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PISA 2021 CREATIVE THINKING STRATEGIC ADVISORY GROUP REPORT

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Table of contents

Tables

Figures

PISA 2021 Creative Thinking Strategic Advisory Group Report

A. Introduction

1. At its 43rd meeting in Paris in April 2017, the PGB agreed on the relevance of establishing creative thinking as the innovative domain for PISA 2021 and asked the Secretariat to clearly define the scope of the assessment early on, and to explore in which domains to anchor the assessment and how to separate creative thinking from both prior knowledge and performance in the main measurement domains.

2. A Strategic Advisory Group was established to offer initial guidance on the conceptual development of the creative thinking assessment. This report, written by the Advisory Group's co-chairs, represents the Group's thinking so far. It was discussed by the PGB's Strategic Development Group in October 2017.

3. The PGB is asked to **CONSIDER** the report's analysis and emerging conclusions; and **PROVIDE FURTHER DIRECTION** for the conceptual development of the creative thinking assessment.

B. Background

Creative Thinking for a changing world

4. Creative Thinking is the process by which we generate fresh ideas. It requires specific knowledge, skills and attitudes. It involves making connections across topics, concepts, disciplines and methodologies. And it leads in turn to new understanding and impact. For young people preparing for a challenging and uncertain future, the capacity to think creatively will be an important underpinning competence.

5. In 2021, the OECD is planning to assess Creative Thinking, as the innovative domain in what will be the eighth PISA cycle. It will be the first time that the international community has conducted an assessment and analysed the factors that drive success in this significant new educational field.

6. The decision to develop and move forward plans for an international assessment of Creative Thinking in 15-year-olds was taken by the PGB at its meeting in April 2017. The PGB reviewed an analysis of relevant conceptual frameworks, malleability, assessment feasibility, cross-cultural relevance and the significance for broader learning outcomes. The analysis also identified five key policy issues that an assessment of Creative Thinking could be expected to illuminate:

- The most effective strategies for teaching and assessing Creative Thinking
- The best programmes for developing teacher capabilities to teach creative thinking
- Relation between performance in Creative Thinking and in maths, reading and science
- The role of families in nurturing Creative Thinking
- The links between Creative Thinking and the use of digital technology

7. The PGB concluded that there are substantial grounds for confidence that a PISA assessment of Creative Thinking can be successful and impactful. At the same meeting, a proposal was endorsed to establish a Strategic Advisory Group, to offer authoritative guidance on how Creative Thinking might be further conceptualised and assessed. Accordingly, the following experts have been convened:

- **Bill Lucas**, UK, Professor of Learning and Director of the Centre for Real World Learning at the University of Winchester in England. He has been central to OECD CERI work on teaching and assessing Critical and Creative Thinking. (Co-Chair)
- **Jack Buckley**, US, former Commissioner of the US Department of Education's National Center for Education Statistics. Currently Senior Vice President for Research and Evaluation at the American Institutes of Research. (Co-Chair)
- **Cesar Nunes**, Brazil, education researcher at the University of Campinas. He, too, has been a key contributor to the CERI project.
- **Sharon Foster**, Australia, Victoria Curriculum and Assessment Authority. Managing Victoria's Critical and Creative Skills Assessment.
- **Lee Ngan Hoe**, Associate Professor, Mathematics and Mathematics Education, NIE Singapore. A teacher educator working closely with Singapore's schools on teaching and assessing aspects of Creative Thinking.
- **Maud Besancon**, Associate Professor at the University of Rennes. Expert in education and child psychology

8. The group was invited to consider an assessment with two main features:

- A cognitive test, delivered in a rich digital environment and consisting of innovative assessment items, to test the capacity of students to use creative thinking approaches, to analyse situations and problems and develop multiple solutions.
- A background questionnaire, targeting students, teachers, parents and schools, to measure other aspects of students' engagement with Creative Thinking and to help understand the factors that best explain and predict student achievement in Creative Thinking.

