What Students Learn Matters

TOWARDS A 21ST CENTURY CURRICULUM

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BETTER POLICIES FOR BETTER LIVES

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Executive Summary

Globalisation and rapid changes in technology are accelerating social, economic, and environmental challenges worldwide. Many of these changes are also opportunities for human advancement, but citizens must be equipped to handle them via a high quality and appropriately designed education. Current predictions around novel industries due to changes in technology and demands from a changing environment will certainly shift the skills required by future graduates. Curriculum can be refined and improved to prepare students for a world of challenges and opportunities. However, there can be a gap between the future needs and the time it takes to redesign and implement a curriculum.

Specifically, there are four dimensions of a time lag between future needs and current curriculum:

1. **Recognition time lag** occurs when the need for curriculum change in response to social and demographic changes (such as digitalisation or globalisation) is not quickly identified.
2. **Decision-making time lag** refers to the delay between when the need for a change is recognised and when an action plan for necessary changes is decided upon, including the time required for consensus-building on the need for change.
3. **Implementation time lag** occurs when new goals or procedures in a revised curriculum are not quickly or thoroughly adopted in classroom practice, affected by factors that inhibit or foster their implementation.
4. **Impact time lag** refers to the time elapsed from the action taken until its impact has become visible in students.

The OECD Learning Compass 2030 is a framework for education for the future. It is a globally shared vision for competencies that will help children and youth not only thrive but also shape their own future in holistic, inclusive, and sustainable ways. The OECD Learning Compass represents shared aspirations among countries/jurisdictions participating in Education 2030 toward education that is future-oriented, globally informed and locally contextualised, and centered on wellbeing at individual, societal, and environmental levels. The Learning Compass can serve as a tool for ensuring a future-oriented view during curriculum redesign and helping to close the recognition gap.

Decision-making time lag is a function of competing demands, articulating goals, and procedures and policies that drive curriculum reform. Countries have various timeframes during which they normally conduct a curriculum reform, but new challenges or societal demands may alter those timelines. In addition, governance structures and the need to build consensus can contribute to the decision to implement a change.

The implementation and impact of the curriculum reform similarly take considerable time. Administrators, schools, and teachers must appropriately plan to develop buy-in and a vision for the change. Teachers can be resistant to change, particularly when earlier reforms were not implemented well or there is no opportunity to learn the how, what, and why of the curriculum. Parents also may feel a loss of agency during a curriculum change especially if they are unclear of the intended goals and purpose. The impact of the curriculum can be difficult to examine given the multitude of changes occurring simultaneously. The full impact may not be realised for years, until students are able to experience the entirety of the curriculum.

The OECD Future of Education and Skills 2030 Policy Questionnaire on Curriculum Redesign (PQC) and Curriculum Content Mapping (CCM) have demonstrated unique examples and common strategies to minimise time lags. Some countries may identify societal goals that are translated to educational goals as a way to manage the curriculum redesign process and time gaps. Student profiles, or prototypes of students and their skills, knowledge, attitudes, and values to be achieved from learning at school can help articulate a vision which can be implemented via a curriculum redesign. Student profiles also can facilitate a smoother implementation of a curriculum when effectively incorporated in a curriculum and communicated to stakeholders.

Analyses suggest that there are common 21st century competencies that countries tend to embrace in their curricula to close time lags. For example, critical thinking and problem solving skills are mapped in over 60% of the curriculum on average across countries in the CCM. Critical thinking skills tend to be found in all seven of the mapped learning areas (national language, mathematics, humanities, science, technologies/home economics, arts, and PE health). The ability to think critically is valued and emphasised across countries and learning areas. These transferrable competencies embedded in curricula are more likely to be cognitive (e.g., critical thinking) than social or emotional skills (e.g., respect, trust) or compound concepts (e.g., agency, co-agency).

Countries also articulate a variety of planned curriculum changes. These include setting specific directions for reforms, changes to educational goals or instruction time, and subject or content renewal, among other changes. Anticipating reforms may imply the potential to shorten the decision-making time lag.

In addition to curriculum patterns and policy planning, countries have many lessons learned from their successes and challenges with curriculum redesign and implementation. These lessons can serve as models or words of caution for other countries seeking to conduct a curriculum redesign and include the following:

- Do not underestimate teachers' fear of the unknown and allow them space for mistakes.
- Empower teachers, rather than diminishing their agency, when developing innovative curriculum through new educational technologies.
- Acknowledge the need for incremental changes to the curriculum while maintaining aspirations for transformational change.
- Avoid reform fatigue among stakeholders by designing synergies between curriculum change and other educational reforms.
- Use structure and discipline when making changes to the digital curriculum, being aware of cyber security threats and personal data issues.

Effective planning and acknowledging key stakeholders in curriculum redesign – especially teachers and students – is key to an effective redesign process. A vision for students as active agents in their learning with the skills to work, live, and thrive in an ever-changing society can serve as a platform for such a process and ideally shorten lags in the redesign process.

Key Messages

We are facing unprecedented challenges – social, economic and environmental – driven by accelerating globalisation and a faster rate of technological developments. At the same time, those forces are providing us with myriad new opportunities for human advancement. The future is uncertain and futures often surprise us; but we need to be open and ready for it and we can also surprise our future. Some strategies include: 1) **forecasting future needs of society** and actively taking into account the students' needs, interests and voices when designing curriculum, and 2) **backcasting**, i.e. articulating a shared vision for student profiles as desired student outcomes, then looking back to today to identify curriculum changes necessary to achieve the shared vision.

In recent years, countries and schools are making a significant shift towards a 21st century curriculum: e.g. **1) Digital curriculum; 2) Personalised curriculum; 3) Cross-curricular content and competency-based curriculum; and 4) Flexible curriculum**. However, changes are made more slowly than expected or desired.

Time lag occurs due to: *1) recognition time lag; 2) decision-making time lag; 3) implementation time lag; and 4) impact time lag.* In reality, most delays arise in the implementation phase as a result from a lack of stakeholder buy-in, insufficient teacher preparation or teacher capacity to implement reforms, and variations in the pace of change across regions, localities or schools in decentralised education systems.

Across these types of 21st century curriculum, what is commonly articulated are future visions on the **student profiles such as student agency, co-agency and transformative competencies (creating new value, taking responsibility, and reconciling tensions, dilemmas, trade-offs and contradictions)**, which are all well aligned with the OECD Learning Compass 2030.

- Student agency and co-agency are both highlighted in many curricula; **student agency** (33 %) emphasised in areas such as national language, humanities, and technologies/home economics, and **co-agency** (27%) also emphasised in national language, humanities and technologies/home economics.
- Among transformative competencies, **creating new value** is present more frequently (35%) in areas such as national language, arts, and technologies/home economics; **taking responsibility** (29%) in national language, humanities and PE health; and **reconciling tensions** (19%) in humanities and national language learning area.
- Among skills, attitudes and values for 2030, cognitive skills are the most highly emphasised, e.g. **critical thinking** (66%) **problem-solving** (59%) both in almost all subject areas; this suggests that these cognitive skills are considered highly transferable across any learning areas. The meta-cognitive skills, **learning–to-learn**, is also included in all areas but to a lesser extent (36%). Attitudes and values are also included in curriculum but to a lesser extent, e.g. **respect** (31%) in areas such as national language, humanities; **trust** (15%), in humanities, PE health,
- Anticipation, action and reflection are embedded in almost all areas, suggesting they are considered as transferable competencies. However, **anticipation**, which is increasingly becoming an important competency to manage uncertainty, is articulated to a lesser extent (34%) than **action** (43%) and **reflection** (41%).

Five key lessons learned from unintended consequences countries experienced when tackling time lag issues suggest:

1. Do not underestimate teachers' fear of the unknown and allow them space for mistakes as current accountability systems, when blindly put into practice, put pressure teachers to keep status quo with what they already know;

2. Empower teachers, rather than diminishing their agency, especially when developing innovative curriculum through new educational technologies, because easy-to-apply automation can deprive opportunities for them to think and find creative solutions, and they should be aware of individual differences among students;

3. Acknowledge the need for incremental changes to the curriculum while maintaining aspirations for transformational change, as the political economy of reform is high in either directions – costs of action and no-action;

4. Avoid reform fatigue among stakeholders by designing synergies between curriculum change and other educational reforms, because some reforms are too frequent or contradictory that schools, teachers, and students would get confused and would need stable, coherent and sustainable changes;

5. Use structure and discipline when making changes to the digital curriculum, being aware of cyber security threats and personal data issues. Of the four types of a 21st century curriculum, digital curriculum is a new development and therefore more conscious efforts are required in advancing digital transformation in curriculum.

What does research say?

WHAT IS TIME LAG?

Time lag in curriculum occurs when the curriculum content that children are learning in school today lags behind what they will be expected to know and do with that knowledge, and how they will engage in the world, when they grow up (the OECD Education 2030 Policy Questionnaire on Curriculum Redesign [PQC]). Curriculum therefore needs refining and improving to align with changes in society (Bude, 2000[1]).[1]

Four dimensions of time lag in curriculum redesign

Four dimensions have been proposed to identify and conceptualise the different types of time lag. They broadly reflect the different phases of curriculum redesign (See Box 1).

Box 1 Four dimensions of time lag in curriculum redesign

1. **Recognition time lag** occurs when the need for a curriculum change in response to social and demographic changes (e.g. digitalisation, globalisation and migration) is not quickly or clearly identified.
2. **Decision-making time lag** refers to the delay between when the need for a change is recognised and when an action plan for necessary changes is decided upon, including the time required for consensus-building on the need for the change.
3. **Implementation time lag** occurs when new goals or procedures in a revised curriculum are not quickly or thoroughly adopted in classroom practice, affected by factors that inhibit or foster their implementation.
4. **Impact time lag** refers to the time elapsed from the action taken until its impact has become visible, i.e. the time it takes for the impact of a curriculum change on students' outcomes to be observed.

Source: Adapted from Halinen (2017[2]) and van den Akker (2018[3]).

It is important to note that there is some overlap between the recognition and decision-making phases and the decision-making and implementation phases. Piloting changes often starts during the decision making phase and continues in the implementation phase, particularly when those who will be implementing the reform are involved in the decision-making process (NCCA, 2017[4]). In addition, the duration and significance of the time lag depends on the context and many other factors, including the nature, extent and depth of the changes and the size and governance structure of the country/jurisdiction.

RECOGNITION TIME LAG

Building a peaceful and sustainable future requires a range of competencies that go beyond being ready for jobs. In today's world, people need to have a great deal of social and environmental awareness, as well as the ability to co-operate, negotiate and find creative solutions to new and old problems. These realities are key drivers for change in transforming education for a better future (OECD, 2018[5]). Recognition time lag also implicitly refers to the ability of people working in education to look beyond the present reality and anticipate the future, in order to understand or imagine what kind of competences will be needed (Halinen, 2017[2]).

Demographic changes, such as migration, urbanisation, ageing and global population growth, raise questions on how limited resources can stretch to meet growing social demands. While science and technology develop at an unprecedented pace, the well-being of societies and individuals in many parts of the globe is threatened by growing inequalities in living standards, access to health care and social inclusion in diverse societies, as well as by violent conflict. Environmental challenges, such as climate change and the depletion of natural resources, also add to the range of global problems that affect communities.

Such societal changes put pressure on education systems to adapt and better support students to overcome their fear of unknown and thrive in a volatile, uncertain, complex and ambiguous world (Johansen, 2013[6]). It takes time for stakeholders to adapt to these changes in society, and that contributes to a recognition time lag before curriculum can be changed.

Speed of change accelerated by technology

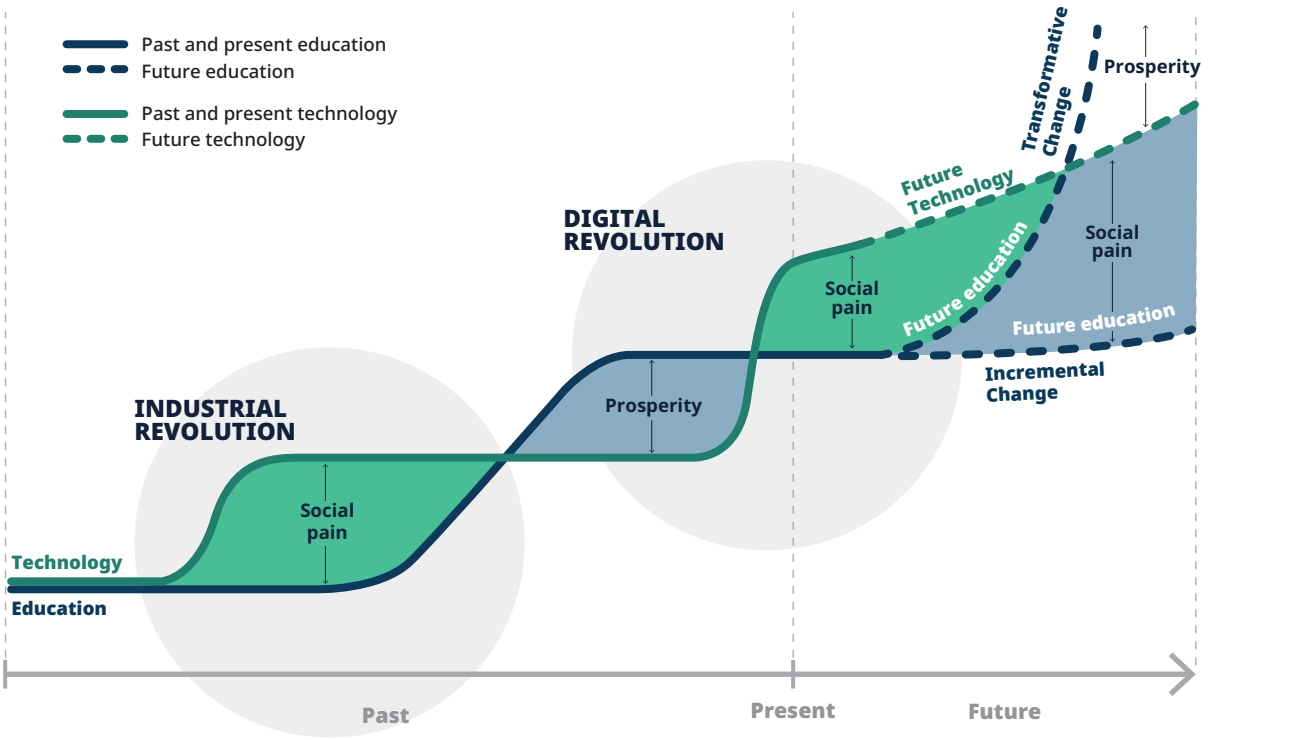
Many of the economic, societal and environmental transformations are taking place very rapidly, but education systems are relatively slow to adapt and change – sometimes for the right reasons and other times for reasons unrelated to students' needs. This challenges the relevance of existing curricula and creates a real risk of ballooning time lag.

For example, education was a driver for technological advances following the industrial revolution, which led to a sustained period of prosperity. But during the digital revolution, technology has outgrown and outpaced changes in education (Figure 1). When the demands and development of technology exceed the education and skills of children and adults, there can be a gap in productivity and prosperity.

Depending on the nature of work being considered, technology has the capacity to either replace work or to supplement and support workers with augmentation. For example, robotics and automation might replace manufacturing work, but likewise new technologies, such as machine-learning can increase the productivity of software developers. Technology that supplements workers (e.g. by speeding up cognitive processes) can generate new investment and manufacturing opportunities (Morgan et al., 2019[7]).

New advancements, such as increased capabilities of medical technologies not only contribute to improved medical care for patients, but also create new skills and capacities for medical practitioners. These advancements in technology can help prepare students for autonomous, wholehearted engagement in their worlds to contribute to our human flourishing (Stevenson, 2020[8]). With a growing reliance on artificial intelligence, skills such as complex problem solving, critical thinking, creativity, people management, and emotional intelligence are increasingly viewed as some of those most reliant on intrinsic human values (World Economic Forum, 2016[9]).

Figure 1 **The race between technology and education**



Note: Inspired by The race between technology and education, Goldin & Katz (Harvard)

As we move forward, education can continue to lag behind technology, or it can catch up and take a lead position, boosting the prospects of increased prosperity. A persistent lag can only increase the level of social pain produced by the gap between technology and the shortage of competencies that can benefit from those technologies. No single change and no incremental changes in the system are likely to bring education up to speed, notably for children and students from disadvantaged backgrounds. The COVID-19 pandemic in 2020 shone a spotlight on the digital divide and equity gaps in education and has amplified them. Speedier and deeper transformational change is vital to shorten the period of social pain, particularly as related to equity.

The political and economic costs of introducing such transformational change are high, but so are the costs of inaction, which may have long-lasting negative impacts on society as a whole.

Such transformational digitalisation is not an end in itself, but should be viewed as one of the means to achieve the paradigm shift required to achieve a new normal in education (see Table 2).

Fear of the unknown and adhering to past successes

Keeping up with constant and rapid changes in the economy and in society can be challenging for education systems, which often tend to perpetuate approaches that have worked in the past. In some countries/jurisdictions, the term "industrial era schools" is often used to convey the time lag that some schools today still experience, with features that prepared students for jobs during the industrial era (i.e. mass production based on assembly lines and the division of labour). Mirroring this in education, "efficiency and mass education" were the norm, and the curriculum was designed to be static, linear, standardised and prescriptive, so that any teacher could teach the same level of content to meet the demands for factory workers.[2]

The organisation of work has changed significantly over time, from the 19th century model based on a strict division of labour, assembly lines and a highly hierarchical culture to the 21st century model of shared responsibility and team-work in flat, open, flexible and transparent organisations. However, in some countries/jurisdictions, this shift in education is not keeping up with the pace of change in society. This is partly due to fear of the unknown which can result in resistance to curriculum change and partly due to the difficulty in building consensus on the types of competencies required to meet future demands.

Resistance to change can also occur when people are overly attached to past solutions. Consistent with the Cognitive Behavioural Model of Panic, the human brain tends to revert to past heuristic models to manage uncertainty, even when those heuristics may now be outdated or even unhelpful (Salkovski, Clark and Gelder, 1996[10]). The relevance of schooling for current and future generations will depend on how promptly and effectively governments can recognise future needs and take action. A country/jurisdiction may have been a top performer in the industrial model of education, but that does not guarantee continued positive performance. Instead, educators must redefine past models of success and reconsider how to manage uncertainty with new solutions. These steps are critical to minimise the potential negative effects of increased time lag.

Difficulty in predicting and identifying future needs and competencies

Recognition time lag also occurs because it is very difficult to predict future changes and to gauge the time required to build consensus on the types of skills, knowledge, attitudes and values needed in our changing world. Part of the challenge lies in the ability to anticipate which competencies are likely to endure.

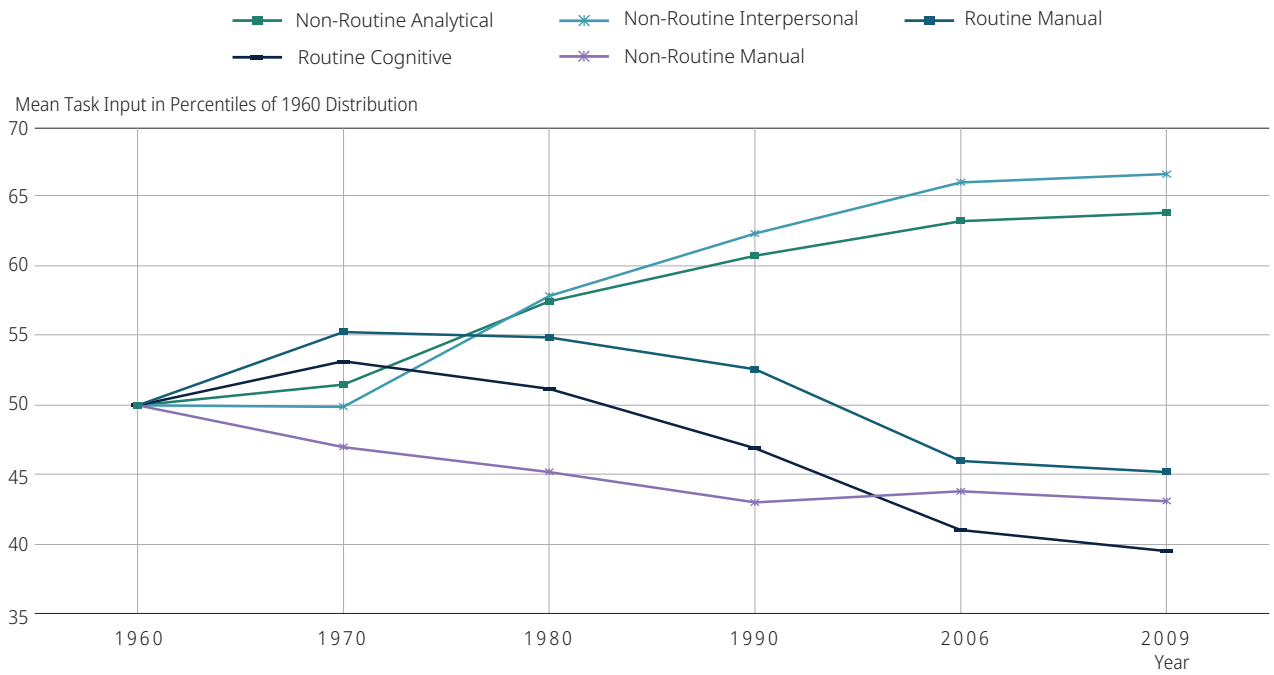
Job-related competencies for an uncertain future with accelerated technological changes

An estimated 65% of children entering primary school are expected to work in completely new jobs that did not exist at the time they started their schooling (World Economic Forum, 2016[9]).[3] Trends in the types of skills required have also shifted dramatically over the past 50 years. Routine manual and cognitive tasks were once the norm, but today's jobs require more non-routine analytic and interpersonal skills (Figure 2). The set of competencies required for some new and emerging jobs have been described as "fusion skills" (i.e. a combination of creative, entrepreneurial and technical skills). These positions, along with activities that require human care (e.g. empathy in the case of health care professionals), are less likely to be replaced by computers (OECD, 2015[11]). With a growing reliance on artificial intelligence (AI), such skills are increasingly viewed as those most reliant on intrinsic human values.

Citizenship in society and digital space

Technologies and jobs are not the only facets of rapid change in society. Traditional forms of civic and social engagement, such as voting and volunteering, have been in decline in many parts of the globe for decades. While voter turnout is influenced by many contextual and local factors, a downward trend has been observed in many countries (Figure 3). In response, an increasing number of countries have started to explicitly articulate citizenship, including global and digital citizenship, as part of educational goals. The aim is to prepare current and future generations to thrive in increasingly complex and diverse societies, which will require trust, tolerance and collaboration in both political and social processes (OECD, 2013[13]).

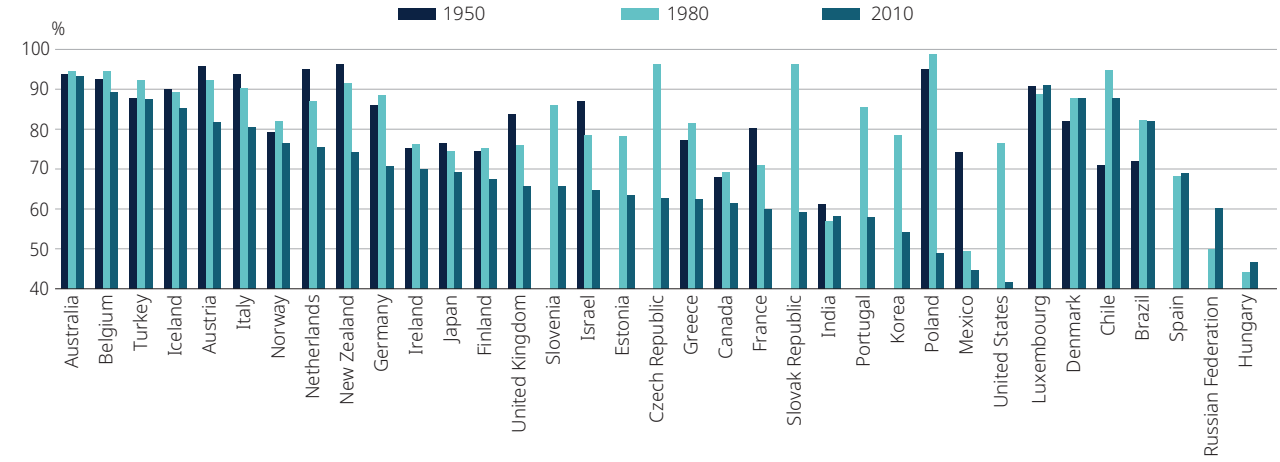
Figure 2 **Trends in types of tasks required for work**



Note: This figure shows how the composition of tasks performed by US workers has changed from 1960 to 2009.
Source: Autor and Price (2013) in Bialik and Fadel (2018, p. 7[12]).

Figure 3 **Fewer people engaged in their democracies**

Parliamentary voter turnout, in 1950, 1980 and 2010 (or nearest available year)



Note: Voter turnout is the total number of votes cast (valid or invalid) divided by the number of people registered to vote, expressed as a percentage. Where the data for countries were not consistently available in the same years, figures from the closest year are used. The year of each data point is available at: https://dx.doi.org/10.1787/888932758074
Source: International IDEA (2011), Voter Turnout Database

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The rise of the Internet and the popularity of social networking sites have the potential to shape new forms of political and social engagement. Some communities have already been tapping into those opportunities to increase the levels of interest and engagement in political activity, particularly among youth (Pew Research Center, 2013[14]). Relatively simple ways to mobilise people around issues that matter to all include, for example, live-streaming town-hall meetings, using platforms to crowdsource ideas and recruit volunteers, using social networks for increasing the reach of public events, etc.

The benefits of digital democracies are yet to be fully realised, and the risks (e.g. privacy, security and equality) are yet to be fully addressed (European Parliament, 2020[15]). However, increased civil involvement will remain a priority in a globally connected world, as the COVID-19 pandemic has dramatically demonstrated.

Environmental literacy for a sustainable future

Overpopulation and economic development put strenuous pressure on the planet. Greenhouse gas emissions, deforestation, disruption of wildlife and ocean life, and loss of biodiversity are among the top environmental concerns for current and future generations. As some types of environmental degradation are not immediately tangible, the perception that such threats are far out in nature and remote from our daily lives represents another threat to our ecosystem (Kollmuss and Agyeman, 2002[16]). And life on the planet – human and non-human – is deeply interconnected in many ways. Consumerism generates waste and pollution; traditional forms of electricity tap into limited natural resources; water and air pollution diminish the supply of fish, crops and potable water; and polluted air, water or food affect human health.

Younger people tend to be more worried about climate change than older people (Reinhart, 2018[17]). Although the research is heterogeneous, young people may have increased consciousness about climate change. They are also more likely to have misunderstandings related to scientific knowledge and often live lifestyles similar to older generations (Ojala and Lakew, 2017[18]). A change in the course and speed of environmental threats requires a shift in people's mindsets: from consumer to steward of nature, from utilitarianism to sustainability, from predatory behaviour to nurturing, restoring and rebuilding for a better future (OECD, 2020[19]).

Individual and collective well-being

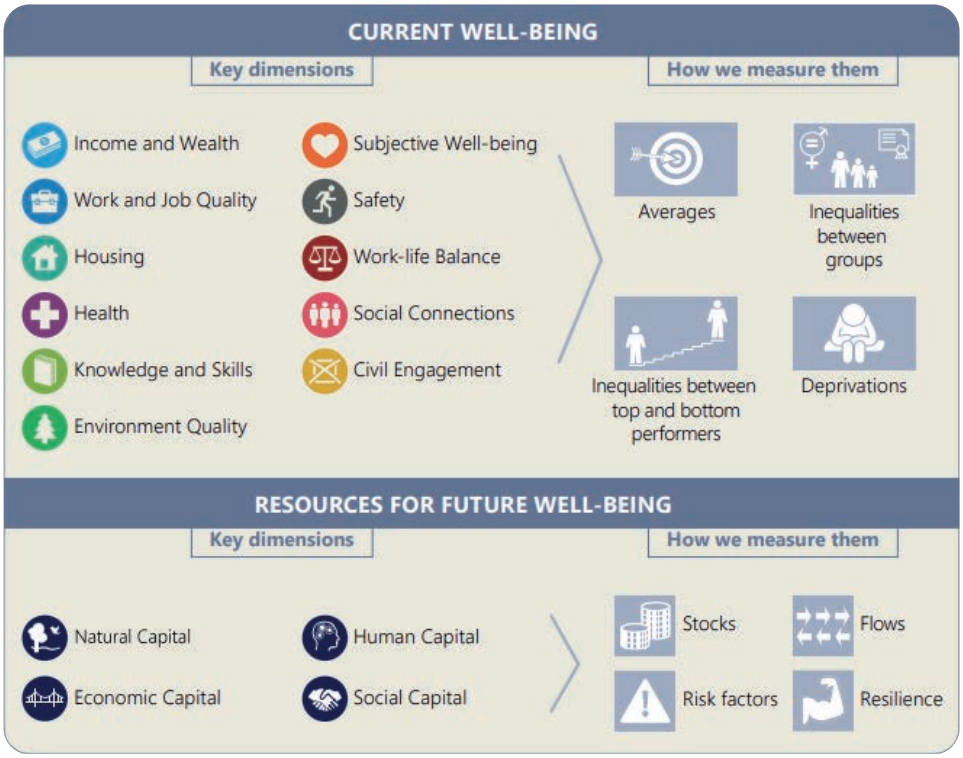
Governments are increasingly recognising that inclusive growth cannot be limited to the material dimensions of well-being, but also needs to encompass the physical and emotional health of all, their safety (and perceptions thereof) and their levels of life satisfaction, as well as their sense of belonging in a community (OECD, 2018[5]). The OECD Well-being framework recognises the complexity of the concept of well-being by assessing not only material conditions but also quality of life factors that influence people's sense of well-being. Figure 4 demonstrates 11 key dimensions of well-being (OECD, 2020[20]).

