What does research say?

WHAT IS CURRICULUM OVERLOAD?

Time is a finite resource for both students and teachers, and students and teachers often feel that a curriculum is crowded or overloaded. When addressing the issue of curriculum overload, curriculum designers frequently face questions such as: "Is it real or perceived?"; "How can we accommodate new demands from society in an already crowded curriculum?"; and "How can we ensure breadth and depth of learning that are both achievable within the time allocated in a curriculum?".

Drawing on the existing literature to address these questions, curriculum overload can be analysed within four dimensions (Box 1).

Box 1 **Four dimensions of curriculum overload**

1. **Curriculum expansion** refers to the tendency to include new content items in the curriculum in response to new societal demands without appropriately considering what items need to be removed.
2. **Content overload** refers to the actual dimension of curriculum overload, rather than as it perceived or experienced (i.e. the excessive amount of content to be taught and learned in relation to the time available for instruction).
3. **Perceived overload** refers to the perceived or experienced dimension of overload, as reported by teachers and students.
4. **Curriculum imbalance** refers to disproportionate attention given to certain areas of the curriculum at the expense of others without appropriate adjustments in the low-priority areas.

Curriculum overload is also known as curriculum overcrowding or curriculum expansion (Voogt, Nieveen and Klopping, 2017[1]). It has been reported by researchers in both developed and developing countries, including Angola, Australia[1], People's Republic of China, England (United Kingdom), Indonesia, Japan, Kenya, Malawi, the Netherlands, New Zealand, the Philippines, Tanzania, Viet Nam, Wales (United Kingdom), Zambia and Zimbabwe (Majoni, 2017[2]).

It is important to note that **curriculum overload is not the same as excessive workload for teachers and school leaders**. Many factors other than the curriculum have an impact on teacher workload, such as changes in administrative structure or student population (Easthope and Easthope, 2000[3]).

This section introduces definitions of these concepts and presents policy considerations as well as research findings on possible impacts of these dimensions on students and teachers. It concludes with a list of areas where additional research can inform how to close knowledge gaps and better inform policies addressing the issue of curriculum overload.

WHAT IS CURRICULUM EXPANSION? HOW DOES IT AFFECT STUDENTS AND TEACHERS?

Curriculum expansion refers to the tendency to include new content items in the curriculum as a response to new societal demands without proper consideration of what needs to be removed. Content expansion is cumulative and often occurs without attempts to remove prior content. Thus curricula become overcrowded over time (Alexander and Flutter, 2009[4]; Kärner et al., 2014[5]; Kuiper, Nieveen and Berkvens, 2013[6]; Voogt, Nieveen and Klopping, 2017[1]; Morgan and Craith, 2015[7]). This can occur due to new societal demands or pressure from lobby groups and a general desire to retain what has always been included in the curriculum. Such societal demands create new pressures on curriculum and teachers.

New societal demands

In our fast-changing world, there are increasing demands on the curriculum to reflect changes in society. Including emerging societal demands, such as digital literacy, financial literacy, literacy for sustainable development and computational thinking, can add a refreshing sense of relevance to what students are expected to learn (Kuiper, Nieveen and Berkvens, 2013[6]). For example, in Japan, the 2017 reform expanded the curriculum to cover content related to languages and computer programming and further increased instruction time, in response to growing demands for globalisation and algorithm/AI/computational thinking. In 2018, as part of its reference framework for quality learning, the European Commission highlighted a set of eight competencies deemed critical for lifelong learning:

- literacy
- multilingualism
- numerical, scientific and engineering skills
- digital and technology-based competences
- interpersonal skills and the ability to adopt new competences
- active citizenship
- entrepreneurship
- cultural awareness and expression (European Commission, 2018[8])

To compete for curriculum space, various actors and interest groups add pressure to reflect their agenda in the curriculum. Oates (2011[9]) also lists competing policy interests on what should be included in the core curriculum as one of the main reasons for overcrowding the national curriculum in England (United Kingdom). Curriculum may also become overcrowded when governments attempt to represent and accommodate all interest groups (Australian Primary Principals Association, 2014[10])[2]. Rawling (2015[11]) for example, points out how England's geography curriculum has been increasingly used for political control, with politically sensitive topics such as climate change added or removed with little consultation with subject knowledge specialists, based on lobbying by various interest groups.

Such demands and pressures may contribute to curriculum expansion, as content priority is sacrificed to meet the political necessity of breadth in coverage (Australian Primary Principals Association, 2014[10]; Kirst, Anhalt and Marine, 1997[12])[3]. In England (United Kingdom), for example, the *Cambridge Primary Review Report* finds that, over time the "list of subjects has simply become longer and longer, and nothing has been removed to accommodate the newcomers" (Alexander and Flutter, 2009[4]). In the period between 1995 and 2010, the national curriculum had repeatedly expanded in response to new societal developments and challenges triggered by technologies, nutrition, media, environment and other fields of human activity (Oates, 2011[9]). Such curriculum expansion includes adding content updates, new subjects, new topics within subjects or new cross-curricular themes to the existing curriculum, and it contributes to curriculum overload, often setting overly ambitious learning goals.

Limited space in curriculum for accommodating new demands

Adding a new subject(s) is one of the high-stakes policy choice. Traditional subjects, such as reading, writing and literature, and mathematics, continue to appear as the main building blocks of curriculum in most countries. On average across OECD countries, around 53% of the curriculum in lower secondary education is devoted to four subjects: reading, writing and literature (15%); mathematics (12%); natural sciences (12%); and second and other languages (14%). The remaining time is distributed among "other" compulsory curriculum (38%) and compulsory flexible curriculum (9%) (Figure 1)[4]. This is true in most OECD countries, except in those where the curriculum does not prescribe learning time (e.g. the Netherlands and the United Kingdom), which gives schools and teachers considerable flexibility in terms of curriculum architecture (OECD, 2020[13]).

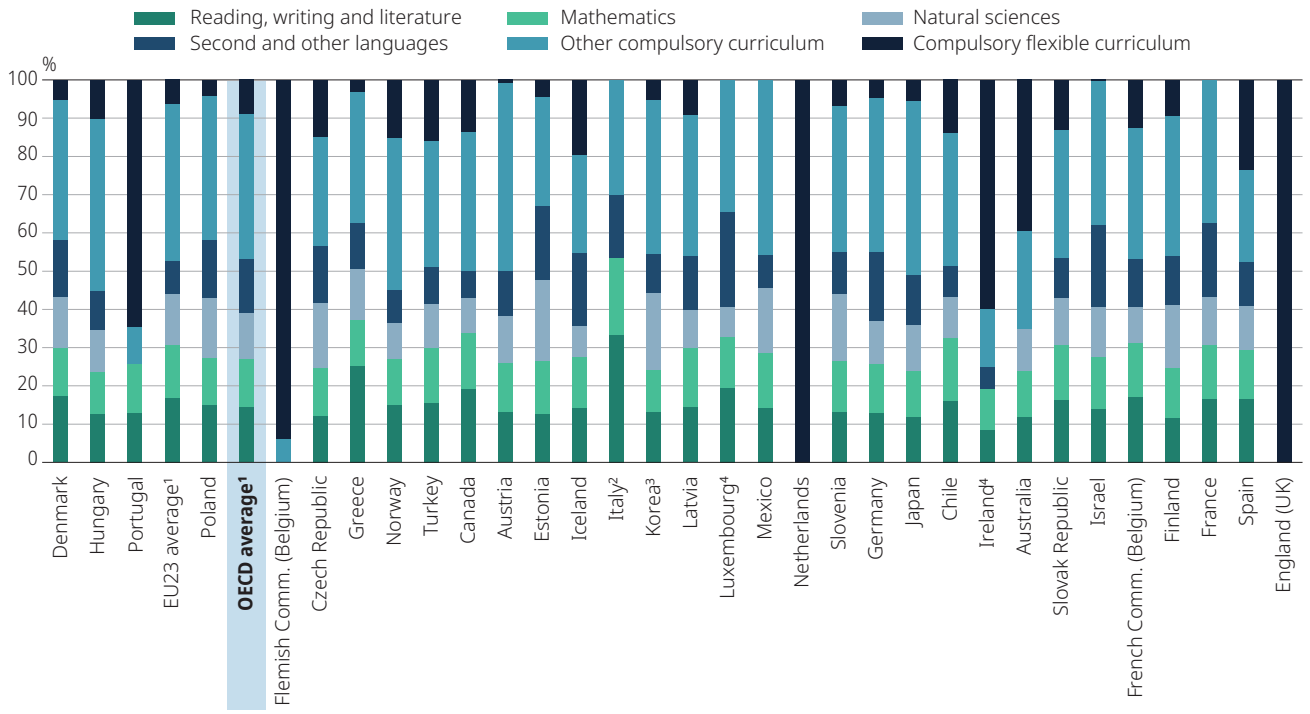
When assessing the risk of curriculum overload from adding a new subject, policy makers usually assess how this strategy will impact the experienced curriculum and how it will affect students' total learning time. They need to weigh the benefits of adding subjects against the current demands of the curriculum.

Unchanged teaching time over the last decade

Adding new topics within existing subjects is a policy alternative to adding new subjects. Embedding topics into what already exists is an option that is less politically charged, but this poses challenges for teachers. As a response to increasing societal demands, an increased number of themes and competencies are introduced in existing subjects (see "What kinds of cross-curricular themes do countries/jursidictions articulate to accommodate new demands?"), without removing much content.

Figure 1 **Instruction time per subject in general lower secondary education (2019)**

As a percentage of total compulsory instruction time, in public institutions



Notes: No marker for a country indicates that there are no data on the total number of compulsory instruction hours for one of the two corresponding reference years.

On 15 May 2020, the OECD Council invited Costa Rica to become a Member. While Costa Rica is included in the OECD averages reported in these tables and charts, at the time of its preparation, Costa Rica was in the process of completing its domestic procedures for ratification and the deposit of the instrument of accession to the OECD Convention was pending.

1. Excludes Australia (in 2014 only), England (United Kingdom), the Flemish Community of Belgium, Ireland (in 2019 only), the Netherlands and Portugal (in 2019 only).

2. Reading, writing and literature includes social studies. Mathematics includes natural sciences.

3. Natural sciences includes information and communication technologies and practical and vocational skills.

4. The second language of instruction includes other national languages taught in 2019.

Countries and economies are ranked in descending order of the percentage-point change in total compulsory instruction hours since 2014.

Source: (OECD, 2020[13]), Tables D1.2 and D1.4. See Source section for more information and Annex 3 for notes (https://doi.org/10.1787/69096873-en).

StatLink https://doi.org/10.1787/888934165282

Figure 2 shows the number of teaching hours per year in lower secondary education across countries and economies and over time. Although it shows considerable variation across countries, a point worth noting is that there is relatively little change in terms of the number of hours of instruction within each country from 2000 until 2018.

Teachers are thus required to integrate new themes or more content within the same amount of teaching time. As a result, students may face the risk of shallow learning if they are not allowed sufficient time to explore new concepts in a meaningful way.

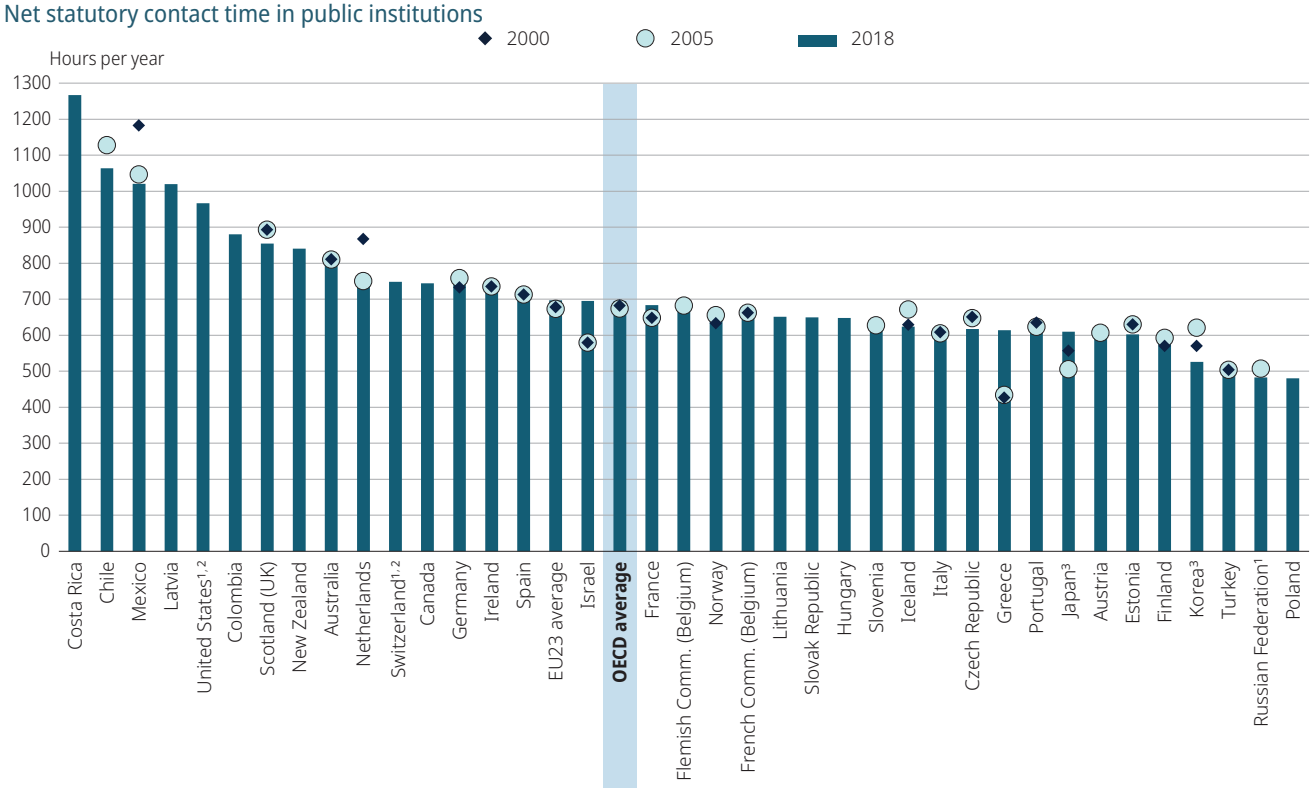
New demands on teachers

Curriculum defines not only what students learn in school, but also how school can help them learn for life (OECD, 2019[14]; Abiko, 2019[15]). If students can see a sense of purpose in learning in their classroom (i.e. see the relevance of learning to what is needed in real life), they are likely to feel more motivated to learn and acquire the types of competencies teachers are trying to help them develop (Eccles and Midgley, 1989[16]). Their interest and engagement levels may be naturally higher than when learning traditional academic subjects. Greater levels of motivation can certainly facilitate student learning (Department of Education and Skills, 2015[17]). Students may feel a sense of relevance when the curriculum is more in line with real-world demands.

But teachers who have not received proper training may not know how to support students in these emerging areas. For example, at a time when digital skills are no longer considered merely "nice to have", but are rather deemed to be a core "must-have" competency for the future (OECD Learning Compass 2030 (OECD, 2019[18])), computational thinking and programming gain prominence in curriculum reform. However, teaching such skills requires specialised training. When teachers don't have that

training, they are likely to feel overwhelmed and helpless (Rutherford, Long and Farkas, 2017[19]). Even well-prepared teachers may experience a drop in their sense of self-efficacy in some of these emerging areas if they have not received sufficient support through either their initial teacher preparation programme or targeted professional development activities (Zee and Koomen, 2016[20]).

Figure 2 **Number of teaching hours per year in general lower secondary education (2000, 2005 and 2018)**



Note: In net statutory contact time in public institutions. The OECD and EU23 averages refer to countries and economies with available data for 2000, 2005, 2010, 2015 and 2018. Countries and economies are ranked in descending order of the number of teaching hours per year in general lower secondary education in 2018.

1. Actual teaching time.

2. Reference year differs from 2018. Refer to the source table for details.

3. Average planned teaching time in each school at the beginning of the school year or semester.

Source: Education at a Glance 2019: OECD Indicators, Figure D4.1, https://doi.org/10.1787/95fa0c1e-en.