C. Conceptualisation

History

9. Creative Thinking is a multi-faceted phenomenon occurring in many domains in all aspects of life – school, work, family and the wider world.

10. The study of creativity is some seventy years old. Most researchers trace its inception to the work of Guilford (1950). Guilford suggested that there are two kinds of thinking: convergent (coming up with one good idea) and divergent (generating multiple solutions). Building on this line of thought Torrance (1970) developed four sub-categories – fluency, flexibility, originality and elaboration.

11. Sternberg (1996) has argued that creativity is three-dimensional. It requires synthesising – the ability to see problems in new ways and escape from conventional thinking; analysing – being able to recognise which ideas are worth pursuing and which are not; and contextualising – having the skills in different settings to persuade others of the value of any specific idea. This idea of context reminds us that creative thinking is

both a solo and a collective activity and most often has a social component (Lave and Wenger, 1991).

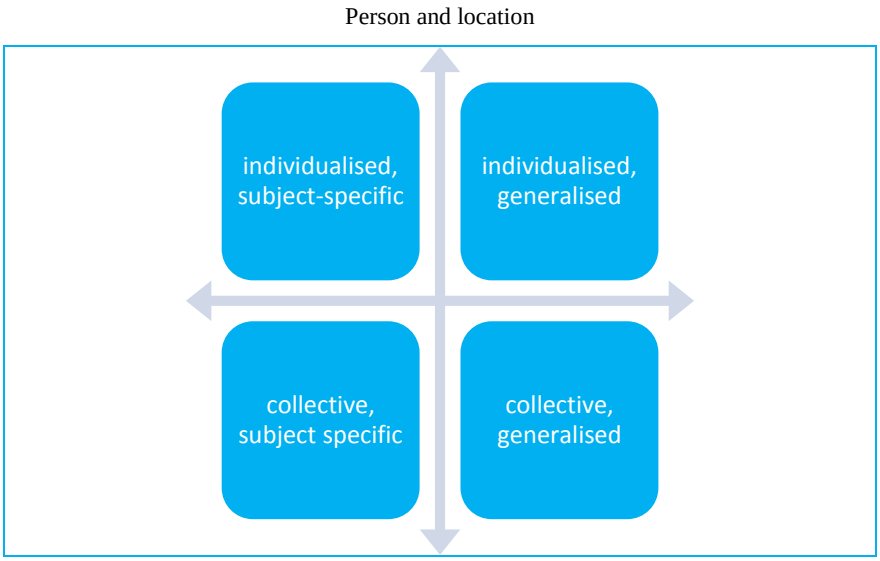
12. Creativity can be viewed as domain-specific or domain-free. There are proponents on both sides of the argument and cases can be made for both views. Typically where the focus is on individuals and creative processes such as divergent thinking the case is stronger for it being domain-general (Plucker, 2005), while when the attention is on creative products it tends to be seen as domain-specific (Sawyer, 2006). There is also a school of thought that sees creativity as having both general and specific components (Baer and Kaufman, 2005).

13. In a comprehensive meta-analysis, Treffinger found 120 definitions of creativity and helpfully grouped them into four broad categories – generating ideas, digging deeper into ideas, openness and courage to explore ideas and listening to one's inner voice (Treffinger et al., 2002).

14. Creativity is closely connected with learning. They both, for example, involve imagination and imitation. Creativity is, nevertheless, but one aspect of learning, albeit a significant and complex one.

15. Craft (2008) provides a model of creativity, Figure 1, within which different approaches can be visualised:

Figure 1. Creativity



Craft's model reminds us that creativity, like Creative Thinking, exists within and beyond domains and has both an individual and a social component.