One example of how the social, economic and individual dimensions are influential on well-being is reflected in the rise of the number of people living alone in many countries. Social and economic changes, such as increased job mobility, greater disposable income, higher rates of divorce and ageing, have given rise to a high number of people in many countries who live alone. The factors increase the risk of social isolation and fragmentation (Figure 5).

Countering the threats of social isolation in this hyper-connected world, young people will need to have life competencies, such as the ability to exercise empathy, to collaborate and learn from others, to negotiate and to positively influence their environment, and particularly to take action to improve their own lives and those of others.

Schools are in a privileged position to guide young people on how to make a difference in the real world. Service learning, for example, which links schools to local needs in their communities, can be an integral component of a curriculum that fosters authentic learning. It can help students to develop social responsibility and other competencies that are needed to fully participate and shape the world around them, for increased individual and societal well-being (David, 2009[21]).

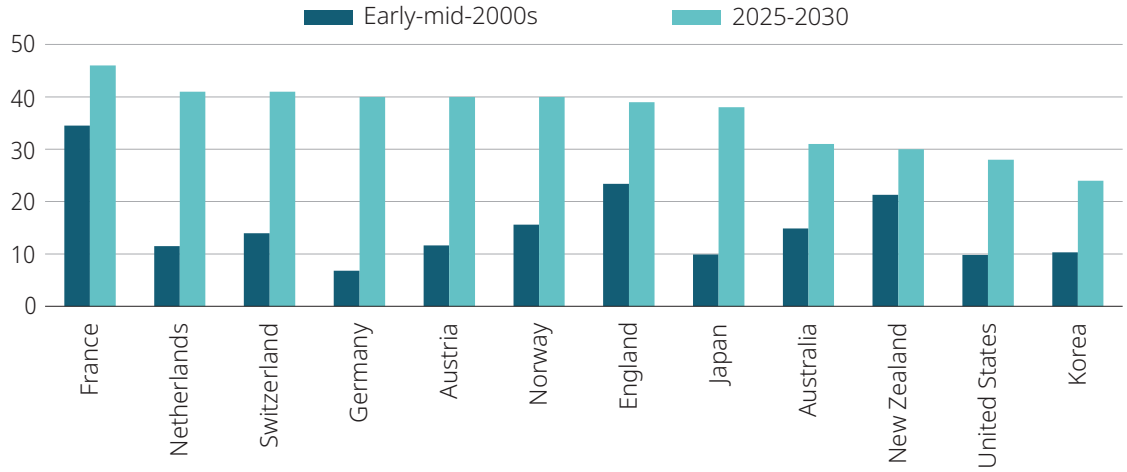
Figure 4 **OECD Well-being framework**



Source: OECD (2020), *How's Life? 2020: Measuring Well-being*, OECD Publishing, Paris, https://doi.org/10.1787/9870c393-en.

Figure 5 **Home alone: The rise in single-person households**

Number of one-person households, in the early to mid-2000s and projected to 2025-2030



Note: A one-person household refers to a household in which a person makes provision for his or her own food or other essentials for living without combining with any other person to form part of a multi-person household.

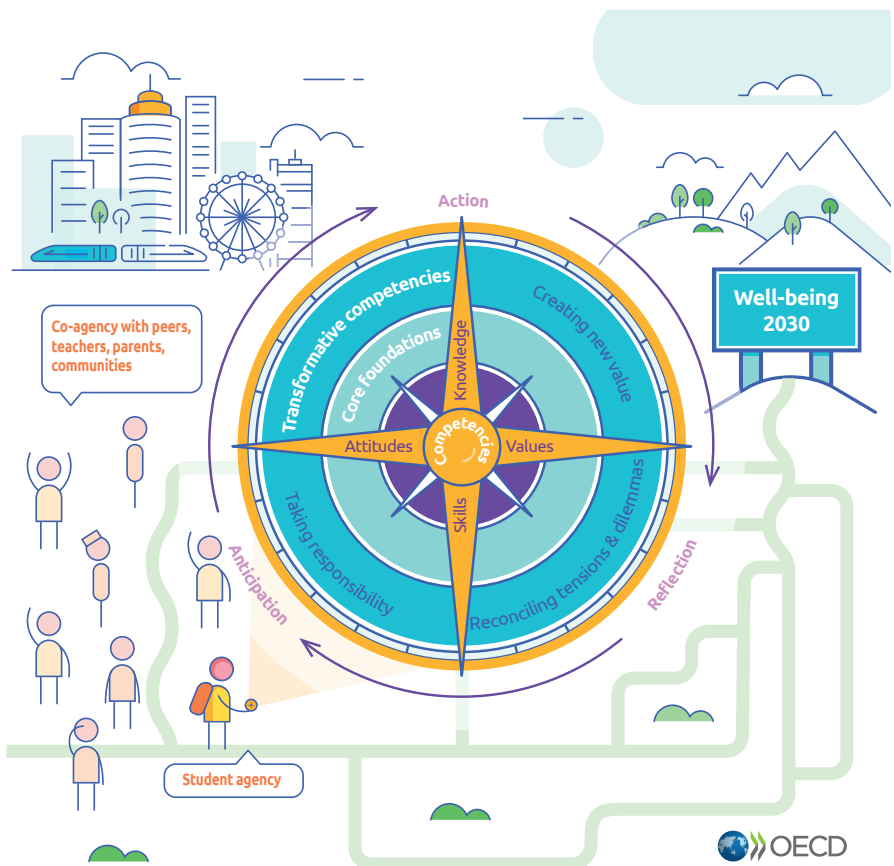
Source: OECD (2011), *The Future of Families to 2030*, OECD Publishing, Paris, https://doi.org/10.1787/9789264168367-en.

OECD Learning Compass 2030

Recognising the importance of minimising the discrepancies between changes in the world and the type of education available to children, many countries worked together to develop the OECD Learning Compass for 2030, a new learning framework for the future (Figure 6). It was co-created as a globally shared vision for the types of competencies (knowledge, skills, attitudes and values) that will help children and youth not only to thrive but also to shape their own future in holistic, inclusive, and sustainable ways. The OECD Learning Compass represents shared aspirations among the countries/jurisdictions participating in Education 2030 project towards a type of education that is future-oriented, globally informed and locally contextualised, and centred on the notion of well-being at individual, societal and environmental levels (OECD, 2018[5]). For country-specific visions and competencies, please see the "Data" section below.

Anchored in the OECD Key Competency Framework (the DeSeCo project) (OECD, 2016[23]), the Learning Compass 2030 maintains solid theoretical underpinnings, but is at the same time practical and easy to apply. The metaphor of the "learning compass" is used to illustrate the types of competencies – the knowledge, skills, attitudes and values – that students need to reach the goal of well-being, just as a compass shows the points used to determine geographic direction and helps you reach your destination. A brief summary of the seven future-oriented competencies follows (for more detail, see the OECD Learning Compass 2030 Concept Note Series (OECD, 2019[22])).

Figure 6 **OECD Learning Compass 2030**



Source: OECD Learning Compass 2030. A series of Concept Notes (OECD, 2019[22])

1. **Student agency/co-agency**: Student agency for 2030 is rooted in the belief that students have the ability and the will to positively influence their own lives and the world around them. It is defined as the capacity to set a goal, reflect, and act responsibly to effect change. It is about acting rather than being acted upon, shaping rather than being shaped, and making responsible decisions and choices rather than accepting those determined by others. The concept of agency has resonance consequently not only for how young people engage in education, but what they take from their schooling as they navigate transitions into work. In education systems that encourage student agency, learning involves not only instruction and evaluation but also co-construction. The concept of co-agency recognises that students, teachers, parents and communities work together to help students progress towards their shared goals.

2. **Core foundations**: The OECD Learning Compass 2030 defines core foundations as the fundamental conditions and core skills, knowledge, and attitudes and values that are prerequisites for further learning across the entire curriculum. The core foundations provide a basis for developing student agency and transformative competencies. All students need this solid grounding in order to fulfil their potential to become responsible contributors to and healthy members of society. Besides basic literacy and numeracy, digital literacy and data literacy are increasingly recognised as fundamental conditions for students to thrive in the future. Core foundations also include social and emotional foundations as well as health foundations (physical and psychological).

3. **Transformative competencies**: To meet the challenges of the 21st century, students need to be empowered and feel that they can help shape a world where well-being and sustainability are achievable – for themselves, for others and for the planet. The OECD Learning Compass 2030 has identified three transformative competencies that students need in order to contribute to and thrive in our world and shape a better future: creating new value, reconciling tensions and dilemmas, and taking responsibility.

4. **Knowledge for 2030**: As part of the OECD Learning Compass 2030, knowledge includes theoretical concepts and ideas, in addition to practical understanding based on the experience of having performed certain tasks. The Education 2030 project recognises four different types of knowledge: disciplinary, interdisciplinary, epistemic and procedural.

5. **Skills for 2030**: Skills are the ability and capacity to carry out processes and be able to use one's knowledge in a responsible way to achieve a goal. The OECD Learning Compass 2030 distinguishes three different types of skills: cognitive and metacognitive; social and emotional; and practical and physical. Some of the key skills explored in the project's curriculum content mapping include: critical thinking, problem solving, learning-to-learn skills, co-operation/collaboration, self-regulation/self-control, adaptability and persistence/resilience.

6. **Attitudes and values for 2030**: Attitudes and values refer to the principles and beliefs that influence one's choices, judgements, behaviours and actions on the path towards individual, societal and environmental well-being. For example, strengthening and renewing trust in institutions and among communities require greater efforts to develop core shared values of citizenship in order to build more inclusive, fair, and sustainable economies and societies. Socially situated attitudes and often unspoken expectations also frame young people's career aspirations and their ability to relate schooling to long-term employment outcomes (Musset and Mytna Kurekova, 2018[24])

7. **Anticipation-Action-Reflection competency development cycle**: The Anticipation-Action-Reflection (AAR) cycle is an iterative learning process whereby learners continuously improve their thinking and act intentionally and responsibly. In the anticipation phase, learners become informed by considering how actions taken today might have consequences for the future. In the action phase, learners have the will and capacity to take action towards well-being. In the reflection phase, learners improve their thinking, which leads to better actions towards individual, societal and environmental well-being.

DECISION-MAKING TIME LAG

Decision-making time lag occurs because, due to various competing demands and concerns, making decisions on new goals, procedures and policies requires a long process that takes time (Halinen, 2017[2]). The decision-making phase typically includes the time required to draft the new curriculum following the recognition that it is time to act and change the curriculum. In some countries, the decision-making process may overlap with the recognition time lag. This is the intentional combining of the process of identifying the need for change as well as engaging in consensus-building with the process of decision-making.

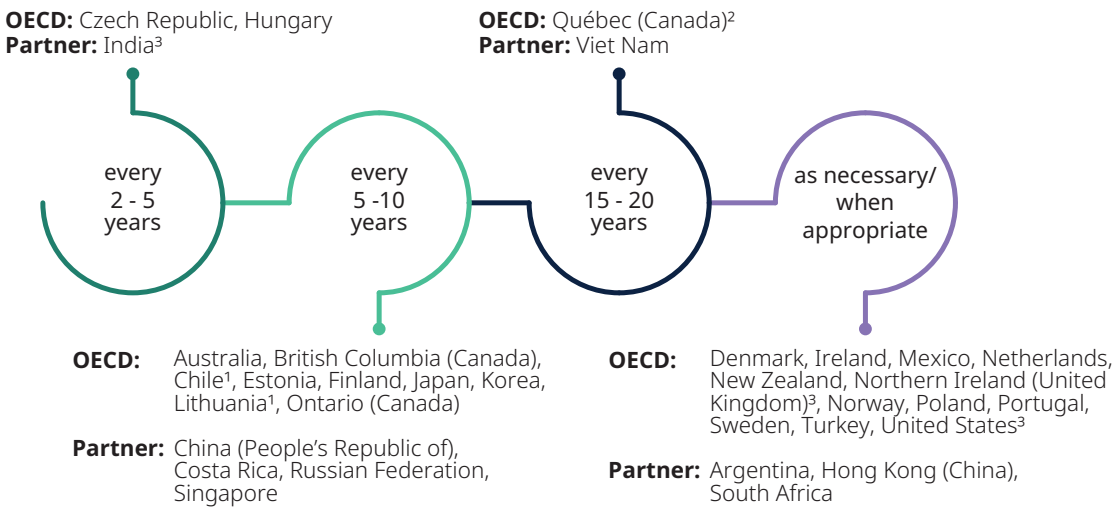
Factors that can affect the length of decision-making time lag include: how frequently major curriculum reforms are designed, whether the curriculum renewal occurs on fixed cycle or an ad hoc basis; the scope and alignment of the reform; and the degree of centralisation or decentralisation in which the curriculum renewal is to take place.

Frequency of curriculum reforms

Countries/jurisdictions tend to distinguish between fixed or regular and ad hoc reforms. Regular reforms are defined as curriculum reforms conducted every set number of years. Ad hoc reforms refer to curriculum reforms conducted when the need arises, without a fixed interval.

Countries/jurisdictions often use fixed reform cycles as an opportunity to conduct comprehensive curriculum changes[4] (Table WEB 11[5]). The frequency of those comprehensive or major reforms varies considerably across countries/jurisdictions, from on an ongoing basis to every 20 years, or as necessary or appropriate as shown in Figure 7. Typically, a little less than half of the countries (15 out of 33) engage in major reforms as necessary or on an ongoing basis, and some by cycles of every 5-10 years (13 out of 33). A few countries/jurisdictions engage in shorter cycles, i.e. every 2-5 years (3 out of 33), or longer cycles, i.e. every 15-20 years (2 out of 33).

Figure 7 **Frequency of major curriculum reforms**



Note: As necessary/when appropriate: country/jurisdiction does not have a set timeframe for curricular reform and initiates curriculum redesign as necessary/when appropriate.

1. Chile conducts reforms every 6-12 years, Lithuania every 10-12 years.
2. With adjustments made as necessary/appropriate.
3. Responses for these countries/jurisdictions were submitted by independent researchers, not government administrations.

Source: Data from the PQC, item 2.1.1.

StatLink https://doi.org/10.1787/888934195017

There is no clear research evidence on the optimal frequency of curriculum reform as curriculum designers operate in different national contexts. Election cycles, for example, may affect whether or not a curriculum reform may take place or continue. These can vary in and among countries/jurisdictions.

Recognising that the frequency of reform cycles can affect how quickly education systems adapt their curriculum to current and future needs, countries/jurisdictions also use a combination of regular and ad hoc reforms to address the need for timelier curriculum renewal (See Table WEB 11[6]). A range of other factors, in addition to the frequency of reforms, can affect the extent and length of the four types of time lag identified in Box 1. They are discussed in the sequence.

Characteristics of fixed and ad hoc curriculum change

Decision-making time lag is associated with dilemmas and trade-offs between a quick response to emerging needs and the risk of a fragmented curriculum.

Countries/jurisdictions typically have built-in periodic curriculum renewal cycles to ensure continuity and efficiency (Sivesind and Westbury, 2016[25]; NCCA, 2017[4]; Pietarinen, Pyhältö and Soini, 2017[26]). However, this process may be more costly than other types of renewal, as more permanent staff are needed to run it (NCCA, 2017[4]). The downside of long-term fixed curriculum life cycles is that they make it difficult to respond to emerging societal needs or research findings in an agile way and thus could cause students to miss out on learning opportunities relevant to actual needs in our changing world.

Ad hoc curriculum reform processes typically involve modifying parts of a curriculum (e.g. adding a new subject, renewing subjects that scored low on international rankings or undertaking reform only at one level). Such ad hoc reforms can be either incremental or radical. They may cost less and require less time and allow more agility in adjusting curriculum, as they are generally only a partial renewal.

It is, however, important to note the risks of ad hoc partial curriculum changes. Various stakeholder groups may have vested interests in including new topics in the curriculum. Simply adding new topics and content without removing any content and without proper consideration of how such new topics fit the overall purpose and design of the curriculum often leads to overload or fragmentation (NCCA, 2017[4]) and may lead to incoherence across grades and learning areas (see (OECD, 2020[27])). Indeed, countries/jurisdictions report both difficulties and opportunities associated with fixed and non-fixed curriculum reform time frames, as well as with frequent or less-frequent reforms.

Scope and alignment of the reform

Most curriculum reforms comprise one or more of the following elements:

- a change in educational goals
- a change in instructional time
- subject renewal (adding new subjects, merging subjects, reorganising subjects into learning areas)
- content renewal (adding new content while reducing other content), either across the curriculum or in only a few grades, a single educational level or the entire grade span.

When changing **educational goals** in the past, it was considered faster to negotiate and plan within a limited set of stakeholders, rather than building support and co-ordinating planning. However, a more democratic approach is increasingly observed across OECD countries. Research shows that what motivates curriculum reform among all stakeholders is a shared sense of urgency on issues such as social, economic, and technological changes, concerns about current performance of the education system, and the desire to strengthen the sense of national identity (Barber, Chijioke and Mourshed, 2010[28]; Bolstad and Gilbert, 2012[29]; Curriculum Development Council, 2015[30]). For example, Scotland (United Kingdom) organised a national debate to discuss how the education system could equip young people for the future, which led to its Curriculum for Excellence (McAra, Broadley and McLauchlan, 2013[31]; Donaldson, 2014[32]). In People's Republic of China (hereafter "China"), one important goal of curriculum reform was to strengthen the national identity, with different stakeholders actively involved in the early consensus-building process (Law, 2014[33]).

There is significant variation in the time required to modify **instructional time** and to **renew subjects and content**, as these changes can apply to only a few grades, to a single educational level or to the entire grade span. In general, curriculum changes that are limited in scope (e.g. covering only a few learning areas, such as literacy and numeracy) or that target only a few grade levels tend to be shorter than extensive reform of an entire national curriculum. In all areas, such reforms can be subject to political pressures and competition among different subjects (OECD, 2020[27]).

Other types of change include **a structural review of the curriculum** (i.e. one that goes beyond modifying subjects). One example is the shift towards a concept-based competency-driven curriculum (OECD, 2020[27]). Structural curriculum reforms are often easier to plan than to actually implement, so it is important to consider how to minimise implementation time lag while the reform is being planned.

Substantive curriculum reform may include **changes in examinations,** as well as in **teacher education/certification requirements**. All of these have their own timetables and can add to the overall time lag in curriculum change. Therefore, intentionally aligning the different aspects of the reform to ensure coherence will result in a steadier, quicker and more sustainable curriculum reform[7] (OECD, Forthcoming[34]).

Governance and time needed to build consensus on the changes

Curriculum redesign requires time for consultation with many different stakeholders, in order to build consensus and ownership and to support development of a quality curriculum (Barnard, 2003[35]; McAra, Broadley and McLauchlan, 2013[31]; Law, 2014[33]; NCCA, 2017[4]). This also adds to the decision-making time lag.

Research on the association between governance models and time lag issues is inconclusive. Some research suggests that the time needed for a whole curriculum redesign tends to be shorter in countries/jurisdictions with centralised curriculum policy than in those with decentralised curriculum policy, given the consultation requirements and processes involved in building consensus (van den Akker, 2018[3]). Other research suggests that smaller reforms at the local level tend to proceed faster and more smoothly than extensive national reforms (NCCA, 2017[4]; Halinen, 2017[2]). The governance model is not the exclusive factor in time lag variations. Other factors such as the scope of the curriculum reform also play a role.

Although some researchers suggest that local/school decision-making can be quicker than national decision making, others point out that the needs of schools vary considerably and that some schools may need to prioritise literacy and numeracy over so-called 21st century skills. Further circumstances that may prolong time needed for local-level or decentralised system decision-making can also include considerations of teacher involvement. Teachers may not feel prepared to take on the role of curriculum designers, or may feel pressure to (include elements to) prepare students for high-stakes testing (Voogt, Nieveen and Klopping, 2017[36]).

The process will also depend on the role of involved stakeholders. Countries/jurisdictions have found different ways to involve teachers. In the redesign process, for example, approaches include: systematic consultation or communication throughout the

whole process; ensuring a key role for teachers in the design team, as in British Columbia (Canada) and the Netherlands, and encouraging active involvement of local levels in school curriculum development, as in Finland (van den Akker, 2018[3]).

Since the scope of curriculum reform varies considerably across countries/jurisdictions as seen earlier, time comparisons regarding curriculum change processes in different contexts need to be evaluated with caution. It is vital to consider the various factors that could play a role, such as the extent and depth of the changes, the role of stakeholders, the levels of co-ordination and buy-in among key stakeholders, and how the changes and the whole review process are designed.

IMPLEMENTATION TIME LAG

A time lag is often reported between the intended or written curriculum and the implemented or taught curriculum (see the Overview brochure of the Education 2030 series of thematic reports on curriculum redesign)[8]. Countries/jurisdictions report different phases involved in a reform, namely, planning, decision-making, preparation, implementation and monitoring:

1. **Planning**: Includes not only planning per se but also related activities, such as subsequent review of strategy and timeline, reviews of literature and national and international curricula, identification of stakeholders and their role, and discussions with stakeholders and experts.
2. **Decision-making**: Can include the time to finalise detailed specifications of the reform and where the curriculum may be redeveloped, based on those specifications.
3. **Preparation**: May encompass preparations for implementation, including dissemination of the new curriculum and guidelines, and preparation of teachers and school facilitators.
4. **Implementation**: Includes the work of implementing the curriculum across the system.
5. **Monitoring**: Includes the period when the curriculum is being monitored and there is time to conduct reviews, follow-ups and evaluations.

Of these phases, a considerable time lag can occur when moving from curriculum redesign to curriculum implementation, in particular, because of the time it takes to prepare schools and teachers to adopt new goals and procedures (Halinen, 2017[2]). Policy makers tend to underestimate the time needed for implementation because they often see it as a technical process.

Complexity of phasing a curriculum reform cycle

Countries/jurisdictions may choose different strategies to structure their major curriculum reform processes. There are complex curriculum design choices they can make:

- Planning a total duration of a reform with different phasing strategies (e.g. Table 1, Figure 9, Figure 10).
- Designing agility and stability through the use of major or ad hoc reforms or combination of both (e.g. Figure 10).
- Designing a scope of reforms, e.g. moving all aspects together or targeting some aspects in focus (e.g. Figure 11 for specific subjects).

These choices need to be considered, in particular, from the perspectives of process management of curriculum change to ensure these changes will bring meaningful change for students as well as to avoid reform fatigue among teachers.

Curriculum reform needs to be considered as serving public goods, not as a means for political or ideological debates. To this end, building more and stronger knowledge base is of critical importance to make informed decision about curriculum change for better student learning and well-being.

Total duration of major reform cycles

The total duration of a reform, including different phases, is defined as the interval between its start and its end year. In a study reviewing 11 jurisdictions, a full national curriculum reform may take 10 years or more (2 years, on average, for decision-making and 8 years, on average for implementation) (van den Akker, 2018[3]). The time elapsed from the official announcement of a curriculum redesign process to the first cohort using the new curriculum ranged from two years to eight years and averaged six years (van den Akker, 2018[3]). The average duration does not include preparatory activities such as awareness building. Nor does it cover the time needed to assess the effects of the reform on student learning outcomes, which depends on the scope of the reform (the grade levels and subjects involved).

Table 1 **Indicative duration of major secondary curriculum reforms and reform phases**

		Indicative duration of a reform	Indicative length of planning phase	Indicative length of decision-making phase	Indicative length of preparation phase	Indicative length of implementation phase	Indicative length of monitoring phase
OECD	Australia[2]	8.5	4.0	5.0	4.5	6.0	5.0
	Austria	8.1	1.0	1.0	1.0	5.5	5.0
	British Columbia (Canada)	7.7	2.0	3.5	4.0	2.7	(m)
	Denmark	3.2	(m)	1.0	(m)	1.0	5.0
	Estonia[2]	12.4	1.8	1.6	3.8	2.6	3.2
	Hungary[2]	3.8	1.4	1.2	1.6	1.2	2.6
	Japan	15.2	3.3	1.8	5.2	11.5	(m)
	Korea[2]	11.4	1.7	1.1	3.1	8.8	4.0
	Lithuania[2]	15.2	3.8	2.6	3.8	13.3	5.8
	Mexico[2]	3.3	1.8	1.3	1.8	1.5	4.0
	New Zealand[2]	11.5	3.5	4.0	2.0	4.0	4.0
	Northern Ireland (United Kingdom)	5.0	2.3	2.3	2.3	2.3	4.0
	Norway[2]	14.0	5.0	3.5	2.0	3.0	7.0
	Poland[2]	3.5	(m)	1.0	(m)	2.0	7.0
	Québec (Canada)	10.5	4.0	2.5	4.5	4.0	(m)
	Scotland (United Kingdom)	11.0	5.0	2.5	7.0	(m)	(m)
	Sweden[2]	8.7	6.0	6.0	5.0	4.7	8.5
	OECD-16 average	9.0	3.1	2.5	3.4	4.6	5.0
Partner	China (People's Republic of)	9.0	1.0	1.0	2.5	11.0	6.0
	Hong Kong (China)[3]	(m)	(m)	(m)	(m)	(m)	(m)
	Costa Rica[2]	8.7	1.0	1.0	1.8	6.3	1.6
	India[2]	12.3	3.7	2.0	3.3	8.3	9.5
	Kazakhstan[1]	10.0	2.0	3.0	4.0	7.0	2.0
	Russian Federation[2]	10.0	2.3	1.3	2.0	6.6	5.3
	Singapore[4]	6.0	(m)	(m)	(m)	(m)	(m)
	Viet Nam	19.0	3.3	1.0	5.8	3.5	15.0
	Global average[3]	9.5	2.9	2.2	3.4	5.3	5.5

Note: This table summarises countries'/jurisdictions' averages across all regular reform cycles reported at the secondary (lower and upper secondary) level. The length of each reform and reform phase is measured from their start year to their end year. It was only calculated when both, a clear start and a clear end year have been provided. The indicative length of each phase was computed by averaging the length of the respective phase across all reform cycles reported for which data were available. The indicative duration of a reform was computed by averaging the length of all reform cycles for which data were available (irrespective of phases). Missing (m) indicates that no sufficient data were available to compute an average.

1. These countries/jurisdictions reported only one major reform on secondary education.

2. These countries/jurisdictions reported at least one curricular regular/major reform cycle in secondary education simultaneously with upper secondary education.

3. Of the 8 partner countries/jurisdictions which submitted data for this comparison, only 7 are included in the Global average. Hong Kong (China) submitted renewals on an ongoing basis (and thus without a fixed interval) which were not included in these calculations.

4. Total length for several of the reform cycles submitted by Singapore was not available. Indicative duration of a reform was thus not calculated as an average of submitted reforms but was directly reported by the country. Singapore reports that a typical review cycle for subjects other than languages is a 6-year cycle. For languages a typical cycle is 10 years

Source: Data from the PQC, item 2.1.2 and the Curriculum Reform Cycle worksheet collected at the Education 2030 9th Informal Working Group meeting. For more details on the reforms see Table WEB 11.[9]

Recent data reported by 25 OECD and partner countries/jurisdictions reveal a similar average of regular curriculum reforms for secondary education, i.e. 9.5 years on average, much longer than typical political election cycle (Table 1). This suggests the importance of the purpose and direction of curriculum reform, which needs to be agreed at the societal level, not as an agenda proposed by one particular political party. The indicative duration and length in this is table needs to be interpreted with specific stages reported in Figure 8, Figure 9 and Figure 11.