StatLink https://doi.org/10.1787/888933980146

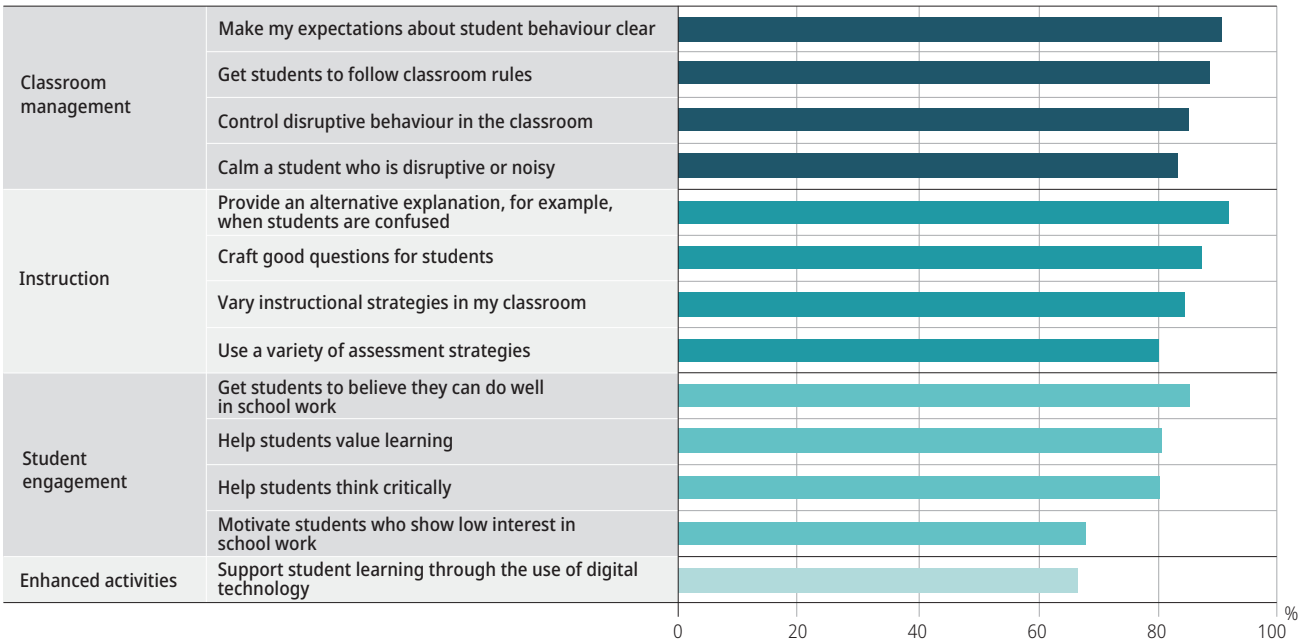
For example, data from the OECD Teaching and Learning International Survey (TALIS) reveal that supporting student learning through the use of digital technology is still a challenge for a large proportion of teachers who participated in the survey, compared with other typical skills (Figure 3).

Japan has also learned from past experience that expansion of content has additional complexities. The modernisation of subject content at the time was highly influenced by the work of J. S. Bruner's *The Process of Education* (Bruner, 1960[21]). The amount of learning contents reached a peak in the National Curriculum Standards revised from 1968 to 1970, which was pointed out that the Standards overemphasized on intellectual education. Subject content was partly redesigned to introduce the newest findings of natural and social sciences into school curriculum. Anecdotally, it has been reported that students struggled with the new content. The reasons for such unintended consequences are still unclear, but they seem to be linked to the levels of difficulty of the new content and the lack of teacher preparation for such new demands (Abiko, 2008[22]).

WHAT IS CONTENT OVERLOAD? HOW DOES IT AFFECT STUDENTS AND TEACHERS?

As noted earlier, resistance to accommodate new demands in curriculum partly comes from the difficulty in removing existing contents and subjects (Alexander and Flutter, 2009, p.17[4]). Content overload refers to the excessive amount of content to be taught and learned in relation to the time available for instruction (Boersma, 2001[23]). To avoid content overload, key considerations during curriculum redesign include: the overall structure of the curriculum; the number of subjects/topics; the quantity and quality of learning time; the pitch of what to include; and the size and language of curriculum documents.

Figure 3 **Percentage of lower secondary teachers who feel they can do the following "quite a bit" or "a lot" (OECD average-31)**



Source: OECD, TALIS 2018 Database, Table I.2.20

StatLink https://dx.doi.org/10.1787/888933932019

Structure and coherence

A poorly designed curriculum that lacks clear structure and coherence can increase the sense of content overload. When it is difficult to navigate through the curriculum, teachers are more likely to misunderstand its intent and use it ineffectively.

New Zealand has been considering how curriculum can be better designed to assist understanding and implementation. Drawing on the work of Graeme Aitken (Aitken, 2005[24]), the Ministry of Education put forward the following six criteria for evaluating the design of a curriculum statement (Ministry of Education (New Zealand), n.d.[25]):

1. It is logically structured around a clear and unambiguous purpose.
2. It clearly explains the rationale for change.
3. It incorporates misconception alerts.
4. It acknowledges teachers' existing understandings and integrates them into the new document.
5. It maximises internal coherence and minimises complexity.
6. It clearly connects abstract ideas to spatially contiguous detail and examples.

As noted above, what happens in a school is wider and more diverse in form than the stated content of a national curriculum. Content overload arises during curriculum redesign and becomes manifest during curriculum implementation (Boersma, 2001[23]), and it can be experienced differently by students, teachers and staff in the school (see "What is perceived overload? How does it affect students and teachers?").

Excessive number of subjects and/or topics per subject within the allotted time

The main challenge is when a curriculum contains an excessive number of subjects and/or topics within individual subjects (Voogt, Nieveen and Klopping, 2017[1]; Kärner et al., 2014[5]; Australian Primary Principals Association, 2014[10]; Haug, 2003[26]; NCCA, 2010[27]; FitzPatrick and O'Shea, 2013[28])[5]. Excessive content is commonly measured based on the analysis of instruction time allocated per content item (Schmidt, Wang and McKnight, 2005[29]; Schmidt, Houang and Cogan, 2002[30]). Research in cognitive science suggests that cognitive overload, associated with increased mental stress and reduced relaxation, results in decreased student performance (Fraser et al., 2012[31]).

Less is more: defining the right number of topics

Content overload is often driven by **unrealistic expectations for retaining both breadth and depth of content within the allotted space and time**. Breadth means the number of subjects included in the curriculum and the number of topics to be taught within subjects. Depth means the degree to which students explore and understand what they are learning.

Achieving an appropriate balance between breadth and depth in curriculum content remains a persistent unresolved issue in education reforms of many countries (Alexander, 2009[32]), with direct consequences for students' learning. Coverage of broad knowledge content is often prioritised over in-depth learning, which results in "more learning" rather than "deeper learning" (Schmidt and Houang, 2012[33]).

Having fewer topics to be covered in more depth in a curriculum often raises concerns about lowering standards of student achievement (UNESCO, 2002[34]). However, research suggests that studying fewer topics in greater depth helps students to develop richer understanding and higher-order thinking that can be transferred beyond specific subjects to new learning areas and new problems (Coker et al., 2016[35]; Schwartz et al., 2009[36]). Schwartz et al. (2009[36]), among others, argue that a focus on learning in depth may improve not only student academic achievement but also student satisfaction (Laird et al., 2008[37]).

Countries/jurisdictions include a wide variety of subjects in their curriculum. At the subject level, the secondary school curriculum of post-Soviet Ukraine in the 2000s included 17 different subjects, with as little as one hour of instruction per subject per week, while an average secondary school student in Uzbekistan studied as many as 28 different subjects (Moreno, 2007[38]). At the level of content items, a high number of topics within subjects has been cited as a major source of curriculum content overload in the United States. While eighth-grade mathematics textbooks in high-performing countries, such as Japan and Singapore, cover about 10 topics, those used in the United States cover as many as 30 topics (Schmidt, Houang and Cogan, 2002[30]). The mathematics and science curriculum in the United States has been criticised as "a mile wide and an inch deep". This approach to curriculum has been found to lead to poorer outcomes than in other countries in terms of student achievement (Schmidt, Houang and Cogan, 2002[30]; Schmidt and Houang, 2012[33]; Schmidt, Wang and McKnight, 2005[29]).

Prioritising some topics as key concepts in a crowded curriculum

An increasing number of countries/jurisdictions have made a clear distinction in curriculum between "key concepts" and "facts and procedural knowledge" to facilitate deeper learning. Accordingly, the concept of "big ideas" (similar to "key concepts", "fundamental ideas" or "essential learning") commonly appears in curricula as a way to highlight essential ideas that, approached from different angles, are crucial to multiple learning areas in both OECD countries and partner economies (Table 1). The simplicity of indicating clearly what are the "big ideas" in a learning area can help teachers remain focused when deciding what to prioritise from the more exhaustive curriculum without being overly prescriptive at the level of content items.

British Columbia (Canada) adopted this "big ideas" model in their curriculum redesign (Figure 4). The curriculum was designed by curriculum development teams that included teachers early in the process. The teams worked together through the revisions, which resulted in a progression of big ideas, curricular competencies and content for each learning area.

Unique to their approach is a clear indication of which content is to be prioritised. In this approach, greater value is placed on competencies and content that transfer across contexts and on a conscious effort to identify what is considered essential learning, among many items that could potentially be present in an exhaustive curriculum. This means, for example, prioritising higher-order concepts and ideas that are fundamental and enduring within a disciplinary body of knowledge and those that possess greater transfer value across disciplines and contexts.

This transferability supports the learning process across subjects in such a way that what students learn in science, for example, might support what they will be learning in social studies. This can be illustrated by the concept of "change", which in the British Columbia curriculum is considered to be transferrable across the subjects of arts education, social studies, science, health education/physical education and mathematics (Table 2).

Table 1 **Use of "big ideas" and key concepts**

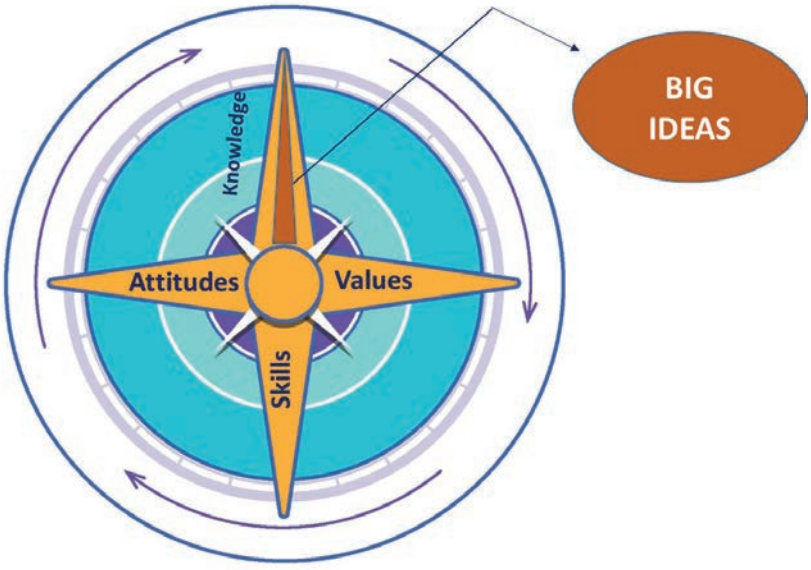
Yes		No	
OECD	Partner	OECD	Partner
Australia	Brazil[1]	Lithuania	Argentina
British Columbia (Canada)	Hong Kong (China)	Netherlands	
Chile	Costa Rica		
Czech Republic	India[1]		
Denmark	Kazakhstan		
Estonia	Russian Federation		
Finland	Singapore		
Hungary	South Africa		
Ireland	Viet Nam		
Japan			
Korea			
New Zealand			
Northern Ireland (United Kingdom)[1]			
Norway			
Poland			
Portugal			
Ontario (Canada)			
Québec (Canada)			
Scotland (United Kingdom)			
Sweden			
Turkey			
Wales (United Kingdom)			

Note: Values displayed in this table include only countries/jurisdiction with responses that could be clearly coded as yes/no.

1. Responses for these countries/jurisdictions were submitted by independent researchers, not government administrations.

Source: Data from the PQC, item 1.1.3.2.

Figure 4 **"Big Ideas" from the lenses of competencies in the OECD Learning Compass 2030**



Source: Adapted from the "Big Ideas" in the British Columbia curriculum model (https://curriculum.gov.bc.ca/sites/curriculum.gov.bc.ca/files/pictures/curriculum_model.png), Education 2030 Conceptual Learning Framework: Background papers, p. 118, https://www.oecd.org/education/2030-project/contact/Conceptual_learning_framework_Conceptual_papers.pdf.

Table 2[1/2] **"Big ideas" across learning areas in the curriculum, British Columbia (Canada)**

	ELA	Arts Education	Social Studies	Science	HE/PE	Mathematics	FRALP
Adapt/Adaptation			•	•			
Authority			•				
Balance		•					
Cause and Effect/ Consequence			•	•	•		
Change		•	•	•	•	•	
Choice			•		•		
Classify/Classification				•	•	•	
Cooperation			•		•		
Community		•	•	•			•
Conflict/Crisis		•	•		•		
Contact			•				
Culture	•	•	•	•			•
Cycles			•	•			
Ecosystems				•			
Energy		•	•	•	•		
Environment			•	•			•
Ethics		•	•	•			
Evolution			•	•			
Forces				•	•		
Form	•	•	•	•	•		•
Form and Function				•			
Genre	•						•
Harmony		•					
Identity	•	•	•		•		•
Innovation			•	•			
Interactions		•	•	•	•		
Interdependence			•				
Matter and Energy				•			
Meaning	•	•					
Motion		•		•	•		
Needs			•	•			
Order			•	•			
Organize			•				
Pattern		•	•	•	•	•	
Place	•	•	•	•			
Point of View/ Perspective	•	•	•				
Power			•				
Processes		•	•	•			
Probability						•	
Properties				•			

Note: ELA – English language arts; HE/PE – Health education/Physical education; FRALP – Français langue première.

Source: Education 2030 – Conceptual Learning Framework: Background papers, p. 137, https://www.oecd.org/education/2030-project/contact/Conceptual_learning_framework_Conceptual_papers.pdf.

Table 2[2/2] **"Big ideas" across learning areas in the curriculum, British Columbia (Canada)**

	ELA	Arts Education	Social Studies	Science	HE/PE	Mathematics	FRALP
Relationship		•	•		•	•	
Resiliency			•				
Resources			•				
Responsibility		•	•		•		
Role	•	•	•		•		•
Society		•	•				
Space		•		•		•	
Stories	•	•	•				
Systems and Structures	•	•	•	•			•
Sustainability			•	•			
Time	•	•	•			•	
Traditions		•	•	•			
Transform		•		•		•	
Unity		•					
Voice	•	•					
Worldviews		•	•				

Note: ELA – English language arts; HE/PE – Health education/Physical education; FRALP – Français langue première.

Source: Education 2030 – Conceptual Learning Framework: Background papers, p. 137, https://www.oecd.org/education/2030-project/contact/Conceptual_learning_framework_Conceptual_papers.pdf.

The New Zealand curriculum provides only high-level guidance. Subject-specific content is not mandated, although key topics and focus areas are identified. For example, the following key topics are included in the Science learning area: New Zealand flora and fauna; interdependence of geosphere, hydrosphere, atmosphere and biosphere; and physical phenomena such as light, sound, heat, motion, waves and forces. In a few instances, the government advises on the importance of including specific content. But, in general, most decisions regarding the selection of topics within each learning area are left to schools guided by the structure of the learning area and the achievement objectives set out in the national curriculum.

In New Zealand, the national curriculum is composed of the New Zealand Curriculum and *Te Marautanga o Aotearoa* (TMOA). Both documents are the result of broad societal consultation, including the views of teachers, principals, school boards, parents, employer representatives, curriculum associations, education sector bodies, academics and the wider community. TMOA is a guide to teaching practices in Māori-medium schools in New Zealand. It is merely a framework, not a complete teaching plan or teaching programme. Here again, schools need to develop their own school-based curriculum. For example, programmes may be planned by learning area, topic or context. Both the New Zealand Curriculum and TMOA succinctly describe what is considered essential for learning. Schools are expected to develop and design their own curriculum based on broad specifications.

In the United States, at the suggestion of the National Science Foundation, a number of award-winning scientists convened to discuss what could be considered "fundamental ideas" in science and how they could be the basis for a new science curriculum. The result was The "8+1" Fundamental Ideas of Science (Figure 5). These fundamental ideas represent answers to three questions:

- How do we know what we know?
- What are things made of?
- How do systems interact and change?

The "*+1*" (meaning "Inquiry") is related to essential ideas, such as probability, scientific reasoning, scales, measurement and orders of magnitude. The new curriculum could in turn embrace the principles of focus, rigour and coherence (Schmidt, 2011[39]). As design principles to guide curriculum contstruction, *focus* suggests that a relatively small number of topics should be introduced to ensure deep, quality learning; *rigour* suggests that topics should be challenging and enable deep thinking and reflection, which is not to be confused with rigid or inflexible design; and *coherence* suggests that topics should be ordered in a logical way to create a progression (OECD, 2019[40])

Figure 5 **The 8+1 Fundamental Ideas of Science**

The 8+1 Fundamental Ideas of Science
Preamble : What is science ? What is science for ?

- Science is able to explain how the natural world works by means of a small number of laws of nature.
- These laws, often expressed mathematically, are explored using tools such as observation, measurement, and description.
- Information is synthesized into understanding through creative thought and with predictions continuously tested by observation and measurement.

How do we know what we know?
Inquiry (+1)

Of what are things made?	How do systems interact and change?
1. Everything is made of atoms and atoms are composed of subatomic particles.	4. Evolution: Systems evolve and change with time according to simple underlying rules or laws.
2. Cells are the basic units of organisms.	5. Parts of a system move and interact with each other through forces.
3. Electromagnetic radiation pervades our world.	6. Parts of a system can exchange energy and matter when they interact.
	7. Physical concepts like energy and mass can be stored and transformed but are never created or destroyed.
	8. Life systems evolve through variation.