16. Students can exhibit growth in creativity as part of normal educational development. In Australia, for example, Victoria's state curriculum continuum shows what progression looks like, in two year periods, over the life of a young person in formal schooling in the broader areas of Critical and Creative Thinking[1] and the global initiative

[1] http://victoriancurriculum.vcaa.vic.edu.au/critical-and-creative-thinking/introduction/scope-and-sequence

New Pedagogies for Deeper Learning[2] (Fullan et al, 2016) has shown how criteria can be developed to describe progress using five markers – limited, emerging, developing, accelerating and proficient. A study undertaken by the Centre for Real-World Learning (Lucas et al, 2013) used the concept of strength (degree to which it is not dependent on others for support), breadth (transferability to other domains) and depth (complexity of knowledge and skills) in describing progress.

17. Craft (2001) usefully reminds us that while only a few may aspire to genius, all of us can show a more ordinary form of creative thinking, what she termed 'little c creativity', the focus of most teaching and learning in schools.

18. In Creative Thinking there has been a shift away from thinking *skills* to thinking *routines* or *habits* (Costa and Kallick, 2002; Ritchhart et al., 2011; Lucas et al. 2013; Lucas, 2016). For unless creative thinking skills are routinely deployed in different domains, they are only useful in an abstract sense. As with many cross-disciplinary capabilities or competences there is a live debate about the degree to which such capabilities are transferable to other contexts (Halpern, 1988).

19. Creative Thinking in the real-world involves both innovation and implementation, originality and functionality. It requires individuals to play with possibilities and make new connections as well as reflecting critically and cooperating appropriately with others; to use intuition and tolerate uncertainty as well as developing techniques and new products/ processes. Different creative habits of mind are useful to various degrees in Creative Thinking according to context and stage. So, for example, playful imagining may be especially helpful as fresh ideas are being generated, while a focus on critical reflection and giving and receiving feedback have an obvious utility as ideas move into action and decisions have to be made about prioritising resources.

20. In designing the PISA 2021 test of Creative Thinking we will be particularly focusing on the processes by which imagination and inquisitiveness can be harnessed in a range of engaging contexts.

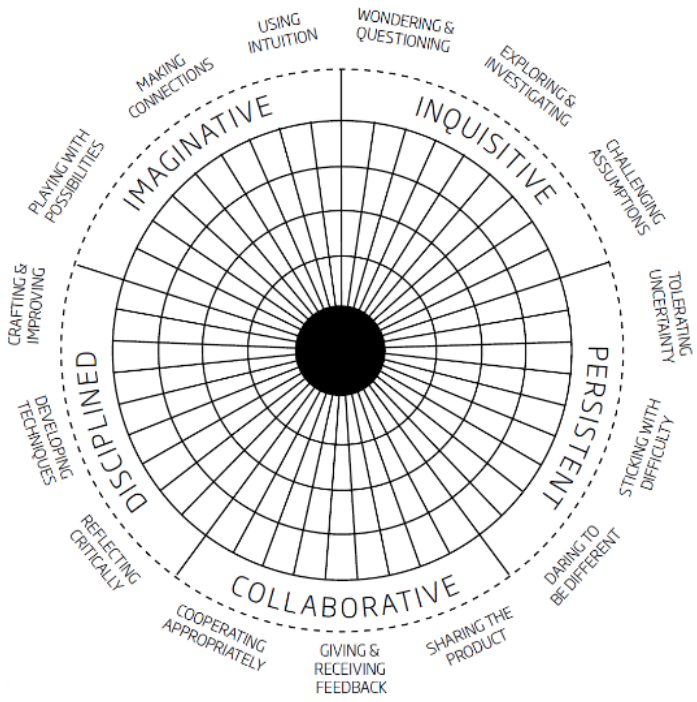
21. In developing the concept of Creative Thinking there will, of course, be many cultural issues to consider. What seems innovative in one part of the world, for example, may be commonplace in another, just as the real-world expression of an innovation in one country may be easier or more difficult in another, (Hempel and Sue-Chan, 2010).

A framework for Creative Thinking

22. Since 2015 the OECD Centre for Educational Research and Innovation (CERI) has led an exploration of the teaching and assessment of Creative Thinking in a number of countries – Brazil, China, Finland, France, Hungary, India, Italy, Netherlands, Slovak Republic, Thailand, United States, and Wales. The conceptual framework on which the project is based is a five-dimensional model of Creative Thinking developed at the Centre for Real-World Learning (Lucas et , 2013; Lucas, 2016), Figure 2.