When looking at the indicative duration of curriculum reform in various countries/jurisdictions in Table 1, it becomes evident that implementation along with monitoring (which can overlap) seem to take most time (i.e. 4.6 and 5 years, respectively, among participating OECD countries) among various phases of a reform. The predominance of the implementation phase in typical curriculum reform timeframes underlines how critical – and often complex – this phase is as it often involves many more schools' actors than those included in preparation stages, which requires intense levels of co-ordination.

That said, it is important to highlight that it would be misleading to compare the length of each phase itself across countries and jurisdictions; it needs to be interpreted in a wider context. For example, these phases may overlap, which can explain a shorter curriculum reform cycle as a whole. Also, the length of implementation may depend on who are involved in the decision-making and preparation phases; if teachers are already involved in the decision making phase, if they are already informed of the purpose and focus of the reform without waiting for the planning or implementation phase, then it would be logical that the length of such phases is shorter than those countries and jurisdictions where teachers are only informed of the direction of reform after the decision-making phase. For example, Figure 8 (for lower secondary education) and Figure 9 (for upper secondary education) show visually the duration of individual phases. At a glance, it becomes evident how variable the length of curriculum reforms as well as the length of phases are across countries and jurisdictions.

Intended overlaps of phasing

Some countries decide for instance to give an early start to the implementation phase, making it overlap with earlier planning phases in the process, most frequently with the decision-making or planning phases. By involving key stakeholders early on in the process (e.g. teachers and school leaders who will play a crucial role in bringing the new curriculum to the classroom) countries and jurisdictions might be paving the way for shortening the implementation phase.

This pattern is observed in some countries with short reform cycles in total. For instance Hungary and Northern Ireland (United Kingdom), with major lower and upper secondary reform cycles ranging from 1 to 7 years long, show an overlap of implementation with the earlier phases of the reform process (preparation, decision-making and planning). Similarly, their monitoring phase often starts as soon as the implementation of the new curriculum is rolled out (Figure 8, Figure 9). An early tracking of progress can help spot obstacles along the way and get a better understanding of challenges faced by schools and teachers so that timely support tailored to local needs can be provided.

In other cases, there is also overlap between implementation and the earlier phases of the reform process, but the monitoring phase only begins a few years after implementation has started. In the 11 year-long Australian lower secondary major education reform from the 2000s, there is considerable overlap between implementation, decision-making and preparation (Figure 8). Even if it might not affect the total duration of the cycle significantly, overlap between the early phases of the reform and implementation might contribute to a smoother transition from decision-making and planning to implementation, ensuring stronger consensus and buy-in from stakeholders along the process. Monitoring does not start in this reform cycle until the fourth year of implementation.

In some cases the overlap between implementation and monitoring is much more prominent than the overlap between the earlier phases of reform. A long period of monitoring concomitant with implementation might contribute to the effectiveness of the reform, by providing timely feedback from practitioners in the field on barriers to implementation.

For example, the long cycle of lower secondary reform in the early 2000s in China (13 years) shows short 1-year overlaps between the decision-making and planning phases, and a long 6-year overlap between implementation and monitoring. In this case, there is also an imbalance between the duration of the earlier and later reform phases: planning, decision-making and preparation are only between 1 and 2 years long, whereas implementation is 11 years long and monitoring is 6 years long (Figure 8).

Also in a lower secondary major reform in India started in the early 2000s, overlap between implementation and monitoring is much more prominent than between monitoring and the earlier phases of reform: implementation and monitoring have been ongoing in parallel since 2007 until 2020. Conversely, implementation overlaps with decision-making and preparation for only one year (Figure 8).

Intended sequencing of different phases

Some countries/jurisdictions show a more sequential pattern, with long cycles, little overlap between phases and long implementation and monitoring phases. This is the case for instance in Japan, with long reform cycles (over 17-year-long cycle in lower secondary and over 20-year-long cycle in upper secondary) with only one-year overlaps between phases and an implementation phase that exceeds half the total duration of the reform cycle (Figure 8, Figure 9). Similarly, in Québec, a considerably long lower secondary reform cycle (24 years) and upper secondary reform cycle (18 years) show little overlap across phases and have a monitoring phase half as long as the total cycle (Figure 8, Figure 9).

The contextual factors (including political, demographic, economic and cultural) are bound to lead to very different styles of reform in general, and varying lengths of the implementation phase, in particular. In fact, by looking at the reform data from various angles, further particularities of curriculum reform become more evident and nuanced. Lithuania tends to reform the lower secondary separately from the upper secondary curriculum in a cyclical fashion. Japan may plan and make decisions for both lower and upper secondary reform at the same time, but only roll out changes for one level at a time. The Russian Federation gravitates towards longer reform cycles while ensuring frequent reforms, to mention a few. Curriculum change, therefore, may require multiple reform cycles, as a single reform may not cover all aspects of necessary change.

It is also important to consider contextual factors that may explain some of the differences in the contrasting examples above, such as the size of the country/jurisdiction, the size of the student population, the number of schools and teachers (please see Contextual Information for Comparative Curriculum Analysis). Various aspects of the curriculum reform itself may impact the length of a curriculum reform. Those suggest, for example, the scope and extent of the changes involved, the frequency in which they occur, the level of stakeholder engagement and the choices countries make regarding sequencing and/or layering of different reform phases.

Major vs ad hoc reforms to keep up with new demands

Ad hoc reforms can help countries address specific emerging demands in an agile way. In most countries, ad hoc reforms are used in-between major reforms to fill in particular gaps. Among countries/jurisdictions ad hoc reforms typically introduced new content or new subject(s) (Figure 10). In this sense, it is usual for ad hoc reforms to have a narrower scope than major reforms.

However, when ad hoc reforms are sequenced, with a carefully-designed intentional alignment with a major reform, they can also introduce progressive and systemic curriculum change. This is the case in countries/jurisdictions such as Sweden.

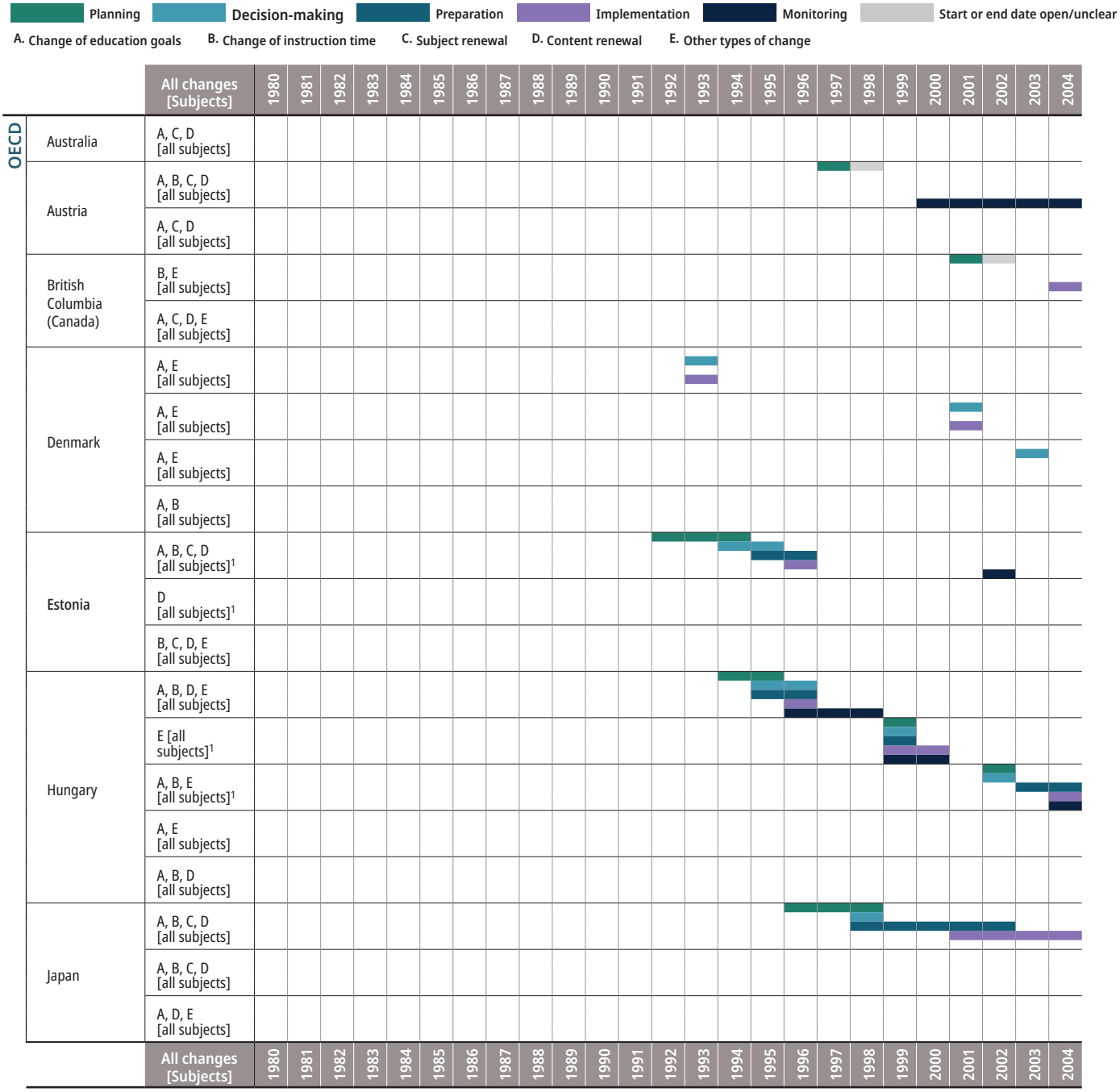
Subject-specific major reforms

In some cases, major reforms target only specific subjects. Some examples of specific subjects reformed in major reforms over the past few decades are reported in Figure 11:

- Australia (2009-2013): mathematics, science, humanities (modern history, ancient history, geography)
- Mexico (1992-2000): social studies
- Mexico (2019): Civic and ethical training, healthy living
- Poland (2006-2007): Polish language
- Poland (2007-2008): Polish language, foreign language
- Poland (2008-2009): Polish language
- Sweden (2011-2019): vocational training
- Costa Rica (1987-1989): Computer science education
- Costa Rica (1994-1998): Civic education, musical education, plastic arts, physical education, education for daily life, affectivity and sexuality, industrial arts, Spanish, social studies.
- Costa Rica (2008): Spanish, civic education, music education, mathematics, plastic arts, physical education, education for daily life, affectivity and sexuality, industrial arts.

- Singapore (2008): Geography, history, additional mathematics, science, physics, chemistry, biology, literature in English, literature in mother tongue languages
- Singapore (2010a): Literature in English, mathematics, science
- Singapore (2012): English language, food & nutrition, music
- Singapore (2011b): Social studies, art, principles of accounting
- Singapore (2011a): Food and consumer education, character and citizenship education, history, geography, social studies, physical education, science NT
- Singapore (2013b): Physical education, nutrition and food science
- Singapore (2013a): Music
- Singapore (2014): Design & technology
- Singapore (2015): Computing
- Singapore (2018): Principles of accounts, elements of business skills

Figure 8 [1/6] **Major curriculum reform cycles lower secondary (all subjects) reported between 1980 and 2030**

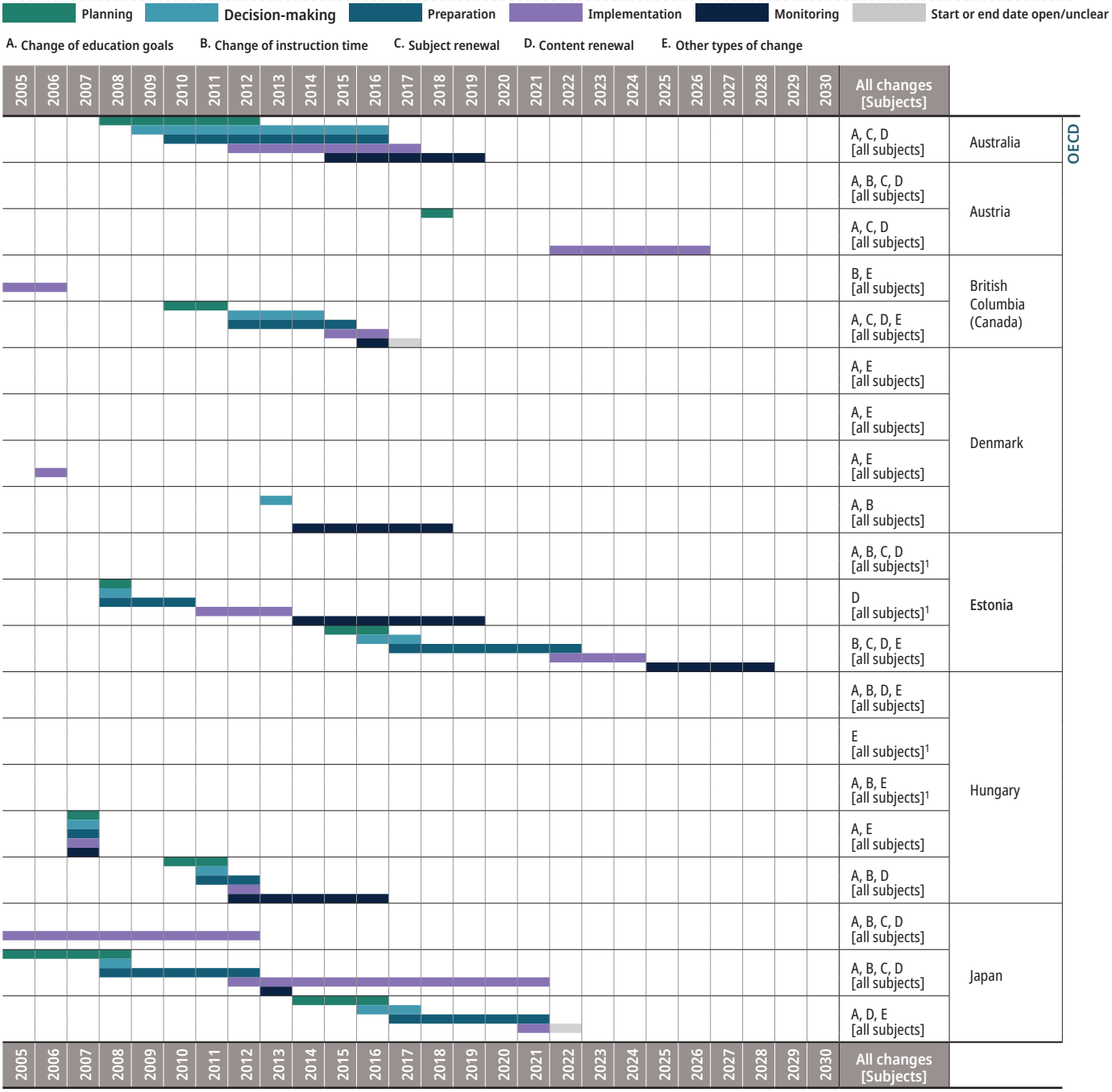


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195036

Figure 8 [2/6] **Major curriculum reform cycles lower secondary (all subjects) reported between 1980 and 2030**

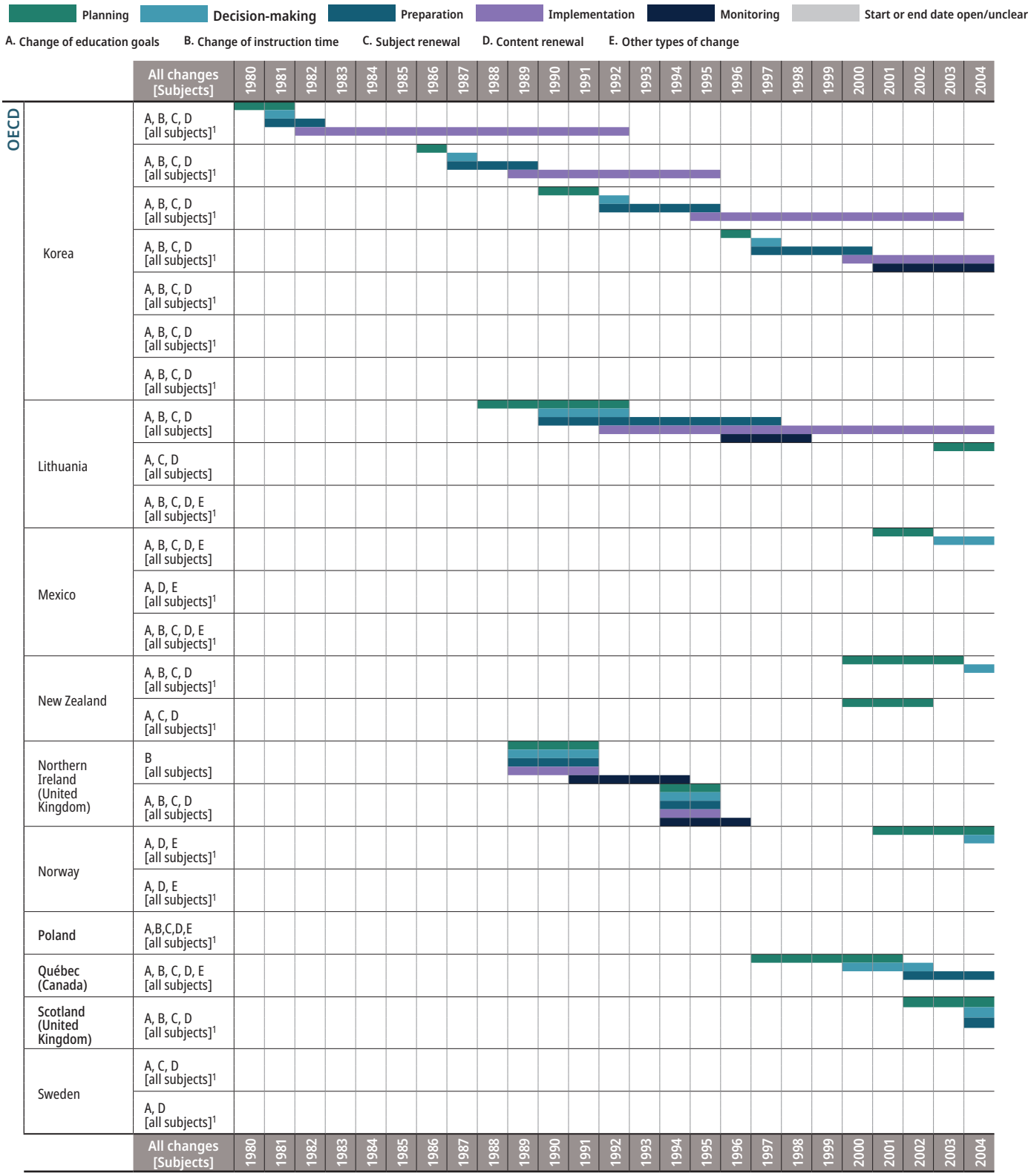


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195036

Figure 8 [3/6] **Major curriculum reform cycles lower secondary (all subjects) reported between 1980 and 2030**

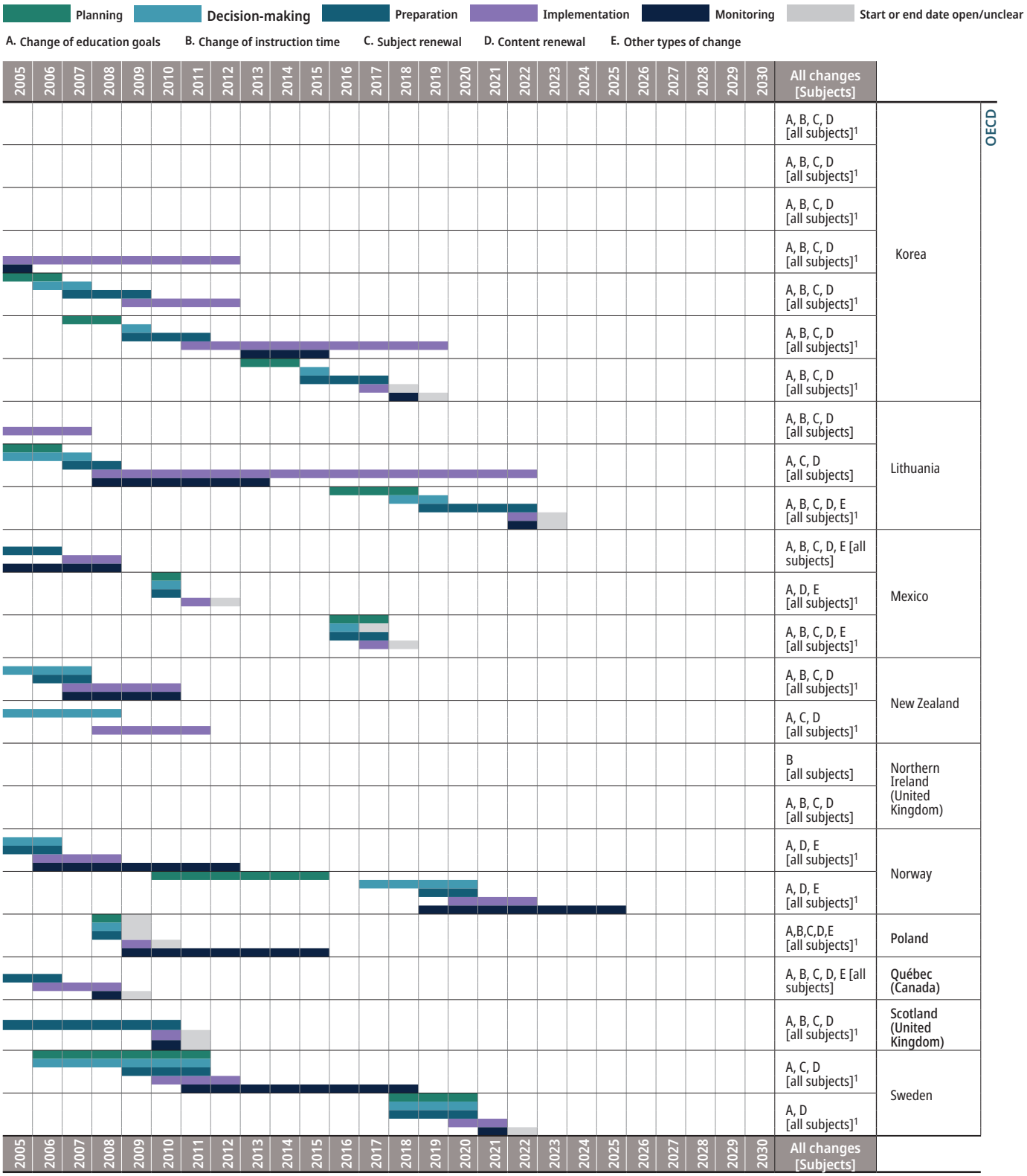


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195036

Figure 8 [4/6] **Major curriculum reform cycles lower secondary (all subjects) reported between 1980 and 2030**

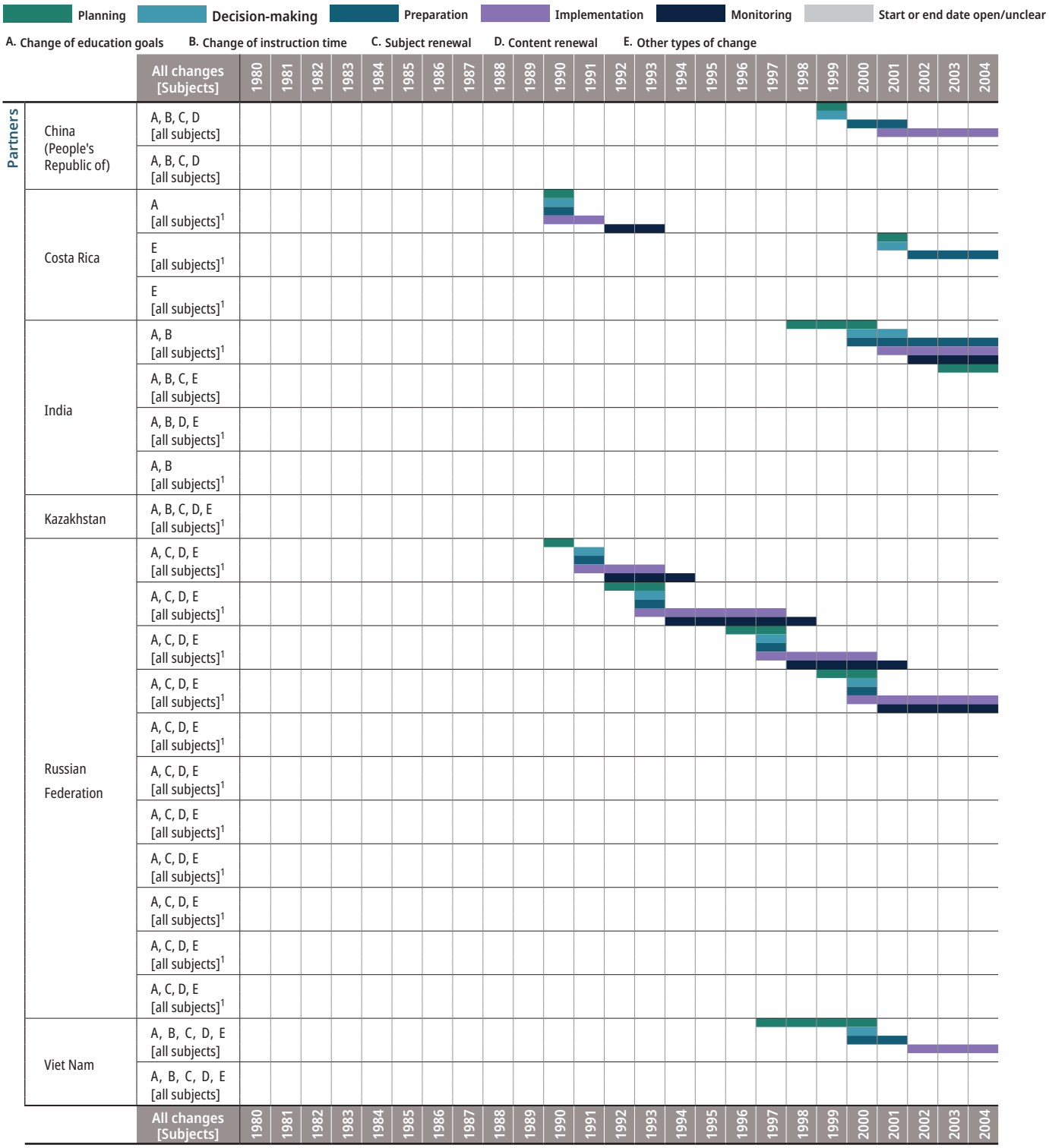


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195036

Figure 8 [5/6] **Major curriculum reform cycles lower secondary (all subjects) reported between 1980 and 2030**

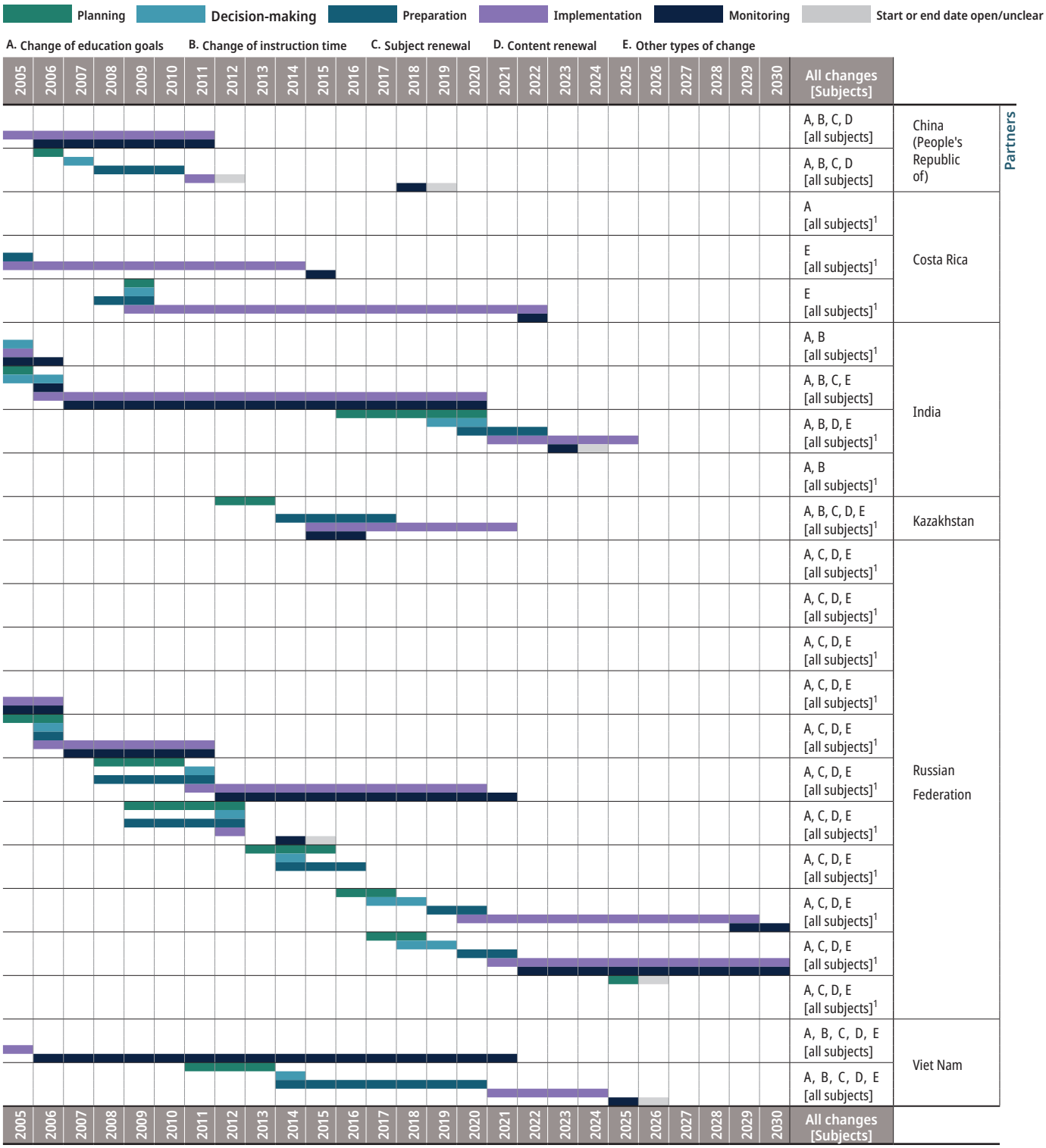


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195036

Figure 8 [6/6] **Major curriculum reform cycles lower secondary (all subjects) reported between 1980 and 2030**