Source: (Schmidt, 2011[39])

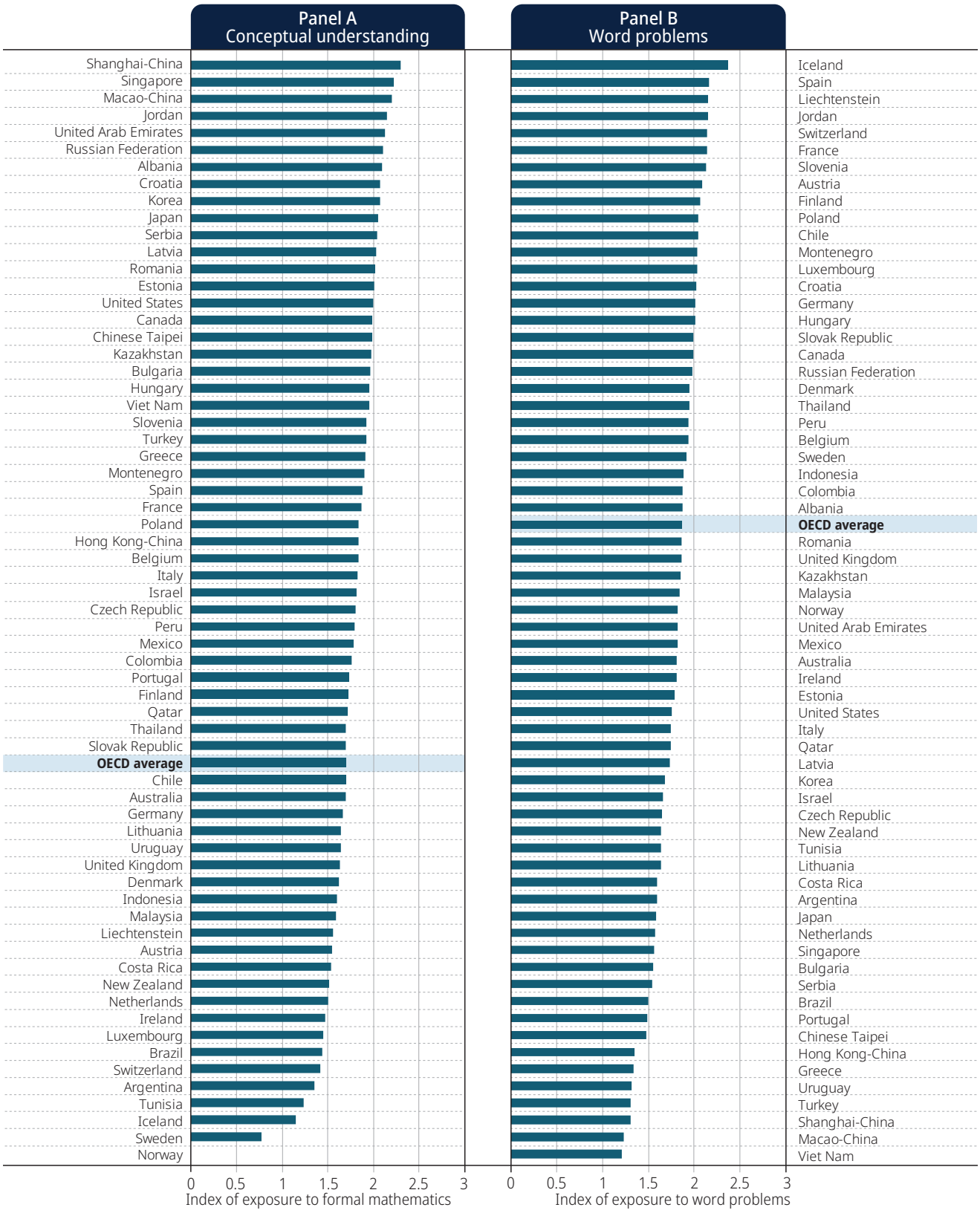
In mathematics, some countries/jurisdictions are also shifting away from disconnected factual knowledge towards more holistic conceptual understanding to make mathematical learning more meaningful to students. Word problems have long been used to convey real-world situations, which help students understand how mathematical concepts can be used outside of school (OECD, 2014[41]). Examples include problems on purchasing furniture with a discount and determining someone's age based on a relationship to the age of others.

Emerging 21st century challenges are also reinforcing the need to foster a deeper conceptual understanding of mathematical content as opposed to rote learning. Addressing these challenges requires equipping students to think mathematically (OECD, 2014[41]). Many countries are fostering conceptual understanding by giving students opportunities to learn different kinds of formal mathematical concepts, such as calculus, complex numbers and trigonometry.

Increased mathematical reasoning and the ability to apply problems in the real world have to go hand in hand. Nonetheless, in already crowded curricula, it is often difficult to make sufficient room for opportunities to learn for both and countries/jurisdictions need to set priorities. Deeper understanding of mathematical concepts is linked to being able to apply mathematical reasoning and problem solving. While word problems are often easier for teachers to apply, they may be more prone to rote learning than to deep learning.

Figure 6 shows how countries/jurisdictions seem to be making different choices in their mathematics curriculum based on students' reported exposure to either word problems or formal mathematics, which supports conceptual understanding. For example, students in Shanghai (China), a high-performing PISA jurisdiction, report the greatest exposure to conceptual understanding through formal mathematics while being much less exposed to word problems among participating countries and economies. In contrast, Iceland shows the opposite pattern: their students are frequently exposed to word problems with comparatively few chances of being exposed to formal mathematics. When faced with limited time, the choices of what to prioritise can make a difference for the type of learning students will experience and how enduring their learning is within and across disciplinary boundaries.

Figure 6 **Exposure to word problems and conceptual understanding**



Note: Panel A shows students exposure to conceptual understanding according to the results of PISA 2012. The exposure to conceptual understanding of mathematics is operationalised as an index of exposure to formal mathematics ranging from 0 (never) to 3 (frequently). Panel B shows students exposure to word problems according to the results of PISA 2012. The exposure to word problems is operationalised as an index of exposure to word problems ranging from 0 (never) to 3 (frequently). For more information on how these indices are constructed see (OECD, 2014[41]).

Source: PISA 2012 Database, Tables I.3.1a and I.3.1b, https://doi.org/10.1787/9789264267510-en.

StatLink https://doi.org/10.1787/888934195739

Reinforcing the notion of "big ideas", "fundamental ideas", and "conceptual understanding' is the concept of "essential learning" as seen earlier in the case of the British Columbia new curriculum. In their framework, the definition of what constitutes essential learning varies by learning area, but it should result from a reflection on what students should know (knowledge, facts) within a learning area, what essential ideas students should understand and use in other contexts, and what students should be able to do in a learning area or across learning areas as a result of learning at a given grade level. The principles[6] include the following (OECD, 2017[42]):

- Pay close attention to the important concepts and big ideas in each area of learning to support the application and transfer of essential learning.
- Ensure that core competencies are explicitly considered in the renewed curriculum to support deeper learning and the transfer of key skills and processes to new contexts.
- Limit the amount of prescription while ensuring a solid focus on essential learning.
- Stress higher-order learning, giving emphasis to the key concepts and enduring understandings (big ideas) that students need to succeed in their education and their lives.
- Allow for flexibility and choice for teachers and students.

Focusing on big ideas and essential learning is one of the common strategies used by countries to mitigate content overload. This will also help facilitate effective learning by keeping the developmental needs of children in mind.

Connecting topics across different subjects for real-world issues

Making connections across subjects (e.g. through cross-curricular themes and competencies) can be an effective strategy of reinforcing content and deep learning (Hurley, 2001[43]). Early childhood education curriculum is not organised by subjects in the first place and, thus, it does not need to break down silos between subjects (Jenkins et al., 2019[44]). However, secondary education teachers may not feel prepared to implement cross-curricular connections, even immediately after their training (Parker, Heywood and Jolley, 2012[45]). In primary education, it is easier to implement the approach as the same teacher teaches all subjects. However, given accountability measures, primary teachers may also find making these connections a challenge (Brand and Triplett, 2012[46]).

Project-based learning can be a model to integrate different subjects and make meaningful connections. These are cross-curricular projects wherein students solve a real-world problem or participate in a group project. They make connections across subjects like science, mathematics and writing, because they need to conduct the project, write up and present material, and solve the problem. Indeed, such approaches can improve learning and attitudes, through the group-oriented nature of the work (Kaldi, Filippatou and Govaris, 2011[47]). Various approaches and methods can be used to facilitate learning, but project-based learning often feels more relevant to students and can be effective at engaging them (Kokotsaki, Menzies and Wiggins, 2016[48]), while there is no conclusive evidence on the impact of such practices on actual learning outcomes.

Coherence among topics across grades, learning cycles and education levels

Research in neuroscience highlights the **value of staging new content** so that the brain can appropriately organise information for deeper understanding (Simon and Tzur, 2004[49]; Simon et al., 2010[50]; Lehrer and Schauble, 2015[51]; Penuel and Shepard, 2016[52]; Shepard, Penuel and Pellegrino, 2018[53]; Giedd, 2004[54]). When introducing new content in a curriculum, prominent attention should be given to **staging or sequencing the new topics**, taking into account students' stress (e.g. feeling overwhelmed by too many materials that are too difficult for them) or boredom (e.g. repeating materials they already understand).

Some repetition of topics is deliberate. It is built into a curriculum to reinforce students' understanding of the ideas or concepts they are learning. If the prerequisite notions have not been properly taught or understood, this may hinder their understanding of new content. This could occur by not paying sufficient attention to what students are presumed to know and what they have actually understood at the start of each grade or level.

Other repetition of topics is considered duplication of content. This is reported as a challenge by countries/jurisdictions such as Australia, Korea and the Netherlands. Some have started to limit such duplication by reducing content or taking an interdisciplinary approach. Most others report using learning progressions (Table 3). In particular, Estonia, Ireland and New Zealand adopted the approach to recognise the non-linear nature and individual differences in learning progressions, rather than organising learning linearly by grades. This is often called a "**spiral curriculum**" (See "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?").

Several report challenges not only in content duplication but also in the disconnect in learning progression between different levels of education. One of the strategies to address the repetition of content and disconnect across grades, is to redefine leaning goals by learning stages rather than grades, such as by primary or secondary cycle, as well as by achievement levels or by other

factors such as discipline or level of complexity. This allows opportunities to review and repeat content throughout the different grades in accordance with the level of the learner's development (see"What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?" section for country examples).

Curriculum progression may refer not only to the transition from simple to complex ideas. It may also be used to help students move from concrete examples to more abstract levels of thinking. These progressions represent a long-term plan of trajectories for students' learning over the years, rather than a grade-by-grade approach and, as such, they are more of an adaptive process (Confrey, 2019[55]).

When curriculum frameworks for each level of education are supported by a coherent, longer span of age coverage, alignment across different education levels becomes easier to achieve. Without such a framework, curriculum committees at each different level of education are likely to make decisions considering the age group specific to that level. This often results in fragmentation, redundancies and inconsistency of topics across levels of education.

Furthermore, it is important to be mindful of students' development across education levels. Curriculum that is primarily built on the priorities of subject areas rather than on what is developmentally appropriate is likely to overlook grade-level transitions and could allow repetition to persist without considering or assessing the needs of students (Eccles and Midgley, 1989[16]). Students may experience a decreased sense of self-efficacy, along with negative attributions to explain failure in the face of new learning (Schunk and Dibenedettto, 2016[56]; Zhen et al., 2010[57]).

Students may start to believe that they are not smart enough to learn the new material (Wigfield et al., 1997[58]). This can lead them to simply stop trying and to develop fixed ideas rather than an enquiring mind (Weiner, 1972[59]). Repeating topics can help students bridge old and new learning. Focus, rigour and coherence remain the critical design principles when considering the amount, level, and sequencing of topics to include in a curriculum (see Overview Brochure)[7].

In Denmark and Sweden, for example, the curriculum framework encompasses primary and lower secondary education in a coherent way, considering and accommodating learning progressions (Figure 7). This helps to avoid fragmentation and content overlaps which can put unnecessary pressure in curricula, increasing curriculum overload and potentially causing students to disengage.

Table 3 **Student learning progressions in the curriculum across different levels of education**

Yes		No	
OECD	**Partner**	**OECD**	**Partner**
Australia	Brazil[1]	Hungary	Viet Nam
British Columbia (Canada)	Hong Kong (China)	Netherlands	
Chile	Costa Rica		
Czech Republic	Kazakhstan		
Estonia	Singapore		
Finland	South Africa		
Japan			
Korea			
Lithuania			
Mexico			
New Zealand			
Northern Ireland (United Kingdom)[1]			
Norway			
Ontario (Canada)			
Poland			
Portugal			
Québec (Canada)			
Scotland (United Kingdom)			
Sweden			
Wales (United Kingdom)			

Note: Values displayed in this table include only countries/jurisdictions with responses that could be clearly coded as yes/no.

1. Responses for these countries/jurisdictions were submitted by independent researchers, not government administrations.

Source: Data from the PQC, item 1.6.

Figure 7 [1/6] **Age coverage of curriculum frameworks across different levels of education**

This table captures the coverage of different curriculum frameworks by age band and ISCED level.

ISCED level 0 | ISCED level 1 | ISCED level 2 | ISCED level 3 | Overlap of age group
frameworks across multiple ISCED levels | not mandatory

		0 year-olds (1)	1 year-olds (2)	2 year-olds (3)	3 year-olds (4)	4 year-olds (5)	5 year-olds (6)	6 year-olds (7)	7 year-olds (8)	8 year-olds (9)	9 year-olds (10)
OECD	Austria	0-6 year-olds (Kindergarten, Pre-school)							7-10 year-olds (Voekschule/Primary)		
	Australia			2-5 year-olds (Early Years Learning Framework)				5-12 year-olds (The Australian Curriculum)			
	British Columbia (Canada)[3]						British Columbia Kindergarten Curriculum	British Columbia Curriculum: Elementary Education			
	Chile	Bases Curriculares de Educación Pavularia (Early Childhood Education Curricular Bases) (0-5 yrs 11 mths)							Bases Curriculares para la Educación Básica (Curricular Bases for Primary Education)		
	Czech Republic			Framework Educational Programme for Preschool Education (FEP PE)					Framework Educational Programme for Basic Education (FEP BE)		
				Framework Educational Programme for Preschool Education (FEP PE)							
	Denmark	0-5 year-olds (Pædagogiske læreplaner / pedagogical curriculum)						6-16 years (Fælles Mål (Common Objectives) for each grade in primary school, including preschool class)			
	Estonia			18mth-6 year-olds (National Curriculum for Preschool Child Care Institutions)					7-12 year-olds (National Curriculum for Basic Schools)		
	Finland	0-6 years (Varhaiskasvatusuunnitelman Perusteet / National curriculum guidelines on early childhood education and care)						Esiopetuksen Opetussuunnitelman Perusteet (National Core Curriculum for Pre-primary education)	7-12 year-olds		
									Perusopetuksen Opetussuunnitelman Perusteet (National Core Curriculum for Basic Education) 7-15 year-olds		
	Hungary	0-3 year-olds (A bölcsődei nevelés-gondozás szakmai szabályai / National Guidance for the education and care of children under the age of 3)			3-6/7 year-olds (Óvodai nevelés országos alapprogramja / National Basic Programme for Kindergarten Education)				6-10 year-olds (Nemzeti alaptanterv + Kerettantervek / National Core Curriculum + Framework Curricula - up-18)		
	Israel				3-6 year-olds (Preschool + Kindergarten)				6-12 year-olds (Primary)		
	Ireland				3-6 year-olds				6-12 year-olds		
		Early Childhood Curriculum Framework: Aistear (up to 6 year-olds)							Primary Curriculum		
	Japan				3-6 year-olds (National Curriculum Standard)				7-12 year-olds (National Curriculum Standard)		
		National curriculum of daycare centre									

Notes: Curriculum frameworks for the different ISCED levels (0 to 3) are shown as bars in increasingly darker shades of blue. Overlaps between different ISCED-level frameworks are marked in dark grey. The figure further depicts overarching curriculum frameworks reported by countries/jurisdictions that do not necessarily correspond to just one ISCED level, which are shown as white boxes with a black frame. Education levels that are non-mandatory are highlighted in light grey. Age brackets where there is no framework coverage are left blank.

1. Data submitted by researcher not governmental institution.

2. United States: Individual states determine their own curricula structure. In many states, local school districts make all curriculum decisions.

3. ISCED levels shown are only provided as a general indication, and do not represent ISCED reporting for Canada as a whole. Additionally, this information only reflects the formal public K-12 system for each.

Source: Data from the PQC, item 0.3

StatLink https://doi.org/10.1787/888934195758

Figure 7 [2/6] Age coverage of curriculum frameworks across different levels of education

This table captures the coverage of different curriculum frameworks by age band and ISCED level.