[2] http://npdl.global/wp-content/uploads/2016/12/npdl-global-report-2016.pdf, pp. 10-12

Figure 2. The Centre for Real-World Learning's five dimensional model of Creative Thinking



23. The model offers a broad view of creativity and has begun to be used in schools across the world. Two dimensions – 'imaginative' and 'inquisitive' – are commonly associated with Creative Thinking. Two other dimensions -'disciplined' and 'collaborative' - are too often neglected. 'Disciplined' is included to challenge the mistaken idea that creative ideas or products emerge without practice; it reminds us that learners need to spend time developing expertise and skill, all the while crafting and improving their work. 'Collaborative' keeps in mind that thinking creatively is normally a social activity. 'Persistent' includes three dimensions which are also closely associated at a generic level with effective learning but specifically important in Creative Thinking.

24. This model deliberately takes a multi-dimensional definition of Creative Thinking, seeking to show how modes of thinking associated with both creativity and critical thinking have valuable contributions to make. The PISA 2021 test will not seek to explore the full range of Creative Thinking habits. As we describe later it will focus on those habits more associated with creativity than with critical thinking.

25. The five Creative Thinking habits are:

1. *Inquisitive*

Creative individuals are good at uncovering and pursing interesting and worthwhile questions both in a specific subject and more generally.

- Wondering and questioning. Not simply being curious, creative individuals pose concrete questions about things to help them understand, and develop new ideas.

- Exploring and investigating. Questioning things alone does not make a creative thinker. Creative individuals act out their curiosity through exploration and follow up on their questions by actively going out, seeking, and finding out more.
- Challenging assumptions. It's important to maintain a degree of appropriate skepticism, not taking things at face value without critical examination.

2. Collaborative

In today's world complex challenges require creative collaboration. Creative individuals recognize the social dimension of the creative process.

- Sharing the product. Creative outputs matter, whether they are ideas or things creating impact beyond their creator.
- Giving and receiving feedback. Creative thinkers want to contribute to the ideas of others, and to hear how one's own ideas might be improved.
- Cooperating appropriately. The creative individual co-operates with others taking into account the nature of the group, the kind of problem and the stage at which the group has reached.

3. Imaginative

At the heart of Creative Thinking is the ability to come up with imaginative solutions and possibilities.

- Playing with possibilities. Developing an idea involves manipulating it, trying it out, and improving it.
- Making connections. Seeing new links between ideas is an important aspect of the synthesizing process of Creative Thinking.
- Using intuition. The use of intuition allows individuals to make new connections tacitly that would not necessarily materialize given analytical thinking alone.

4. Persistent

Creative individuals do not give up easily.

- Sticking with difficulty. Persistence in the form of tenacity is important, enabling an individual to get beyond familiar ideas and come up with new ones.
- Daring to be different. Creative thinking demands a certain level of self-confidence as a pre-requisite for sensible risk-taking.
- Tolerating uncertainty. Being able to tolerate uncertainty is important when actions or even goals are not fully set out.

5. Disciplined

Creative Thinking, like any 'subject' requires knowledge and skill in crafting and shaping the creative product or process.

- Developing techniques. Creative thinkers practise a range of conceptual and practical skills in order to improve.
- Reflecting critically. Evaluation is the way in which progress can be seen and understood and the quality of new ideas or novel thinking can be checked.

- Crafting and improving. Taking pride in work, attending to details, practising and correcting any errors are indicators of the higher levels of Creative Thinking.

26. The OECD-CERI project has taken aspects of the Centre for Real-World Learning's model (Figure 1) and helpfully described it as both a set of activities and a process over time with four stages:

1. Inquiring - playing with unusual and radical ideas
2. Imagining - generating ideas and connections
3. Doing - producing, performing or envisioning something that is personally novel
4. Reflecting - assessing the novelty of a solution and of its possible consequences.

