation, notably competency-based curricula.

1. Why critical thinking matters

Critical thinking has become key to the skill set that people should develop to have better prospects in the labor market and a better personal and civic life. This mainly relates to the increasing importance of and reliance on innovation in most economies, but also job prospects and political responsibility in the digital age.

Skills for innovation

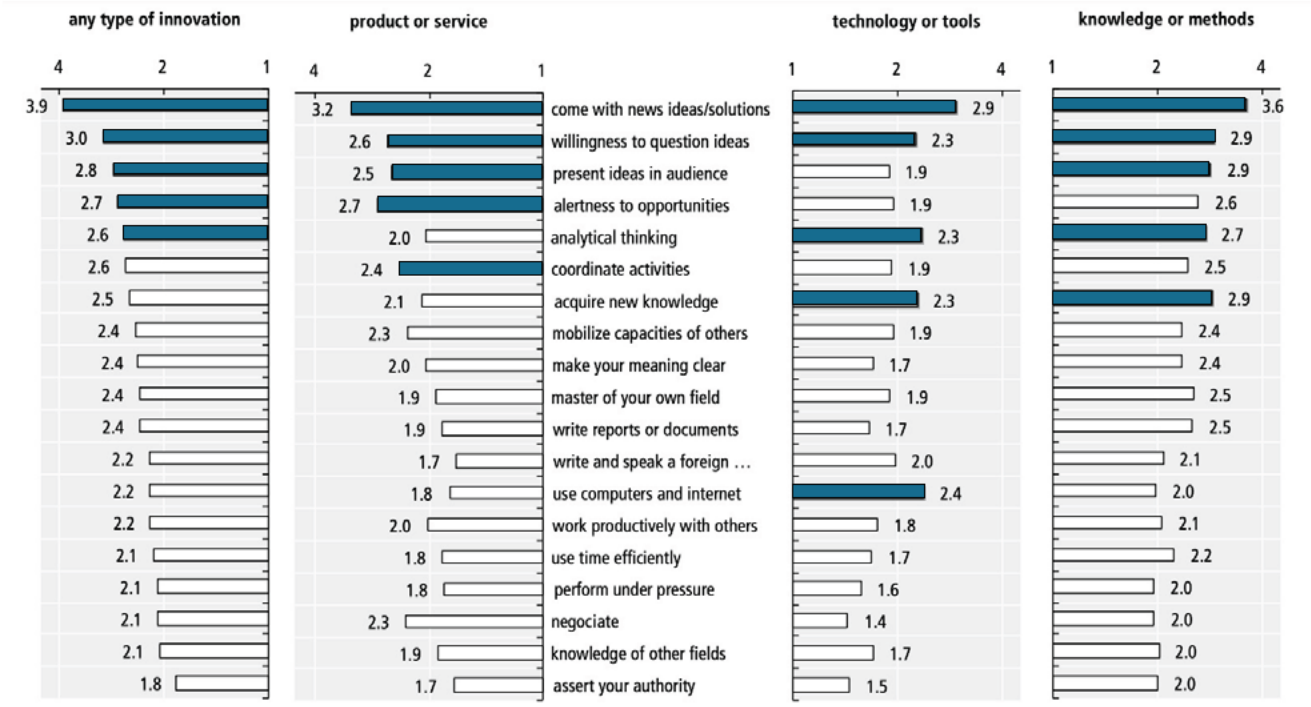
Innovation requires critical thinking skills. Innovation policy typically emphasizes the roles of science, technology, engineering, and mathematics in innovation, the role of entrepreneurship, and advanced higher education degrees such as doctorates. Analyzing two international surveys of tertiary education graduates (Reflex and Hegesco) covering 19 European countries and Japan, Avvisati et al. (2013) show that tertiary education graduates from all fields of study do contribute to innovation in the labor market. However, when it comes to product or technology innovation, engineers, scientists, and mathematicians tend to be more likely to contribute compared to their peers in other domains. They are also more likely to hold a 'highly innovative job' that contributes to the innovation process in an organization that is at the forefront of absorbing innovation.

Avvisati et al. (2013) go one step further and identify some specific skills that matter for innovation at the individual level, whatever the field of study. By comparing the (self-reported) job requirements of highly innovative and non-innovative jobs, the most critical skills for innovation that distinguish "innovators" from "non-innovators" were identified. The skills that distinguish innovators from non-innovators the most are creativity (e.g., "come up with new ideas and solutions") and critical thinking (e.g., the "willingness to question ideas"), followed by communication (e.g., "ability to present ideas in audience") entrepreneurialism (e.g., "alertness to opportunities"), analytical thinking, ability to coordinate activities, and the ability to acquire new knowledge (Figure 1).

On average, with all types of innovation combined, innovators are about three times as likely as non-innovators to say that critical thinking is a very important skill to perform their job. These innovation skills match our assumptions regarding individual skills for innovation, but it is noteworthy that they are triangulated in an analytical way rather than self-reported by individuals in a direct question. As it can thus not be the result of a social desirability bias, this analysis gives strong support to the widespread idea that critical thinking represents a crucial ingredient to innovation alongside other skills.

Figure 1. Skills critical for the most innovative jobs, by type of innovation

Tertiary-educated workers who contribute to their organization's innovation activities face higher skill requirements than non-innovative graduates.



Source: Avvisati et al. (2013). Authors' calculation. Based on Reflex and Hegesco. Odds ratios correspond to the likelihood of mentioning the skill as required for workers in innovative jobs, compared to workers in non-innovative jobs. Generalized odds ratios are computed from logistic regressions controlling for country and sector of activity. The five most critical skills are highlighted in blue for each type of innovation.