ISCED level 0 | ISCED level 1 | ISCED level 2 | ISCED level 3 | Overlap of age group
frameworks across multiple ISCED levels | not mandatory

10 year-olds (11)	11 year-olds (12)	12 year-olds (13)	13 year-olds (14)	14 year-olds (15)	15 year-olds (16)	16 year-olds (17)	17 year-olds (18)	18 year olds (19)	19 year-olds (20)		
7-10 year-olds (Voekschule/ Primary)	11-14 year-olds (Neue Mittelschule, Allgemeinbildende höhere Schule (AHS))				15-18 year-olds (AHS, Berufsbildende höhere Schule (BHS))				BHS	Austria	OECD
5-12 year-olds (The Australian Curriculum)			12-16 year-olds				16-18 year-olds			Australia	
			The Australian Curriculum + courses developed by states and territories								
British Columbia Curriculum: Elementary Education			British Columbia Curri-culum: Secondary Education, Grades 7-9			British Columbia Curriculum: Secondary Education, Grades 10-12				British Columbia (Canada)[3]	
Bases Curriculares para la Educación Básica (Curricular Bases for Primary Education)										Chile	
Framework Educational Programme for Basic Education (FEP BE)		Framework Educational Programme for Basic Education (FEP BE)								Czech Republic	
6-16 years (Fælles Mål (Common Objectives) for each grade in primary school, including preschool class)							General Upper Secondary (læreplaner curriculum) / Vocational Upper Secondary Education (lokale læreplaner, local curriculum)			Denmark	
7-12 year-olds (National Curriculum for Basic Schools)			13-15 year-olds (National Curriculum for Basic Schools)			16-19 year-olds (National Curriculum for Upper Secondary Schools)				Estonia	
7-12 year-olds			13-15 year-olds (National Curriculum for Basic Schools)			16-19 year-olds (National Core Curriculum for General Upper Secondary Education, ages 16-18/19 Lukion Opetus-suunnitelman Perusteet OR National Qualification Require-ments for Vocational Education and Training, ages 16-18/19 Ammatillisen Koulutuksen Tutkintojen Perusteet)				Finland	
Perusopetuksen Opetussuunnitelman Perusteet (National Core Curriculum for Basic Education) 7-15 year-olds											
	10-14 year-olds				14-18 year-olds (subject-changes based on the current curriculum reform					Hungary	
6-12 year-olds (Primary)			13-15 year-olds (Middle School)			16-18 year-olds (High School)				Israel	
6-12 year-olds			12-16 year-olds				16-18 year-olds			Ireland	
Primary Curriculum			Junior Cycle Framework				Senior Cycle				
7-12 year-olds (National Curriculum Standard)			13-15 year-olds (National Curriculum Standard for Junior High School)			16-18 year-olds (National Curriculum Standard for High School)				Japan	

Notes: Curriculum frameworks for the different ISCED levels (0 to 3) are shown as bars in increasingly darker shades of blue. Overlaps between different ISCED-level frameworks are marked in dark grey. The figure further depicts overarching curriculum frameworks reported by countries/jurisdictions that do not necessarily correspond to just one ISCED level, which are shown as white boxes with a black frame. Education levels that are non-mandatory are highlighted in light grey. Age brackets where there is no framework coverage are left blank.

1. Data submitted by researcher not governmental institution.
2. United States: Individual states determine their own curricula structure. In many states, local school districts make all curriculum decisions.
3. ISCED levels shown are only provided as a general indication, and do not represent ISCED reporting for Canada as a whole. Additionally, this information only reflects the formal public K-12 system for each.

Source: Data from the PQC, item 0.3

StatLink https://doi.org/10.1787/888934195758

Figure 7 [3/6] Age coverage of curriculum frameworks across different levels of education

This table captures the coverage of different curriculum frameworks by age band and ISCED level.

ISCED level 0 | ISCED level 1 | ISCED level 2 | ISCED level 3 | Overlap of age group
frameworks across multiple ISCED levels | not mandatory

		0 year-olds (1)	1 year-olds (2)	2 year-olds (3)	3 year-olds (4)	4 year-olds (5)	5 year-olds (6)	6 year-olds (7)	7 year-olds (8)	8 year-olds (9)	9 year-olds (10)
OECD	Latvia		1.5 - 6 year-olds (Preschool Education Guidelines)						7-15/16 year-olds (Basic Education Standard)		
	Lithuania	0 - 6 year-olds (Pre-school)							7-10 year-olds (Primary)		
	Luxembourg					4-6 year-olds (Cycle 1)			7-11 year-olds (Cycle 1 & 2 & 3)		
	Korea	누리과정 (Nuri Curriculum) (not mandatory)							6-11 year-olds(National Elementary School Curriculum)		
	Mexico	0-3 year-olds (Modelo de Atención con Enfoque Integral para la Educación Inicial / National Guidance for the education and care of children under the age of 3)			3-5 year-olds (Pre-school)				6-11 year-olds (Primary)		
	Netherlands					4-12 year-olds (doelen* Objectives)					
	New Zealand	Te Whāriki (early childhood curriculum)					Curriculum and Te Marautanga o Aotearoa (the national curriculum for Māori medium schooling) up-18				
	Northern Ireland (United Kingdom)[1]					4-11 year-olds					
	Norway		1-6 year-olds (Rammeplan for barnehagens innhold og oppgaver / Framework Plan for the Content and Tasks of Kindergartens)						6-12 year-olds (Kunnskapsløftet 2020 (KL20) / Knowledge Promotion 2020)		
	Ontario (Canada)[3]					The Kindergarten Program		The Ontario Curriculum: Elementary			
	Poland				3-7 year-olds					7-15 year-olds	
	Portugal				3-5 year-olds (Pre-primary)			6-9 year-olds (Primary)			
	Québec (Canada)[3]					QEP: Preschool Education Program for 4-Year-Olds and Preschool Education Program		Québec Education Program (QEP): Elementary			
	Sweden	0-5 year-olds (Läroplan för förskolan / Lpfö 18, revised 2018 / Curriculum for the Preschool)						6-9 year-olds			
								6-15 year-olds (Curriculum for the compulsory school, preschool class and school-age educare - revised 2018)			
	Turkey	prior to school						Primary School (grades 1-4)			
	Wales (United Kingdom)	(m)									
	United States[1,2]										

Notes: Curriculum frameworks for the different ISCED levels (0 to 3) are shown as bars in increasingly darker shades of blue. Overlaps between different ISCED-level frameworks are marked in dark grey. The figure further depicts overarching curriculum frameworks reported by countries/jurisdictions that do not necessarily correspond to just one ISCED level, which are shown as white boxes with a black frame. Education levels that are non-mandatory are highlighted in light grey. Age brackets where there is no framework coverage are left blank.

1. Data submitted by researcher not governmental institution.

2. United States: Individual states determine their own curricula structure. In many states, local school districts make all curriculum decisions.

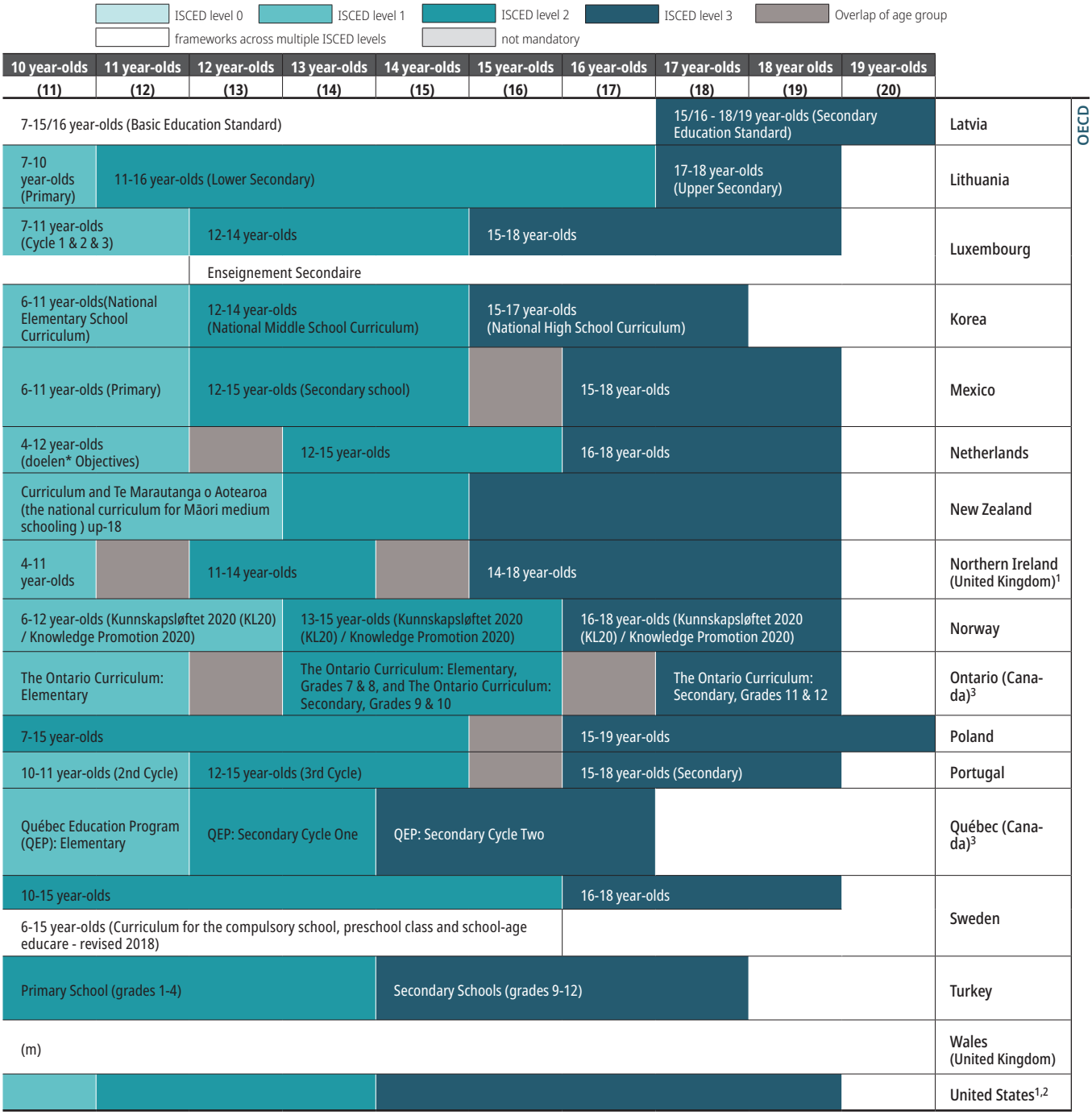
3. ISCED levels shown are only provided as a general indication, and do not represent ISCED reporting for Canada as a whole. Additionally, this information only reflects the formal public K-12 system for each.

Source: Data from the PQC, item 0.3

StatLink https://doi.org/10.1787/888934195758

Figure 7 [4/6] **Age coverage of curriculum frameworks across different levels of education**

This table captures the coverage of different curriculum frameworks by age band and ISCED level.



Notes: Curriculum frameworks for the different ISCED levels (0 to 3) are shown as bars in increasingly darker shades of blue. Overlaps between different ISCED-level frameworks are marked in dark grey. The figure further depicts overarching curriculum frameworks reported by countries/jurisdictions that do not necessarily correspond to just one ISCED level, which are shown as white boxes with a black frame. Education levels that are non-mandatory are highlighted in light grey. Age brackets where there is no framework coverage are left blank.

1. Data submitted by researcher not governmental institution.

2. United States: Individual states determine their own curricula structure. In many states, local school districts make all curriculum decisions.

3. ISCED levels shown are only provided as a general indication, and do not represent ISCED reporting for Canada as a whole. Additionally, this information only reflects the formal public K-12 system for each.

Source: Data from the PQC, item 0.3

StatLink https://doi.org/10.1787/888934195758

Figure 7 [5/6] Age coverage of curriculum frameworks across different levels of education

This table captures the coverage of different curriculum frameworks by age band and ISCED level.

ISCED level 0 | ISCED level 1 | ISCED level 2 | ISCED level 3 | Overlap of age group
frameworks across multiple ISCED levels | not mandatory

Partner	0 year-olds (1)	1 year-olds (2)	2 year-olds (3)	3 year-olds (4)	4 year-olds (5)	5 year-olds (6)	6 year-olds (7)	7 year-olds (8)	8 year-olds (9)	9 year-olds (10)
Argentina										
Brazil[1]	0-3 year-olds (Creches) (not mandatory)				4-5 year-olds (Pré-Escolas)		6-10 year-olds (Fundamental I, grades 1-5)			
China (People's Republic of)							6-12 year-olds			
Hong Kong (China)				3-5 year-olds (Kindergarten Education)			6-11 year-olds (Primary Education)			
Costa Rica	Up-6 year-olds							6-12 year-olds		
India[1]							up to 6 year-olds	6-10 year-olds		
Kazakhstan				3-6 year-olds				6-11 year-olds		
Russian Federation	2mth-6 year-olds (Pre-school Educational Standard)							6-10 year-olds (Primary School Educational Standard)		
Singapore					Pre-primary (ISCED 0)			Primary (ISCED 1)		
South Africa	0-3 year-olds (Early Childhood Development)				4-5 year-olds (Grade R)		5-7 years-olds (Foundation phase)		8-10 year-olds (Intermediate)	
Viet Nam	3 months-5 year-olds (Nursery and Kindergarten)						6-10 years old (primary)			

Notes: Curriculum frameworks for the different ISCED levels (0 to 3) are shown as bars in increasingly darker shades of blue. Overlaps between different ISCED-level frameworks are marked in dark grey. The figure further depicts overarching curriculum frameworks reported by countries/jurisdictions that do not necessarily correspond to just one ISCED level, which are shown as white boxes with a black frame. Education levels that are non-mandatory are highlighted in light grey. Age brackets where there is no framework coverage are left blank.

1. Data submitted by researcher not governmental institution.

2. United States: Individual states determine their own curricula structure. In many states, local school districts make all curriculum decisions.

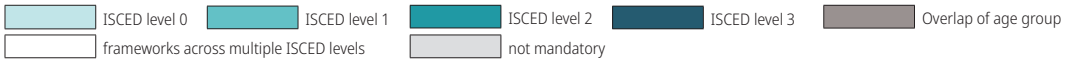
3. ISCED levels shown are only provided as a general indication, and do not represent ISCED reporting for Canada as a whole. Additionally, this information only reflects the formal public K-12 system for each.

Source: Data from the PQC, item 0.3

StatLink https://doi.org/10.1787/888934195758

Figure 7 [6/6] **Age coverage of curriculum frameworks across different levels of education**

This table captures the coverage of different curriculum frameworks by age band and ISCED level.



10 year-olds (11)	11 year-olds (12)	12 year-olds (13)	13 year-olds (14)	14 year-olds (15)	15 year-olds (16)	16 year-olds (17)	17 year-olds (18)	18 year olds (19)	19 year-olds (20)		
										Argentina	Partner
6-10 year-olds (Fundamental I, grades 1-5)	11-14 year-olds (Fundamental II, grades 6-9)				Up to 17 year-olds (Ensino Médio)					Brazil[1]	
6-12 year-olds			12-15 year-olds							China (People's Republic of)	
6-11 year-olds (Primary Education)		12-14 year-olds (Junior Secondary Education)			15-17 year-olds (Senior Secondary Education)					Hong Kong (China)	
6-12 year-olds			13-17 year-olds			15-18 year-olds				Costa Rica	
6-10 year-olds										India[1]	
6-11 year-olds		11-16 year-olds					16-18 year-olds			Kazakhstan	
	10-15 year-olds (Basic General Educational Standard)					16-18 year-olds (Secondary General Educational Standard)				Russian Federation	
Primary (ISCED 1)			Lower Secondary (ISCED2)		Upper Secondary (ISCED3)					Singapore	
8-10 year-olds (Intermediate)	11-13/14 year-olds (Senior Phase)				15-18 year-olds (Further Education and Training)					South Africa	
6-10 years old (primary)	11-14 year-olds (lower secondary)				15-17 year-olds (upper secondary)					Viet Nam	

Notes: Curriculum frameworks for the different ISCED levels (0 to 3) are shown as bars in increasingly darker shades of blue. Overlaps between different ISCED-level frameworks are marked in dark grey. The figure further depicts overarching curriculum frameworks reported by countries/jurisdictions that do not necessarily correspond to just one ISCED level, which are shown as white boxes with a black frame. Education levels that are non-mandatory are highlighted in light grey. Age brackets where there is no framework coverage are left blank.

1. Data submitted by researcher not governmental institution.

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3. ISCED levels shown are only provided as a general indication, and do not represent ISCED reporting for Canada as a whole. Additionally, this information only reflects the formal public K-12 system for each.

Source: Data from the PQC, item 0.3

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Furthermore, some countries/jurisdictions, such as Denmark, Finland and Japan, recognise that learning starts at age 0 by extending the curriculum framework to cover the early years (Figure 7). This approach contributes further to ensuring alignment between school requirements and children's natural learning process and developmental stages. This way, the curriculum in early-childhood, primary and secondary education can be seen as a continuum to prepare students to navigate future challenges with a progressive approach.

As seen earlier, content overload refers to excessive content expected to be taught in a limited amount of time. The number of mandated instruction hours per school year therefore sets the limits within which content is to be taught. When there is too much content planned and insufficient time to teach everything, the quality of teaching may suffer, in the absence of strategic decisions about what to prioritise.

Quality of learning time and student well-being

Empirical evidence on the relationship between school instruction time and student achievement is inconclusive. Added instruction time has been found to provide more learning opportunities and to correlate with higher academic achievement (Rivkin and Schiman, 2015[60]; Huebener, Kuger and Marcus, 2017[61]; Andersen, Humlum and Nandrup, 2016[62]). Extra instruction time has also been shown to help lower-performing students to catch up with higher-performing students (Rivkin and Schiman, 2015[60]; Lavy, 2015[63]). However, more hours of instruction do not automatically translate into better scores and quality learning (Alexander, 2009[32]; FitzPatrick and O'Shea, 2013[28]; Alexander and Flutter, 2009[4]; OECD, 2014[64]).