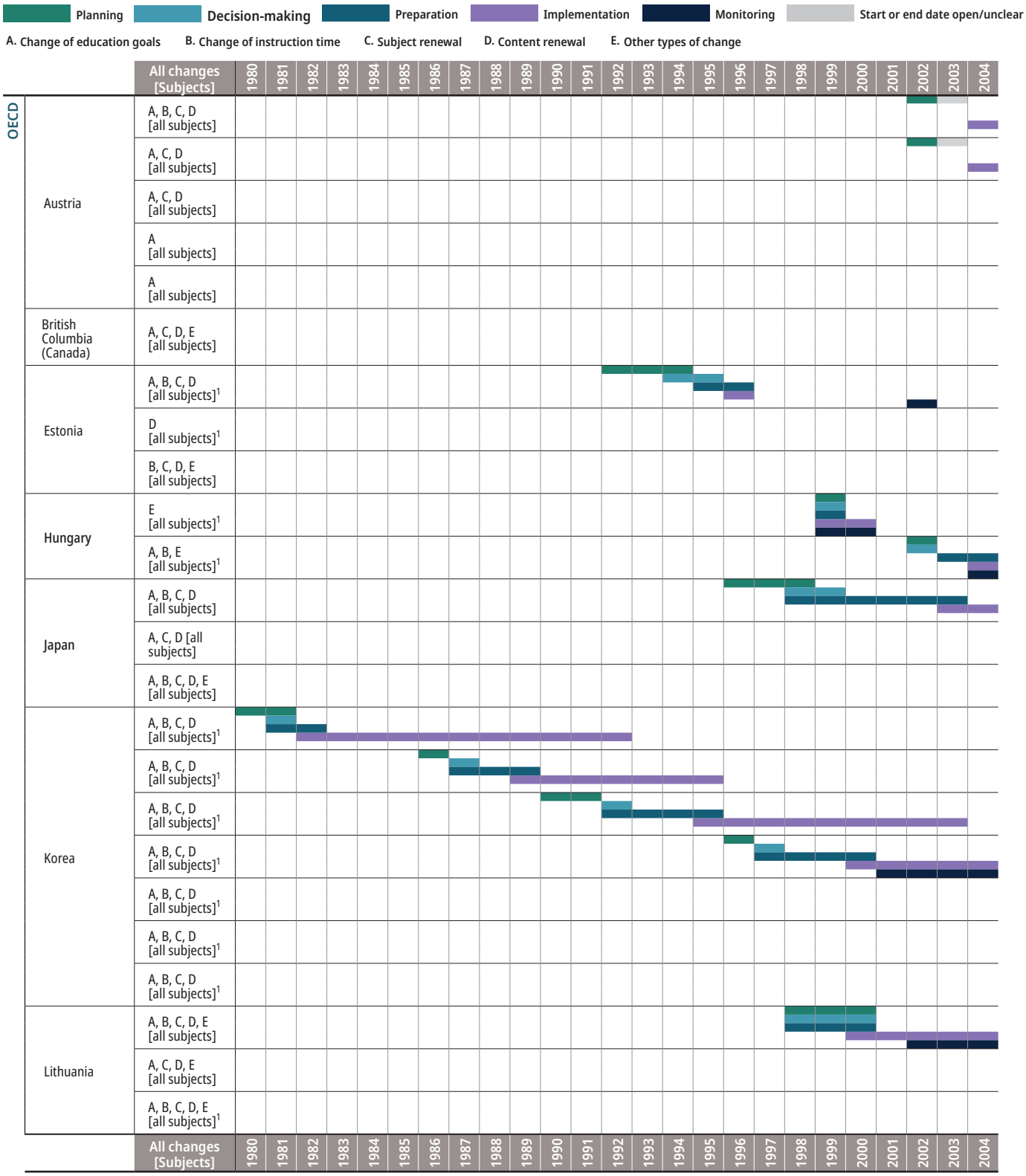


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195036

Figure 9 [1/6] **Major curriculum reform cycles upper secondary (all subjects) reported between 1980 and 2030**

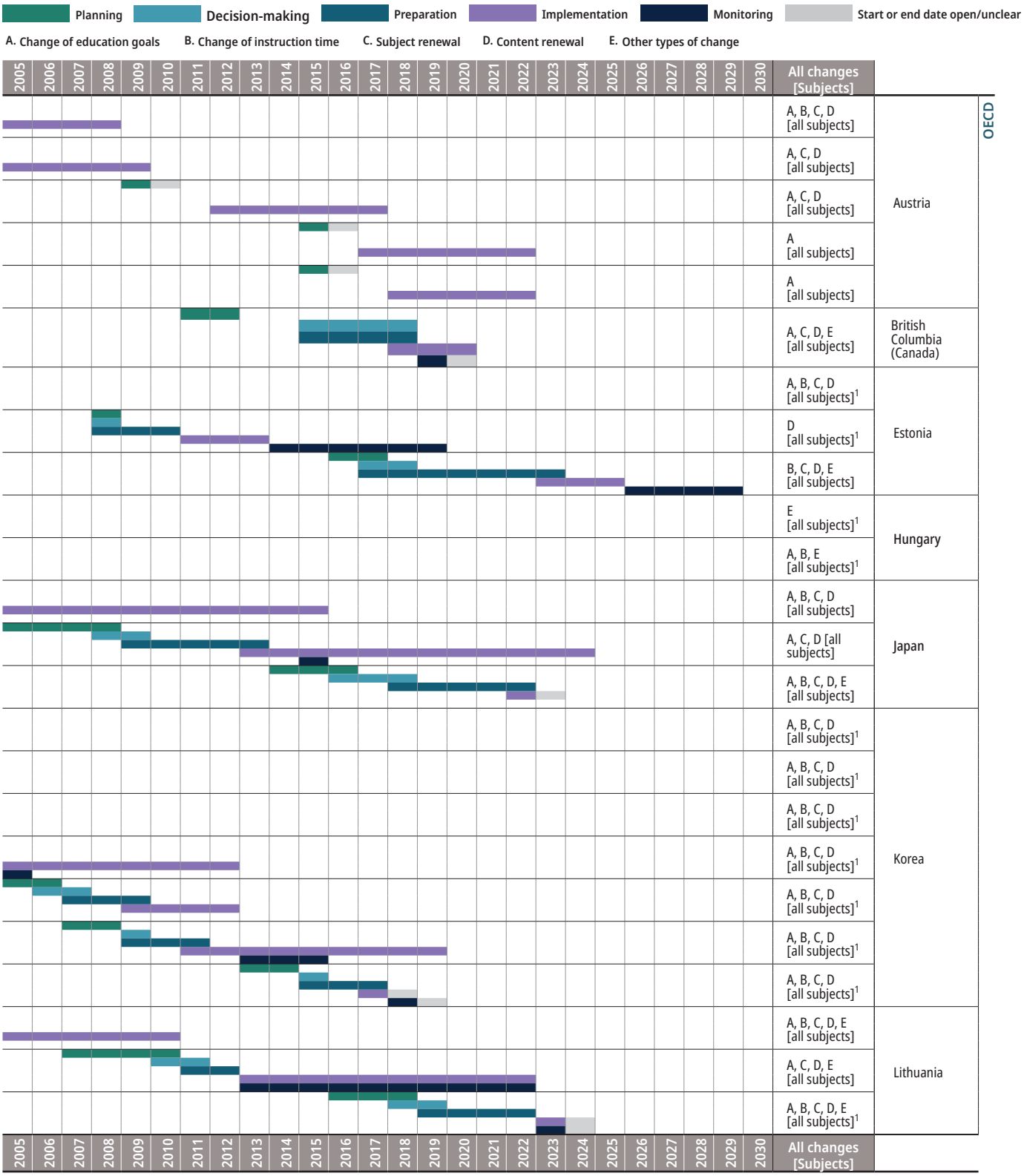


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195055

Figure 9 [2/6] **Major curriculum reform cycles upper secondary (all subjects) reported between 1980 and 2030**

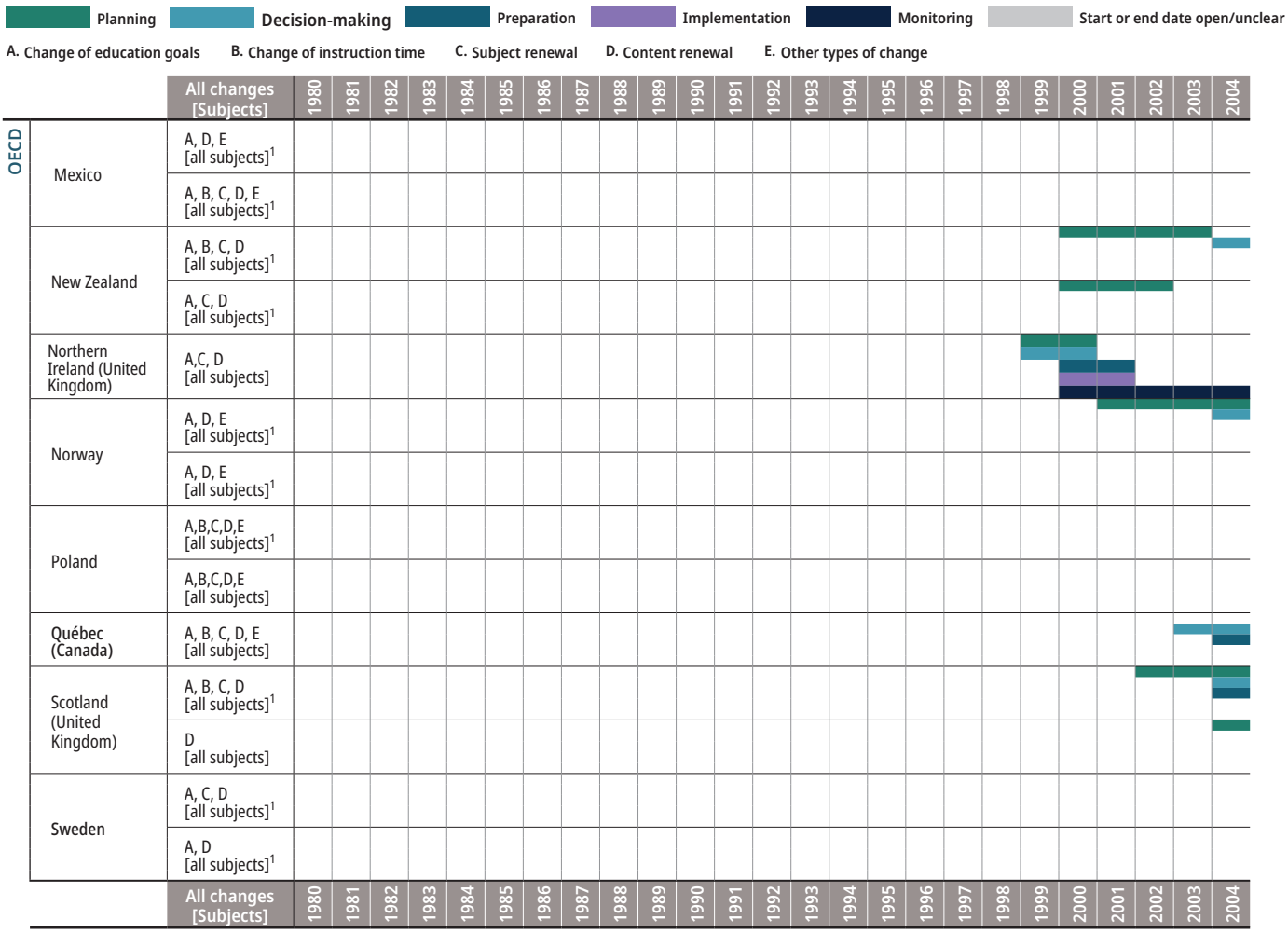


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195055

Figure 9 [3/6] **Major curriculum reform cycles upper secondary (all subjects) reported between 1980 and 2030**

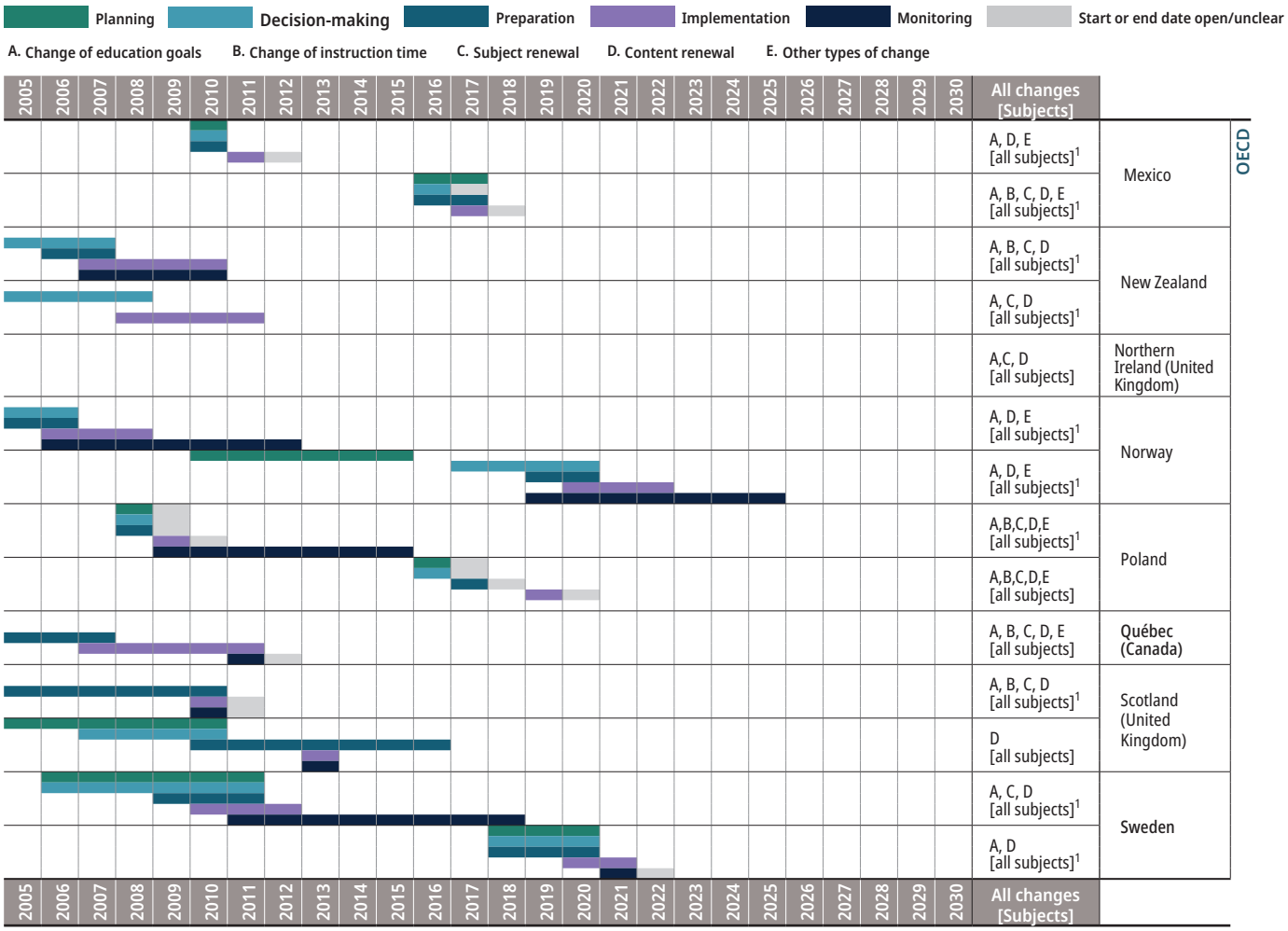


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195055

Figure 9 [4/6] **Major curriculum reform cycles upper secondary (all subjects) reported between 1980 and 2030**

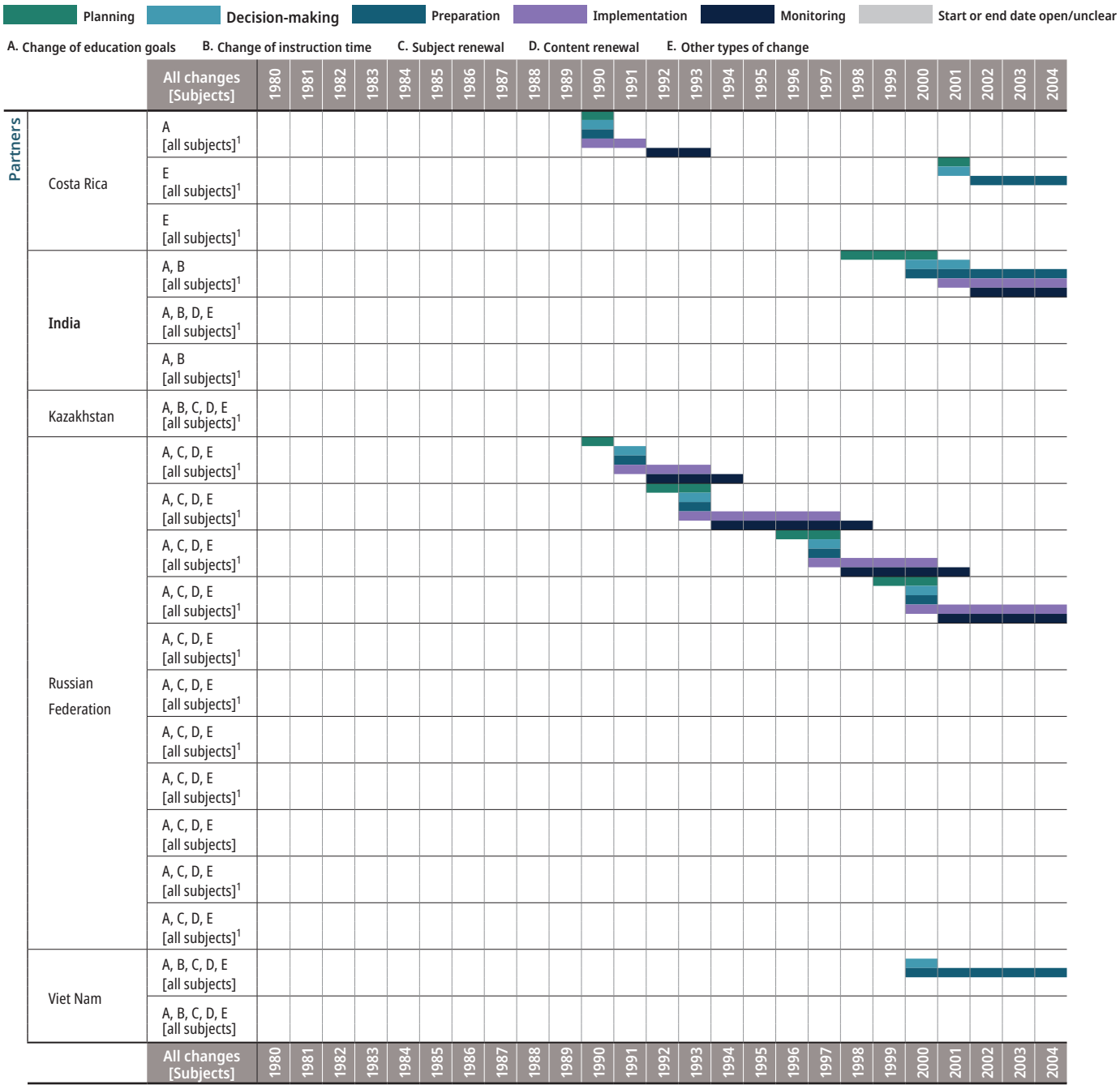


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195055

Figure 9 [5/6] **Major curriculum reform cycles upper secondary (all subjects) reported between 1980 and 2030**

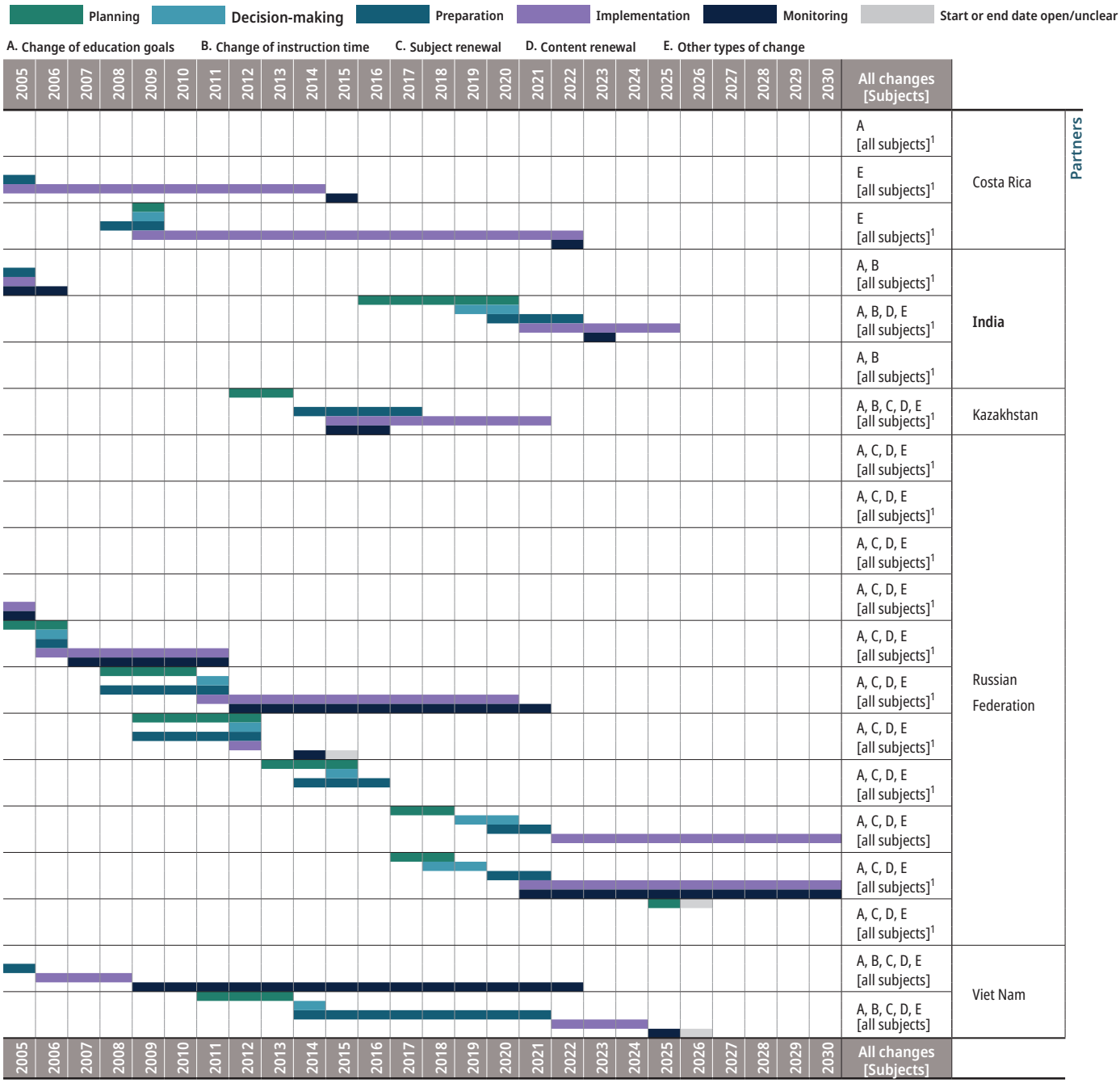


Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195055

Figure 9 [6/6] **Major curriculum reform cycles upper secondary (all subjects) reported between 1980 and 2030**



Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

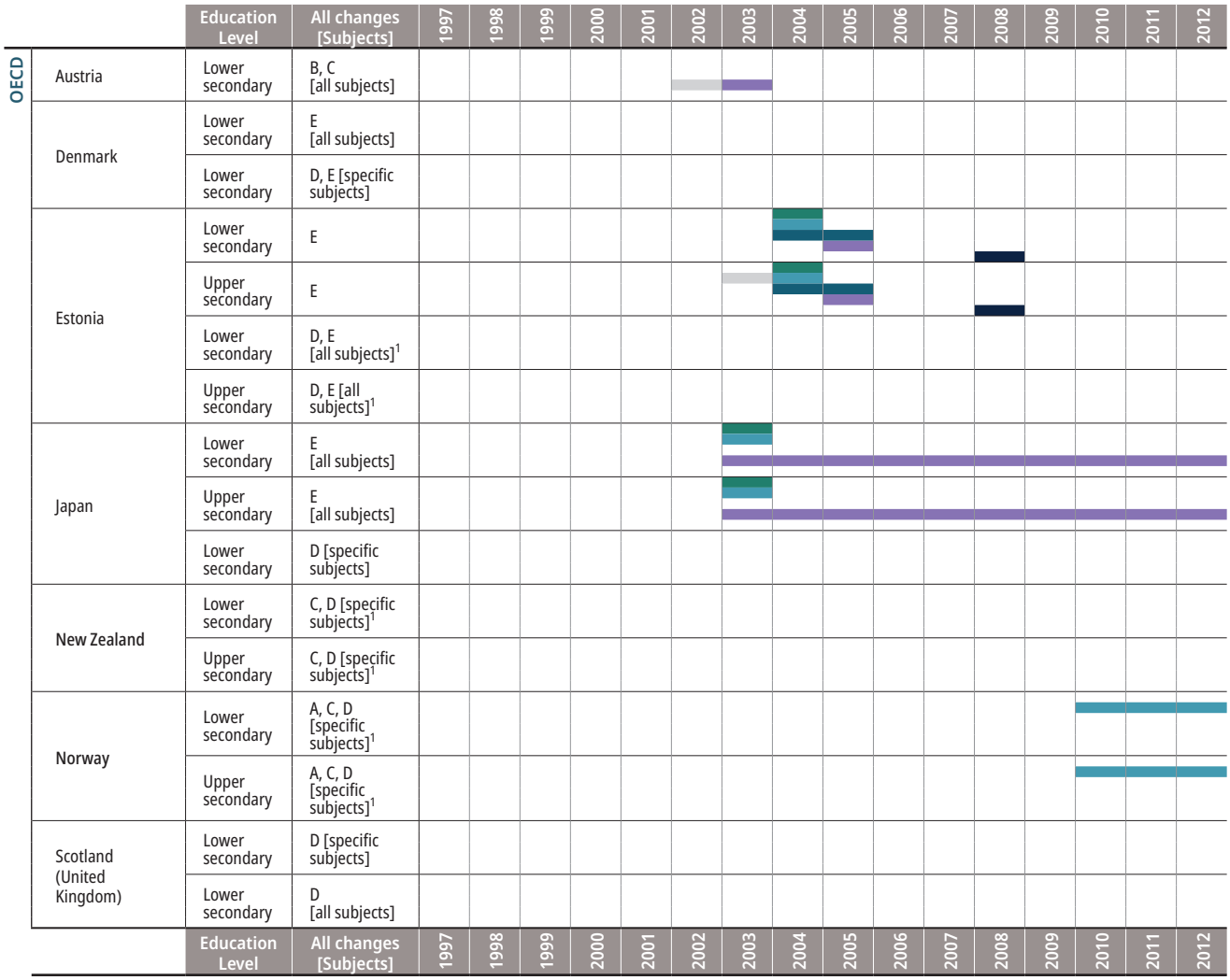
Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195055