Skills for the digital age

Critical thinking skills are necessary in the digital age. The development of artificial intelligence, robotics, and the globalization of OECD societies have led many observers and media to speculate on the future of jobs (OECD, 2019a, 2019b; Baldwin, 2019). Will some jobs disappear from OECD economies and be outsourced to countries where workers receive comparatively lower compensation? More fundamentally, will a large share of the jobs performed by human beings be automated and performed by different types of computers, especially robots and AI-supported agents? According to recent OECD estimates, 14% of jobs in the OECD area are at risk of being completely automated, while another 32% is likely to change significantly (OECD, 2019c). While this is unlikely to lead to fewer jobs for humans, there will be a significant cost to adjust to these changes.

Chief Executive Officers and Chief Human Resource officers of multinational and large domestic companies that answered the "Future of Job" survey of the World Economic Forum (WEF) identified critical thinking as 3rd among the top 10 most important skills in the labor market in 2018 ("analytical thinking and innovation" and "complex problem solving" being first and second). They forecast it to remain the 5th most demanded skill in 2022 (WEF, 2018).

Other reports using different methodologies point in the same direction (Petrone, 2019a, 2019b; Accenture, 2018; Bughin et al., 2018). All in all, there seems to be a consensus that creativity and critical thinking will become more important in professional life, and in much higher demand in the labor market in the decades to come, inter alia as a result of the ongoing automation of many roles in a more digital economy.

Critical thinking for personal and social well-being

Beyond the economic argument, higher-order skills such as critical thinking matter because they contribute to people's well-being and to democratic societies. While at the top of Bloom's taxonomy for their level of complexity and demand (under the term "evaluate"), it can also be interpreted as corresponding to highest-level human needs in some psychological traditions (e.g., Maslow).

Critical thinking plays a role in individual well-being, but is more often seen as an essential pillar of the functioning of modern democracies. The ancient philosophical tradition saw it both as a way to have a good and a happy life (Hadot, 1995) and a means toward good government. In modern democracies, people are expected to exercise their critical thinking as an integral part of being citizens, with the ability to make an independent and well-grounded opinion to vote, and weigh the quality of arguments presented in the media, and other sources of information (Brookfield, 1987). In a digital world, in which a multiplicity of views, theories, facts, and challenges to all those, critical thinking has become even more important to make a judgment on the multiplicity of information available on social networks (see Machete & Turpin, 2020).

2. Defining critical thinking

Critical thinking mainly aims at assessing the strength and appropriateness of a statement, theory, or idea through a questioning and perspective-taking process, which may or may not in turn result in a possibly novel statement or theory. Critical thinking need not lead to an original position to a problem. The most conventional one may be the most appropriate. However, it typically involves the examination and evaluation of different possible positions.

Critical thinking is usually traced back to the dialectic method of Socrates and of its followers, who sought the truth based on questioning, identifying, and challenging statements and their underlying hypotheses to see whether they held water. One of the philosophical schools that put a radical version of critical thinking at the core of its philosophy is skepticism (also known as pyrhonnysm). The Sceptics emphasized the limits of human knowledge and maintained that "suspending our judgment" was ultimately the appropriate stance towards existing theories. This form of radical skepticism was taken seriously by philosophers, and its discussion and critique have led to the foundations of many philosophical theories of knowledge and science since the 17th century. Descartes and his successors attempted to create a hierarchy of beliefs and evidence, while others theorized the limitations (and functioning) of the human brain (e.g., Hume and Kant). The philosophy of enlightenment revived the idea that common beliefs could be criticized and challenged and that knowledge, science, and free-thinking could lead to better societies – a philosophy illustrated by the Diderot and D'Alembert Encyclopédie.

In education, research on critical thinking usually refers to Dewey (1933) as the first famous user of the word in English (although most of the time he talked about "reflective thinking"). Dewey (1933) noted: "The essence of critical thinking is suspended judgment, and the essence of this suspense is an inquiry to determine the nature of the problem before proceeding to attempts at its solution." Critical thinking would thus be an initial skepticism allowing for inquiry and better understanding of the problem at hand before proposing a solution. Critical thinking can easily be linked to the two speeds of thinking highlighted by Kahneman (2011): fast and slow thinking. While fast thinking is successful for most daily situations, it includes several systematic biases of the mind that lead humans to give irrational or wrong solutions to even relatively simple analytical problems. Conversely, slow thinking is the reflective and analytical thinking that attempts to remedy some of the biases of fast thinking, including confirmation bias (that speeds up the thinking process) and usually leads to a right or rational solution to a problem (should one have the relevant technical knowledge to solve it). At its best, critical thinking is one of the different forms of thinking slow, although it is not limited to finding the right answer to a problem. It also includes determining its nature.

Applied to education, the theory of critical thinking has been developed by philosophers such as Ennis (1996; 2018), Facione (1990), and McPeck (1981) (see Davies & Barnett, 2015 and Hitchcock, 2018 for an overview of the literature). Hitchcock (2018) summarizes most conceptions by defining critical thinking as "careful goal-directed thinking" – another version of Ennis' (2018) definition: "reasonable reflective thinking focused on deciding what to believe or do." In many cases, definitions of critical thinking emphasize logical or rational thinking — that is, the ability to reason, assess arguments and evidence, and argue in a sound way to reach a relevant and appropriate solution to a problem. This is also what standardized assessments of critical thinking tend to assess. However, critical thinking arguably goes beyond good analytical thinking and includes a dimension of critique and perspective-taking — not so much in the sense of taking someone else's perspective, but in the sense of perspectivism (as developed by philosophers such as Leibniz and Nietzsche), which is looking at things from different perspectives. All perspectives or ways of seeing things may not be equivalent, and some may be stronger than others, but they can all be valid and derived from rational or good thinking, and thus true.