Of course what is unusual or radical to one learner may not be for another, just as personal novelty will be a function of age, experience, expertise in a domain and so forth.

Construct description and analysis

27. Creative Thinking is made up of knowledge (disciplinary, inter-disciplinary and practical), skills (cognitive and metacognitive, social and emotional, physical and practical skills) as well as certain attitudes and values.

28. Creative Thinking calls on both divergent and convergent thinking. It is malleable and can be developed by cultivating certain habits of mind (attitudes), acquiring and practising various skills and learning and applying knowledge, often from more than one discipline.

29. In arriving at our proposed construct analysis, Table 1, we have taken into consideration:

- An extensive body of research about Creative Thinking – which has led us to focus largely on the Inquisitive and Imaginative dimensions of the five-dimensional model (Figure 1), both divergent and convergent thinking modes, along with an emphasis on being Disciplined, reflecting our interest in the learnability of Creative Thinking and how progression is indicated
- The potential for assessment innovation – by selecting five skills not much measured in schools and corresponding attitudes that are empirically linked to achievement in Creative Thinking.
- The opportunity to explore both the *products* or outputs – broadly defined – of students' Creative Thinking and the *processes* by which outputs are achieved, including, for example, idea generation, refinement and implementation.
- The orientation of current Creative Thinking teaching and assessment – drawing on OECD CERI evidence to ensure this is reflected in the PISA assessment
- Cultural awareness – focusing on processes of thinking that support creative solution across all cultural contexts; and avoiding the assessment of values, on the grounds that they are highly influenced by culture.

Table 1. Dimensions of Creative Thinking to be explored in PISA 2021

Skills	Attitudes
- Wondering and questioning	- Tolerating uncertainty
- Exploring and investigating	- Sticking with difficulty
- Playing with possibilities	- Daring to be different
- Making connections	
- Crafting and improving	

D. Assessing Creative Thinking

Introduction

30. The previous section explored a broad conceptualisation of the domain of Creative Thinking and placed some restrictions on it that can begin to guide the contractor toward a narrower, operational definition, amenable to measurement under PISA testing conditions. The purpose of this section is to add greater detail to this operational definition and provide clear guidance for the development of the PISA Creative Thinking assessment.

Structure and Form of the Cognitive Assessment

31. The PISA cognitive assessment consists of "clusters" of items that are presented to sampled students via a matrix sampling design, so that no student sits for the entire assessment. The operational test length is two hours, with each student presented with four 30 minute clusters. Two of these clusters are drawn from the major domain (which rotates among the three content areas of Reading, Mathematics, and Science). The remaining hour of testing time is dedicated to one or two clusters in one or two of the other domains, including the innovative domain. We anticipate the need to develop enough assessment content in Creative Thinking to allow for the field testing of four clusters, and we expect a sufficient number of items or testlets will be accepted in field testing to form three operational clusters—a total of 90 minutes of operational Creative Thinking content.

32. PISA 2021 will be designed to be taken entirely via computer, which will allow for the development of innovative item types ranging from digital presentation of traditional items all the way to interactive simulation and potentially the use of process-tracing and measurement of student response timing and strategies and behaviours (e.g. mouse tracking or use of editing features) in scoring.

Operational Definition of Creative Thinking for the Cognitive Assessment

33. As discussed above, the PISA 2021 cognitive assessment of Creative Thinking will measure a construct composed of five selected skills: Wondering and Questioning, Exploring and Investigating, Playing with possibilities, Making connections, and Crafting and improving.

34. Each of the five skills can be further broken down into multiple sub dimensions. However, it is not necessary that the assessment clusters include content from every one of these sub dimensions.