Figure 10 [1/4] Ad hoc curriculum reform cycles reported between 1997 and 2030

Planning | Decision-making | Preparation | Implementation | Monitoring | Start or end date open/unclear

A. Change of education goals | B. Change of instruction time | C. Subject renewal | D. Content renewal | E. Other types of change



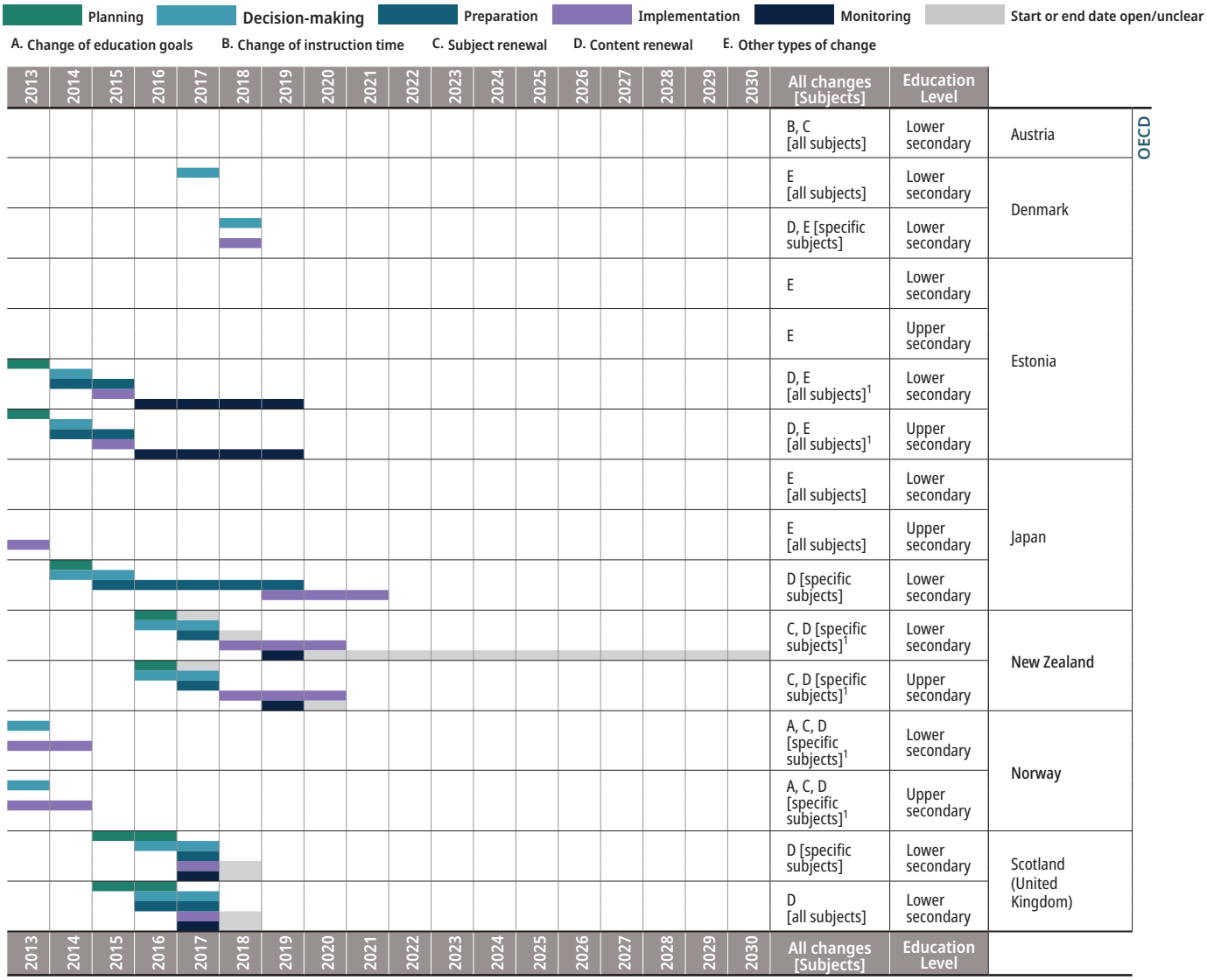
Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Hong Kong (China) adopts an ongoing curriculum renewal approach for responding quickly to local and global changes. Some of these ongoing reforms can have a wide scope including, for example, updates on curriculum goals, contents or learning time.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195074

Figure 10 [2/4] **Ad hoc curriculum reform cycles reported between 1997 and 2030**



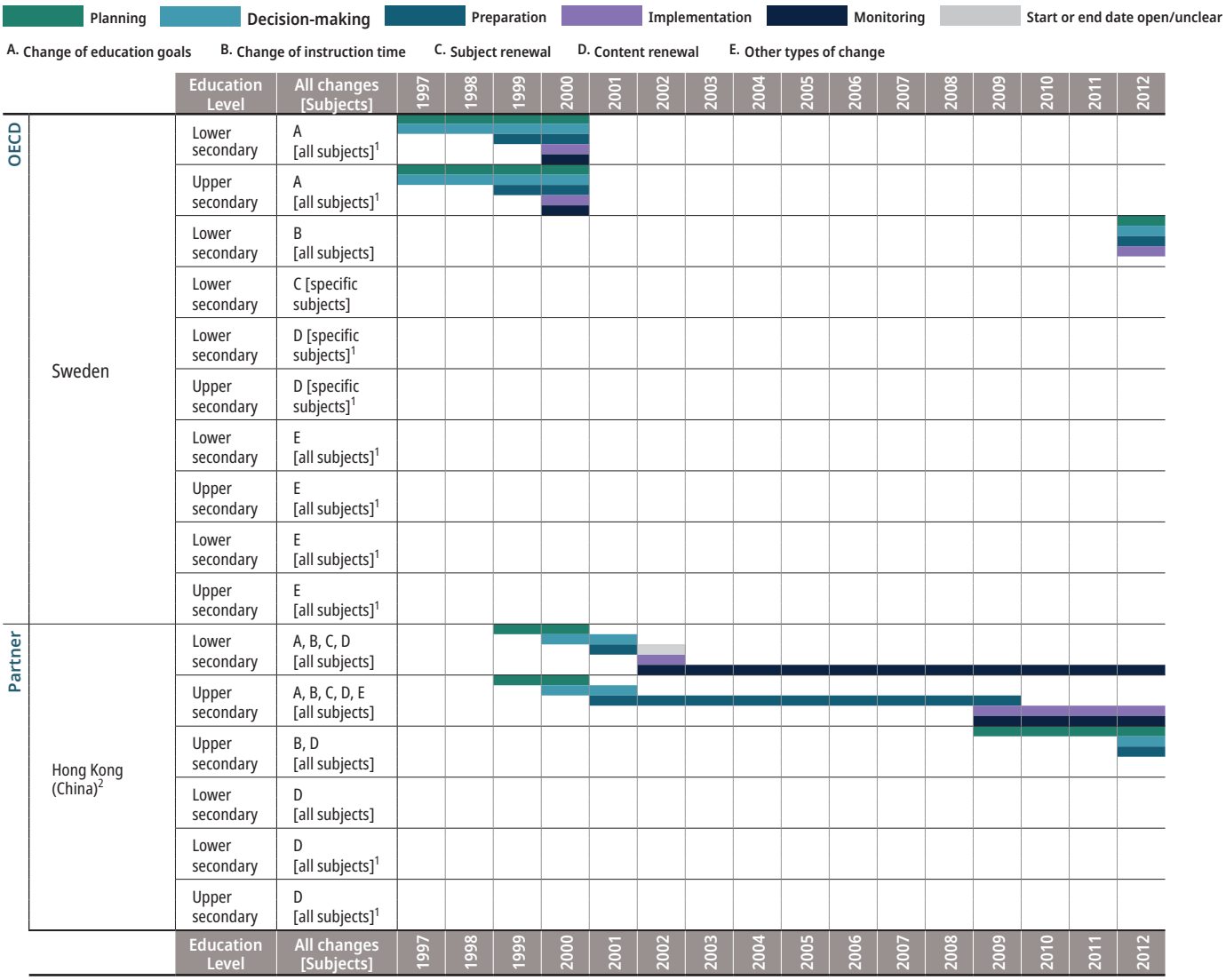
Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Hong Kong (China) adopts an ongoing curriculum renewal approach for responding quickly to local and global changes. Some of these ongoing reforms can have a wide scope including, for example, updates on curriculum goals, contents or learning time.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195074

Figure 10 [3/4] Ad hoc curriculum reform cycles reported between 1997 and 2030



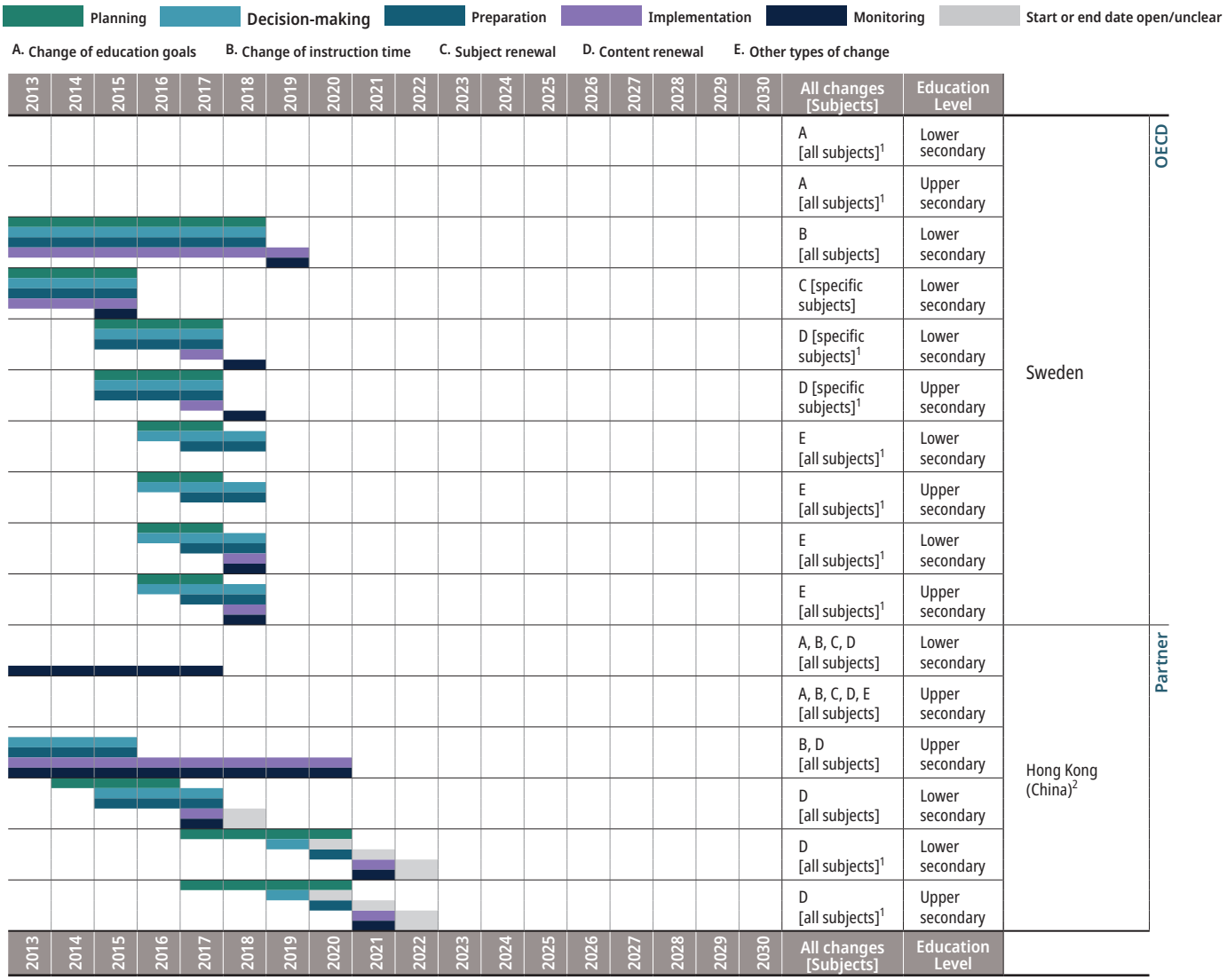
Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Hong Kong (China) adopts an ongoing curriculum renewal approach for responding quickly to local and global changes. Some of these ongoing reforms can have a wide scope including, for example, updates on curriculum goals, contents or learning time.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195074

Figure 10 [4/4] **Ad hoc curriculum reform cycles reported between 1997 and 2030**



Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Hong Kong (China) adopts an ongoing curriculum renewal approach for responding quickly to local and global changes. Some of these ongoing reforms can have a wide scope including, for example, updates on curriculum goals, contents or learning time.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

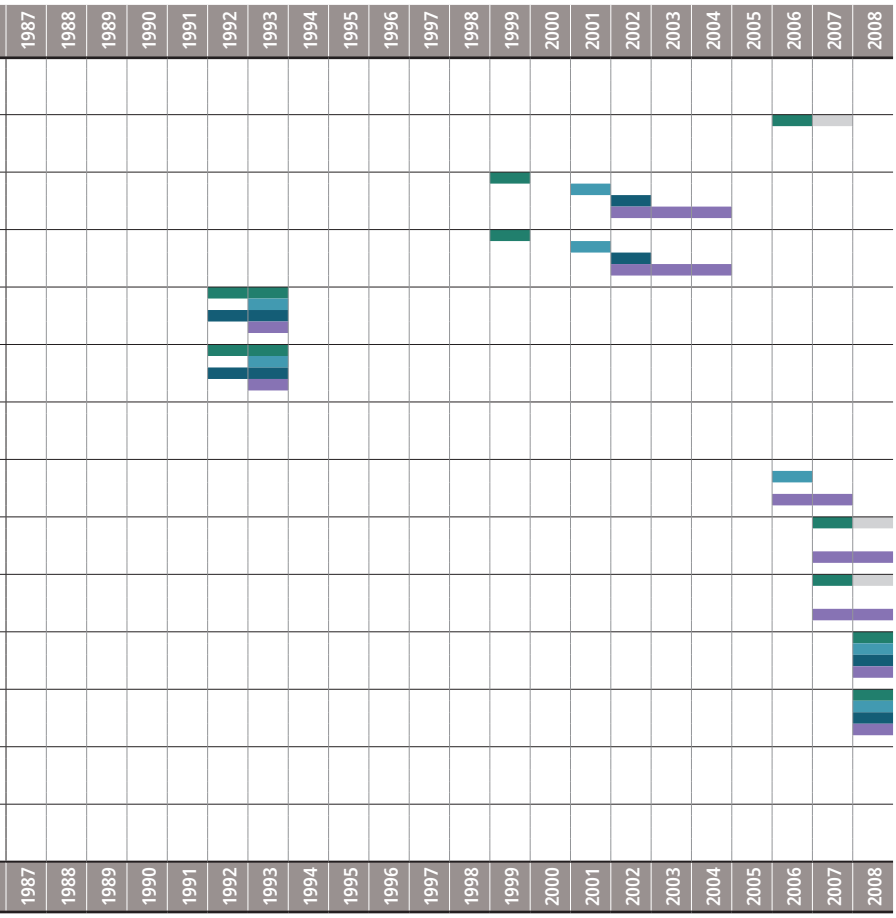
StatLink https://doi.org/10.1787/888934195074

Figure 11 [1/4] **Major curriculum reform cycles (only specific subjects) reported between 1987 and 2030**

Planning | Decision-making | Preparation | Implementation | Monitoring | Start or end date open/unclear

A. Change of education goals | B. Change of instruction time | C. Subject renewal | D. Content renewal | E. Other types of change

		Education Level	All changes [Subjects]
OECD	Australia	Upper secondary	C, D [specific subjects]
	Denmark	Lower secondary	A, E [specific subjects]
	Estonia	Lower secondary	A, B, C[1]
		Upper secondary	A, B, C1
	Mexico	Lower secondary	A, B, C, D, E [specific subjects][1]
		Upper secondary	A, B, C, D, E [specific subjects][1]
		Lower secondary	C, D, E [specific subjects]
	Poland	Lower secondary	C [specific subjects]
		Lower secondary	A, D [specific subjects][1]
		Upper secondary	A, D [specific subjects] [1]
		Lower secondary	D [specific subjects] [1]
		Upper secondary	D [specific subjects] [1]
		Upper Secondary	C [specific subjects]
	Sweden	Upper secondary	A, B, E [specific subjects]



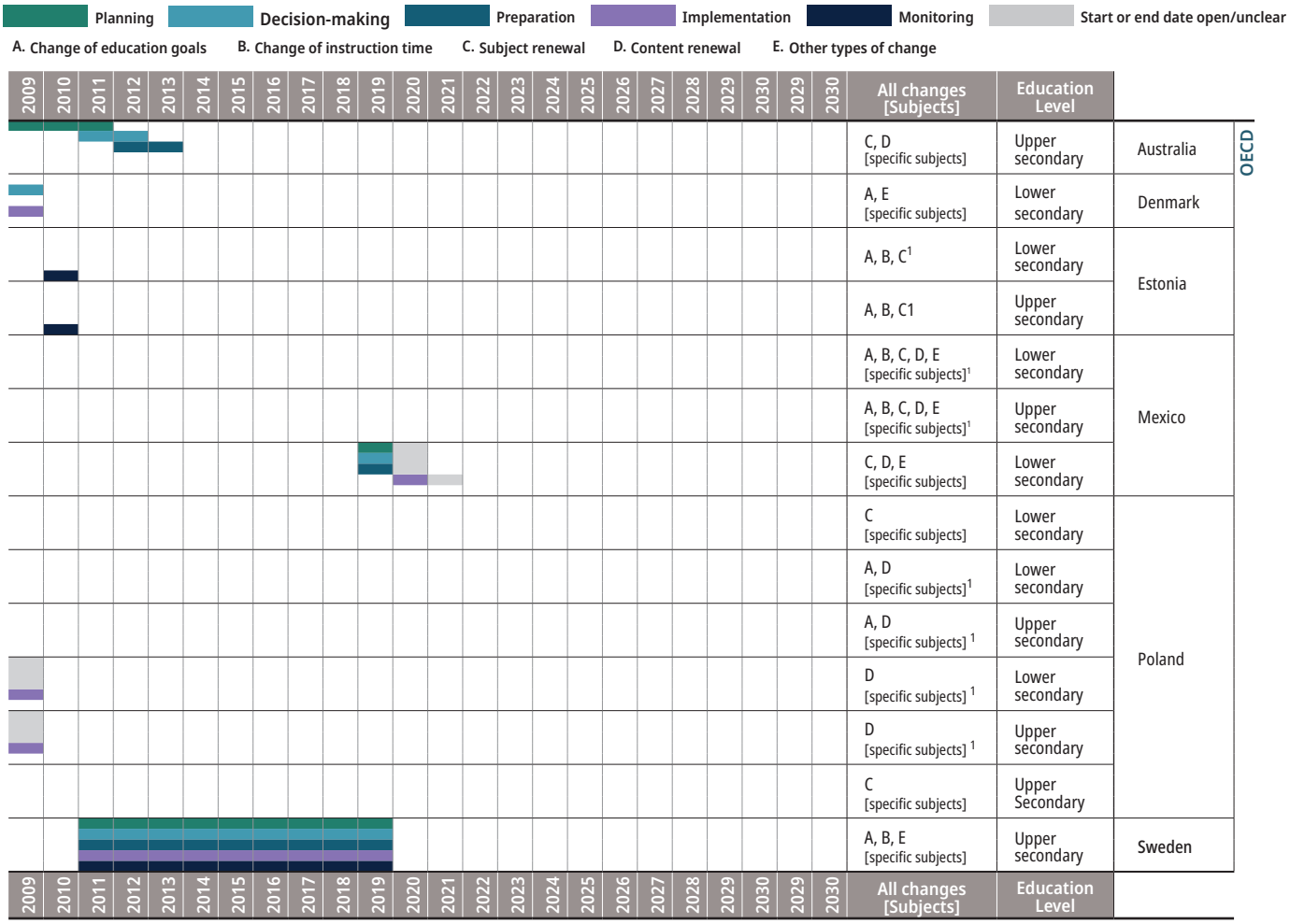
Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Singapore's typical review cycle for subjects other than languages is a 6-year cycle. For languages a typical cycle is 10 years.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195093

Figure 11 [2/4] **Major curriculum reform cycles (only specific subjects) reported between 1987 and 2030**



Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Singapore's typical review cycle for subjects other than languages is a 6-year cycle. For languages a typical cycle is 10 years.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

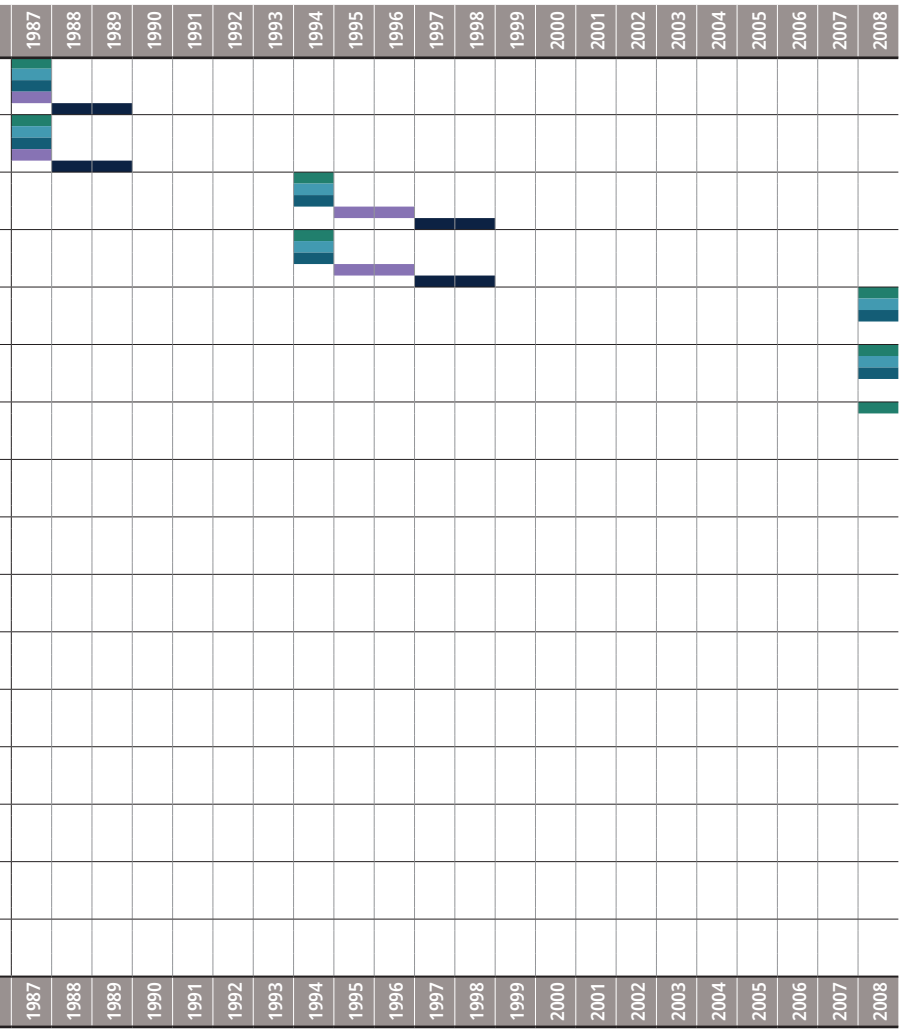
StatLink https://doi.org/10.1787/888934195093

Figure 11 [3/4] **Major curriculum reform cycles (only specific subjects) reported between 1987 and 2030**

Planning | Decision-making | Preparation | Implementation | Monitoring | Start or end date open/unclear

A. Change of education goals | B. Change of instruction time | C. Subject renewal | D. Content renewal | E. Other types of change

Partners	Education Level	All changes [Subjects]
Costa Rica	Lower secondary	C, D [specific subjects][1]
Costa Rica	Upper secondary	C, D [specific subjects][1]
Costa Rica	Lower secondary	A, D [specific subjects][1]
Costa Rica	Upper secondary	A, D [specific subjects][1]
Costa Rica	Lower secondary	C, D [specific subjects][1]
Costa Rica	Upper secondary	C, D [specific subjects][1]
Singapore[2]	Upper Secondary	D, E [specific subjects]
Singapore[2]	Lower Secondary	B, D, E [specific subjects]
Singapore[2]	Lower Secondary	D, E [specific subjects]
Singapore[2]	Upper Secondary	B, D, E [specific subjects]
Singapore[2]	Upper Secondary	D, E [specific subjects]
Singapore[2]	Lower Secondary	D, E [specific subjects]
Singapore[2]	Upper Secondary	D, E [specific subjects]
Singapore[2]	Lower Secondary	D, E [specific subjects]
Singapore[2]	Upper Secondary	D, E [specific subjects]
Singapore[2]	Upper Secondary	D, E [specific subjects]



Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Singapore's typical review cycle for subjects other than languages is a 6-year cycle. For languages a typical cycle is 10 years.

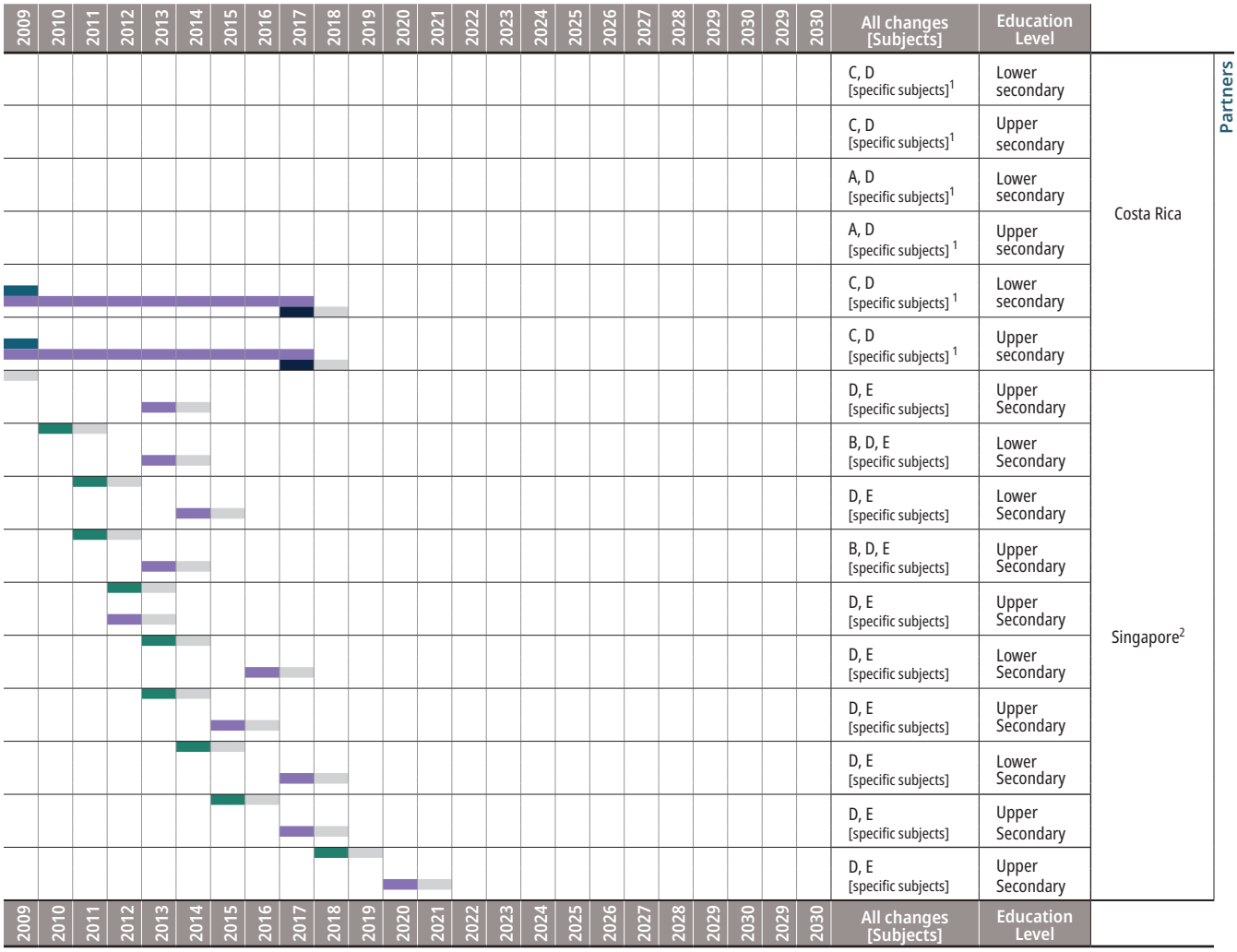
Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195093

Figure 11 [4/4] **Major curriculum reform cycles (only specific subjects) reported between 1987 and 2030**

Planning | Decision-making | Preparation | Implementation | Monitoring | Start or end date open/unclear

A. Change of education goals | B. Change of instruction time | C. Subject renewal | D. Content renewal | E. Other types of change



Note: 1. These reforms were reported as conducted at lower and upper secondary education simultaneously.