This view has been well illustrated in modern epistemology by Foucault (1966) with his epistemes (historically accepted knowledge) or Kuhn (1962) with his paradigms. When supplementing Karl Popper's falsification theory, perhaps Lakatos (1980) provided one of the best illustrations of what critical thinking and its perspectivist dimension may look like in science. Scientists do indeed have different theories to explain natural or social phenomena. Their research programs embody these different views or perspectives. Lakatos noted that a scientific research program (that is, a theory) is composed of a 'hard core' of assumptions and procedures and a 'protective belt' of secondary assumptions and procedures. Typically, scientists never challenge the hard core of their research program, but rather change the secondary assumptions and theories to accommodate facts that do not fit with it. In the normal regime of a research program, there is indeed not time to challenge assumptions. Challenging the hard core of a research program, that is, its assumptions and ways of thinking, may lead to a better understanding of its framework; in some cases, this may lead to another research program with a different set of assumptions – an occurrence of creative thinking. Within disciplines, a variety of research programs often compete, even though some may be more widely accepted or successful in explaining relevant phenomena than others. Some disciplines can be seen as competing research programs departing from different sets of values or assumptions about what matters and theories to explain observed facts (for example, economics and sociology).

Thus, critical thinking is not merely limited to finding the right or appropriate solution after a reflective thinking process within a specific theory, paradigm, or discipline. It is not just about having a critical look at the secondary belt of assumptions to find a way to adapt the theory. From time to time, it is also about being able and willing to challenge the core assumptions of theories, paradigms, or accepted knowledge. It is about recognizing the possible value of other perspectives or research programs, assessing their possible strengths and weaknesses, and recognizing that all theories or research programs have their unproven assumptions, and thus, possible limitations and biases – as reasonable and aligned with empirical perceptions or fast thinking' as they might be. In addition to rational or logical thinking, critical thinking includes two other dimensions: 1) the recognition of multiple perspectives, or possibility to challenge a given one); and 2) the recognition of the assumptions and limitations of any perspective, even when it appears superior to all other available ones.

What are the cognitive processes or sub-skills involved in critical thinking? Based on the review of the research literature and on working with teachers to find a 'teacher-friendly' language (Vincent-Lancrin et al., 2019), the underlying macro-processes can be summarized under the following headings (and allow for establishing parallelism with creativity): inquiring, imagining, doing, and reflecting.

Inquiring. Determining and understanding the problem at hand, including its boundaries, is a first important dimension of a critical thinking inquisitive process. Sometimes this includes wondering why the problem is posed in a certain way, examining whether the associated solutions or statements may be based on inaccurate facts or reasoning, and identifying the knowledge gaps. This inquiry process partly concerns rational thinking (checking facts, observing, analyzing the reasoning), but includes a more 'critical' dimension when it comes to identifying the possible limitations of the solution and challenging some of the underlying assumptions and interpretations, even when facts are accurate. In many cases, inquiring involves acquiring knowledge, verifying knowledge, and examining the components of the problem in detail as well as the problem as a whole.

Imagining. In critical thinking, imagination plays an important role as the mental elaboration of an idea – but any thinking involves some level of imagination. At a higher level, imagining is also about identifying and reviewing alternative or competing world views and theories and assumptions, so as to consider the problem from multiple perspectives. This allows for better identification of the strengths and weaknesses of the proposed evidence, arguments, and assumptions, even though this evaluation also belongs to the inquisitive process. Imagination also plays a role in thought experiments, which can be a strong component of any good thinking and also a way to explore alternatives and make a point when experimentation is not possible (Dennett, 2013).

Doing. The product of critical thinking is one's position or solution to a problem or judgment about others' positions or solutions. This mainly implies good inference — a balancing act between different ways of looking at the problem, and thus recognition of its possible complexities. As with any good thinking, critical thinking implies the ability to argue and justify one's position rationally, according to existing perspectives and socially recognized ways of reasoning, or possibly some new ones.

Reflecting. Finally, even though one may consider one's position or way of thinking superior to some alternatives — perhaps because it embraces a wider view or is better supported by existing evidence — critical thinking implies some self-reflective process about the perspective one endorses, its possible limitations and uncertainties, and thus a certain level of humility and openness to other competing ideas. While one does not have to embrace ancient skepticism and suspend one's judgment in all cases, this may sometimes be the most appropriate position.

Critical thinking has also been studied as a disposition or attitude. Teaching and learning critical thinking in multiple disciplines is about developing this attitude, which can then be demonstrated as a skill. For example, Barnett (2015) distinguished different forms of criticality: critical reason (applied to knowledge), critical self-reflection (applied to self), and critical action (applied to the world). Vardi (2015) highlighted three dispositions involved in critical thinking: 1) self-regulation (self-discipline and self-management); 2) having an open, fair and reasonable mind, a preparedness to identify and face one's own biases, and preparedness to reconsider one's own views where warranted; and 3) being committed to ongoing self-improvement and being ready to develop one's knowledge. In the same spirit, Thomas and Lok (2015) analyzed the dispositions or personal attitudes that support the development and application of critical thinking skills: being open-minded and fair-minded; being truth-seeking and curious; avoiding cultural- or trait-induced bias and dichotomous black-and-white thinking. Synthesizing the research literature on critical thinking, Hitchcock (2018) categorized critical thinking dispositions as follows: attentiveness, the habit of inquiry, self-confidence, courage, open-mindedness, willingness to suspend judgment, trust in reason, and truth-seeking.