Furthermore, a growing body of research suggests that the relationship between hours of learning and student performance is not linear (Cattaneo, Oggenfuss and Wolter, 2017[65]; Huebener, Kuger and Marcus, 2017[61]). The 2015 report of the OECD Programme for International Student Assessment (OECD, 2016[66]) also found that time spent on learning, both within and outside school instruction time, does not correlate to students' academic performance (Figure 8). Transferring uncovered curricular content to students' personal time as homework also has been reported to have a potentially negative impact on students' mental and physical health (Chraif and Anitei, 2012[67]).

Compromising students' well-being with excessive learning hours or excessive homework is also a common challenge when addressing curriculum overload (See "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?"). This challenge needs to be balanced with the benefits of homework, such as the long-term development of children's motivation, strategies for coping with mistakes and setbacks and the time for children to develop positive beliefs about achievement (Bempchat, 2004[68]).

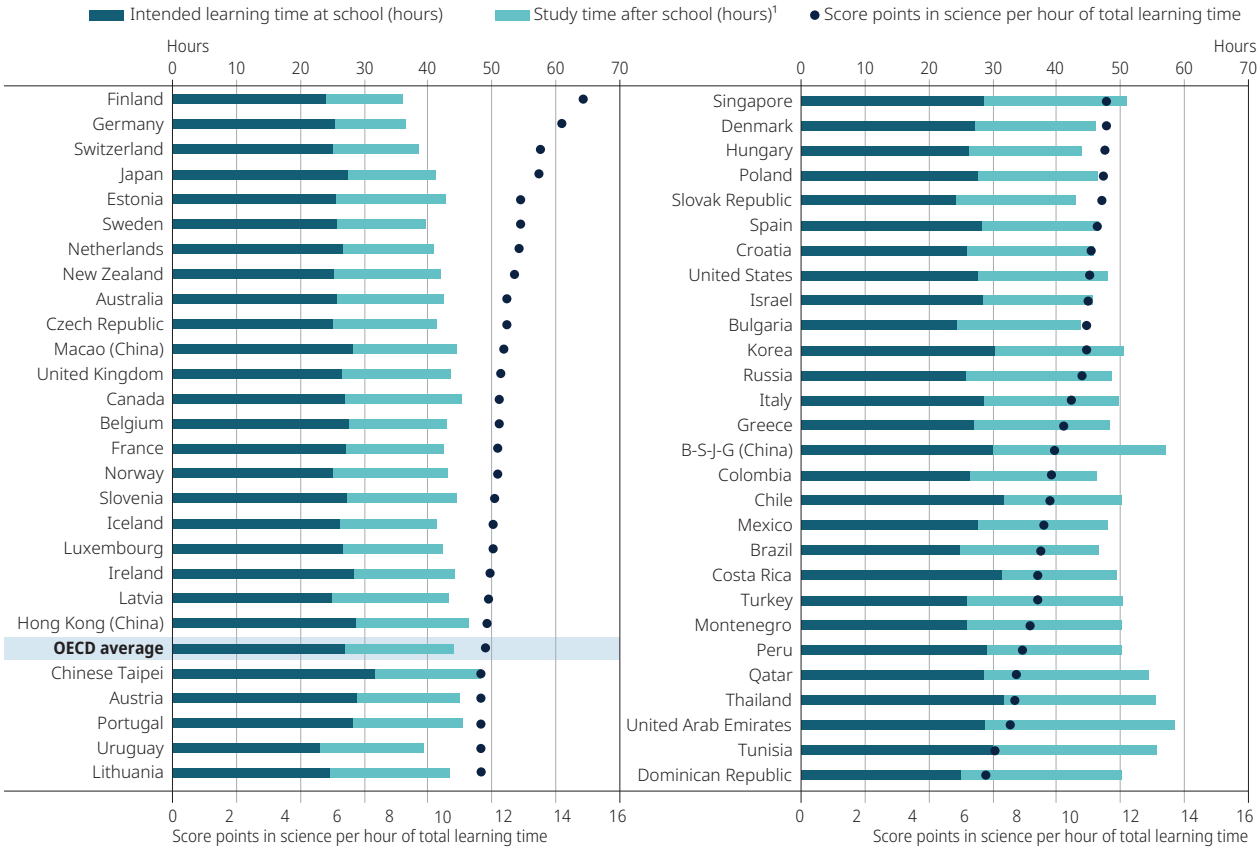
If teachers feel pressured to teach everything in an overloaded curriculum, it may also lead them to teach a shallow version of the curriculum or to leave what cannot be covered in school instruction time for students to pick up in their personal time outside of school. Content overload may also be further challenged by or may, in some instances, encourage the use of private tutors, also known as shadow education (Bray, 2011[69]). In Asia and parts of Europe, it is common for students to participate in tutoring after the school day, either as a supplement to their typical day or to help students with content from their school work. In Japan, for example, this is called *juku*, while in Korea, it is known as *hagwon*.

In some countries/jurisdictions that have undergone curriculum redesign or otherwise have an overloaded curriculum, parents sought out additional help when students could not finish the material. In Malta, for example, teachers expressed the need to finish the curriculum at all costs, even if students could not follow the material (Budiene and Zabulionis, 2006[70]). Elsewhere, the trend is for tutors to supplement with extra material, potentially dominating students' already burdened lives and contributing to adverse psychological and educational outcomes (Bukowski, 2017[71]). There is also a significant gap in use of tutoring services by socio-economic status, with higher-income families being more likely to use such services, again, contributing to educational disparities (Bray, 2020[72]).

Acknowledging that students are all different and they learn differently, including their prior knowledge and pace of learning, it is essential to anticipate the needs of teachers for guidance on priorities, as mentioned earlier. Teachers otherwise may attempt to cover everything for all students and some students, in particular low-performing students, may feel overwhelmed by the volume of content in any given learning unit. To meet expectations, they may need to spend a lot of extra time studying outside school hours on top of regular extra-curricular activities. This can make it difficult for them to participate in other activities that are important for full development and fostering a balanced lifestyle, such as time to socialise and be with friends, time to play, time to exercise and time to sleep (Marhefka, 2011[73]).

Student voice is critical in understanding overload as countries/jurisdictions seek to avoid it. Box 2 explores student perspectives on their educational experiences in relation to learning hours. In addition to learning within school, many participate in other activities and have other demands on their time. They report being busy and eager to be able to spend more time on topics that engage them.

Figure 8 **Relationship between PISA scores and learning time**



Note: 1. Hours spent learning in addition to the required school schedule, including homework, additional instruction and private study.

Countries and economies are ranked in descending order of the score points in science per hour of total learning time.

Source: OECD, PISA 2015 Database, Figure II.6.23, https://doi.org/10.1787/9789264267510-en.

StatLink https://doi.org/10.1787/888934195777

Box 2 **Student perspectives on curriculum overload**

During the 9th Informal Working Group meeting (IWG) in British Columbia (Canada), students from the Education 2030 project's Focus Group 3 shared their perspectives on how their school schedules impact their learning and well-being and what changes could improve this relationship. Most students felt that their schedules were jam-packed with classes and study time. The majority of participating students had at least six hours of classes and two hours of self-study every day. Upon reflecting on the concept of deep learning, most students wished they had more time to dig deeper into topics that interest them or to engage in extra-curricular activities without compromising most of their free time.

Maria is a 16-year-old student from Portugal who likes her school but finds her schedule a bit too demanding: "I have too many classes, which does not help, because quantity does not mean quality. It makes me feel tired and lowers my school performance." Every day, she attends school from 8:30 until 17:30. On Fridays, she enjoys practicing sports after school, but on other weekdays she goes home to study until 21:00. She thinks that since not all time spent in school is always used productively, having fewer classes would improve her well-being without hampering her learning: "If school ended early, I would have more time to sign up for activities, for self-study and for group projects."

Ayumi is a 15-year-old student from Japan. She lives a bit far from school, so every day, she wakes up at 6:00 (earlier than she'd like to!) to commute there on a local train. During the Education 2030 IWG meeting in British Columbia, she realised that her school day is just as intense as that of many students in other countries. Every day, from 8:00 until 15:00, Ayumi

has six 1-hour learning blocks. After this, she usually helps to clean her classroom and then stays at school to attend club activities. That semester, she signed up for swimming. When she gets home at 18:00, she has dinner with family and works on homework until 20:30. After this, during her free time, she sometimes reads books about historical figures before going to bed: "Sometimes I hear about interesting characters during history classes, and then I read about them at home. It would be interesting if we had time to talk more about them in school, but this is not always the case."

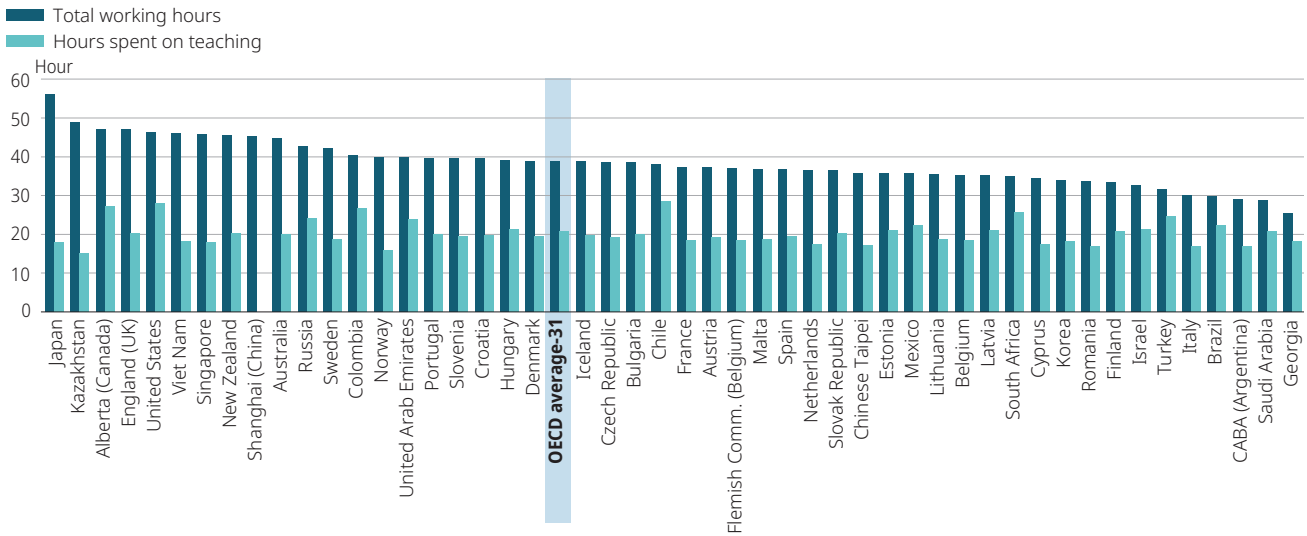
Jay is a 17-year-old student from British Columbia (Canada) who, on top of attending school, also works part-time. Her school day usually starts at 8:00 and goes until 13:30. She enjoys having no classes in the afternoon because it allows her to work, study, practice sports and spend time with her mother, who is ill. She thinks that she learns more when school classes have a good balance between teaching time and practice: "When teachers provide content on and on during classes I have a harder time paying attention. I find lessons where we have to solve problems more interesting. Some teachers would give us problems to work on at home and then we use in-class time to discuss different approaches of looking at these issues. However, because I work and take care of my mother, I prefer days when not all teachers send homework at the same time."

Teachers' sense of agency, professionalism and well-being

Excessive content may also require teachers to spend extra time outside of teaching hours to prepare lesson plans and assess students' progress, including grading and providing individual feedback to students. Furthermore, the "mile-wide-and-inch-deep" approach mentioned earlier can lead to disengagement among students and teachers. Some repetitions are deliberately built into a curriculum for students to reinforce and deepen their understanding of concepts or ideas that they are learning in a developmentally appropriate sequencing. However, topics that appear repeatedly within and across disciplines without a clear purpose are likely to create negative perceptions and experiences among students and teachers (Schmidt, Wang and McKnight, 2005[29]; Schmidt, Houang and Cogan, 2002[30]).

Teachers in countries/jurisdictions where their administrative load is already significant (which is not uncommon in Asian countries, such as Korea and Japan) may end up investing time outside of working hours to meet the expectations. Lesson preparation and administrative tasks related to the curriculum may reduce the time actually consecrated to teaching. If only a small amount of their time is actually spent teaching, teachers' sense of overload may further increase. Of their working time, they only spend an average of 53% on teaching (Figure 9).

Figure 9 **Weekly hours teachers report spending at school**



Note: Average number of 60-minute hours teachers report having spent at the current school on the following activities during the most recent complete calendar week. Countries and economies are ranked in descending order of the average number of total working hours of teachers.

Information on data for Cyprus: https://oe.cd/cyprus-disclaimer

Source: TALIS 2018 Results (Volume I), OECD 2019, Table I.4.57, https://doi.org/10.1787/1d0bc92a-en.

StatLink https://doi.org/10.1787/888934195796

An unsustainable workload is also associated with teachers' decisions to leave the profession (Torres, 2016[74]). In addition, the non-teaching-related workload of teachers or the time devoted to preparing lessons or performing administrative duties is strongly related to burnout, whereas teaching-related workload has a more modest relationship (Lawrence, Loi and Gudex, Teachers and Teaching[75]). The more responsibilities teachers have, the more time they will need to spend away from their core activity of teaching. For teachers to feel supported and remain in the profession, it may be critical to monitor the time they spend on their work outside of the classroom.

Curriculum overload can, therefore, threaten teachers' ability to cope with expectations, impact their levels of satisfaction with the profession and deprive them of their sense of agency by leaving no room for their own creativity. It can also affect their individual well-being, through chronic fatigue due to excessive working hours.

Pitch for what to include in a curriculum

Content overload is also caused when overly ambitious learning goals and student outcomes are set in a curriculum without careful consideration for the allotted space and time. Additional sources of content overload can arise based on how they are translated into syllabuses, textbooks, assessment materials and homework. A fundamental challenge for curriculum designers is to define the right "pitch" in the curriculum. This means achieving an appropriate level of aspirations, ambitions and challenges for all students while recognising the differences among students' learning progressions and their prior knowledge and skills. Content overload is thus a relative concept, as it depends on who uses the curriculum.

Neuroscience research confirms what many teachers already know from experience, that the brain can respond to stimuli and benefit more from learning if content and the learning environment are aligned for optimal stimulation and reinforcement (Dubinsky, Roehrig and Varma, 2013[76]). When students are bored or stressed (due to excessive demands, fear of failure and repeated information), their metabolic responses may block information from being processed in the brain, with clear negative implications for learning (Dubinsky, Roehrig and Varma, 2013[76]; Goswami, 2008[77]).

The challenges when defining the pitch for curriculum include trade-offs between aiming higher and focusing on essentials, and ensuring opportunities to learn and opportunities to succeed.

Trade-offs between aiming higher and focusing on essentials

A curriculum without high aspirations or challenging contents can lead to disengagement among high-performing students, while a curriculum with overly ambitious aspirations and too much content can risk disengagement among low-performing students, leaving them to fall behind. There is no silver bullet and no single answer to determine the right pitch for a curriculum that can capture the needs and aspirations of all students.

Japan, for example, reduced content and decreased the amount of instruction time in its 1998 reform to ease anxiety among students and parents about intensified competition for university entrance. The goal was to leave no student to fall behind and to enhance the quality of learning time, but the reform was misunderstood as a lowering of standards. In response to a backlash to that reform, the 2008 curriculum increased both content and instruction time.

Hong Kong (China) reported that the curriculum set at the high end of the standards was pitched for the full ability spectrum of students, but the curriculum allows adaptations to cater to the individual needs of students. Higher-ability students might cover all of the content, while lower-ability students may study only the foundational elements rather than all content. However, many schools and parents that were not accustomed to such an idea would encourage all students to study all content items. As a result, weaker students found that studying all of the curriculum content was too heavy (See "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?").

When expectations are unrealistic, some teachers may decide to partially cover the content specified in the curriculum while assigning the remaining parts for students' self-learning through additional homework assignments. As noted earlier, this can have negative consequences for students' well-being.

Ensuring opportunities to learn and opportunities to succeed

When excessive content sets out unrealistic expectations, learning goals end up not being met as intended. In Chile, for example, research on the coverage of the curriculum reveal that a majority of courses offered in mathematics and language do not cover 100% of the minimum mandatory objectives (Ramírez, 2006[78]). If students will need literacy and numeracy as a prerequisite to learn new content in later grades, students whose teachers did not cover the previous contents are likely to miss out on opportunities to learn. The more fundamental concepts and skills these students miss, the higher the chances are that they will also miss out on opportunities to succeed, at in later stages in life. Therefore, core foundations should be considered as fundamental priorities in the curriculum.

Children from socio-economically disadvantaged backgrounds in particular may miss out on these key opportunities. Research from the United States has shown that poor reading skills of third-grade students, who do not have access to reading materials or opportunities to learn to read at home are associated with lower chances of students graduating from high school (Hernandez, 2011[79]; Sparks, 2020[80]). Such research findings reinforce the importance of public policies, including the purpose and function of a curriculum in addressing inequity.

When selecting what subjects/topics to include in a curriculum and in what order, it is important to consider each subject-specific learning goal as an independent block that should develop only in a linear sequential order, but rather as an inter-dependent piece of a puzzle which can help a student to learn. The piece then fits within and across different subjects in a developmentally appropriate sequential order. The sequence should consider the nature of each subject; some subjects require a linear and hierarchical order when learning concepts for the developmentally appropriate sequencing (e.g. mathematics) and others (e.g. history) do not assume sequential or hierarchical progression but learning is measured by mastery of levels of complexity within each skill, which can occur in a concurrent and interrelated manner (Zarmati, 2019[81]; Confrey, 2019[82]).