35. Our current view of the sub dimensions for each skill is as follows, Table 2:

Table 2. Creative Thinking Skills

	Wondering and Questioning
1	Generating good questions, useful ideas and fresh thinking.
2	Using imagination to consider multiple possibilities and perspectives.
	Exploring and Investigating
1	Seeking out additional information or points of view to see an idea from other perspectives.
2	Going more deeply into ideas or lines of enquiry to consider the potential for implementation of new processes or products.
	Playing with Possibilities
1	Considering multiple potential future uses and applications of ideas
2	Developing scenarios with many different lines of thought and action
	Making Connections
1	Recognizing the possible linkages between concepts and ideas within a domain.
2	Combining concepts and ideas across domains and timescales to generate fresh thinking.
	Crafting and Improving
1	Being willing and able to review own process or product development as part of a cycle of improvement.
2	Creating improved drafts, prototypes or iterations which build on earlier versions

36. These five skills are assumed to be closely correlated, although theoretically distinct. To this extent, it is possible that the test items will yield a unidimensional scale. On the other hand, some if not all the skills entail both convergent and divergent thinking, albeit in varying proportions: if it is thought that the divergence and convergence aspects of Creative Thinking are fundamentally different, then a unidimensional scale will not be achieved, as the same task (or set of tasks) cannot measure both. This critical issue will require further investigation during the field test.

37. Will the assessment require the construction of test items within a specific domain or domains? Since we are interested in assessing not just creative processes but creative products too, the assessment should indeed be domain-specific (paragraph 12 above). It is proposed that the test developer should design items and testlets set in the PISA domains familiar to all students in the assessed population: Reading, Mathematics, and Science. It is not necessary that the items be balanced equally across these domains. Indeed, two or even three domains might be combined in a single item. For example, a Making Connections item set may require the student to apply a mathematical concept in an unfamiliar scientific context.

In addition, the assessment items and/or testlets should be set in contexts reflective of real-world educational tasks or problems appropriate for the global 15-year-old population, in order to make the assessment more authentic and engaging for students and enhance face validity with the public and policy makers.

Cross-cultural Validity

38. Given the general goal of PISA to produce cross-nationally and cross-culturally valid and reliable educational measurement, it is imperative that the 2021 Creative Thinking assessment items be developed in such a way as to ensure that they do not introduce any form of bias or differential functioning by student national origin or membership in a defined subpopulation such as a language or ethnic minority group.

39. The assessment of creativity and, by extension, Creative Thinking in a cross-national study is complex due to cultural differences in definition (Fryer and Fryer-Bolingbroke 2011). This has implications for valid assessment design. For

example, Shah (2013) compares the performance of subjects on the Abbreviated Torrance Test for Adults in the United States and India and finds that, while their overall ability score distribution is similar, there are performance differences by national original in some content domains. This may be driven by different curricular or cultural emphasis on creativity in some domains (i.e. legitimate average ability differences) or it may be driven by differential item functioning (DIF). The PISA 2021 Creative Thinking assessment should be designed to measure the former while avoiding the latter.

40. The assessment developer should establish steps at both the content development/ review stage and at the pilot/field testing/psychometric review stage to ensure cross-cultural validity. This may include specialized training for item developers who may have limited experience in developing item sets for cross-national/cultural assessment, multiple levels of cross-national expert review at the item screening stage, and testing of item sets for cross-cultural DIF.

Item/Testlet Types

41. Since PISA 2021 will be a computer-administered assessment, the test developer should take full advantage of the digital presentation in the measurement of the skill dimensions. We envision that an operational cluster of Creative Thinking assessment content will consist of between 2 and 4 testlets or item sets sharing a common stimulus. For example, in the case of an Exploring and Investigating item set in a science context, the student may be presented with a small simulation of a laboratory environment and be able to design an experiment given some equipment constraints or other factors that require a creative solution. An item set like this should not assume any particular science content knowledge (this could be instead provided in the body of the stimulus/simulation) but instead measure Exploring and Investigating through a combination of probes/prompts and process tracing of how the student engages with the simulated environment to seek one or more solutions.