Figure 1. Critical thinking

In sum, critical thinking is a slow thinking process involving analytical thinking, looking at problems from different perspectives, and being willing to challenge assumptions and conventional ways of thinking before reaching a position. Critical thinking does not necessarily end in a critique of the most widely accepted position on a topic, which may indeed be the strongest one based on existing evidence. It requires having mere opinions, rather than convictions, about facts, theories, and assumptions. Here are a few examples of critical thinking actions: questioning and evaluating ideas and solutions before forming one's opinion; carefully considering several possible alternatives to one's decision; fully considering different arguments or views before rejecting or accepting them; suspending one's judgment before one has time to inquire and while one is inquiring; fighting one's confirmation bias (as well as other ones); accepting that there is not enough evidence to conclude firmly and remaining indecisive because of the uncertainty. By contrast, while they can be valuable, the following actions cannot be considered an expression of critical thinking: finding the solution of a well-specified complex problem (this is just problem-solving that may or may not require any critical thinking); accepting the first idea that comes to mind (fast thinking); repeating without further examination what existing theories, authorities, or local cultural views say (dogmatism, ethno-centrism); refusing all other conclusions as a matter of principle based on the possible remaining uncertainties, or just because it is widely accepted socially.

3. Teaching critical thinking

Using conceptual rubrics to be intentional in developing critical thinking

Overall, there is a common understanding among researchers on the key dimensions of critical thinking, such as those described in the previous section. There are two main elements: thinking thoroughly and exploring alternatives. However, transferring the concept to a consistent educational application requires further translation. This is where rubrics intervene.

Rubrics are a way to simplify, translate and construct a social representation of what creativity and critical thinking look like in the teaching and learning process. They aim to create a shared understanding of what creativity means in the classroom and shared expectations among teachers, and among teachers and students. Rubrics simplify big concepts to make them relevant to teachers and learners in their actual educational activities. Rubrics are a metacognitive tool that helps make learning visible and tangible, and teaching intentional. Different types of rubrics serve different purposes. Conceptual rubrics are those that merely clarify what counts or what teachers and students should particularly keep in mind.

Table 1. OECD rubrics on creativity (domain-general, comprehensive, and class-friendly)

	COMPREHENSIVE (Coming up with new ideas and solutions)	CLASS-FRIENDLY (Coming up with new ideas and solutions)
INQUIRING	• Understand context/frame and boundaries of the problem • Identify and question assumptions, check the accuracy of facts and interpretations, analyze gaps in knowledge	• Identify and question assumptions and generally accepted ideas or practices
IMAGINING	• Identify and review alternative theories and opinions and compare or imagine different perspectives on the problem • Identify strengths and weaknesses of evidence, arguments, claims, and beliefs	• Consider several perspectives on a problem based on different assumptions
DOING	• Justify a solution or reasoning on logical, ethical, or aesthetic criteria/reasoning	• Explain both strengths and limitations of a product, a solution, or a theory justified on logical, ethical, or aesthetic criteria
REFLECTING	• Evaluate and acknowledge the uncertainty or limits of the endorsed solution or position • Reflect on the possible bias of one's own perspective compared to other perspectives	• Reflect on the chosen solution/ position relative to possible alternatives

Note: This rubric is meant for teachers/faculty use to identify the student skills related to creativity and to critical thinking that they have to foster in their teaching and learning, not for assessment. Each column is generally presented alongside the "creativity" rubric in the same "comprehensive" or "class-friendly" format.

As part of its project on "Fostering creativity and critical thinking in education", the OECD worked with teachers and school networks in 11 countries to develop rubrics and other supporting materials through a quick prototyping process (Vincent-Lancrin et al., 2019). Two domain-general conceptual rubrics were developed: a comprehensive rubric and class-friendly rubric. Domain-specific adaptations of those rubrics were also developed. Table 1 shows the comprehensive domain-general rubric (first column), and class-friendly domain-general rubric (second column) for critical thinking. A portfolio of domain-specific rubrics (for science, math, language art, music, and visual arts) was also developed. Depending on the subject of the lesson and the learning outcomes they want to achieve, using a conceptual rubric while designing a lesson helps teachers to build some assignments or tasks that help students to develop at least some of the sub-skills of creativity or critical thinking. Some lessons may just develop a few sub-skills, while others could cover the full range. Existing lessons could be modified according to the same process, just adding one opportunity to develop a sub-skill here and there, thanks to small changes to the lesson or its pedagogical delivery.

The conceptual rubrics also represent a key element of a quality assurance method. After decomposing their lessons or entire course or project into steps, teachers can identify when students were given the possibility or were requested to practice some of the skills identified in the rubric. Thus, they can double- check whether their designed lessons had the quality they wanted as far as critical thinking objectives are concerned. Examples of lesson plans developed during the project include a mapping of the different steps of the lesson against the sub-skills of the conceptual rubrics.

The OECD rubrics were meant to be used by teachers working in real-life settings in different ways: 1) designing and revising lesson plans so that they give students the opportunity to develop their critical thinking skills and creativity; 2) assessing student work and progression in the acquisition of these skills; and 3) generating newly aligned rubrics adapted to their local context or self-assessment tools. The fieldwork showed that seven in ten teachers participating in the international network did on average use the OECD rubrics for those purposes. The rubrics have thus proven to be useful and were well adopted by teachers in most of the countries in which the project was implemented.