Education is a complex system with students in classrooms influenced by their teachers, schools, communities, local and regional educational agencies within states; all of which have an influence on the content, pedagogy, and outcomes as a part of a larger ecosystem. An ecosystem approach to curriculum design (see the Overview Brochure) is still new, and thus there is not yet a solid body of research. However, some countries/jurisdictions have started to explore this concept as a new form of spiral curriculum, as in Estonia, Ireland, and New Zealand (See "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?").

The size, volume, and language of curriculum documents

Content overload may also be related to the excessive size of curriculum-setting statutory documents (i.e. the number of objectives, subjects and pages in which the curriculum is defined and elaborated) (Australian Primary Principals Association, 2014[10]; FitzPatrick and O'Shea, 2013[28]; Haug, 2003[26]; Voogt, Nieveen and Klopping, 2017[1]; ACARA, 2018[83]; NCCA, 2010[84]; Hong and Youngs, 2019[85]; Sousa, 2013[86])[8].

The number of pages and words in curriculum documents can indicate overload: "…it is a strong measure of general overcrowding such that, if teachers have to read a greater number of pages to understand the curriculum, they will take longer to understand what is expected of them" (Australian Primary Principals Association, 2014, p. 4[10])[9].

For example, the 1999 Irish primary school curriculum content was elaborated in 23 books amounting to over 3 650 pages (FitzPatrick and O'Shea, 2013, p.126[28]). As of 2014, Australia's curriculum comprised over 1 700 pages (Australian Primary Principals Association, 2014[10])[10]. This rendered the curriculum difficult to understand and manage, with teachers struggling to divide instruction time to cover all subjects while trying to meet the needs of all students (FitzPatrick and O'Shea, 2013[28]).

Some countries/jurisdictions have been able to appropriately adjust their curriculum. Norway reduced the volume of curriculum documents, used clearer language, and made priorities clearer when reducing content. On the other hand, Ontario (Canada) experienced a distinct challenge. Although the size of the mandatory curriculum itself was short, teachers did not consistently make a distinction between the core curriculum and optional guidelines. That led to the misunderstanding that there was more content to teach than what was actually in the mandatory document (See "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?").

Another experience commonly reported by several countries/jurisdictions is that, even when a national curriculum can be stated in a short, concise form, the brief form can actually create overload and incoherence at the school level. Perceived overload is mainly due to a lack of specific details and clarity on what should be taught and to what depth and the task of developing a working curriculum at local and school levels. Uncertainty, anxiety and ineffectiveness all can be high, especially for teachers, when there is much local political pressure without proper support mechanisms (Kyriacou, 2011[87]).

WHAT IS PERCEIVED OVERLOAD? HOW DOES IT AFFECT STUDENTS AND TEACHERS?

Excessive content is also measured based on end-user feedback from teachers, administrators and students (Kuiper, Nieveen and Berkvens, 2013[6]; Silver et al., 2011[88]). Thus, it is critically important to distinguish between actual and perceived overload. Policy makers first need to establish facts, by asking such questions as:

- Is overload "real" or "perceived"? (as discussed in the section above on content overload)
- If the overload is real, what factors might explain it?
- If the overload is a perceived, whose perception is it? And what are the possible sources or roots of such a perception?

If the overload is real, one possible solution is to reduce content, as in Korea, Norway and Singapore. If the overload is real, with a dilemma in trade-offs between schools and national authorities in responsibility for curriculum design, as in Finland, Norway, and New Zealand, the country-specific context affecting that balance must be addressed.

If the overload is a perception, different solutions are possible, depending on the country-specific context. For example, it was necessary to address assessment overload in Australia[11], mistrust in frequent curriculum changes in Japan, and misunderstanding about focusing on essentials and lowering standards in Portugal.

Once perceived overload is identified as an issue, policy makers can consider ways to strategically manage stakeholders' perceptions. In curriculum redesign processes, it is of critical importance to anticipate and manage potential unintended processes and consequences. For example, the National Council for Curriculum and Assessment in Ireland suggests perceptions of overload as follows:

> Much of what we know about curriculum overload comes from teachers. Some observers may question the extent to which the overload phenomenon is imagined, perceived or real. (…) National and international experience and evidence (…) suggests that the overload issue is very much a reality for teachers, and paradoxically, is often an unintended consequence of education reform." (*NCCA, 2010, p. 7*[27]).

In fact, curriculum overload is an intricately intertwined mix of reality and perception. To reduce the risk of unintended consequences, it is very valuable to learn more about possible consequences through both research and the experience of peer countries/jurisdictions. The main factors driving perceived overload include: the number of subjects/topics to cover in the allotted time; the frequency, focus and types of assessments, textbooks, learning materials and homework; the size and volume of curriculum documents; the structure and coherence of the curriculum; and the lack of readiness for reform or reform fatigue.

Perception driven by the number of subjects/topics to cover in the allotted time

Too many subjects/topics to teach within a specific time frame can cause actual content overload, but it also be a question of perception. Based on end-user feedback, teachers' perceptions of having "too much to teach" within the available instruction time can be one of the main criteria for identifying curriculum content overload (Australian Primary Principals Association, 2014[10])[12]. Finland sees overload stemming from this too, citing criticism from teachers that its previous National Core Curriculum had more to do with "heaviness" created at the local level than requirements outlined in the national document (See "What types of challenges do countries face in addressing curriculum overload, and what strategies do they use to address these challenges?").

Teachers who perceive that there are too many topics in their subject curriculum may feel pressured to provide extensive coverage of the content required by the curriculum. This perception may lead to shallow rather than deeper learning for students. This, in turn, may frustrate teachers and sap their motivation and sense of purpose, i.e. teacher agency, as described in the OECD Learning Compass 2030 (OECD, 2019[14]). Ultimately, they may be unable to exercise professional judgment.

On the other hand, teachers may make individual decisions on what they can realistically teach within a given learning unit or cycle. This could result in discrepancies in the taught curriculum across classrooms and schools and even the entire system.

Perception driven by the frequency, focus and types of assessments

Perceptions about content overload are also driven by a sense of assessment overload. As students do not read the learning goals in the written curriculum document itself, they are most likely to perceive or experience examinations and assessments as the most visible learning goals. Indeed, students often only see assessments as the curriculum (Ramsden, 1993[89]). Assessments drive what students perceive as being important to learn (Brown, Bull and Pendlebury, 2013[90]) and what is eventually retained in a curriculum across redevelopment cycles (Kärkkäinen, 2012[91]).

Although the curriculum may encourage development of more holistic skills alongside content knowledge, when exams are heavily based on mastering content, students will likely be steered towards what gets tested at the expense of other important development areas. This "teaching to the test" can mean that what could be mastered will be compromised by what will be tested (Jennings and Bearak, 2014[92]). This phenomenon is more commonly seen at the high school level as students approach their transition to college, but it can also be observed in early grades.

The types of assessments matter as well. Reliance on examinations, particularly high-stakes exams to pass to another grade or for college entrance, can cause significant anxiety, as early as in primary school (Segool et al., 2013[93]). Moreover, test anxiety decreases performance in school (McDonald, 2010[94]). Depth of learning and retention may also not be as great as that achieved through other forms of assessments or engagement with learning material (Hackthorn et al., 2011[95]). When curriculum relies on exams, especially as the sole assessment technique or as a gatekeeping tool, students' well-being can suffer.

Finally, curriculum standards and assessment must be aligned. Without clear progression and scaffolding of the curriculum, students may struggle to learn (Heritage, 2008[96]). Having the time and opportunity to learn could be further challenged in an overloaded curriculum.

Perception driven by the size of curriculum documents, textbooks, learning materials and homework

The size, volume and details of a curriculum can cause actual content overload, as discussed earlier, but they can also create the perception or the experience of overload among students, teachers and principals (Voogt, Nieveen and Klopping, 2017[1]).

Students are unlikely to know much about the sheer volume of the physical curriculum and related documents, but they can be a burden for teachers. At each cycle of education reform and curriculum redesign, an excessive number of pages in new curriculum documents may signal to teachers that the curriculum is overloaded. An immediate negative reaction to very large documents may set the scene for a perception of curriculum overload, even if the curriculum avoids an overly prescriptive tone and is careful to include detailed guidance to teachers on how to implement it (See "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges?").

Perceptions about curriculum overload are also created by excessive use of textbooks, learning materials and homework. For example, too much homework that is not explained well or does not have clear links to course material, can be boring, demotivating, and ineffective in helping learning (Bryan and Burstein, 2004[97]). The content and volume of textbooks can also be excessive and not appropriately modified to a new curriculum or local contexts and culture (Wang, 2014[98]). This makes them difficult for teachers to use and overwhelming for students and parents. Textbooks can have a cultural bias too, making them less accessible to all learners (Wang, 2014[98]; Ndura, 2004[99]). Easy-to-use teaching materials can also help ensure that a curriculum is implemented as intended and reduce teacher frustration (Kärkkäinen, 2012[91]).

Curriculum documents should support teachers to effectively convey and support the curriculum and learning by their students. Similarly, textbooks should be a resource for students to reinforce learning in the classroom and convey material clearly. However, when the curriculum is overloaded or textbooks are not appropriately modified, teachers can be frustrated and students overwhelmed.

Perception driven by the lack of readiness for reform or reform fatigue

Teachers' perceptions on curriculum change in general may accelerate or alleviate their perceptions on content overload. They are not always ready for reform. Finland reported that teachers involved in developing curricula tend to add rather than replace content, observing that they want to add new content in response to changing times and needs, but they hardly let go of any of the previous goals or content[13]. This suggests that teachers may perceive content overload differently depending on their own preparedness for curriculum change and readiness to digest and use any new support materials.

Busy teachers may not find the time to review such long documents and fully understand the new curriculum. They may become dismissive of the latest reform, preferring instead to resort to their previous classroom practices and lesson plans as something more feasible and long-standing. They may quickly lose interest in better understanding the new curriculum and discount it as one more transitory reform cycle that is likely to be short-lived. These are some signs of reform fatigue among teachers that can be sparked simply by the physical presentation of the curriculum (Dilkes, 2014[100]). However, mechanisms and processes can be put in place to effectively manage change and provide additional support and coaching to teachers and administrators (see "What types of challenges do countries/jurisdictions face in addressing curriculum overload, and what strategies do they use to address these challenges? ").

WHAT IS CURRICULUM IMBALANCE? HOW DOES IT AFFECT STUDENTS AND TEACHERS?

Curriculum imbalance occurs when certain subjects are given priority at the expense of others. More precisely, it refers to disproportionate attention given to certain portions of a curriculum at the expense of others without corresponding adjustments in the conditions or expectations for teaching and learning in those low priority areas. Such imbalance creates a sense of overload in prioritised subjects and a sense of being under-valued or threatened by competition with other subjects. Given that curriculum space is limited, any curriculum choices imply trade-offs.

Some countries/jurisdictions make a distinction between core and non-core subjects. In many OECD countries and partner economies, this usually corresponds to a distinction between academic and non-academic subjects (Table 4). To a lesser extent, some countries/jurisdictions intentionally avoid making the distinction, according the same priority to academic and non-academic subjects, as in British Columbia (Canada), Ontario (Canada) and Québec (Canada), Chile, the Czech Republic, New Zealand, Portugal and Sweden, as well as in partner countries like Argentina, China and India.

Table 4 **Distinction between core and non-core subjects in the curriculum**

Makes the distinction		No distinction	
OECD	Partner	OECD	Partner
Australia	Brazil[1]	British Columbia (Canada)	Argentina
Denmark	Hong Kong (China)	Chile	China
Estonia	Costa Rica	Czech Republic	India[1]
Hungary	Kazakhstan	Finland	
Ireland	Russian Federation	New Zealand	
Japan[2]	South Africa	Ontario (Canada)	
Korea		Portugal	
Lithuania		Québec (Canada)	
Netherlands		Scotland (United Kingdom)	
Northern Ireland (United Kingdom)[1]		Sweden	
Norway			
Poland			
Turkey			
United States[1]			

Note: Values displayed in this table include only countries/jurisdictions with responses that could be clearly coded as yes/no.

1. Responses for these countries/jurisdictions were submitted by independent researchers, not government administrations.

2. Japan makes the distinction in upper secondary education, but not in elementary and lower secondary education.

Source: Data from the PQC, item 1.1.3.2.

Portugal abandoned the distinction between core and non-core subjects in 2016. This distinction had been introduced in 2012 to harmonise curricula on a national level, but teachers and families considered it too restrictive. New Zealand does not use this distinction either, but uses other measures to indicate the relative importance of learning, such as the introduction of national standards for literacy and mathematics.

Such priority subjects are often given a disproportionate amount of instruction time (NCCA, 2010[27]). Such decisions are often driven by the social and political agenda, high-stakes national or state examinations, and/or international assessments.

Social and political agenda

Over-prioritisation of some subjects may occur by the force of tradition, often for elements considered as "core curriculum" or "the basics" that are historically seen as most important within the school curriculum. It can also occur when the curriculum becomes a means for delivering certain social and political agendas. The United States and European countries sought to strengthen their mathematics and science curriculum as an avenue to boost their international competitiveness (Sahlberg, 2016[101]). Many countries in Africa revised their curriculum to depart from the legacy of colonisation (Majoni, 2017[2]). Similarly, after the fall of Soviet Union, curriculum that had been heavily influenced by ideology was revised to strengthen national elements and develop a standards-based, skill-centred and outcome-oriented curriculum (Moreno, 2007[38]).

Reprioritisation of underprioritised subjects

When curriculum elements are prioritised or reprioritised without sufficient consideration of what content should be removed or replaced, the curriculum can lose its overall balance (ACARA, 2018[83]; Alexander and Flutter, 2009[4]; Kuiper, Nieveen and Berkvens, 2013[6]; van Silfhout, 2016[102]; Voogt, Nieveen and Klopping, 2017[1]). As school instruction time is limited, other subjects consequently receive less instruction time. For example, subjects such as physical education, arts and music often need to compete for instruction time with so-called "academic subjects" or with core subjects for space in the curriculum.

In Ireland, physical education was once perceived as an underprioritised subject in lower secondary education (MacPhail and Halbert, 2005[103]). This imbalance was addressed and physical education is now part of the core curriculum area of well-being in the Junior Cycle Reform 2015 (Ireland's reform of ISCED 2). All students must receive 135 hours of physical education spread across the three years. While there is no one-size-fits-all solution that applies across contexts, learning areas and grade levels, some approaches to curriculum content redesign do take into account the need to pre-emptively reduce the threat of content overload.

High-stakes national or state examinations

Over-prioritisation of some subjects and topics can be impacted by policy mechanisms, such as accountability systems and assessments, which signal subject priorities, especially when accountability mechanisms do not coherently link to the curriculum (Jennings and Bearak, 2014[92]). When there is a policy of high-stakes examinations and assessment of student performance (e.g. standardised testing, high school graduation exams, university entrance exams), curriculum may opt to allocate more instruction time to the subjects included in these high-stakes exams.

In England, amidst the focus on high-stakes testing and performance statistics, little or no resources (including instruction time) were allocated to arts and music education, despite the rhetorical commitment of the government of the time to foster creativity (Alexander and Flutter, 2009[4]). Traditionally, literacy and numeracy occupied half of the instruction time in England, while all other subjects had to be squeezed into the remaining half (Alexander, 2009[32]), as cited in (Voogt, Nieveen and Klopping, 2017[1]).

High-stakes examinations play an important role in determining how teachers set their priorities when balancing breadth and depth in curriculum content. Teachers may opt to use a teach-to-the-test approach in the subjects with high-stakes exams, although teachers in various contexts reportedly favour the breadth-of-learning approach, as it provides more curricular coherence and ensures coverage of the knowledge field (Schunk and Dibenedettto, 2016[56]). Teachers overwhelmed by requirements to cover an overloaded curriculum may, in turn, teach to the test, whereby subjects and learning items that are tested receive disproportionately more classroom attention.

Teachers who emphasise fast-paced content coverage may thus curtail in-depth reflection among students and discourage exploration of and engagement with curriculum content (Muijs and Reynolds, 2017[104]). High volumes of content to learn in a limited time may also lead to poor study habits that favour rote learning and memorisation rather than deep understanding, and the broader contexts of support matter for how children can learn and succeed in those contexts (Darling-Hammond et al., 2020[105]).

Furthermore, it has been reported that the teaching-to-the-test mode of instruction undermines teacher autonomy, restricts teachers' choice of pedagogical practices and limits instructional formats to repetition, rote learning and drill (van der Embse et al., 2017[106]). Teachers restricted to using the transmission model of teaching may experience loss of their agency to make professional decisions, choose pedagogies that work best for their students, foster critical thinking and creative group work, and apply content knowledge to everyday life (Stein, Kintz and Miness, 2016[107]). Narrowing of the role of teachers to fast-paced content delivery may deter potentially good candidates from joining the profession.

Even in countries whose curriculum places student well-being as part of their core values and goals, such high-stakes exams can increase levels of student anxiety and fear of failure (e.g. poor grades, not passing a test), thus negatively impacting their overall sense of life satisfaction. PISA data highlights the prevalence of school-related anxiety among 15-year-old students across OECD countries (Figure 10). This suggests the critical importance of a well-thought alignment between curriculum goals and assessment policies and practices (OECD, Forthcoming[108]).