42. The developer may want to draw on more traditional assessments of creativity or Creative Thinking in the creation of some items within item sets if such sources provide valid and reliable items that measure aspects of the skills enumerated above. For example, the Torrance Test of Creative Thinking (TTCT as revised in Torrance 1999) has extensive validity and reliability data and TTCT verbal creativity scores have been shown to have predictive validity over a long period (Plucker 1999). Similarly, Urban and Jellen's (1996) Test of Creative Thinking (Divergent Production) takes an image production approach and has demonstrated high levels of concurrent validity and internal reliability cross-nationally. While neither these nor many of the other related assessments that have been developed over the years is sufficient to measure all aspects of the Creative Thinking construct defined here, they may nevertheless be a useful source.

43. Ideally all the items in the Creative Thinking cognitive assessment will be machine scoreable either through the analysis of simple input (e.g. multiple choice) or else through the analysis of more complex student response process data. However, it is likely that some items may require human scoring (machine scoring infeasible) if this is necessary for valid and reliable measurement of one or more dimensions of the construct. Again, in the event of item sets requiring human scoring, special care must be taken in the training of raters and the assessment of interrater reliability during the development of scoring procedures to ensure that rater severity is uniform and not varying cross-culturally.

44. As an example of an item set that measures several of the skills and sub dimensions of Creative Thinking as operationally defined here, consider the "Bike Lanes" task from the 2014 National Assessment of Educational Progress Technology and Engineering Literacy assessment[3] administered to eighth grade students (approximately 13 years old) in the United States. This task first explains the design criteria of an urban bicycle route system and then asks the student to redesign the route while taking into account constraints of cost, time, and geography. Overall this task, although not explicitly designed as part of a Creative Thinking assessment, requires that the student demonstrate aspects of Exploring and Investigating, Playing with Possibilities, and Crafting and Improving. Breaking the task up into numerous subparts means that some are amenable to machine scoring (i.e. a single correct answer that can be determined from simple student input) while others require human judgment via a scoring rubric.

Reporting Proficiency in Creative Thinking

45. In keeping with standard practice in past PISA assessments, scores on the Creative Thinking assessment should be placed, if possible, into three achievement levels (four categories) – Below level 1, Level 1, Level 2, and Level 3, in order of increasing difficulty. This will require setting three achievement thresholds derived via a judgmental standard setting process.[4]

Measuring the Attitudinal Dimensions of Creative Thinking in the Student Background Questionnaire

46. Along with the cognitive assessment sections, PISA also includes a student background or contextual questionnaire. The structure of the student questionnaire has varied somewhat across PISA cycles, but it is likely that, for Creative Thinking, students would be requested to respond to approximately 30 minutes' worth of questions in three broad areas (besides demographics and basic descriptive information): student characteristics (including, in some cases, personality traits or other unobservable constructs), experiences and practices (classroom and otherwise) related to the domain of creative thinking, and disposition toward the domain of creative thinking (including concepts like self-efficacy as well as attitudinal descriptors).

47. Students' attitudes in the three key dimensions identified above, Daring to be different, Sticking with difficulty, and Tolerating uncertainty, will be measured in the student background questionnaire. Unlike in the case of the five cognitive skill dimensions, we will report out performance on these three scales individually. As in the cognitive Creative Thinking assessment, the items in the attitudinal scales must be cross-nationally/cross-culturally valid and free of differential item functioning to the extent feasible.

[3] https://www.nationsreportcard.gov/tel_2014/#tasks/bikelanes.

[4] Although there are several possible methods of standard setting, experience from the 2014 U.S. National Assessment of Educational Progress's Technology and Engineering Literacy assessment (a somewhat analogous complex, computer-based test) suggests that either an item-mapping or a body of work approach may be advisable (http://downloads.pearsonassessments.com/naeptelassessment/assets/documents/TEL%20ALS%20Design%20Document%2010%2028%202014.pdf)

48. Attitudinal constructs will be measured through the construction of scales comprised of relevant sets of items. In each case, in addition to issues of cross-cultural appropriateness, the developer should design the scales to mitigate social desirability biases in response (Table 3).