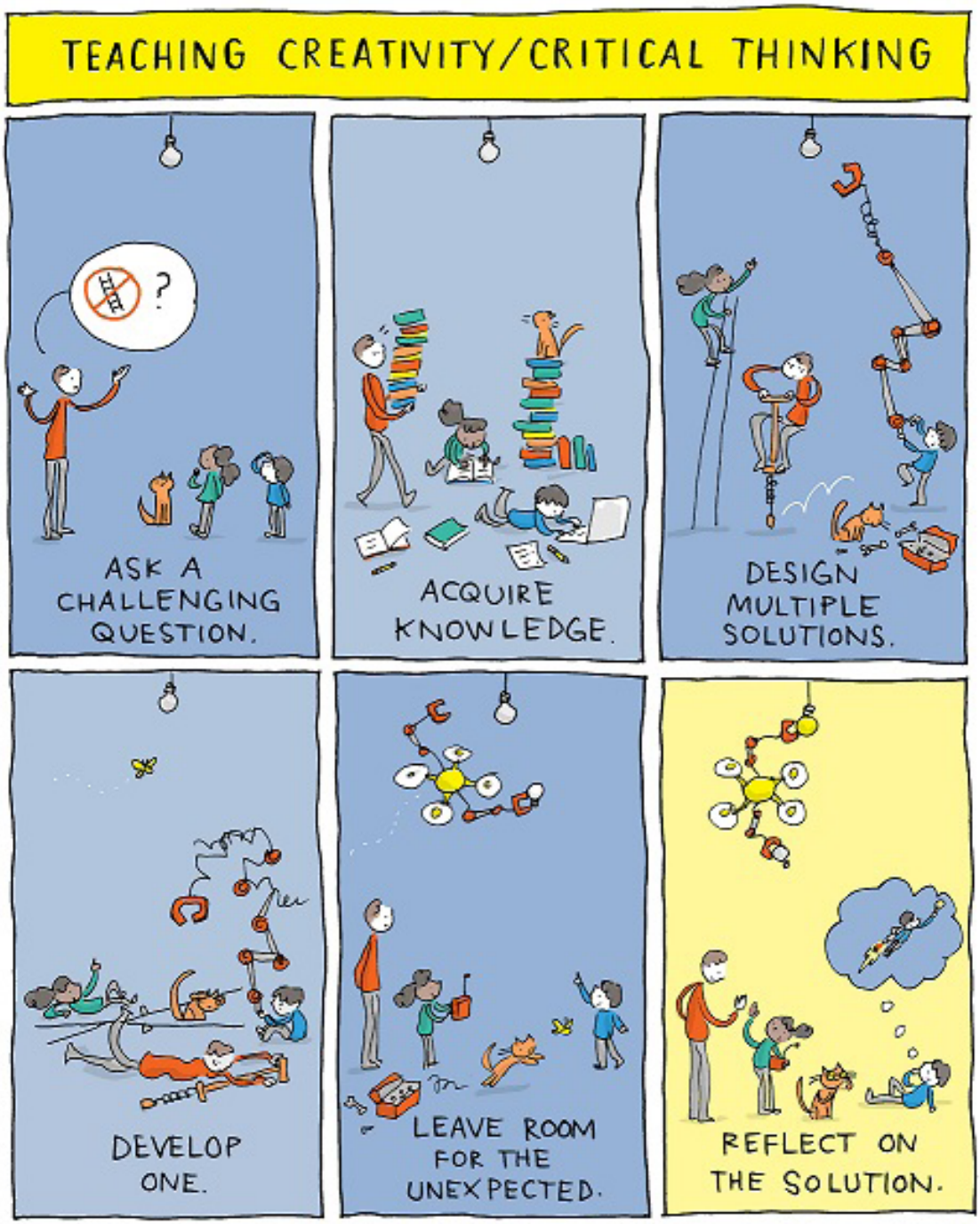
Designing lesson plans including critical thinking as a learning objective

The conceptual rubrics presented above can support teachers to review their curriculum units and plan lessons that give students opportunities to develop the sub-skills identified by the rubrics. However, they do not guide all key dimensions of the pedagogies. While critical thinking can be nurtured in any domain, it requires giving students certain types of tasks and problems.

Based on the feedback from the field as well as the peer review of proposed lessons by teachers, pedagogues, and researchers (Vincent-Lancrin et al., 2019), a set of design criteria was developed to support teachers further. The criteria build on learning science principles, including motivation, cognitive activation, self-regulation, and opportunities for formative assessment (see Table 2 and Figure 2 for a free adaptation). These design criteria for good lesson plans represent another set of quality checks and a new perspective on how to approach pedagogical redesign to foster students' critical thinking. By following these design criteria, teachers will be able to nurture students' critical thinking.

The design criteria highlight that tasks to develop and then demonstrate critical thinking skills in education share some general features. For example, they seek to engage students, may have a deliberate open nature, and encourage students to explore multiple solutions to problems within parameters and constraints that clarify goals, yet remain relatively flexible to allow students to address them with a certain level of agency.

Figure 2. Teaching critical thinking (and creativity)



The successful teaching of critical thinking also hinges critically on teachers' attitudes and in their ability to create learning environments where students feel safe to take risks in their thinking and expressions. This in turn presupposes a positive attitude towards mistakes and learner empowerment. A positive attitude among teachers towards student "mistakes" or "failure" can take the form of using these to trigger reflection about learning opportunities, thus helping students to see misunderstandings and other matters — too often labeled 'failures' — as a chance for improvement. Choosing questions and tasks that teachers themselves cannot resolve can make it clear to students that the thinking process behind a problem can be as important as its answer. This is typically the role of the Driving Question Board in project-based learning (Schneider et al., 2020), which has to come with a positive teacher attitude towards students' questions and explanations.