2. Singapore's typical review cycle for subjects other than languages is a 6-year cycle. For languages a typical cycle is 10 years.

Source: Data collected through the Curriculum Reform Cycle worksheet and PQC, item 2.1.2.

StatLink https://doi.org/10.1787/888934195093

Resistance to change among teachers

Teachers often have ambiguous feelings about curriculum change and the impact that reforms may have on themselves and their teaching. A possible consequence of not being involved in the decision-making process is a lack of sense of ownership of the new or revised curriculum. Other factors include lack of understanding and training, individuals' attitudes towards change and innovation, lack of agency, and/or fear of change, as revisions in the curriculum may require adding new subjects or removing existing subjects, with potential changes in job profiles or even loss of jobs (Harris and Graham, 2019[37]; Jenkins, 2020[38]; OECD, 2019[39]).

If teachers are reluctant to change and to adopt a more future-oriented curriculum that addresses new skills, competencies, and future jobs, students may miss out on opportunities to develop skills that could help them later in life (World Economic Forum, 2016[9]). In the short run, however, rapid changes may pose more direct challenges to teachers and their teaching than to students, as teachers may need to "unlearn and relearn". That is harder to do than to simply learn, especially if support and professional development are not provided (see "How do countries compare?").

Likewise, even highly motivated teachers can suffer from reform fatigue when they face rapid and continuous reforms, and they may find it difficult to cope with the changes. This may negatively impact teachers and cause them to lack enthusiasm in enacting the new curriculum (Dilkes, Cunningham and Gray, 2014[40]; Kennedy, 2013[41]). Finally, if teachers feel under-represented in the design process, they may develop resistance to the intended changes, which can cause further delays in the redesign phase (King, 2017[42]; van Schaik, Voogt and Nieveen, 2017[43]).

This resistance may have unintended consequences for students and principals. Data from the Programme for International Student Assessment (PISA) show that, on average across OECD countries, nearly 30% of 15-year-old students are in schools whose principals identify staff resistance to change as a factor that hinders students' learning (Figure 12). These results suggest that a curriculum reform on top of latent resistance may further impede the curriculum implementation process.

Teacher stress is one of the factors that can cause delay in implementation of curriculum changes. For teachers in many countries and jurisdictions, "keeping up with changing requirements from local, municipal/regional, state or national/federal authorities" is a predominant source of stress. Of 11 potential sources of teacher stress investigated in the 2018 Teaching and Learning International Survey (TALIS), keeping up with these changing requirements was the third most frequently cited source of stress (after "having too much administrative work to do" and "being held responsible for students' achievement"). On average across the OECD, 41% of teachers report that keeping up with changing requirements from education authorities is a source of stress, either "quite a bit" or "a lot", with considerable between-country variation (Figure 13).

Implementation is not straightforward, but rather a complex process of buy-in, communication and training (Fullan, 2007[44]). It should be planned as:

- purposeful (realising the overall goals of curriculum reform)
- multidirectional (because stakeholders may adapt the reform to their possibilities and perceptions)
- contextualised (because it is influenced by the political environment, institutional settings and the wider external context) (Viennet and Pont, 2017[45]).

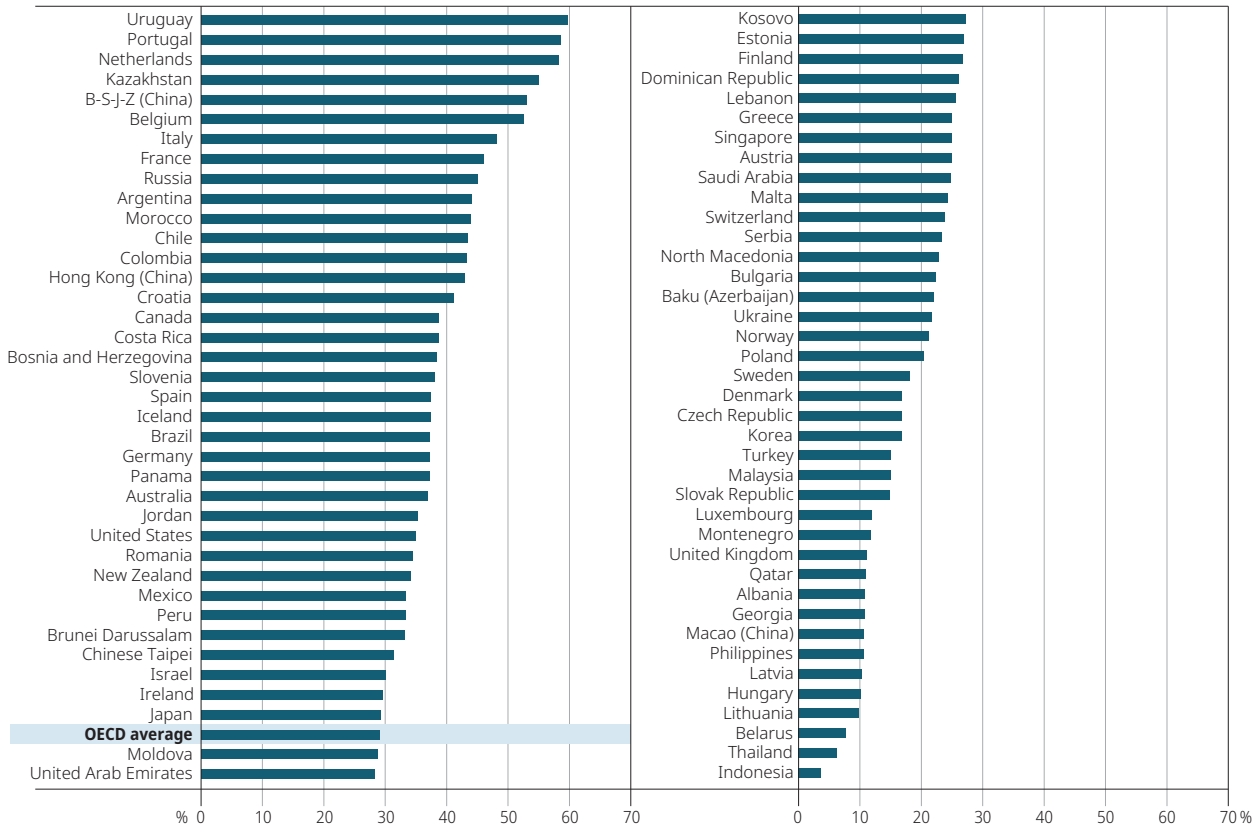
In recent years, countries/jurisdictions are exploring an ecosystem approach to curriculum development and are inclined not to make a distinction between design and implementation. This is done by involving designers in implementation at the same time (OECD, Forthcoming[34]). The ecosystem approach is believed to address complex challenges such as the following (Fullan, 2007[44]).

Limits to parental agency to support their children's learning

Curriculum implementation may include additional involvement of parents, as changes may need at least parental understanding, if not support. A growing body of evidence shows that children and youth perform better at school when their parents support their learning at home. The long-term benefits for children are not limited to academic performance, but also include their social and emotional development, their attitudes towards learning, their enjoyment of learning and later integration in society (OECD, 2012[47]; OECD, 2013[48]).

Not all parents, however, have the time or feel prepared to support their children with school-related work. Many barriers may get in the way of their engagement, such as competing demands at work and at home, lack of understanding of what is required of their children at school, feelings of unpreparedness to help their children in specific subject areas, a belief that learning is the work of teachers, and even a lack of awareness that they can make a real difference in their children's learning. The disconnect between school life and home life can be exacerbated in disadvantaged or immigrant families, thus compromising full implementation of the curriculum among certain groups of students (Duncan, Magnuson and Vortuba-Drzal, 2017[49]).

Figure 12 **Percentage of students in schools whose principal reported that student learning is hindered "to some extent" or a "lot by staff" resisting change**

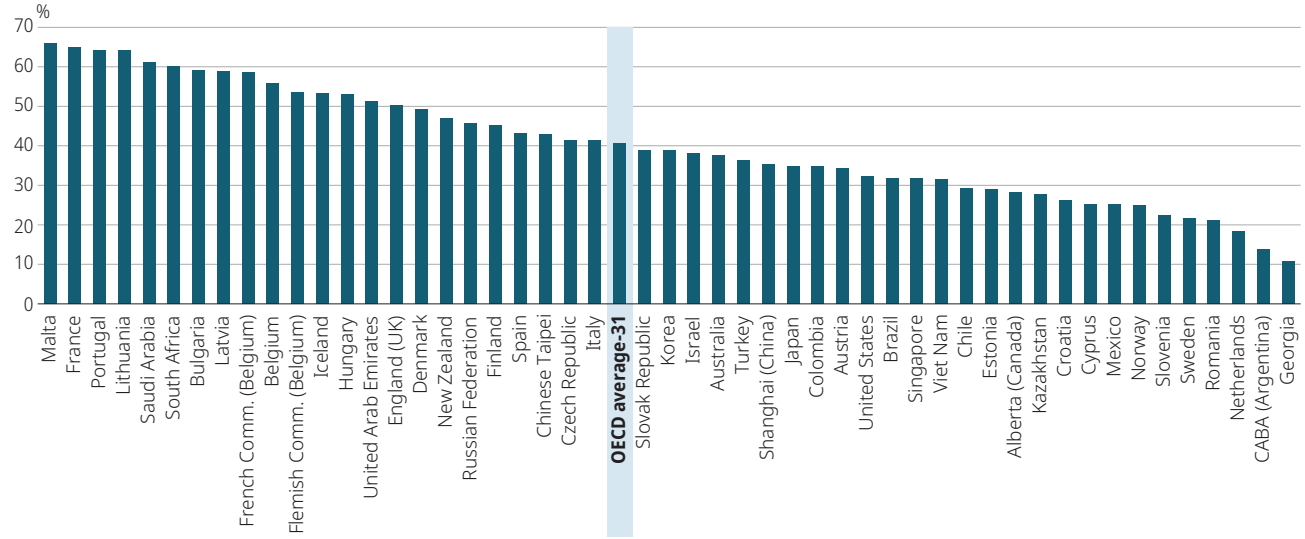


Source: OECD, PISA 2018 Database, Table III.B1.7.1, https://doi.org/10.1787/acd78851-en

StatLink https://doi.org/10.1787/888934195112

Figure 13 **Teachers' experience of stress relating to keeping up with changing requirements from education authorities**

Percentage of teachers for whom keeping up with changing requirements from local, municipal/regional, state or national/federal authorities is a source of stress "quite a bit" or "a lot"



Source: OECD, TALIS 2018 Database, Table II.2.43, https://doi.org/10.1787/19cf08df-en.

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

StatLink https://doi.org/10.1787/888934195131

Reducing the implementation time lag, therefore, includes restoring the links between schools and families and getting parents involved in their children's learning journey, as they too are part of the ecosystem in which students learn. They can actively support the well-being and learning experiences of their children, but they may need clear guidance from school leaders and teachers to see themselves as partners in the learning journey, rather than clients.

Simple ways in which parents can be encouraged to exercise agency and share the responsibility for their children's development include following their child's daily activities at home, accompanying their progress by talking to the child and teacher, asking the teacher how to best support learning at home, participating in school activities and volunteering (Lakind and Atkins, 2018[50]). Some parents may have the ability and desire to get involved by taking leadership roles in schools and communities, but it is important to ensure that the most vulnerable students do not go unheard (OECD, 2012[47]). Building in opportunities to encourage the voices of parents of disadvantaged students should also shorten the implementation time lag as adjustments may be executed as soon as needs are identified.

Effective implementation needs time to prepare well

Processes included in the implementation time lag include preparation of guiding materials and guidelines for school leaders and teachers, as well as teacher training (SLO, 2008[51]; McAra, Broadley and McLauchlan, 2013[31]; Mølstad, 2015[52]; NCCA, 2017[4]). Providing professional development opportunities is particularly relevant when adding new subject areas and 21st century competencies (Brown et al., 2014[53]; NCCA, 2017[4]; Sinnema, 2011[54]; McAra, Broadley and McLauchlan, 2013[31]).

Preparative steps are likely to take time, but they are important investments for successful implementation. Overlooking the alignment of textbooks, teacher guidance materials teacher training, and assessment and evaluation to the new curriculum is likely to create greater delays in implementation in the long run. School leaders and teachers may misunderstand the reform, which can lead to unintended outcomes or to further debate, both of which can extend the time lag. In the Czech Republic, for example, reforming the school-leaving examination took 14 years of debating and testing various versions and modes of implementation, even after the initial policy was passed (OECD, 2016[55]).

IMPACT TIME LAG

Impact time lag occurs because of the time it takes to realise and assess the impact of curricular changes within education systems and in society at large (Halinen, 2017[2]). The time it takes for teaching to change and for students to get the learning experiences intended by the new curriculum depends on the scope of the changes and the organisation of the curriculum design process. Far more time is needed for the change in students learning outcomes to be observed (Halinen, 2017[2]).

The time needed for the effect to be observable may be shorter for curriculum redesign with a specific and/or narrow focus. For instance, improvements in numeracy and literacy in international performance were achieved in six years or less in Chile, Latvia and Hong Kong (China), once policy makers and the public recognised the urgency for change and acted on a set of interventions with determination (Barber, Chijioke and Mourshed, 2010[28]).

Box 2 **The Japanese national curriculum standard**

Through the Japanese national curriculum standard (NCS), revised in 1998, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) created time for a new area of study and decreased instruction time and curriculum content compared to the previous curriculum. This curriculum was broadly criticised as so called Yutori education (a phrase used to criticise drops in scholastic ability), based on Japan's performance in reading literacy in PISA 2003. When MEXT revised the national curriculum standard in 2008, it increased both instruction time and curriculum content. The Central Council for Education in Japan has pointed out the following issues regarding the 1998 NCS: MEXT could not efficiently disseminate the purpose of curriculum redesign, reduced the curriculum content in a way that damaged the consistency of subjects, and could not properly co-ordinate integrative study and subjects. MEXT also did not include sufficient instruction time to acquire and utilise knowledge and skills in the subjects (Central Council for Education in Japan, 2008[57]).

Regarding integrated study, MEXT continued the policy so that students would engage in problem-solving learning and inquiry across subjects. Thus, the revision of the NCS in 2008 incorporated integrated study while reducing instruction time. In fact, National Assessment of Academic Ability surveys in Japan have revealed that the average correct answer rate for literacy and mathematics is higher for students who are actively engaged in integrated study (NIER, 2016[58]). In short, when considering a curriculum redesign, it is necessary to verify it from a long-term, rigorous perspective.

For national curriculum reforms, the time needed to see the effects on learning outcomes usually includes the time needed for the design process and the schooling time needed to integrate the reform. Identifying the effects of a complete curriculum redesign may take more than 15 years (SLO, 2008[51]; Desha, Hargroves and Smith, 2009[56]).

A new reform of the curriculum is often announced before the previous one has completely come into effect. This can pose a challenge for policy makers if the curriculum redesign process is heavily influenced by political cycles that may affect continuity of the reform. For the real impact of a curriculum change to be observed, continuity of curriculum reform is essential. If reforms swing from one direction to another, research to measure the real impact of the selected curriculum reform is not be possible. This can lead to a need for more research to make the curriculum design more systematic and also to gain trust and buy-in among key actors of the reform to help reduce the time lags in recognition, decision-making, implementation and therefore impact.

CURRICULUM INNOVATIONS AIMING TO ELIMINATE TIME LAGS FOR STUDENTS AND TEACHERS

To reap the full potential of eliminating time lags in education, countries/jurisdictions and schools can adjust their practices to reflect current needs and predict those of the future. Building on these future-oriented school practices, a new normal in education started to emerge (Table 2), which had been anticipated and delineated even before the COVID-19 crisis (OECD, 2019[22])

To put this new normal into action in classrooms, a growing number of countries and jurisdictions are adapting their curriculum, pedagogies, assessments, governance structure, educational management and the role of students in education. On the other hand, students are still being taught with traditional pedagogical techniques little changed since the 1900s (Schleicher, 2018[60]).

Table 2 **The new normal in education**

Features	Traditional education system	Education system embodying the new normal
Education system	Education system is **an independent entity**	Education system is **part of a larger ecosystem**
Responsibility and stakeholders engagement	**Decisions made based on a selected group of people** and thus they become accountable and responsible for the decisions made **Division of labour** (principals manage schools, teachers teach, students listen to teachers and learn)	**Decision-making and responsibilities shared among stakeholders**, including parents, employers, communities, and students **Shared responsibility** (everyone works together and assumes responsibility for a student's education, and students also learn to be responsible for their own learning)
Approach to effectiveness and to quality of school experience	**Outcomes most valued** (student performance, student achievements are valued as indicators to evaluate systems for accountability and for system improvement) **Focus on academic performance**	**Valuing not only "outcomes" but also "process"** (in addition to student performance and student achievements, students' learning experiences are in and of themselves recognised as having intrinsic value) **Focus not only on academic performance but also on holistic student well-being**
Approach to curriculum design and learning progression	**Linear and standardised progression** (the curriculum is developed based on a standardised, linear learning-progression model)	**Non-linear progression** (recognising that each student has his/her own learning path and is equipped with different prior knowledge, skills and attitudes when he/she starts school)
Focus of monitoring	**Valuing accountability and compliance**	**System accountability as well as system improvements** (e.g. continuous improvement through frequent feedback at all levels)
Student assessment	**Standardised testing**	**Different types of assessments used for different purposes**
Role of students	**Learning by listening** to directions of teachers with emerging student autonomy	Active participant with both **student agency and co-agency** in particular with teacher agency

Source: *OECD Learning Compass 2030: A Series of Concept Notes*, Table 2, p.14 (OECD, 2019[22]; OECD Education and Skills YouTube channel, 22 October 2019[59])

To close such time lags, some countries/jurisdictions and schools have made significant changes in curriculum in past decades. Such attempts can be categorised in four types of curriculum innovations:

1. **Digital curriculum** can include digital content or organisational features to implement curricular elements, online materials, tools, depositories, hardware, software and other applications. The definition varies across countries/jurisdictions and is evolving as schools experiment with a greater number of digital applications (Pepin et al., 2016[61]; Graesser, McNamara and VanLehn, 2005[62]; Papadakis, 2016[63]; OECD, Forthcoming[64]).

2. **Personalised, individualised, differentiated or tailored curriculum** is a curriculum that is tailored to students' individual needs, skills and interests (Pane et al., 2017[65]). Personalised learning has many definitions and connotations (Maguire, Ball and Braun, 2013[66]), but its main purpose is to improve learning by customising instruction to each learner (e.g. by considering one's prior knowledge, learning style, pace of learning). Personalised curriculum combined with technology, provides the opportunity for students to learn anywhere, anytime. For schools and teachers, a personalised curriculum enables an adaptation of the curriculum to the specific characteristics and needs of each learner (Peterson et al., 2018[67]).

3. **Cross-curricular content and competency-based curriculum** are built across disciplinary or subject boundaries in an effort to enable students to connect knowledge in a more holistic way to meet students' interests and serve society (Goodlad and Su, 1992[68]).

4. **Flexible curriculum** allows schools, teachers and local bodies to adapt, implement or modify curriculum by providing educators with freedom to craft learning content, goals, pedagogies and assessments (Jonker, März and Voogt, 2020[69]; Roumen et al., 2018[70]).

Some of these curriculum innovations are not new per se, but they have not yet become mainstream. Work-related learning is one that needs to be more deeply integrated to support future-ready students (department for children, 2009[71]). One of the main reasons is the high cost of implementation. Personalised and flexible curricula have existed for some time, but political and economic costs have been relatively high. To effectively implement these curriculum innovations would require a whole-system change that would include granting more local autonomy, enhancing teacher competencies and changing teacher training.

With such an ecosystemic approach to curriculum design, these curriculum innovations hold promise to support learning and improved outcomes for all students while reducing time lags. Details on each of these curriculum innovations follow.

Digital curriculum

Bridging the gap between future needs and current educational offerings has never been a straightforward task, notably in regard to digitalisation in education. However, such approaches may prove useful in various phases of curriculum redesign.

Creating space for digital literacy in curriculum

Table 3 shows that many countries/jurisdictions have made changes to the curriculum to integrate digitalisation and content related to information and communications technology (ICT), either by creating new subjects or by introducing new content, themes or competencies within the existing curriculum.

Several countries/jurisdictions have introduced (or are planning to introduce) one or more new ICT-related subjects in the curriculum, for example:

- Australia, Ireland, New Zealand, Portugal, India, Kazakhstan and Viet Nam propose **computer science, technology** or **information technology** as a separate subject.
- Norway, Argentina, and Costa Rica present **programming/coding** as a separate subject.
- Argentina and South Africa propose **robotics** as a separate subject.

Most countries/jurisdictions in Table 3 have introduced (or are planning to introduce) new digital and/or ICT-related content in existing subjects, such as **technology** or **science**, or through **cross-curricular themes or competencies** related to ICT:

- Australia, Chile, Estonia, Hungary, Ireland, Japan, the Netherlands, New Zealand, Scotland (United Kingdom) and Wales (United Kingdom), Brazil, and Kazakhstan report the introduction of ICT as cross-cutting content across multiple subjects or the entire curriculum.
- Chile, Japan, Norway, Québec (Canada), Sweden and Hong Kong (China) enhanced curriculum content on programming which could be infused in specific subjects or across subjects.

Table 3 **Strategies to change curriculum to enable digital learning**

Adding new ICT-related subject(s) to a curriculum		Introducing digital and/or ICT-related contents, themes or competencies within an existing curriculum	
OECD	**Partner**	**OECD**	**Partner**
Australia	Argentina	Australia	Brazil[1]
British Columbia (Canada)	Costa Rica	Chile	Hong Kong (China)
Denmark	India[1]	Denmark	India[1]
Ireland	Kazakhstan	Estonia	Kazakhstan
Japan	Singapore	Finland	Russian Federation
New Zealand	South Africa	Hungary	Singapore
Norway	Viet Nam	Ireland	South Africa
Portugal		Japan	Viet Nam
		Korea	
		Lithuania	
		Netherlands	
		New Zealand	
		Northern Ireland (United Kingdom)	
		Norway	
		Poland	
		Québec (Canada)	
		Scotland (United Kingdom)	
		Sweden	
		Wales (United Kingdom)	
		Turkey	

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

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

Source: Data from the OECD Education 2030 Policy Questionnaire on Curriculum Redesign (PQC), item 2.5.3.

The content of the ICT curriculum often includes disciplinary knowledge on digital and ICT tools, such as computer hardware and software, and informatics and information technology, as well as interdisciplinary knowledge on society, science, ethics and the environment. Different cognitive and metacognitive skills, such as creativity, critical thinking and problem solving, computational thinking and applied programming, are cited by the majority of countries/jurisdictions, but some also cite social and emotional skills, such as communication. A few countries/jurisdictions also cite attitudes and values such as self-awareness in relation to ICT. In an age of the information society and post truth, these skills and attitudes are very relevant for students. (See Box 3 for more details on the content of selected ICT curricula.)

Box 3 **Learning objectives of the ICT curriculum**

Some countries/jurisdictions have introduced mandatory or elective subjects on ICT. The **Australian** curriculum includes a Digital Technologies learning area. It aims to develop knowledge, understanding and skills to ensure that, individually and collaboratively, students can design, create, manage and evaluate sustainable and innovative digital solutions to meet and redefine current and future needs. They are instructed in the use of computational thinking and the key concepts of abstraction, data collection, representation and interpretation.

Students learn to interpret and use specifications, algorithms and implementation to create digital solutions. One aim is for them to confidently use digital systems to efficiently and effectively automate the transformation of data into information and to creatively communicate ideas in a range of settings. They are taught to apply protocols and legal practices that support safe, ethical and respectful communications and collaboration with known and unknown audiences. They also learn how to apply systems thinking to monitor, analyse, predict and shape the

interactions within and between information systems and the impact of these systems on individuals, societies, economies and environments.

Some countries have introduced mandatory or elective subjects on ICT. **Estonia** proposes an elective Informatics subject which aims to direct students to develop the basic skills of learning and working with computers, primarily to search for information, process and analyse it and compile text documents and presentations. After completion, students understand and know how to avoid potential threats to health, security and personal data protection that are likely to occur when using ICT. Using ICT, they are taught to create a functioning and efficient learning environment, participate in virtual communities and use the online environment to publish digital materials in compliance with good practice in intellectual property protection.

In **Japan**, the approach to digitalisation is grounded in two main pillars: information literacy, which permeates the curriculum, and more specialised content on programming, information security, networks and databases. Japan considers information literacy as the foundational competency for learning and aims to develop it across subjects. In a society where it is difficult to predict the future, Japan recognises it is necessary to take the initiative in grasping information, thinking about what is important, collaborating with others while utilising the information, and taking on the challenge of creating new value. In elementary school, education on programming is compulsory from 2020. It is aimed to help students acquire logical thinking through programming in mathematics and science. In high school, there is a subject called "Information" where all students learn amongst others about programming, information security, networks, and databases.

The **Netherlands** has made its Information Sciences course, which was compulsory from 1993 to 2006, into an elective course. With only 30 minutes a week and only one year of instruction in the area, the original subject was not very prominent in the curriculum. It covered the use of standard software and some awareness of the effects of ICT on personal and societal life. After the core objectives were reconsidered, it was transformed into an elective subject in 2006. Today, some other subjects contain ICT-related content or use ICT tools. In art courses, for example, students have to report on their participation in artistic activities by visual or auditory means. This may give rise to some ICT-related activities, such as video editing.

Using technologies for a specific purpose in classrooms and schools

New educational technologies can offer the opportunity to support teachers in enhancing pedagogical practice in the classroom, school administration and system management (Figure 14). For example, social robots can be used as tutors or peers, particularly in primary school. At the classroom level, learning analytics has the potential to increase students' engagement with diversified strategies, provide personalised learning using adaptive technologies, classroom analytics by using data on behaviours, and the capacity to better serve students with special needs through assistive technologies.

At the school or system level, learning analytics, AI, and the Internet of Things might reduce dropout through early warning systems, provide improved or new system-level data for intervention or policy support, and help improve assessments by measuring not just students' knowledge but also how they think. Meanwhile, Blockchain technologies could help with stopping fake degrees or certificates, for example, and improving transfer of credentials. Closing this gap between the digital revolution and educational technologies should be considered in curriculum renewal.

In the context of curriculum design, digital transformation is still an evolving phenomenon, and thus the concept of "digital curriculum" is not well defined. It is often framed in terms of digital curriculum resources (or materials or programmes) because of the wide variety of materials and tools that teachers and students can access (Pepin et al., 2017[73]).

Figure 14 **Applications of technologies in education**

	Classroom	School and system management
Robotics	**Social robots in education**	
Learning analytics	Increasing students' engagement in learning	Improving assessment
Artificial intelligence	Personalising learning	Reducing dropout
Internet of things	Classroom analytics	Learning analytics for schools and systems
	Better serving students with special needs	
Blockchain		A new credentialing ecosystem

Source: (Bouckaert, 2020[72])

Box 4 **Technology in India's Curriculum**

More recently, some countries have been adding content on AI to their curriculum. India has revised its ICT curriculum. Artificial intelligence, digital literacy, coding and computational thinking are now introduced as core subjects in middle and secondary schools to be integrated across their curriculum.

There is also an increasing focus in Indian middle and secondary schools on AI-integrated interdisciplinary learning through project-related work. Artificial Intelligence is derived from disciplines such as science, mathematics, philosophy, sociology, computing, and others. By integrating AI into the core curriculum, India hopes to prepare youth to function in future-oriented environments and professions. This approach adopts a "skills-based" education as opposed to a "knowledge intensive education" to be ready for the future of AI.

Likewise, teachers are receiving additional training on how to use AI in the classroom, which includes materials such as curriculum resources supplements, lesson plans and instructional videos. The Central Board of Secondary Education (CBSE) aims to introduce AI as a multi-disciplinary pedagogical approach in Grades 6-12. Teachers are to be trained using an integrated approach and a "train-the-trainer" model to further be able to match relevant topics/themes from the curriculum with AI concepts.