The role of international assessments

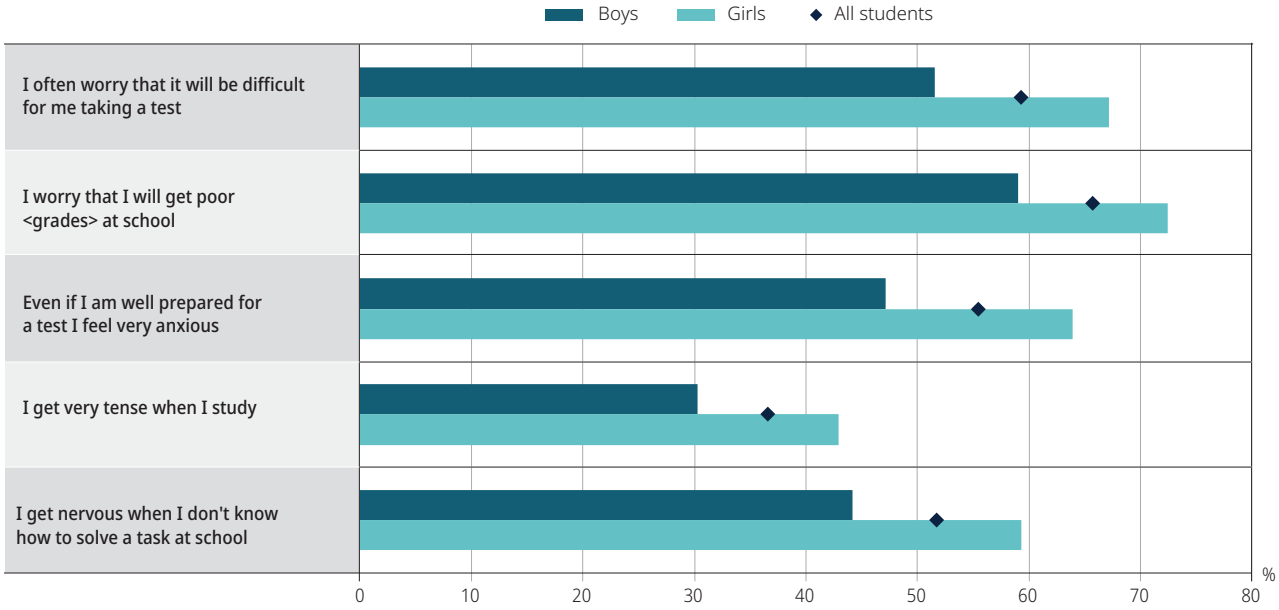
Globalisation and international competitiveness have been highlighted as major rationales for prioritising literacy and numeracy as they are consistently and reliably measured by international student assessments, such as PISA, the International Association for the Evaluation of Educational Achievement's Progress in International Reading Literacy Study or its Trends in International Mathematics and Science Study. Recent changes to international assessments like PISA are integrating new innovative domains, such as collaborative problem solving, creative thinking or global competency; which help to expand the common understanding of what matters in learning (OECD, 2020[109]). (See "Local and global citizenship, peace").

However, international assessments do not always suggest narrowing of the curriculum. In Japan, a 1998 decision to reduce curriculum content had to be reversed to some extent in response to public concerns that schools were lowering the standards in public education. Those concerns were raised in light of the lower-than-expected results of Japanese students in the 2003 PISA study. Other countries/jurisdictions, including Ontario (Canada) (Sahlberg, 2016[101]) and the Netherlands (Kuiper, Nieveen and Berkvens, 2013[6]), opted to increase instructional time for those core subjects to better prepare students for national/provincial and international tests. For the same reasons, the 2002-15 No Child Left Behind legislation in the United States prompted most school districts to shift teaching time from social studies, arts and music to reading skills, mathematics and science (Sahlberg, 2016[101]). In analysing the impact of reform efforts on schooling, Pasi Sahlberg (2016[101]) concludes that: "Reading, mathematics and science have now become the main determinants of perceived success or failure of pupils, teachers, and schools in many education systems."

Regardless of overall curriculum requirements, implementation becomes a factor. Both teachers and students may experience curriculum imbalance and thus overload if the priority for teaching and learning is steered towards giving greater instructional time to some subjects at the expense of others (Lambert, 2001[110]). Thus, it is becoming increasingly important that school leaders and teachers become aware of the issue of curriculum overload themselves and can make informed curriculum decisions and choices as co-designers of an enacted curriculum.

Figure 10 **Prevalence of schoolwork-related anxiety, by gender**

Percentage of students who reported that they "agree" or "strongly agree" with the following statements



Source: OECD, PISA 2015 Database, Tables III.4.1, III.4.2 and III.4.5.

StatLink https://dx.doi.org/10.1787/888933470845

WHAT IS STILL UNKNOWN?

Curriculum redesign occurs on regular intervals. This chapter has covered issues related to curriculum overload that policy makers can keep in mind when redesigning curriculum. Research has examined how overload can occur and suggested strategies and processes for designing curriculum with relevant stakeholders, being responsive to the needs and well-being of students. However, additional research can help illuminate how curriculum overload can be avoided and what components matter especially for students.

In general, there is limited research on curriculum overload. Research focused specifically on students is particularly lacking. Quantitative methodologies that can identify more precise links between curriculum in general and overload in particular are also lacking. Finally, the field can also benefit from additional research in more countries and jurisdictions.

A better understanding of curriculum overload can emerge as new research is conducted. Currently, much remains to be explored. Critical research needs include:

- **Research on this as a key policy issue**: Curriculum overload needs to be recognised as a policy research topic in its own right, not merely a consequence of misinformed education policy or a reason for failures in reform implementation. This includes the need to:
  - clarify the links between perceived and actual overload, fine-tune its definition and manifestations and explore in more detail the factors that contribute to it
  - examine the balance between coverage and depth of content that should be covered in curriculum, with more granular analysis of students of various socio-economic backgrounds and differing prior knowledge and skills among other factors

  - accelerate research on political economy of reform with a specific focus on curriculum overload, as curriculum change is politically charged and has trade-offs in terms of policy solutions, with high costs for action or inaction.

- **Studies on student voices, choice and experiences**: Most existing research is focused on the perspectives of teachers, administrators and institutions, while the impact of curriculum overload on students remains under-researched (Schmidt and Houang, 2012[33]). There are very few studies documenting students' views and experiences on the number of topics covered in school. Research is also still scarce on student choice in the specific context of curriculum overload and content reduction is also still scarce (OECD, Forthcoming[111]).
- **Empirical studies involving quantitative methodologies**: Most of the available literature draws on qualitative methodologies and self-reporting techniques. While curriculum overload has a strong perceived dimension, impact studies are needed to identify the significance of various contributing factors and the relationships between them. This would make it possible to assess the effects of curriculum overload in the following ways:
  - By identifying the interplay of curriculum overload with related factors. It has been suggested that, instead of considering breadth and depth of a curriculum, attention should be paid to the balance between content and the learning process built into curricula, as well as to quantitative links between instruction time, academic performance, the quality of teaching and the type of student/school (Schwartz et al., 2009[36]).
  - By examining the effects of overload on students (learning outcomes and their well-being, in particular those of disadvantaged students); teachers (teaching practices, self-efficacy and teachers' well-being); parents (supporting students at home, e.g. homework overload issue, particularly for disadvantaged students), and the interplay among students, teachers and parents.
  - By investigating instructional time as a mediating factor of the effects of overload on students' learning outcomes, including the organisation of instruction time and its interplay with out-of-classroom activities (out-of-school schedule, sleep, play and socialisation).
  - By documenting curriculum coverage through empirical studies. Systematic school, local, regional and country data about how much of the curriculum is actually covered in schools can be very helpful for gauging levels of curriculum overload in various contexts.
- In-depth case studies from a greater number of regions and contexts: Available evidence-based literature is often limited to country-specific contexts, such as Australia, England (United Kingdom), Estonia, Ireland, the Netherlands, New Zealand and Singapore. Additional comparative research can identify contextual conditions of curriculum overload and effective solutions across educational contexts (e.g. federal and decentralised governments, tracking and non-tracking, and integrated and differentiated models of instruction).

Notes

1. Note concerning the current and subsequent references to Australian Primary Principals Association (APPA) in this report: The APPA views were written while the Australian Curriculum was being externally reviewed in 2014 and content overload was identified as an issue at that time.
2. See Note 1
3. See Note 1
4. Other compulsory curriculum includes different subjects that cannot be classified within the other groups or which specifically reflect national concerns. The following types of subjects could be included in this category: Latin, ancient Greek, classical studies, minority languages that have not been reported in the Languages 2-5 columns, environmental education, and personal development and well-being (OECD, 2018[143]). An in-depth analysis of other subjects included under "other" compulsory curriculum can be found in OECD subject-specific reports with an exclusive focus on domains like physical education (OECD, 2019[112]).
5. See Note 1
6. https://www.oecd.org/education/2030-project/contact/Conceptual_learning_framework_Conceptual_papers.pdf
7. See (OECD, 2020), *Overview brochure of the Education 2030 series of thematic reports on curriculum redesign*, OECD Publishing, Paris.
8. See Note 1
9. See Note 1
10. See Note 1
11. See Note 1
12. See Note 1
13. *OECD Future of Education and Skills 2030 Curriculum analysis*, Progress Report of 9th IWG meeting, [EDU/EDPC(2019)13/ANN1].

References

Abiko, T. (2019), *私教育再生 [Regeneration of private education]*, Sayusha. [15]

Abiko, T. (ed.) (2008), *平成20年版　中学校新教育課程：教科・領域の改訂解説 [The new curriculum of lower secondary education in 2008: commentary on revised subjects and areas of learning]*, Meijitosho. [22]

ACARA (2018), *Monitoring the effectiveness of the foundation - Year 10 Australian curriculum*, https://www.acara.edu.au/docs/default-source/curriculum/2018-monitoring-the-effectiveness-of-f-y10-australian-curriculum-report.pdf. [83]

Aitken, G. (2005), *Curriculum design in New Zealand social studies: Learning from the past*, http://hdl.handle.net/2292/22856. [24]

Alexander, R. (ed.) (2009), *Towards a new primary curriculum: A report from the Cambridge Primary Review. Part 2:The Future*, Cambridge Primary Review. [32]

Alexander, R. and J. Flutter (2009), *Towards a new primary curriculum. Part 1: Past and present*, Cambridge Primary Review, Cambridge, http://dx.doi.org/10.13140/RG.2.1.3460.0086. [4]

Ames, C. and R. Ames (eds.) (1989), *Stage-environment fit: Developmentally appropriate classrooms for young adolescents*, Academic Press. [16]

Andersen, S., M. Humlum and A. Nandrup (2016), "Increasing instruction time in school does increase learning", *Proceedings of the National Academy of Sciences*, Vol. 113/27, pp. 7481-7484, http://dx.doi.org/10.1073/pnas.1516686113. [62]

Australian Primary Principals Association (2014), *The overcrowded primary curriculum: A way forward*, https://www.appa.asn.au/wp-content/uploads/2015/08/Overcrowded-primary-curriculum.pdf. [10]

Bempchat, J. (2004), "The Motivational Benefits of Homework: A Social-Cognitive Perspective", *Theory into practice*, Vol. 43/3, pp. 189-196, http://dx.doi.org/10.1207/s15430421tip4303_4. [68]

Boersma, K. (2001), *SLO en overladen onderwijs [SLO and overloaded education]*, SLO. [23]

Brand, B. and C. Triplett (2012), "Interdisciplinary curriculum: An abandoned concept?", *Teachers and Learning: Theory and Practice*, Vol. 18, pp. 381-393. [46]

Bray, M. (2020), "Shadow Education in Europe: Growing Prevalence, Underlying Forces, and Policy Implications", *ECNU Review of Education*, http://dx.doi.org/doi.org/10.1177/2096531119890142. [72]

Bray, M. (2011), *The challenge of shadow education: Private tutoring and its implications for policy makers in the European Union*, European Commission, Brussels. [69]

Brown, G., J. Bull and M. Pendlebury (2013), *Assessing student learning in higher education*, Routledge. [90]

Bruner, J. (1960), *The process of education*, Harvard University Press, Cambridge. [21]

Bryan, T. and K. Burstein (2004), "Improving homework completion and academic performance: Lessons from special education", *Theory into Practice*, Vol. 43/3, pp. 213-219. [97]

Bukowski, P. (2017), *Shadow education within the European Union from the perspective of investment in education*, London School of Economics, London, https://doi.org/10.1177/2096531119890142. [71]

Cattaneo, M., C. Oggenfuss and S. Wolter (2017), "The More, the Better? The Impact of Instructional Time on Student Performance", *Education Economics*, Vol. 25/5, pp. 433-445, http://dx.doi.org/10.1080/09645292.2017.1315055. [65]

Chraif, M. and M. Anitei (2012), "Overload Learning, Attachment and Coping Styles Predictors of Mental and Physical Health of Teenage High School Students in Romania", *Procedia - Social and Behavioral Sciences*, Vol. 69, pp. 1842-1846, http://dx.doi.org/10.1016/j.sbspro.2012.12.135. [67]

Coker, J. et al. (2016), "Impacts of Experiential Learning Depth and Breadth on Student Outcomes", *Journal of Experiential Education*, Vol. 40/1, pp. 5-23, http://dx.doi.org/10.1177/1053825916678265. [35]

Confrey, J. (2019), *Future of Education and Skills 2030: Curriculum analysis. A Synthesis of Research on Learning Trajectories/Progressions in Mathematics*, https://www.oecd.org/education/2030-project/about/documents/A_Synthesis_of_Research_on_Learning_Trajectories_Progressions_in_Mathematics.pdf. [82]

Confrey, J. (2019), "Leading a Design-Based Research Team Using Agile Methodologies to Build Learner-Centered Software", in *Research in Mathematics Education, Designing, Conducting, and Publishing Quality Research in Mathematics Education*, Springer International Publishing, Cham, http://dx.doi.org/10.1007/978-3-030-23505-5_9. [55]

Darling-Hammond, L. et al. (2020), "Implications for educational practice of the science of learning and development", *Applied Developmental Science*, Vol. 24/2, https://doi.org/10.1080/10888691.2018.1537791. [105]

Department of Education and Skills (2015), *Framework for junior cycle 2015*, http://www.education.ie/en/Publications/Policy-Reports/Framework-for-Junior-Cycle-2015.pdf. [17]

Dilkes, J. (2014), "The New Australian Curriculum, Teachers and Change Fatigue", *Australian Journal of Teacher Education*, Vol. 39/11, http://dx.doi.org/10.14221/ajte.2014v39n11.4. [100]

Dubinsky, J., G. Roehrig and S. Varma (2013), "Infusing Neuroscience Into Teacher Professional Development", *Educational Researcher*, Vol. 42/6, pp. 317-329, http://dx.doi.org/10.3102/0013189x13499403. [76]

Easthope, C. and G. Easthope (2000), "Intensification, Extension and Complexity of Teachers' Workload", *British Journal of Sociology of Education*, Vol. 21/1, pp. 43-58, http://dx.doi.org/10.1080/01425690095153. [3]

European Commission (2018), *Council Recommendation of 22 May 2018 on key competences for lifelong learning (Text with EEA relevance.)*, pp. 1–13, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2018.189.01.0001.01.ENG. [8]

Fraser, K. et al. (2012), "Emotion, cognitive load and learning outcomes during simulation training", *Medical Education*, Vol. 46/11, pp. 1055-1062, https://doi.org/10.1111/j.1365-2923.2012.04355.x. [31]

Giedd, J. (2004), "Structural Magnetic Resonance Imaging of the Adolescent Brain", *Annals of the New York Academy of Sciences*, Vol. 1021/1, pp. 77-85, http://dx.doi.org/10.1196/annals.1308.009. [54]

Goswami, U. (ed.) (2008), *Principles of Learning, Implications for Teaching: A Cognitive Neuroscience Perspective*, Blackwell Publishing, Oxford, pp. 381-399, https://doi.org/10.1111/j.1467-9752.2008.00639.x. [77]

Hackthorn, J. et al. (2011), "Learning by Doing: An Empirical Study of Active Teaching Techniques", *Journal of Effective Teaching*, Vol. 11/2, pp. 40-54. [95]

Haug, P. (2003), *Evaluering av Reform 97: Sluttrapport frå styret for Program for evaluering av Reform 97 [Evaluation of Reform 97: Final report from the board of the Program for evaluation of Reform 97],* Norges forskningsråd, Oslo, https://www.forskningsradet.no/siteassets/publikasjoner/1108644083551.pdf. [26]

Heritage, M. (2008), *Learning progressions: Supporting instruction and formative assessment*, Council of Chief State School Officers, Washington, DC, https://csaa.wested.org/wp-content/uploads/2020/01/Learning_Progressions_Supporting_2008.pdf. [96]

Hernandez, D. (2011), *Double jeopardy: How third-grade reading skills and poverty influence high school graduation*, https://files.eric.ed.gov/fulltext/ED518818.pdf. [79]

Hong, W. and P. Youngs (2019), "Why are teachers afraid of curricular autonomy? Contradictory effects of the new national curriculum in South Korea", in *Teachers' Perceptions, Experience and Learning*, Routledge, http://dx.doi.org/10.4324/9781351173285-2. [85]