Table 2. Design criteria for activities that foster creativity or critical thinking skills

A pedagogical activity aligned with the OECD rubric on creativity and critical thinking should:	Competences
1. Create students' need/interest to learn	• Usually implies starting with a big question or an unusual activity. • May imply coming back to these questions several times during the activity.
2. Be challenging	• Often, the lack of student engagement comes from learning goals or activities that lack challenge. The tasks should be challenging enough, though not too difficult given the students' level.
3. Develop clear technical knowledge in one domain or more	• The activity should include the acquisition and practice of both content and procedural knowledge (technical knowledge).
4. Include the development of a product	• A product (a paper, a presentation, a performance, a model, etc.) makes the learning visible and tangible. • Teachers and students should also be attentive to and possibly document the learning process.
5. Have students co-design part of the product/solution or problem	• Products should thus in principle not all look alike.
6. Deal with problems that can be looked at from different perspectives	• Problems should have several possible solutions. • Several techniques may be used to solve them.
7. Leave room for the unexpected	• Teachers and students do not have to know all the answers. • The most commonly adopted techniques/solutions may have to be taught and learned, but there should be room for exploring or discussing unexpected answers.
8. Include space and time for students to reflect and give/receive feedback	

Source: Vincent-Lancrin et al. (2019)

4. Assessing critical thinking

What is important to teach must also be assessed both by teachers and by education systems. In the case of critical thinking, some aspects are already part of common practices — notably the "logical" aspect, such as justifying one's claims, and identifying strengths and weaknesses of arguments. What is less often done is the "critique" part of critical thinking, including perspective-taking.

Formative assessment of critical thinking

Beyond a better understanding of the skills that one should develop, rubrics can also be used to assess student work. This is usually their main use in countries where they are popular. They usually have descriptors of different levels of proficiency for each of their dimensions, either attached to a specific assignment or an unspecified one.

Table 3 presents the OECD assessment rubric on critical thinking that was developed iteratively with teachers and experts to support the formative assessment of critical thinking – but could be used in a summative way too. It has four proficiency levels. The two lower levels were intentionally defined so that they would not correlate with the "technical skills" in the subject of the assignment. The initial level of progression ("dormant") suggests that the student work demonstrates a good level of mastery of the technical learning outcome in the subject, but not in critical thinking. The lower level describes a lack of effort to demonstrate those skills in the assignment. The second level ("emergent") describes a relatively low level in these skills, but an attempt to demonstrate them. They are deliberately combined with a possibly lower level of mastery in the technical skills in the subject (that is, the other learning goals of the assignment). The third level ("flourishing") shows a good understanding of the problem, presents an argued position that is compared to one alternative perspective, and understands the assumptions of the proposed position. The fourth level ("outstanding") differs by comparing to more than one alternative perspective, provides sound evidence, and is self-reflective.

Table 3. OECD assessment rubric: Creativity

	Level 4 **Outstanding**	Level 3 **Flourishing**	Level 2 **Emergent**	Level 1 **Dormant**
Product	**The student work:** • presents a specific personal position to a clearly formulated problem • relates this position to alternative theories or perspectives within or outside the discipline • justifies the position with good evidence • acknowledges the assumptions and limitations of the chosen position.	**The student work:** • presents a personal position to a clearly formulated problem • relates this position to one alternative theory or perspective within or outside the discipline • justifies the position with some evidence • acknowledges the assumptions of the chosen position.	**The student work:** • presents a position to a problem that is not clearly formulated • relates this position to one alternative theory or perspective within the discipline • provides little evidence or acknowledges only minimally the assumptions and limitations of the chosen position.	**The student work:** • presents a commonly accepted position to a problem • justifies it with sound evidence, but • fails to question its assumptions or consider other possible perspectives on the problem.
Process	**The work process:** • considers several ways of formulating and answering a problem • challenges several common positions or ideas about the problem • shows a clear understanding of the strength and limitations of the chosen and alternative positions • shows an openness to the ideas, critiques, or feedback of others when relevant.	**The work process:** • considers one other way to formulate and answer the problem • challenges one common position or idea about the problem • shows a clear understanding of the strength and limitations of the chosen and the alternative positions.	**The work process:** • shows the willingness to go beyond one's initial way to formulate and answer the problem, but • does not clearly identify the assumptions of the examined theories or practices or their strengths and weaknesses.	**The work process:** • shows little willingness to explore other positions or theories than the most commonly accepted one • shows no willingness to question the assumptions of the chosen position, theory, or practices.

Notes: The class-friendly assessment rubric for critical thinking is supposed to assess a task targeting the acquisition of some learning outcome in a discipline or more. It is not meant to assess a "critical thinking" exercise, but any exercise in which students have space to develop their critical thinking skills. "Product" refers to a visible final student work (for example the response to a problem, an essay, an artifact of a performance). The criteria are meant to assess the student's work even if the learning process is not observable by the rater or was not fully documented. "Process" refers to the learning and production process observed by the teachers or documented by the students: the process may not be entirely visible in the final product as some interim ideas or aspects of the process may not be reflected in the final student work. Typically, the process could show a greater level of acquisition of the skills than the product. Levels 1 to 4 correspond to a continuum. Level 1 corresponds to little effort to exercise one's critical thinking, whether the technical requirements of the task are met or not. Level 2 corresponds to some effort, even though the technical requirements of the task are not met. Level 3 corresponds to both an output that shows some level of critical thinking and some technical mastery. Level 4 combines both a high level of critical thinking and technical mastery. It should be noted that Level 4 may correspond to a conventional position, to the extent that it is well understood and related to other ones.