Table 3. Attitudinal Dimensions of Creative Thinking

	Daring to Be Different
1	Willingness to seek and use novel solutions to problems
2	Acceptance of diverse viewpoints within a team with a particular goal or task assignment
3	Extent to which the student agrees that reward of novel ideas or processes can exceed the risk
	Sticking with Difficulty
1	Extent to which the student continues to work on academic tasks even when encountering obstacles or setbacks
2	Extent to which the student continues to work on non-academic tasks even when encountering obstacles or setbacks
3	Extent to which the student agrees that sticking with difficulty is a necessary component of creative thinking
	Tolerating Uncertainty
1	Willingness to take on tasks in an academic setting that are require new solutions and approaches that may not be successful
2	Willingness to take on tasks in a non-academic setting that are require new solutions and approaches that may not be successful
3	Extent to which student recognises that the discomfort of not having clear answers can be a valuable part of the creative thinking process

Other Questionnaire Considerations

49. Note that while the PISA student questionnaire will be developed to measure these three attitudinal scales, the questionnaire should also measure relevant aspects of classroom practice, students' self-reports of relevant educational experiences and relevant learning outside the classroom.

Next Steps

50. Based on the guidance of the Strategic Advisory Group, the following additional work should be undertaken:

1. Developing a consensual view on complexity levels and relative weightings, in relation to the assessment of skills.
2. Determining and including performance level descriptors for the three achievement levels, describing in each case what 15-year-old students should know and be able to do.
3. Providing example task models in one or more skill dimensions.
4. Identifying examples of existing good practice in schools around the world.

E. Embedding Creative Thinking in Education

51. It is in the nature of the PISA Innovative Domain that the areas chosen for assessment are nascent or at least still emerging. Creative Thinking falls somewhere between the two. As a topic, it is attracting interest in many countries and the decision to assess it as part of PISA 2021 will raise its profile further. But without the development of national and local strategies and the emergence of best practice, Creative Thinking will remain at the margins of the school experience. As we look around the world, what progress has been made so far and what directions might be taken next?

52. Creative Thinking features in a number of national and state curricula. Sometimes in the form of Creativity or Critical and Creative Thinking, it appears as a cross-cutting

competence in the frameworks of Korea, Singapore, Finland, Estonia, Canada and Australia, amongst others. It would be true to say that summative assessment has not kept pace with curriculum, with the exception of Victoria, where assessment items have been developed and deployed across Years 1-10.

53. In a number of countries, often without the spur of formal curricula, Creative Thinking is being incorporated into teaching and learning in schools. For example, Thomas Tallis School in London emphasises the development of creative habits of mind across the curriculum; and Brunswick East Primary School in Melbourne provides a Critical and Creative Thinking enquiry project into human ingenuity, innovation and invention. Finland is designing innovative approaches to formative assessment, encouraging students to use cell phones to self-report on their creative skills and attitudes. Under the umbrella of the CERI project, Brazil has led the way in combining teaching and assessment. Teachers have designed a range of activities to nurture student creativity. Students self-assess, using scaffolding rubrics. In turn, the teachers publish the activities, outputs and self-assessment materials within a professional learning community.

54. There are relatively few examples, however, of professional development initiatives for Creative Thinking, nor in areas such as leadership and stakeholder engagement. Advances in all three will be vital if Creative Thinking is to be more widely embedded.

55. In *Teaching Creative Thinking* (2017), Lucas and Spencer argue that professional development might take a number of directions, including helping teachers apply creative thinking to their own practice, through innovation, reflection, challenge and adjustment; and introducing signature pedagogies. They suggest that school leaders should support Creative Thinking by modelling creativity and risk-taking, exposing colleagues to new thinking and experiences and adopting creativity as a core value within the school.

56. There is clearly substantial scope for drawing stakeholders into developing Creative Thinking in students. With the concepts properly explained, parents can be enlisted to model critical and creative thinking in the way they talk to their children. Museums, galleries and other cultural institutions can offer programmes to elicit critical and creative responses. And employers have an opportunity to build creative and critical thinking skills through service learning and volunteering.

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