Source: *Artificial Intelligence Integration Across Subjects*, Central Board of Secondary Education, India: http://cbseacademic.nic.in/web_material/Curriculum20/AI_Integration_Manual.pdf; and OECD Future of Education and Skills 2030 Social Partners – Dream a Dream, Vishal Talreja, Co-Founder and Trustee. Image reproduced with permission.

Countries/jurisdictions also define and interpret digital curriculum differently, often distinctly from the way researchers do. A common policy is to seize new and untapped opportunities of technological developments to design curriculum differently. The degree to which countries/jurisdictions digitalise their curriculum and the ways they do so vary considerably. In some, digital curriculum means posting curriculum documents online, such as in the form of PDF files. In others, there is an interactive and dynamic digital curriculum, integrating curriculum content and learning materials, as well as pedagogical and assessment functions. In New Zealand, for example, the digital curriculum is seen as a medium to invite learners to actively participate in designing and creating their own digital solutions to contemporary challenges (New Zealand Ministry of Education, 2017[74]).

Exploring new opportunities with a digital curriculum

Several mechanisms of digital delivery encompass digital curriculum. For example, interactive platforms typically not only give access to content in a non-linear way, they also allow users (e.g. teachers, local authorities) to design lessons, pedagogical activities and curricula. Navigation of curriculum content beyond the boundaries of individual subjects may spur collaboration between teachers who are expected to teach the same theme (e.g. sustainable development) within their own disciplines, thus promoting cross-curricular delivery. It may also help school leaders to spot opportunities to develop specific competencies in a systematic way by joining efforts across different subjects and levels.

The stages of digitalisation of curriculum are varied with almost half of the participating countries/jurisdictions (43%) report providing some digital version of the curriculum, some (16%) are on the way to implementing a fully interactive digital curriculum, and a few (14%) have already implemented an interactive digital curriculum (Table 4). The following are some approaches to implementation:

- **Digital curriculum documents**: In **New Zealand**, the curriculum is available as PDF, HTML and Word documents that can be manipulated. The curriculum is understood to set direction rather than provide detailed content to teachers, which is why it is assumed that teachers do not need to manipulate the text interactively.
- **Preparing an interactive digital curriculum**: Interactive digital curriculum enables the user to dynamically interact with the curriculum through hyperlinks or interactive tools. The e-curriculum web-service in **Finland** and the smart curriculum planner in **Hungary** both provide a platform for local authorities to create their own curricula. Similarly, the interactive platform envisaged by **Korea** aims to support teachers to manipulate and filter the curriculum and become designers of their own teaching. **Argentina** proposes an extensive plan that includes an integrated digital curriculum platform, as well as teacher training and financial aid, active roles for students and peer-to-peer learning.
- **Using an interactive digital curriculum**: The current **Norwegian** ministry's national curriculum is presented digitally. Online, teachers can filter what they need and find resources and guidelines on how to approach the curriculum in practice.

Table 4 **Stages of digitalisation of the curriculum**

Digital curriculum documents		Preparing an interactive digital curriculum		Using an interactive digital curriculum	
OECD	Partner	OECD	Partner	OECD	Partner
British Columbia (Canada)	Brazil[1]	Chile	Argentina	Australia	South Africa
Czech Republic	Hong Kong (China)	Finland		Estonia	
Ireland	Kazakhstan	Hungary		Norway	
Japan	Viet Nam	Korea		Poland	
Lithuania		Ontario (Canada)			
Mexico					
Netherlands					
New Zealand					
Portugal					
Québec (Canada)					
Scotland (United Kingdom)					
Sweden					

Note: Data displayed in this table include only countries/jurisdictions with responses that could be clearly coded as yes/no. Countries/jurisdictions are reported in mutually exclusive categories according to their reported stage of development of digital curriculum.

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

Source: Data from the PQC, item 2.5.1.

In summary, while there is no consensus on what a digital curriculum is, commonly emerging trends towards digital curriculum include the following:

- **Interactivity**: This refers to the use of a digital platform, which is the base of a digital curriculum, enabling dynamic interactions between groups of learners, such as students and teachers. For example, the eTwinning platform in Europe supports teacher collaboration across school networks (Papadakis, 2016[63]) (see Box 5).
- **End-user participation**: This involves the end-user in the ultimate design, given the choice and adaptability of the curriculum. It enhances participation and shifts the role of curriculum designer, as more choices are made by end-users. In this sense, teachers, students and programmers may all be considered designers. (See Box 5 and Box 6).
- **Integration**: This refers to integrating content, textbooks and tools for pedagogies and assessments into one platform. Such integration is gradually erasing the boundaries between curricula, pedagogies and assessment (see Box 6).
- **Cross-grade and cross-subject learning progressions**: A digital curriculum makes some conceptual learning progressions that cut across grades and disciplines more explicit and accessible. Students and teachers may have easier access and better understanding of prerequisite learning that may have been missed in earlier grades or that can be reinforced in other learning areas. This can help students fill in learning gaps (see Box 5 and Box 6).

Box 5 **Interactivity and end-user participation in a vocational school in Belgium**

GO! Technisch Atheneum Keerbergen (Belgium) is an official member of the Flemish UNESCO schools network engaged to address the UN Sustainable Developmental Goals. Innovation is being implemented on many levels throughout the curriculum, as a core value of the school. Its view is that innovation can never be seen on its own and always serves one or more specific needs in society. They like to express it as "innovation as a catalyst for sustainable development".

Due to the COVID-19 situation and school shutdowns, the project-based science, technology, engineering and mathematics (STEM) courses offered for 12-14 year-old students in the school's fablabs[1] were unable to continue. It is difficult to give students remote instruction for STEM, as students are mainly motivated and engaged by creating and doing. They need clear instruction and room for creativity. To tackle the problem of lack of material and equipment at students' homes, the school network decided to deliver do-it-yourself STEM packages[2] prepared in the fablab with laser cutting technology. That way, students could continue working at home with basic technical equipment (e.g. glue and a screwdriver). At the same time, earlier experiments were intensified with a digital virtual reality/360° platform that the school recently started to use. This allows students to discover learning concepts in a virtual way, bringing real examples closer to them and building motivation by involving them in real-life situations.

To merge the project-based STEM exercise with this opportunity to let students discover future learning concepts in virtual reality, the school decided to let students make their own VR goggles (also known as Google cardboard). To introduce students to this new way of virtual learning, instructions were developed on 360°[3] and 3D movies,[4] along with a step-by-step project-based manual. All instruction could be consulted on the website and the school's educational platform. After completing the VR goggles, students were not only able to discover more educational VR applications and 360° learning content,[5] but the whole school has also provided a virtual tour to facilitate study choice.[6] Due to COVID-19, most of the guidance embedded at school on study choices was unavailable. Using their VR goggles or normal desktop computer, students now could virtually explore from home which curriculum elements best suited their interests.

Another example of an interactive and a more student-centred remote learning approach was initiated by a partner school, GO! Atheneum Eureka. It launched a joint pilot exploring VR applications for education, in a government-funded framework to embed innovations in vocational education and training. The school was specifically looking for a solution to enhance students' motivation and interaction in mechanical courses for 14-16 year-olds that were mainly based on dry formulas and calculations. Due to a lack of digital support on classic learning content platforms, they started using a whiteboard application in virtual reality. By casting the VR experience of the teacher to the students' screens at home with real-time meeting solutions, students could follow all the actions that the teacher initiated, so they became even more involved in the course than they were in the classroom. On the whiteboard, the teacher could put his own notations, but also and more interestingly, he could add digital documents and pictures while making annotations and point out relations between them when applicable. Both students and teachers experienced this way of remote learning as very interactive and more student-centred.

Note: 1. A fablab (or makerspace) is an educational and creative environment with diverse basic to high-tech equipment.

2. STEM package: http://www.technischatheneumkeerbergen.be/vr-stem-pakket/

3. 360-degree video instruction: https://storage.net-fs.com/hosting/6237654/1/index.htm

4. 3D instruction video: http://www.technischatheneumkeerbergen.be/wp-content/uploads/2020/04/WhatsApp-Video-2020-03-28-at-21.52.44.mov

5. For example, the Mendeleev exercise on Thinglink platform: https://www.thinglink.com/scene/1296454650223919105

6. Virtual tour school: http://www.takeerbergen.be/virtualtour/

Source: The OECD Future of Education and Skills 2030 School Networks - GO! Technisch Atheneum Keerbergen, Steven Hendrickx, School Principal.

Box 6 End-user participation and integration in digital curriculum: A lesson from Israel

Lady Davis, a public high school in Tel Aviv, Israel (1 800 students, Grades 7-12) is characterised by a unique culture of change, with a focus on pedagogical autonomy for all teachers. Over the past three years, all humanities and social science subjects were integrated into a year-long interdisciplinary and interactive project-based learning programme, based on formative assessment processes, such as students' self- and peer- reflections and presentations. COVID-19 also propelled the teachers at the school to take advantage of even more innovative and interactive techniques to involve students.

Using multiple technological tools

Communication and interactions between teachers and students at Lady Davis are based on the multiple applications of Google Classroom. Teachers continuously introduce new ideas and practices to the interdisciplinary learning environment, exercising teacher agency and promoting both student agency and co-agency. The recent COVID-19 lockdown found Lady Davis relatively prepared for online learning, as most teachers simply enhanced the use of the Google Classroom infrastructure, including the school's quick subscription to Zoom for synchronous teaching. While no one was ready for school closures, as the prevailing culture is that of change, Lady Davis's teachers were able to adjust quickly. They started to develop innovative pedagogies focusing on two dimensions: setting up the framework for full online learning, which breaks down time and space limitations; and developing new pedagogical methods by integrating multiple technological tools. As one of the teachers said: "The closure forced us to jump into the water, which was full of technological tools and applications ready to innovate our pedagogy."

The framework for full online learning

Daily life under closure does not resemble routine school, and it was clear that a synchronous lesson in this new reality should last 25-30 minutes, with a 5-minute introduction and then 15-20 minutes of group learning on practical and interactive assignments (using Zoom's breakout rooms feature), moving towards a plenary discussion to close the session.

New pedagogical methods by integrating multiple technological tools

Teachers liked the intimacy of Zoom's breakout rooms, where they could mentor and guide the students. However, they still needed to deal with emotional dislocations during these synchronous sessions and found that conversations and discussions that promote empathy were the best solution. Teachers also increased the level of collaboration among themselves and started to teach online in teams, for example integrating literature and Bible studies in an interdisciplinary setting to focus on dilemmas and conflicts, and developing students' critical thinking, an essential 21st century skill.

Instead of sitting a quiz or a test, students' task was to develop creative digital videos in groups to present and interpret the dilemma or the conflict presented in the stories they learned. Hence, different types of assessments were used for different purposes, highlighting teamwork, peer evaluation and self-reflection. Teachers reported that the level of engagement and collaboration among students was higher than in a bricks-and-mortar setting.

Teachers also used WhatsApp as a pedagogical platform, for example in cinema studies. Students received messages via the class WhatsApp group to watch several film excerpts and met back in the group after one hour for a class discussion. As WhatsApp documents all conversations and messages, the content generated by students in the discussion provided the resources for research work assigned to them. According to the teacher, it was the first time he could use content generated during the students' discussion as pedagogical content.

Inventing a new normal towards a hybrid learning environment

The leadership at Lady Davis decided to take these experiences further and drew up a plan using design-thinking methods to develop a hybrid school targeting their first-circle stakeholders: teachers, students and parents. The first workshop was conducted with 15 prominent teachers to re-imagine the new normal. The workshop used Lean Canvas methodology, looking at the new pedagogical experiences resulting from the school closure and reassembling them into a hybrid learning environment.

The main teachers' recommendations that emerged from the workshop can be categorised in three dimensions. First was a new school organisation. For example, each grade level will go to the brick-and-mortar school three or four days a week, while they will learn on line from home on the remaining one or two days. This setting will promote choice, active learning and skills development (i.e. student agency). Second, teachers' learning time (continuous professional development) and collaboration will change dramatically and will play a key role in designing a learning environment that values agency. Third, reducing curriculum overload will allow for the development of social-emotional as well as communication competencies. As this is a work in progress, involving students and parents will be the focus of the next stage.

Source: The OECD Future of Education and Skills 2030 School Networks, Summary of the breakout group discussions at the First Global Forum on the Future of Education and Skills 2030, 19-20 May 2020

Diverse digital technologies can be incorporated into a curriculum with a well-defined scope and sequencing of curricular content (Pepin et al., 2017[73]; Choppin et al., 2014[75]). For example, curriculum content can be integrated into:

- **E-textbooks** (Pepin et al., 2016[61]):
  - Digitalised traditional textbooks with add-on digital material, such as embedded videos or inclusion of a QR code hyperlinked to such recorded videos.
  - Highly interactive e-textbooks that can easily be customised by teachers. These have dynamic sets of tools that can be used for learning, assessment or problem solving. E-textbooks can also function as dynamic rather than static documents that teachers can modify and tailor to their students' needs.

- **Curated online materials** (online materials organised in a curriculum sequence) with affiliated assessments.
- **Repositories of lesson materials** organised in a curriculum sequence according to requirements of a national curriculum, primarily focused on tasks and interactive activities for students.

When these components are integrated, teachers can use the digital curriculum dynamically to select lessons, videos, tasks and assessments in response to their students' needs. They adapt the tools to their unique classroom characteristics (Pepin et al., 2017[73]).

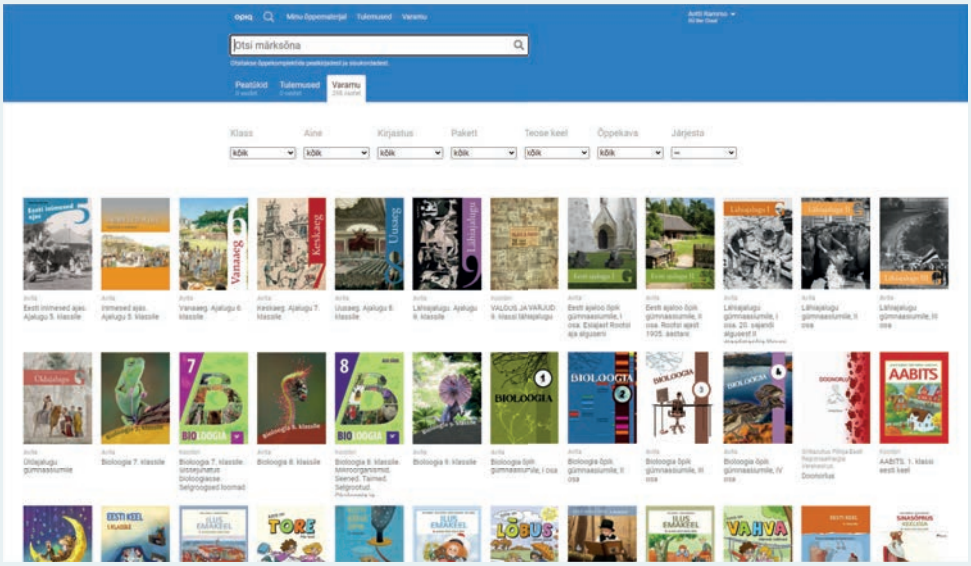
Box 7 **E-textbooks in Estonia**

The use of e-textbooks is becoming a growing and irreversible trend in Estonian schools. Rough estimates indicate a sharp increase in the number of students resorting to the use of digital textbooks since the beginning of the COVID-19 pandemic crisis: from 40 000 students/month to about 360 000/month, nearly a tenfold increase.

While the pandemic might have accelerated the need for teachers and students to tap into the affordances of digital technology for remote learning, the trend towards digitalisation of learning materials had been well on its way even prior to the crisis in the country.

Teachers in Estonia have access to a rich library of e-textbooks through an interactive learning platform called *Opiq.ee*[10] (Figure 15). The digital collection covers most subjects (languages, mathematics, science, history, geography, etc.) from first grade to high school and options are available in both Estonian and Russian language (the two official languages of instruction in the country). Most students in Grades 4-6 (73%) and in Grades 7-9 (81%) are active users of Opiq e-textbooks. The digital textbooks are fully funded by the government. Each school receives funding according to the number of students. Basic school licenses are made available for free to all schools.

Figure 15 **Opiq**



Source: Opiq website, www.opiq.ee

The digital textbooks are mirror images of the paper textbooks, but with a number of additional digital and interactive features.

Teachers and students:

- can look up linked content in other e-textbooks from different grades;
- can easily access rich content in multi-media format (e.g. a music lesson is accompanied by samples of recorded music illustrating various styles and periods); written text is also accompanied by the option of spoken text (more inclusive of students with special needs);

- link to definitions or further explanations of the selected text and/or images;
- access visual simulations of experiments that may be unpractical or too expensive to realise in a real school laboratory;
- work on tasks that vary in difficulty from basic comprehension to deeper understanding of the lesson by formulating and testing hypotheses for various phenomena;
- Teachers can also customise a lesson's content by creating links to other texts and/or online materials within a particular lesson or adding their own materials (by attaching files in text, audio or video format);

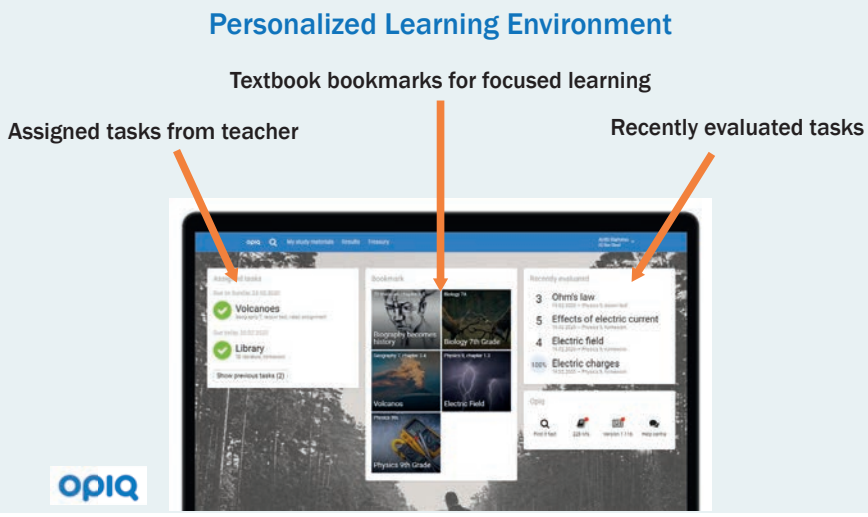
Figure 16 **Opiq e-textbook Student Interface**

Through the **e-diary** function of digital textbooks, teachers can:

- Hand in assignments to individual students, follow their submission and provide exclusive feedback;
- Manage classroom assignments as well as individual assignments and progress;
- Review students' work, provide targeted feedback to students and grade their assignment;
- Make students' grades available at the school level (with access limited to relevant users);
- Share students' progress with their parents;
- Share exceptional student work with the entire school community, all from a single tool.

The e-diary function has different levels of access and interfaces for various users: school leaders, teachers, students and parents.

Figure 17 **Opiq e-textbook Teacher Interface (Personalised Learning Environment)**



The contents of textbooks in general, including e-textbooks, are reviewed by a team of experts. Publishers must follow the government's requirements for identifying reviewers and make all reviews public on a portal managed by the Ministry of Education and Research. Content items in each subject area and expected learning outcomes are required to be aligned with the national curricula. Teachers receive training from the publishing companies directly (e.g. online tutorials), through school-level professional development activities and/or through self-directed learning.

Source: Ministry of Education and Research, Republic of Estonia.

Digitalising textbooks

A considerable body of research has shown that, in some countries/jurisdictions, teachers rely heavily on textbooks for teaching (Sikorova, 2012[76]). With the increasing availability of digital devices, such as personal computers, tablets and e-readers, and the flexible availability they give to students and teachers, digitised textbooks have become more and more common.

Most countries/jurisdictions (70%) have in place some sort of national approval process for digital textbooks or a policy to encourage their use (Table 5). Among these, 41% formally encourage the use of digital textbooks. About 24% of countries/jurisdictions have no formal policy for their encouragement but do have initiatives to start using digital textbooks. In Lithuania and the Russian Federation, there is an approval process for digital textbooks. The other OECD and partner countries have no formal national policy to encourage digital textbooks for diverse reasons, such as local authorities or schools having responsibility for textbooks.

Table 5 **Extent to which countries/jurisdictions encourage digitalisation of textbooks**

Formal encouragement of the use of digital textbooks		No formal policy to encourage digital textbooks but other measures in place			
		Initiatives to foster digital learning materials		National approval process for digital textbooks	
OECD	Partner	OECD	Partner	OECD	Partner
Chile	Argentina	Denmark	Costa Rica	Lithuania	Russian Federation
Czech Republic	Brazil[1]	Ireland			
Estonia	China	Lithuania			
Finland	Hong Kong (China)	Netherlands			
Hungary	India[1]	New Zealand			
Japan		Norway			
Korea		Scotland (United Kingdom)			
Mexico		Turkey			
Poland					
Portugal[2]					

Note: 1. Responses for these countries/jurisdictions were submitted by independent researchers, not government officials.
2. Pilot projects involving the use of digital textbooks are being carried out in several Portuguese schools, but wide expansion of these is not confirmed.
Source: Data from the PQC, item 1.7.6.

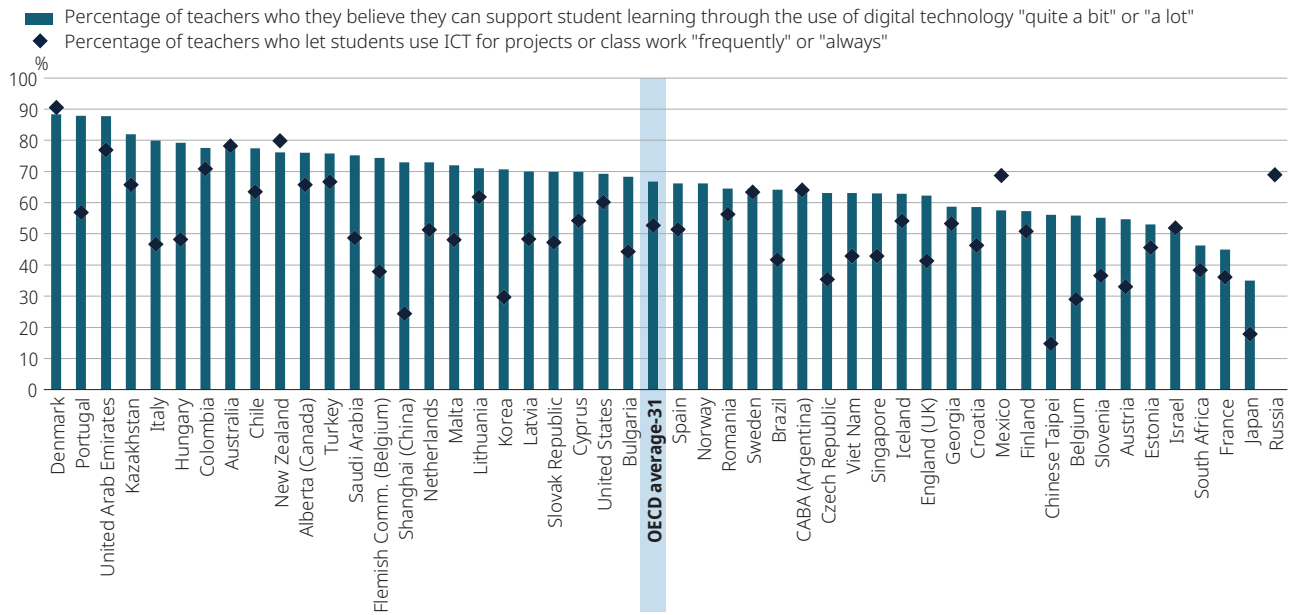
Empowering teacher agency to support student learning using technology

Closing the implementation time lag implies preparing teachers to not only deliver ICT-related curriculum contents, but also to integrate the use of ICT technologies in the classroom to support learning. When properly embedded into pedagogical practice, digital technologies can support active and engaged learning and illustrate creative uses of technology that students will be able to transfer to their life outside the school. However, for digital tools to support meaningful learning experiences, teachers need appropriate training and support that will enable them to gradually transform their teaching practices.

As a general trend, countries/economies with higher levels of teacher self-efficacy are also those where teachers more frequently allow students to use ICT in the classroom (Figure 18). For example, TALIS 2018 data show that Denmark is the country with the highest proportion of teachers reporting that they believe they can support student learning through digital technology "quite a bit" or "a lot" (88% of teachers), and it is also the country with the highest proportion of teachers indicating that they let students use ICT for projects or class work "frequently" or "always" (90%). Japan is the country with the lowest proportion of teachers who report confidence in their ability to support student learning through use of technology (35%) and also the lowest proportion of teachers reporting student use of ICT "frequently" or "always" (18%).

Despite this general trend, some countries/economies have considerable gaps between teachers' sense of efficacy in supporting student learning using technology and student use of ICT in the classroom. For example, 71% of teachers in Korea report confidence in supporting student learning through digital technology, yet only 30% report frequently letting students use ICT for project or class work. This pattern is evident in a number of OECD countries, including Belgium (Flemish community) and Italy, as well as in Shanghai (China) and Chinese Taipei (Figure 18). These large gaps between teacher efficacy and practice suggest that factors other than teacher confidence can be implicated in the frequency with which teachers facilitate students' use of technology in their classrooms.

Figure 18 **Teachers' self-efficacy for using digital technology to support student learning and frequency with which students are permitted to use ICT for projects or class work**



Notes: Results based on responses of lower secondary teachers. Countries and economies are ranked in descending order of the percentage of teachers who believe they can support student learning through the use of digital technology "quite a bit" or "a lot" (no data were available for Russian Federation on this variable).

Examples of digital technologies are computers, tablets and smart boards. ICT: Information and communication technology.

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

Source: TALIS 2018, Tables I.2.20 and I.2.1, https://doi.org/10.1787/19cf08df-en

StatLink https://doi.org/10.1787/888934195150

Personalised curriculum

Personalised curriculum is not new. For many years, personalisation of curriculum has been used to support students with developmental disabilities, with the aim of providing an inclusive curriculum (Knowlton, 1998[77]). The term also goes back to early efforts to individualise instruction at the beginning of the 20th century (Boninger, Molnar and Salda, 2019[78]; Bloom, 1984[79]). The term personalised curriculum is often used interchangeably with personalised learning, individualised curriculum, individualised learning and differentiated learning (Alan Millward, 2002[80]; Tomlinson, 2005[81]).

The innovative aspect of personalised curriculum, combined with the use of technology, lies in the possibility for students to learn anywhere, anytime and any way. It includes ways to validate their prior knowledge and interests, build in individual learning styles and progressions, give them relevant and continuous feedback and accommodate different paces of learning. For schools and teachers, a personalised curriculum makes it possible to combine different practices in adapting the curriculum to the specific characteristics and needs of each learner (Peterson et al., 2018[67]).

Involving students as co-designers of curriculum

Recent literature points to the importance of students' views and voices on their education (Bron, Nieveen and Voogt, 2017[82]). As put by Alison Cook-Sather in her article about curriculum reform, "This way of thinking is premised on the following convictions: that young people have unique perspectives on learning, teaching, and schooling; that their insights warrant not only the attention but also the responses of adults; and that they should be afforded opportunities to actively shape their education." (OECD, 2018[5]; Cook-Sather, 2006, p. 359[83]). Taking students' voices into account in curriculum redesign can make the curriculum more relevant to their needs and learning experiences (Bron, 2014[84]). Recognising the needs, expectations and interests of students is only the first step in ensuring that their voices are considered and reflected in the curriculum redesign to make it more relevant and motivating to them.

In various countries, such as Australia, Canada, New Zealand, the United Kingdom and the United States, it has become increasingly important to include student voices on what and how they learn in the decision-making process (Bron, 2014[84]; Cook-Sather, 2006[83]; Sinnema and Aitken, 2013[85]). For example, students were actively involved during the recognition phase of curriculum redesign in the Netherlands (van Schaik, Voogt and Nieveen, 2017[43]) and Finland (Pietarinen, Pyhältö and Soini, 2017[26]). In the Netherlands, primary and secondary school students were asked to share their ideas about the new curriculum. Finland collects data on students' opinions of the existing curriculum to inform the upcoming renewal. Both Scotland (United Kingdom) and Wales (United Kingdom) undertook systematic engagement with stakeholders, including students, before beginning the design process itself.

By including students' perspectives in their decision-making process, these countries/jurisdictions acknowledge the valuable insights that students can offer by sharing their views on how they learn best and how they experience the changes in the curriculum. Their perspectives can be very different from those of their teachers and parents. Failing to recognise students' interests may lead to negative responses to curriculum change.