While final products say something about students' learning and skill acquisition, they do not tell the whole story about the learning process. It could actually be that the final product does not fully reflect the learning, and that teachers' assessments would differ if they had documentation about the whole process rather than just the final output. The two product and process approaches correspond to two different assessment situations, depending on what the assessor can see and assess (or wants to). Assessing the learning process implies that the assessor(s) could see it (or documentation about it, for example through a portfolio).

There is nonetheless a similar logic between the product and process dimensions of the scoring rubric. Level 1 ("dormant") corresponds to a production process during which students did not explore alternatives, challenge assumptions, and quickly jumped to conclusions and a position. Level 2 ("emergent") corresponds to more attempts to explore alternatives, suspend judgment and be careful in one's thinking, but includes a partially inappropriate understanding of the framing of the problem. At Level 3 ("flourishing"), students manage to consider and understand another way of looking at the problem, are able to challenge some aspect of it (or see why it could be challenged), and are self-aware of the strengths and possibly limitations of their position. Finally, at Level 4 ("outstanding"), students went further and explored several rather than just one alternative theory or formulation of the problem, challenged several positions, and showed an openness to feedback and critiques in addition to their own understanding of the strengths and limitations of their position.

When provided with an appropriate task that requires them to demonstrate critical thinking, this rubric can be used to clarify expectations about critical thinking, to give feedback on students' work process and output, and even to grade student work on this dimension by attaching points to the different levels of the rubric. It should be noted that typically, other learning outcomes such as content knowledge, communication, creativity, etc., will also be graded, and specific descriptors of proficiency level for those other learning goals should also separately provided.

Exams and standardized assessments of critical thinking

Critical thinking should also be one of the dimensions assessed in national exams –in particular, in exams at the transition of different levels of education (for example, university entrance exams where they exist). It can also be part of (low-stake for students) national evaluations, to inform the system. Several countries have started to develop these. In France, the Ministry of Education is developing new computer-based assessments on critical thinking alongside other skills such as creativity, collaboration, and complex problem-solving, to measure the cross-curricular skills required by the French curriculum as a part of the students' annual evaluations (Rocher, 2019).

At the international level, the OECD PISA program measures some aspects of critical thinking as part of its assessment of science — notably the logical part of critical thinking when asking students to demonstrate or to identify scientific reasoning. Moreover, the assessment of global competences focused on a key aspect of critical thinking: perspective-taking. In some ways, it could be interpreted as an assessment of critical thinking focusing on the international culture, subject as it is partly about understanding and appreciating work views of others (OECD, 2018, 2020).

Many standardized tests also exist in higher education, such as the California Critical Thinking Skills Test, the Collegiate Learning Assessment, Critical-thinking Assessment Test (CAT), the HEIghten critical thinking assessment, the International Critical Thinking Essay Test, or the Macat Critical Thinking Assessments. Ennis and Chatin (2020) listed and annotated over 40 critical thinking assessments in English. Advantages of these standardized assessments are that they provide systems or institutions with quick benchmarks and some standards. However, as with any test, it is crucial to be sure that the measured construct of critical thinking matches the definition of critical thinking adopted by the education system or institution. They are also not a substitute for developing formative and summative tests to be used by teachers in schools and universities.

5. 10 steps for policymakers and practitioners to drive the change

This final section summarizes the method that could drive actual change towards competency-based curricula for critical thinking on the ground. Some of the steps are at the system level, whereas others are for teachers and school principals at the implementation level.

Step 1. Be explicit about why creativity matters in your education policy

The reasons why critical thinking has become essential in education should be clearly articulated in the country's or institution's policy or strategy. This can be for economic (jobs or innovation), political, or personal reasons.

Step 2. Define what you mean by creativity

In many cases, the lack of implementation is not due to a resistance to change, but more to the lack of clear understanding of what the objectives mean. Teachers tend to vaguely understand what critical thinking means; what it means in their teaching or how they can observe whether learners are making progress may be unclear. Thus, it is important to have both definitions and conceptual rubrics that are anchored in, and to make the research literature on those subjects more tangible and applicable.

Step 3. Integrate creativity in the subject knowledge in the curriculum

Many curriculum documents include a competency list in addition to the knowledge, values, and attitudes that education aims to develop. It is noteworthy that subject knowledge and skills are not separate. Adding competencies to knowledge is just a way to make that traditional aspect of education more salient. The importance of critical thinking as a learning outcome is often described in the preambles of curriculum documents, while the "knowledge" part focuses on content and procedural knowledge of the subject. This does not help, as curricula should also keep in mind and exemplify how critical thinking is embedded in the teaching of the subject.

Step 4. Make creativity part of exams and evaluations

What is assessed is eventually what matters to students and teachers. Thus, it is essential to assess critical thinking formally, either as part of national evaluations or as part of exams. This has to be done in the context of the assessment of a subject rather than as a generic exercise. This will show students, parents, and teachers (and employers) that the skill is taken seriously, and become an integral part of what students are supposed to learn in a country or an institution.

Step 5. Create alignment and incentives at all levels of education

The teaching and learning of critical thinking can start in primary education and continue through higher education. For this to happen, there should be some alignment and continuity from one level to the other. The OECD project on Fostering Creativity and Critical Thinking in Education showed that the same conceptual rubrics and methods could be used at all levels of education, with the right teacher adaptations. Higher education institutions have to value critical thinking and include some critical thinking dimension in their university entrance exams, where those exist, for the secondary education level to take it seriously. This creates the right incentives and alignment of all actors in the system.