Huebener, M., S. Kuger and J. Marcus (2017), "Increased instruction hours and the widening gap in student performance", *Labour Economics,* Vol. 47, pp. 15-34, http://dx.doi.org/10.1016/j.labeco.2017.04.007. [61]

Hurley, M. (2001), "Reviewing Integrated Science and Mathematics: The Search for Evidence and Definitions From New Perspectives", *School Science and Mathematics*, Vol. 101/5, pp. 259-268, https://doi.org/10.1111/j.1949-8594.2001.tb18028.x. [43]

Jenkins, J. et al. (2019), "Boosting school readiness: Should preschool teachers target skills or the whole child?", *Economics of Education Review*, Vol. 65, pp. 107-125, http://dx.doi.org/10.1016/j.econedurev.2018.05.001. [44]

Jennings, J. and J. Bearak (2014), ""Teaching to the test" in the NCLB era: How test predictability affects our understanding of student performance", *Educational Researcher*, Vol. 43/8, pp. 381-389, http://dx.doi.org/doi.org/10.3102/0013189X14554449. [92]

Kaldi, S., D. Filippatou and C. Govaris (2011), "Project-based learning in primary schools: effects on pupils' learning and attitudes", *Education 3-13*, Vol. 39/1, pp. 35-47, https://doi.org/10.1080/03004270903179538. [47]

Kärkkäinen, K. (2012), Bringing About Curriculum Innovations: Implicit Approaches in the OECD Area, *OECD Education Working Papers*, No. 82, OECD Publishing, Paris, https://doi.org/10.1787/5k95qw8xzl8s-en. [91]

Kärner, A. et al. (2014), *Principal steps toward curricular freedom in Estonia CIDREE yearbook 2013,* SLO, http://www.cidree.org/cidree_yearbook/yearbook-2013/ [5]

Kirst, M., B. Anhalt and R. Marine (1997), "Politics of Science Education Standards", *The Elementary School Journal*, Vol. 97/4, pp. 315-328, http://dx.doi.org/10.1086/461868. [12]

Kokotsaki, D., V. Menzies and A. Wiggins (2016), "Project-based learning: A review of the litertautre", *Improving Schools*, Vol. 19/3, pp. 267-277, https://doi.org/10.1177/1365480216659733. [48]

Kuiper, W. and J. Berkvens (eds.) (2013), *Moving up the line - Schools at the hub of policy development in Ireland*, CIDREE, http://www.cidree.org/wp-content/uploads/2018/07/yb_13_balancing_curriculum_regulation_and_freedom.pdf. [28]

Kuiper, W. and J. Berkvens (eds.) (2013), *Portugal - The mirage of curricular autonomy*, CIDREE, http://hdl.handle.net/10400.3/2461. [86]

Kuiper, W., N. Nieveen and J. Berkvens (2013), *Curriculum regulation and freedom in the Netherland - A puzzling paradox*, SLO/CIDREE, https://dspace.library.uu.nl/handle/1874/289592. [6]

Kyriacou, C. (2011), "Teacher stress: Directions for future research", *Educational Review*, Vol. 53/1, pp. 27-35, http://dx.doi.org/doi.org/10.1080/00131910120033628. [87]

Laird, T. et al. (2008), "The effects of discipline on deep approaches to student learning and college outcomes", *Research in Higher Education*, Vol. 49, pp. 269-294, https://doi.org/10.1007/s11162-008-9088-5. [37]

Lambert, P. (2001), *Curriculum reform in primary schools: Policy steering in and out of schools*, University of Sydney. [110]

Lavy, V. (2015), "Do Differences in Schools' Instruction Time Explain International Achievement Gaps? Evidence from Developed and Developing Countries", *The Economic Journal*, Vol. 125/588, pp. F397-F424, http://dx.doi.org/10.1111/ecoj.12233. [63]

Lawrence, D., N. Loi and B. Gudex (2019), "Understanding the relationship between work intensification and burnout in secondary teachers", *Teachers and Teaching*, Vol. 25/2, pp. 189-199, https://doi.org/10.1080/13540602.2018.1544551. [75]

Lehrer, R. and L. Schauble (2015), "Learning Progressions: The Whole World is NOT a Stage", *Science Education*, Vol. 99/3, pp. 432-437, http://dx.doi.org/10.1002/sce.21168. [51]

MacPhail, A. and J. Halbert (2005), "The implementation of a revised physical education syllabus in Ireland: circumstances, rewards and costs", *European Physical Education Review*, Vol. 11/3, pp. 287-308, http://dx.doi.org/10.1177/1356336x05056769. [103]

Majoni, C. (2017), *Curriculum overload and its impact on teacher effectiveness in primary schools*, Open Access Publishing, http://doi.org/10.5281/zenodo.290597. [2]

Marhefka, J. (2011), "Sleep Deprivation: Consequences for Students", *J Psychosoc Nurs Ment Health Serv.*, Vol. 49(9), pp. 20-25, http://dx.doi.org/10.3928/02793695-20110802-02. [73]

McDonald, A. (2010), "The Prevalence and Effects of Test Anxiety in School Children", *Educational Psychology*, Vol. 21/1, pp. 89-101, https://doi.org/10.1080/01443410020019867. [94]

Ministry of Education (New Zealand) (n.d.), *Develop smart policy and curriculum documents to support educational improvement*, Ministry of Education, https://www.educationcounts.govt.nz/__data/assets/pdf_file/0004/122539/case-32-complete.pdf. [25]

Moreno, J. (2007), "The Dynamics of Curriculum Design and Development: Scenarios for Curriculum Evolution", in *School Knowledge in Comparative and Historical Perspective*, Springer Netherlands, Dordrecht, http://dx.doi.org/10.1007/978-1-4020-5736-6_12. [38]

Morgan, M. and D. Craith (2015), "Workload, stress and resilience of primary teachers: Report of a survey of INTO members", *Irish Teachers' Journal*, Vol. 3/1, pp. 9-20, https://www.into.ie/app/uploads/2019/07/IrishTeachersJournal2015.pdf. [7]

Muijs, R. and R. Reynolds (2017), *Effective Teaching: Evidence and Practice*, Sage. [104]

NCCA (2010), *Curriculum overload in primary schools: An overview of national and international experiences,* https://ncca.ie/media/2052/curriculum_overload_in_primary_schools_an_overview_of_national_and_international_experiences.pdf. [27]

NCCA (2010), *Curriculum overload in primary schools: Experiences and reflections from the learning site,* https://ncca.ie/media/2053/curriculum_overload_in_primary_schools_experiences_and_reflections_from_the_learning_site.pdf. [84]

Ndura, E. (2004), "ESL and Cultural Bias: An Analysis of Elementary Through High School Textbooks in the Western United States of America", *Language, Culture, and Curriculum*, Vol. 17/2, pp. 143-153, https://doi.org/10.1080/07908310408666689. [99]

Oates, T. (2011), "Could do better: using international comparisons to refine the National Curriculum in England", *The Curriculum Journal*, Vol. 22/2, pp. 121-150, http://dx.doi.org/10.1080/09585176.2011.578908. [9]

OECD (2020), *Education at a Glance*, OECD Publishing, https://doi.org/10.1787/69096873-en. [13]

OECD (2020), *PISA for Schools website - Frequently Asked Questions*, https://www.oecd.org/pisa/aboutpisa/pisa-based-test-for-schools-faq.htm (accessed on 1 November 2020). [109]

OECD (2019), *OECD Future of Education 2030. Making physical education dynamic and inclusive for 2030. International curriculum analysis*, https://www.oecd.org/education/2030-project/contact/OECD_FUTURE_OF_EDUCATION_2030_MAKING_PHYSICAL_DYNAMIC_AND_INCLUSIVE_FOR_2030.pdf. [113]

OECD (2019), *OECD Future of Education and Skills 2030 Curriculum analysis: Progress report on the draft international synthesis report*. [40]

OECD (2019), *OECD Future of Education and Skills 2030. Conceptual learning framework. A series of concept notes,* OECD Publishing, Paris, http://www.oecd.org/education/2030-project/teaching-and-learning/learning/learning-compass-2030/OECD_Learning_Compass_2030_Concept_Note_Series.pdf. [14]

OECD (2019), *OECD Future of Education and Skills 2030: OECD Learning Compass 2030*, http://www.oecd.org/education/2030-project/teaching-and-learning/learning/learning-compass-2030/OECD_Learning_Compass_2030_concept_note.pdf. [18]

OECD (2018), *Education at a Glance 2018: OECD Indicators*, OECD Publishing, Paris, https://doi.org/10.1787/eag-2018-en. [112]

OECD (2017), E*ducation 2030 - Conceptual Learning Framework: Background Papers*, https://www.oecd.org/education/2030-project/contact/Conceptual_learning_framework_Conceptual_papers.pdf. [42]

OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, https://doi.org/10.1787/9789264266490-en. [66]

OECD (2014), *Education at a Glance 2014: OECD Indicators*, OECD Publishing, Paris, https://dx.doi.org/10.1787/eag-2014-en. [64]

OECD (2014), *PISA 2012 Results: What Students Know and Can Do (Volume I, Revised edition, February 2014): Student Performance in Mathematics, Reading and Science*, PISA, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264208780-en. [41]

OECD (Forthcoming), *An ecosystem approach to curriculum redesign and implementation (title TBC)*, OECD Publishing, Paris. [108]

OECD (Forthcoming), *Curriculum flexibility and autonomy (title TBC)*, OECD Publishing, Paris. [111]

Parker, J., D. Heywood and N. Jolley (2012), "Developing pre-service primary teachers' perceptions of cross-curricularl teaching through reflection on learning", *Teaching and Learning: Theory and Practice*, Vol. 8/6, pp. 693-716, https://doi.org/10.1080/13540602.2012.746504. [45]

Penuel, W. and L. Shepard (2016), "Social Models of Learning and Assessment", in *The Handbook of Cognition and Assessment*, John Wiley & Sons, Inc., Hoboken, NJ, USA, http://dx.doi.org/10.1002/9781118956588.ch7. [52]

Ramírez, M. (2006), "Understanding the low mathematics achievement of Chilean students: A cross-national analysis using TIMSS data", *International Journal of Educational Research*, Vol. 45/3, pp. 102-116, http://dx.doi.org/doi.org/10.1016/j.ijer.2006.11.005. [78]

Ramsden, P. (1993), "Theories of learning and teaching and the practice of excellence in higher education", *Higher Education Research and Development*, Vol. 12/1, pp. 87-97, https://doi.org/10.1080/0729436930120108. [89]

Rawling, E. (2015), "Curriculum change and examination reform for geography 14-19", *Geography*, Vol. 100/3, pp. 164-168. [11]

Rivkin, S. and J. Schiman (2015), "Instruction time, Classroom Quality, and Academic Achievement", *The Economic Journal*, Vol. 125/588, pp. F425-F448, http://dx.doi.org/10.1111/ecoj.12315. [60]

Rutherford, T., J. Long and G. Farkas (2017), "Teacher value for professional development, self-efficacy, and student outcomes within a digital mathematics intervention", *Contemporary Educational Psychology*, Vol. 51, pp. 22-36, http://dx.doi.org/doi.org/10.1016/j.cedpsych.2017.05.005. [19]

Sahlberg, P. (2016), "The Global Educational Reform Movement and Its Impact on Schooling", in *The Handbook of Global Education Policy*, John Wiley & Sons, Ltd, Chichester, UK, http://dx.doi.org/10.1002/9781118468005.ch7. [101]

Schmidt, W. et al. (2011), *Towards Coherence in Science Instruction: A Framework for Science Literacy*, Michigan State University, https://edwp.educ.msu.edu/wp-content/uploads/sites/34/2020/02/PROMSE-Coherent-Science-PRRvol8.pdf. [39]

Schmidt, W. and R. Houang (2012), "Curricular Coherence and the Common Core State Standards for Mathematics", *Educational Researcher*, Vol. 41/8, pp. 294-308, http://dx.doi.org/10.3102/0013189x12464517. [33]

Schmidt, W., R. Houang and L. Cogan (2002), "A coherent curriculum: The case of mathematics", *American Educator*, Vol. 26/2, pp. 10-26. [30]

Schmidt, W., H. Wang and C. McKnight (2005), "Curriculum coherence: an examination of US mathematics and science content standards from an international perspective", *Journal of Curriculum Studies*, Vol. 37/5, pp. 525-559, http://dx.doi.org/10.1080/0022027042000294682. [29]

Schunk, D. and M. DiBenedetto (2016), "Self-efficacy theory in education", *Handbook of Motivation at School*, Vol. 2, pp. 34-54, https://www.routledgehandbooks.com/doi/10.4324/9781315773384.ch3. [56]

Schwartz, M. et al. (2009), "Depth versus breadth: How content coverage in high school science courses relates to later success in college science coursework", *Science Education*, Vol. 93/5, pp. 798-826, http://dx.doi.org/10.1002/sce.20328. [36]

Segool, N. et al. (2013), "Heightened Test Anxiety Among Young Children: Elementary School Students' Anxious Responses to High-Stakes Testing", *Psychology in the Schools*, Vol. 50/5, pp. 489-499, https://doi.org/10.1002/pits.21689. [93]

Shepard, L., W. Penuel and J. Pellegrino (2018), "Using Learning and Motivation Theories to Coherently Link Formative Assessment, Grading Practices, and Large-Scale Assessment", *Educational Measurement: Issues and Practice*, Vol. 37/1, pp. 21-34, http://dx.doi.org/10.1111/emip.12189. [53]

Silova, I., V. Budiene and M. Bray (eds.) (2006), *Lithuania*, Open Society Institute. [70]

Silver, R. et al. (2011), "Curriculum implementation in early primary schooling in Singapore", *CRPP Research Report*, http://hdl.handle.net/10497/4453. [88]

Simon, M. et al. (2010), "A Developing Approach to Studying Students' Learning through Their Mathematical Activity", *Cognition and Instruction*, Vol. 28/1, pp. 70-112, http://dx.doi.org/10.1080/07370000903430566. [50]

Simon, M. and R. Tzur (2004), "Explicating the Role of Mathematical Tasks in Conceptual Learning: An Elaboration of the Hypothetical Learning Trajectory", *Mathematical Thinking and Learning*, Vol. 6/2, pp. 91-104, http://dx.doi.org/10.1207/s15327833mtl0602_2. [49]

Sparks, S. (2020), *In Many Districts, a Child's Academic Trajectory Is Set by 3rd Grade*, http://blogs.edweek.org/edweek/inside-school-research/2020/02/Academic_mobility_low.html. [80]

Stein, K., T. Kintz and A. Miness (2016), "Reflectiveness, Adaptivity, and Support: How Teacher Agency Promotes Student Engagement", *American Journal of Education*, Vol. 123/1, https://doi.org/10.1086/688168. [107]

Torres, A. (2016), "Is this work sustainable? Teacher turnover and perceptions of workload in charter management organizations", *Urban Education*, Vol. 51/8, pp. 891-914, https://doi.org/10.1177/0042085914549367. [74]

UNESCO (2002), *Building the capacities of curriculum specialists for education reform*, UNESCO, Paris, http://www.ibe.unesco.org/fileadmin/user_upload/archive/curriculum/Asia%20Networkpdf/vienrepor.pdf. [34]

van der Embse, N. et al. (2017), "The influence of test-based accountability policies on teacher stress and instructional practices: a moderated mediation model", *Educational Psychology*, Vol. 37/3, pp. 312-331, https://doi.org/10.1080/01443410.2016.1183766. [106]

van Silfhout, G. (2016), *Ruimte en sturing in het onderwijssysteem*, SLO nationaal expertisecentrum leerplanontwikkeling. [102]

Voogt, J., N. Nieveen and S. Klopping (2017), *Curriculum Overload: A Literature Study,* Unpublished OECD Reference Document. [1]

Wang, D. (2014), "The New Curriculum and the Urban-Rural Literacy Gap", *Chinese Education and Society*, Vol. 44/6, pp. 87-101, https://doi.org/10.2753/CED1061-1932440606. [98]

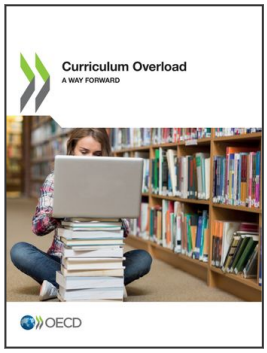
Weiner, B. (1972), "Attribution theory, achievement motivation, and the educational process", *Review of educational research*, Vol. 42(2), pp. 203-215. [59]

Wigfield, A. et al. (1997), "Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study", *Journal of Educational Psychology*, Vol. 89/3, pp. 451-469, http://dx.doi.org/doi.org/10.1037/0022-0663.89.3.451. [58]

Zarmati, L. (2019), *Future of Education and Skills 2030: Curriculum analysis. Learning progression in history*, https://www.oecd.org/education/2030-project/about/documents/Learning%20progression%20in%20history%20-%20Zarmati.pdf. [81]

Zee, M. and H. Koomen (2016), "Teacher Self-Efficacy and Its Effects on Classroom Processes, Student Academic Adjustment, and Teacher Well-Being: A Synthesis of 40 Years of Research", *Review of Educational Research*, Vol. 86/4, pp. 981-1015, http://dx.doi.org/doi.org/10.3102/0034654315626801. [20]

Zhen, R. et al. (2010), "Trajectory patterns of academic engagement among elementary school students: The implicit theory of intelligence and academic self-efficacy matters", *British Journal of Educational Psychology*, http://dx.doi.org/doi:10.1111/bjep.12320. [57]



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