While these first 5 steps concern the system design, driving change at the practice level also draws on conditions that were experienced during the above-mentioned project. One of those important conditions is time, as driving change is challenging and takes time. Countries could develop and implement practice-engaged programs such as the one developed and implemented by the OECD. The project was based on four elements: collaborative work with practitioners to understand how their teaching can give more space to critical thinking and develop teacher-friendly resources; providing teachers with learning opportunities; work with teachers on the establishment of rubrics, lesson plans, and assessments; and, evaluation of progress to identify practices that work best, but also to adjust the project if necessary. Those are reflected in the 5 next steps.

Step 6. Make sure school principals support work towards fostering creativity

As is the case at the system level, it is important for the institution's leadership to publicly support and embrace the development of skills such as critical thinking as part of its education strategy. Improving one's practice is difficult and time-consuming, and some teachers may feel the effort is not worthwhile if not recognized in some way; others will not even feel authorized.

Step 7. Provide teachers with continuous professional learning opportunities

Participating in action research projects or any transformative program is in itself a professional learning opportunity. However, when some practices are innovative, they have to be accompanied by possibly diverse forms of professional learning — from workshops to peer learning through exchanges and diverse platforms. These professional learning opportunities can take different forms depending on the context, but they have to be more than a one-off workshop, and be sustained over time.

Step 8. Provide teachers with learning tools and exemplars

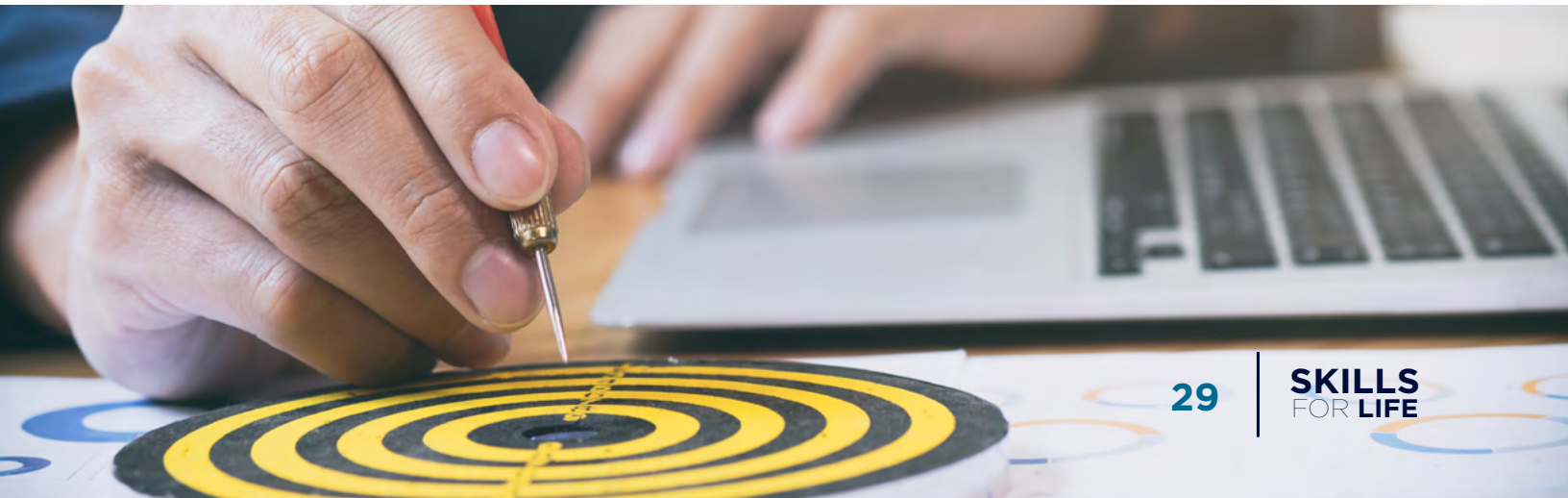
While professional development through face-to-face is ideal, teachers should also be empowered to develop their students' critical thinking skills through other remote, independent forms of learning. As part of its project, the OECD developed a bank of resources for teachers comprised of conceptual rubrics (including those presented above), assessment rubrics, lesson plans, assessment tasks, design criteria for good lessons involving creativity or critical thinking, and a method to use them as a complementary set of resources. Video examples showing how those lessons could be implemented in the spirit of the OECD Global Teaching Insights platform, or classroom observation tools, could also be provided. The objective is really to trigger teachers' self-reflection and to get them inspired by peer educators' work so they can design or adapt their own lesson plans.

Step 9. Create and support international and domestic communities of practice

Learning communities or communities of practice bringing together professionals interested in similar topics or trying to achieve similar goals are a strong way for them to learn. They can learn with peers either through face-to-face or virtual learning communities. This can certainly be created around specific programs or projects, whether national or international — but also, albeit with more uncertainty, around digital platforms where peers exchange ideas, comment on each other's lessons, etc.

Step 10. Monitor and evaluate the effects and impacts

Finally, it is essential to invest in some form of monitoring, and ideally a proper evaluation of teachers' practices. Do they improve their teaching skills when participating in those programs? Do their learners become stronger at critical thinking while continuing to learn the subject knowledge they are supposed to learn? Do their social and emotional skills improve, as well as their engagement in learning? Does education become more enjoyable and meaningful? The OECD developed an evaluation protocol and instruments for countries or districts interested in evaluating their progress with a robust quasi-experimental design. Depending on the context, other forms of evaluation could also be considered.



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