Involving students as owners of their own learning

Personalised curriculum should not only be used to motivate students based on their interest for new technologies but should also be made relevant by connecting students to the world in and outside schools (Kumpulainen, Mikkola and Rajala, 2018[86]). Students are generally prepared to do extra work if the learning expected in the curriculum is more adapted to their interests (Courtney and Anderson, 2010[87]; Stefl-Mabry, Radlick and Doane, 2010[88]).

Having students' voices recognised in curriculum redesign may add time to the process by increasing the recognition time lag. But it can save time later and shorten the implementation time lag while increasing students' satisfaction and commitment to learning in or out of school.

If students' voices and needs are already built into the curriculum at the design stages, classroom lessons, choices of content and activities are likely to be more attractive and relevant to students, which can boost their motivation and commitment to learning (Bron, 2014[84]; Cook-Sather, 2006[83]). Otherwise, students will need to rely more heavily on the discretion and ability of their teachers to listen, understand and adapt their teaching to their students' current needs and future interests.

National curricula that are revised under fixed renewal cycles (e.g. every five or ten years) certainly present advantages for both teachers and students. In principle, having a fixed cycle allows schools and teachers the time to familiarise themselves with the curriculum and perfect its implementation over a number of school years. This adds stability, efficiency and predictability in what is expected of both teachers and students, which can facilitate planning tasks for school leaders and teachers (Sivesind and Westbury, 2016[25]; NCCA, 2017[4]; Pietarinen, Pyhältö and Soini, 2017[26]).

Flexible curriculum

Curriculum flexibility is conceptualised as adaptability and accessibility of the curriculum for schools and teachers to respond to students' needs and capabilities, and it assumes autonomy of schools and teachers with regard to the curriculum or parts of it (Saarivirta and Kumpulainen, 2016[89]; Newton and da Costa, 2016[90]). It is a multidimensional concept that is understood differently by different stakeholders and in different countries and jurisdictions.

Building on the categorisations developed by researchers (Tucker and Morris, 2011[91]; Jonker, März and Voogt, 2020[69]), the four dimensions of flexibility are highly relevant to current policy discussions in many OECD countries:

1. Flexibility on learning content concerns the what of curriculum, including the goals, new subjects, prioritisation of concepts and interdisciplinary themes.
2. Flexibility on pedagogy concerns the how of curriculum, including instructional approaches, learning activities, grouping of students, and materials and resources.
3. Flexibility on assessment concerns the standards of the curriculum and how it is determined that they have been met.
4. Flexibility on learning time concerns the how much of learning: instruction time, and organisation of time.

A flexible curriculum can be conceived along a continuum between completely flexible and completely fixed (Tucker and Morris, 2011[91]). In reality, however, curriculum flexibility does not mean complete flexibility, because any curriculum has some degree of constraint set by government regulations, in the form of input factors (e.g. attainment goals and standards) and output factors (e.g. national exams, standardised tests and the inspecting bodies) (Kuiper and Berkvens, 2013[92]). Curriculum flexibility, therefore, allows the degree of freedom that schools and teachers have over the curriculum for site-specific curricular choices.

A key consideration for policy makers and curriculum designers is to carefully set the appropriate degrees of flexibility granted to local authorities, school leaders, teachers, and students in deciding what and how to teach and learn in any given learning area. An aspirational future vision for student profiles and education goals coherent with the vision can act as a general guide and empowerment tool for teachers and students.

A forthcoming volume will explore in greater depth the role of curriculum flexibility in curriculum redesign (OECD, Forthcoming[93]).

Cross-curricular content and competency-based curriculum

One growing challenge for schools lies in effectively preparing students for successful transitions into employment. While young people need to make more decisions about what and where they will study as they stay in education for longer, such investment decisions are becoming more difficult due to labour market turbulence. Recent OECD analysis has shown that young people's career aspirations tend to be narrow, optimistic and distorted by social circumstances (Musset and Mytna Kurekova, 2018[24]). Ongoing OECD work makes use of national longitudinal datasets to identify indicators of better than anticipated employment outcomes in adulthood (Mann, Denis and Percy, forthcoming, 2020[94]). Analysis shows that schools have important roles to play in broadening and enriching the career thinking of students, supporting their exploration of the labour market and facilitating first-hand experiences of workplaces. Effective provision develops student agency, enabling critical reflection on the relationship between educational experiences and labour market outcomes.

Countries and jurisdictions are increasingly making their curriculum relevant to real-world situations by articulating either cross-curricular competencies or cross-curricular themes. Cross-curricular competencies are those that are likely to transfer across learning areas, such as problem-solving skills, creativity and curiosity. Cross-curricular themes are likely to be understood when concepts from different disciplines are learned in an authentic and meaningful way, such as environmental sustainability, global citizenship and media literacy (see "How are demands for 21st century competencies and key concepts integrated into school curriculum?"). New jobs may require some of the skills promoted by learning material in a cross-curricular way (World Economic Forum, 2016[9]).

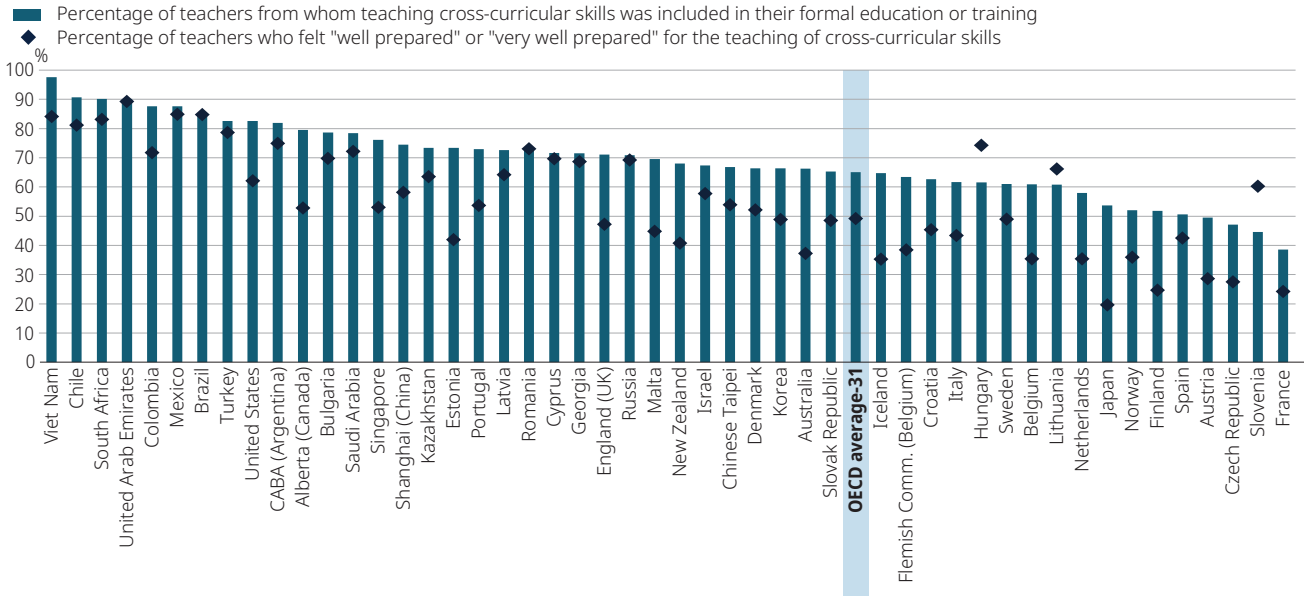
In the absence of effective support measures for teachers to implement such cross-curricular themes and competencies in the new written curriculum, students may be exposed to a vastly different experienced curriculum, as their learning will depend on teachers' individual interpretations of what this means in practice. The challenge appears to lie partly in the types of teaching education programmes that teachers have attended and the types of professional development activities that they have been engaged in, which matter for teacher preparedness.

Preparing teachers for teaching cross-curricular skills

Teaching cross-curricular materials requires unique skills that traditional training programmes may not emphasise. However, best integrating themes and 21st century competencies may require the ability to teach across the curriculum. Countries/jurisdictions report that teachers have these skills to varying extents.

Less than 50% of teachers in the Czech Republic, France and Slovenia report that teaching cross-curricular skills was included in their formal education or training (Figure 19). Furthermore, teachers in Finland, France and Japan report the lowest rates of perceived preparedness to teach cross-curricular skills (25% and below).

Figure 19 **Coverage of teaching cross-curricular skills in teacher education and sense of preparedness to teach cross-curricular skills**



Note: Results based on responses of lower secondary teachers. Countries and economies are ranked in descending order of the percentage of teachers for whom teaching cross-curricular skills was covered in their education. Examples of cross-curricular skills include creativity, critical thinking and problem-solving.

Source: TALIS 2018, Tables I.4.13 and I.4.20, https://doi.org/10.1787/1d0bc92a-en

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

StatLink https://doi.org/10.1787/888934195169

The gap between what is included in formal education and the sense of preparedness is particularly high in Estonia and Japan, where there is a difference of more than 30 percentage points between teachers reporting that teaching cross-curricular skills was included and teachers reporting that they feel "well prepared" or "very well prepared". Only in Hungary, Lithuania, Slovenia, Brazil and Romania is the percentage of teachers who report that they feel at least "well prepared" in teaching cross-curricular skills at least the same or higher than the percentage of teachers who report that this was included in their formal education.

The promotion of play as a pedagogical tool helps to encourage creative thinking and ultimately builds cross-curricular competencies (Barnes, 2015[95]). However, play as a pedagogical tool can be integrated not only into student education but also into teacher education. Thus, one possible approach to prepare teachers for teaching cross-curricular skills is to train them to address students' interests and development as a part of student-centric curriculum in K-12 education, including encouraging student play when developmentally appropriate (Pane et al., 2017[96]). In addition, research into the effects and effectiveness of arts in teacher education to help new teachers discover their own areas of creativity to enhance their curricular confidence suggests that play and creativity are underutilised in teacher education (Barnes and Shirley, 2007[97]).

WHAT IS STILL UNKNOWN?

Peer-reviewed research on time lag is scarce, as this aspect of curriculum development is only recently receiving greater attention in education policy circles. One of the difficulties with studying time in curriculum renewal processes is that curriculum design and implementation are highly contextual. This makes it difficult for research findings to be generalised across different education systems and political contexts.

Nevertheless, both systematic impact studies as well as exploratory and case studies can shed more light on a number of questions and topics that remain underexplored. Some of these are described below:

- **Future needs**: In light of rapid social and technological developments affecting how we live and work in a global economy, it is not an easy task to try to forecast the future and prepare for it. Various countries/jurisdictions acknowledge the difficulties they face when designing curricula in trying to incorporate future needs without a clear vision of what the future will look like (see Table 7 in "Challenges and strategies" section). Uncertainties about the types of jobs that will survive digital developments in the fourth industrial revolution (the combination of cyber-physical systems, the Internet of Things, and the Internet of

Systems), or the types of jobs that will be created as a result of it, make it challenging for educators and curriculum designers to be specific about the types of competencies students will need in the future.

- **Inclusion of students' voices in curriculum renewal**: Research on this topic is still in its infancy, and not much is known regarding the impact of student involvement in curriculum redesign on time lag. Existing research on students' voices focuses mainly on how it emerges in the interaction between teachers and students in the classroom. Little is known about conditions that facilitate the inclusion of students' voices in curriculum redesign (i.e. how this can actually be done and how it would affect reduction of time lag, teachers' practices and students' outcomes).
- **Implications of different types of curriculum reform on time lag**: The time implications of reforming a knowledge-based curriculum may be very different than those of reforming a competency-based curriculum, and these distinctions still need further exploration.
- **Impact on students' outcomes (e.g. learning, participation levels, motivation and engagement)**: Not much is known on how much students are affected by time lag in curriculum reform processes, apart from the fact that if change is needed, delays in making those changes will be detrimental to successive cohorts of students. Research is needed on this, while acknowledging that it is a complex issue, as it takes time before the impact of renewal can be observed and any effect on students becomes apparent. Longitudinal and cohort studies are needed to study the impact of curriculum renewal in the long run. Policy makers need to consider how they can facilitate such studies by making use of existing databases.
- **Schools and community as curriculum designers**: Time lag may be partly addressed when national curricula allow for decentralised curriculum development at the local or school level. However, a better understanding is needed of how schools and communities can be prepared to develop a quality curriculum that is timely and future-oriented. Context matters, as the educational system and the political context may affect how decentralised curriculum design can best be organised.
- **Resistance to change from school staff, particularly teachers**: To better understand the impact of resistance from teachers and other stakeholders on time lag and on students' outcomes, further research is needed with a more granular examination of the reasons for such resistance.
- **Forward planning**: At the national level, the paucity of research on time lag is particularly acute for time lag in curriculum reform processes. Most research in this section is, therefore, based on research on curriculum design processes. Further research on time lag would benefit from a focus on forward planning.

Furthermore, research on curriculum innovations is often exploratory and fragmented. The review suggests that the following areas need further study:

- **Systematic stock-taking of existing definitions of curricular innovations**: Overall, the field of curriculum innovation lacks a coherent definition, notably across domains (research or practice).
- **Implications of curriculum innovations for teaching preparation and professional learning**: Building on the findings noted above, teachers need support and ongoing professional development to develop such competencies in their preparation. This will help ensure that they have the tools and skills to implement these curricular innovations.
- **Cost-effectiveness and cost-benefit analysis of adopting ICT tools in learning and teaching**: Innovative tools and practices require funding to develop and disseminate them and to train teachers and staff. It is unclear whether the benefits of these processes outweigh the costs.
- **Extent to which digital technology is being used to enhance personalised learning**: Learning analytics is an important component of a digital curriculum and a personalised curriculum. In order to use learning analytics to improve learning, research is needed to connect learning analytics with models of learning.

Notes

1. A curriculum can be manifested differently across countries: e.g. syllabus, course of study, programme of studies, programme of study, educational programme.
2. For written source: https://www.oecd.org/education/2030-project/contact/OECD_Learning_Compass_2030_Concept_Note_Series.pdf; for visualisation:www.youtube.com/watch?v=mlXvQKUS-_Q
3. McLeod, Scott and Karl Fisch, "Shift Happens": https://youtu.be/SBwT_09boxE
4. The OECD Education 2030 Policy Questionnaire on Curriculum Redesign (PQC) provides data on the frequency of curriculum reform of 34 countries/jurisdictions (upper and lower secondary education).
5. Table WEB 11: Number and type of curriculum reforms reported between 1980 and 2030 by country/jurisdiction. StatLink: https://doi.org/10.1787/888934195663.
6. Table WEB 11: Number and type of curriculum reforms reported between 1980 and 2030 by country/jurisdiction. StatLink: https://doi.org/10.1787/888934195663.
7. An approach that considers curriculum change as part of a larger ecological change, for which managing the process requires a much more organic approach than top-down decision making. The ecosystem approach entails that multiple, nested systems in an individual's environment directly and indirectly impact a child's development throughout life:
   - The **microsystem** contains the groups and institutions with which a child directly interacts (e.g. school, family, peers, neighbourhood).
   - The **mesosystem** is the connection between the various groups and institutions within a child's microsystem, for example, the connection between a child's teacher and parents.
   - The **exosystem** is the larger societal structure that indirectly influences a child. Though the child may not directly interact with the exosystem, settings or institutions within the exosystem directly interact with someone in the child's microsystem. This could include the parents' workplace or government-mandated education reforms.
   - The **macrosystem** contains social and cultural policies and beliefs that affect the larger context in which the child operates.
   - The **chronosystem** addresses changes over time in the environments with which the child interacts
8. See (OECD, 2020), *Overview brochure of the Education 2030 series of thematic reports on curriculum redesign,* OECD Publishing, Paris.
9. Table WEB 11: Number and type of curriculum reforms reported between 1980 and 2030 by country/jurisdiction. StatLink: https://doi.org/10.1787/888934195663.
10. https://www.opiq.ee/

References

Alan Millward, A. (2002), "Individualised educational programmes. Part I: a literature review", *Jorsen*, Vol. 2/3, https://doi.org/10.1111/j.1471-3802.2002.00170.x. [80]

Barber, M., C. Chijioke and M. Mourshed (2010), *How the World's Most Improved School Systems Keep Getting Better,* McKinsey. [28]

Barnes, J. and I. Shirley (2007), "Strangely familiar: Cross-curricular and creative thinking in teacher education", *Improving Schools*, Vol. 10/2, pp. 162-179, https://doi.org/10.1177/1365480207078580. [97]

Bialik, M. and C. Fadel (2018), *Knowledge for the Age of Artifical Intelligence: What Should Students Learn?*, https://curriculumredesign.org/wp-content/uploads/CCR_Knowledge_FINAL_January_2018.pdf. [12]

Biesta, G. and M. Priestley (eds.) (2013), *Emerging international trends in curriculum*, Bloomsbury, London. [85]

Bloom, B. (1984), "The 2 Sigma Problem: The search for methods of group instruction as effective as one-to-one tutoring", *Educational Researcher*, Vol. 13/6, pp. 4-16. [79]

Bolstad, R. and J. Gilbert (2012), *Supporting Future-Oriented Learning & Teaching: A New Zealand Perspective,* New Zealand Ministry of Education. [29]

Boninger, F., A. Molnar and C. Salda (2019), *Personalized Learning and the Digital Privatization of Curriculum and Teaching*, National Education Policy Center, Boulder, CO, https://nepc.colorado.edu/publication/personalized-learning. [78]

Bouckaert, M. (2020), *Smart Data and Digital Technology in Education: Learning Analystics, AI and Beyond,* Presentation by Mathias Bouckaert (Centre for Educational Research and Innovation, OECD) at the E2030 Focus Group 1 Zoom webinar on 9 July 2020. https://www.oecd.org/education/ceri/smart-data-digital-technology-education-learning-analytics-ai.htm [72]

Bron, J. (2014), "What students want to learn? Involving students in negotiating the social studies classroom curriculum", *Journal of International Social Studies*, Vol. 4/1, pp. 3-16, https://files.eric.ed.gov/fulltext/EJ1149459.pdf. [84]

Bron, J., N. Nieveen and J. Voogt (2017), *Student voice in curriculum development Report* prepared under the auspices of the OECD Future of Education and Skills 2030 project, University of Amsterdam, Amsterdam. [82]

Brown, N. et al. (2014), "Restart: The resurgence of computer science in UK schools, ACM transactions on computing education", *ACM Transactions on Computing Education*, Vol. 14/2, pp. 1-22, http://dx.doi.org/10.1145/2602484. [53]

Bude, U. (2000), *Curriculum Conferences. New Directions in Curriculum Development in Africa*, DSE – Zed Texts. [1]

Central Council for Education in Japan (2008), "Improvement of the National Curriculum Standard for kindergarten, primary schools, lower and upper secondary schools and special-needs schools", in *幼稚園、小学校、中学校、高等学校及び特別支援学校の学習指導要領等の改善について*. [57]

Choppin, J. et al. (2014), "A typology for analyzing digital curricula in mathematics education", *Internatinal Journal of Education in Math, Science and Technology*, Vol. 2/1. [75]

Cook-Sather, A. (2006), "Sound, Presence, and Power: "Student Voice" in Educational Research and Reform", *Curriculum Inquiry*, Vol. 36/4, pp. 359-390, http://dx.doi.org/10.1111/j.1467-873x.2006.00363.x. [83]

Courtney, L. and N. Anderson (2010), "Do rural and regional students in Queensland experience an ICT "turn-off" in the early high school years?", *Australian Educational Computing*, Vol. 25/2, pp. 7-11. [87]

Curriculum Development Council (2015), *Ongoing curriculum renewal of the school curriculum: Focusing, deepening and sustaining. An overview.* [30]

David, J. (2009), "Teaching social responsibility: What research says about service learning and civic participation", *Educational Leadership*, Vol. 66/8, pp. 83-84, http://www.ascd.org/publications/educational-leadership/may09/vol66/num08/Service-Learning-and-Civic-Participation.aspx. [21]

Department for Children, Schools and Families (2009), *The Work-Related Learning Guide (Second Edition)*, Department for Children, Schools and Families, United Kingdom https://dera.ioe.ac.uk/10591/7/Work-related_learning_Redacted.pdf. [71]

Desha, C., K. Hargroves and M. Smith (2009), "Addressing the time lag dilemma in curriculum renewal towards engineering education for sustainable development", *International Journal of Sustainability in Higher Education*, Vol. 10/2, pp. 184-199, http://dx.doi.org/10.1108/14676370910949356. [56]

Dilkes, J., C. Cunningham and J. Gray (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. [40]

Donaldson, G. (2014), "Teacher education and curriculum change in Scotland", *European Journal of Education Research, Development, and Policy*, Vol. 49/2, pp. 178-191, http://dx.doi.org/DOI: 10.1111/ejed.12077. [32]

Driscoll, P., A. Lambirth and J. Roden (eds.) (2015), *An Introduction to Cross-Curricular Learning,* Sage. [95]

Duncan, G., K. Magnuson and E. Vortuba-Drzal (2017), "Moving beyond correlations in assessing the consequences of poverty", *Annual Review of Psychology*, Vol. 68, pp. 413-434, https://doi.org/10.1146/annurev-psych-010416-044224. [49]

English, L. and D. Kirshner (eds.) (2016), *E-textbooks in/for Teaching and Learning Mathematics: A Potentially Transformative Educational Technology*, Taylor and Francis. [61]

European Parliament (2020), *(Re)thinking Democracy. Digital Democracy: Is the Future of Civic Engagement Online?*, https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646161/EPRS_BRI(2020)646161_EN.pdf. [15]

Fullan, M. (2007), *The New Meaning of Educational Change*, Teachers College Press, New York. [44]

Graesser, A., D. McNamara and K. VanLehn (2005), "Scaffolding deep comprehension strategies through Point&Query, AutoTutor, and iSTART", *Educational Psychologist*, Vol. 40/4, pp. 225-234, http://dx.doi.org/10.1207/s15326985ep4004_4. [62]

Halinen, I. (2017), *Managing time-lag dilemma in OECD countries*, Internal report prepared for the OECD 2030 study, OECD, Paris. [2]

Harris, R. and S. Graham (2019), "Engaging with curriculum reform: Insights from English history teachers' willingness to support curriculum change", *Journal of Curriculum Studies*, Vol. 51/1, pp. 43-61, https://doi.org/10.1080/00220272.2018.1513570 [37]

Jackson, P. (ed.) (1992), *Organization of the Curriculum*, Macmillan. [68]

Jenkins, G. (2020), "Teacher agency: The effects of active and passive responses to curriculum change", *The Australian Educational Researcher*, Vol. 47/1, pp. 167-181, https://doi.org/10.1007/s13384-019-00334-2 [38]

Johansen, B. (2013), "Navigating the VUCA world", *Research-Technology Management*, Vol. 56/1, pp. 10-15. [6]

Jonker, H., V. März and J. Voogt (2020), "Curriculum flexibility in a blended curriculum", *Australasian Journal of Educational Technology*, Vol. 36/1, http://dx.doi.org/10.14742/ajet.4926. [69]

King, D. (2017), *Curriculum Reform in Ireland: Applying a Contextual Lens to Enactment of a New Curriculum in Lower Secondary Education,* Paper presented at ECER,Copenhagen. [42]

Knowlton, E. (1998), "Considerations in the design of personalized curricular supports for students with development disabilities", E*ducation and Training in Mental Retardation and Developmental Disabilities*, Vol. 33/2, pp. 95-107, https://www.jstor.org/stable/23879158?seq=1. [77]

Kollmuss, A. and J. Agyeman (2002), "Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental?", *Environmental Education Research*, Vol. 8/3, pp. 239-260, http://dx.doi.org/10.1080/13504620220145401. [16]

Kuiper, W. and J. Berkvens (2013), Editorial Introduction, *Balancing Curriculum Regulation and Freedom across Europe: CIDREE yearbook 2013*, SLO, Enschede. [92]

Kumpulainen, K., A. Mikkola and A. Rajala (2018), "Dissolving the digital divide: Creating coherence in young people's social ecologies of learning and identity building", in *Handbook of Comparative Studies on Community Colleges and Global Counterparts, Springer International Handbooks of Education*, Springer International Publishing, Cham, http://dx.doi.org/10.1007/978-3-319-53803-7_7-2. [86]

Lakind, D. and M. Atkins (2018), "Promoting positive parenting for families in poverty: New directions for improved reach and engagement", *Children and Youth Services Review*, Vol. 89, pp. 34-42, https://doi.org/10.1016/j.childyouth.2018.04.019. [50]

Law, E. and C. Li (eds.) (2013), *Transformational Issues in Curriculum Reform: Perspectives from Hong Kong*, Sense Publishers. [41]

Law, W. (2014), "Understanding China's curriculum reform for the 21st century", *Journal of Curriculum Studies*, Vol. 46/3, pp. 332-360, http://dx.doi.org/10.1080/00220272.2014.883431. [33]

Maguire, M., S. Ball and A. Braun (2013), "What ever happened to ...? 'Personalised learning' as a case of policy dissipation", *Journal of Education Policy*, Vol. 28/3, pp. 322-338, http://dx.doi.org/10.1080/02680939.2012.724714. [66]

Mann, A., V. Denis and C. Percy (forthcoming), *Career Ready? How schools can better prepare young people: Work in the era of COVID-19*, OECD Publishing. [94]

McAra, K., E. Broadley and J. McLauchlan (2013), *Curriculum for Excellence in Scotland-Local Flexibility or National Exemplification?*, SLO. [31]

Mølstad, C. (2015), "State-based curriculum-making: approaches to local curriculum work in Norway and Finland", *Journal of Curriculum Studies*, Vol. 47/4, pp. 441-461, http://dx.doi.org/10.1080/00220272.2015.1039067. [52]

Morgan, F. et al. (2019), "Toward understanding the impact of artificial intelligence on labor", *Proceedings of the National Academy of Sciences*, Vol. 14, pp. 6531-6539, https://doi.org/10.1073/pnas.1900949116. [7]

Musset, P. and L. Mytna Kurekova (2018), *Working it out: Career Guidance and Employer Engagement*, OECD Publishing, Paris, https://doi.org/10.1787/51c9d18d-en. [24]

NCCA (2017), *Curriculum Development Process - Draft Document for Discussion,* NCCA, Dublin. [4]

New Zealand Ministry of Education (2017), *Digital Technologies Hangarau Matihiko*, New Zealand Ministry of Education, Wellington, https://education.govt.nz/assets/Documents/Ministry/consultations/DT-consultation/DTCP1701-Digital-Technologies-Hangarau-Matihiko-ENG.pdf (accessed on 28 April 2020). [74]

Newton, P. and J. da Costa (2016), "School autonomy and 21st century learning: the Canadian context", *International Journal of Educational Management*, Vol. 30/7, pp. 1279-1292, http://dx.doi.org/10.1108/ijem-11-2015-0151. [90]

NIER (2016), "National Assessments of Academic Ability FY2016 - Survey results", in *平成28年度 全国学力・学習状況調査 調査結果のポイント*, https://www.nier.go.jp/16chousakekkahoukoku/16hilights.pdf. [58]

OECD (2020), *Curriculum Overload: A Way Forward,* OECD Publishing, Paris, https://doi.org/10.1787/3081ceca-en. [27]

OECD (2020), *Environment at a Glance 2020*, OECD Publishing, Paris, https://doi.org/10.1787/4ea7d35f-en. [19]

OECD (2020), *How's Life? 2020: Measuring Well-being*, OECD Publishing, Paris, https://doi.org/10.1787/9870c393-en. [20]

OECD (2020), *TALIS 2018 Results (Volume II): Teachers and School Leaders as Valued Professionals*, TALIS, OECD Publishing, Paris, https://doi.org/10.1787/19cf08df-en. [46]

OECD (2019), *OECD Learning Compass 2030. A series of Concept Notes*, OECD, Paris https://www.oecd.org/education/2030-project/contact/OECD_Learning_Compass_2030_Concept_Note_Series.pdf. [22]

OECD (2019), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, TALIS, OECD Publishing, Paris, https://doi.org/10.1787/1d0bc92a-en. [39]

OECD (2018), *The Future of Education and Skills, Education 2030: The Future We Want (position paper)*, OECD, Paris, https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf. [5]

OECD (2016), *E2030 Conceptual Framework: Key Competencies for 2030 (DeSeCo 2.0)*, OECD, Paris, https://www.oecd.org/education/2030-project/about/documents/E2030-CONCEPTUAL-FRAMEWORK-KEY-COMPETENCIES-FOR-2030.pdf. [23]

OECD (2016), "What can governments do to implement education policies effectively?", in *Teaching Excellence through Professional Learning and Policy Reform: Lessons from around the World*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264252059-5-en. [55]

OECD (2015), *Future Shocks and Shifts: Challenges for the Global Workforce and Skills Development*, *A research paper* by Thor Berger and Carl Benedikt Frey, OECD, Paris, https://www.oecd.org/education/2030-project/about/documents/Future-Shocks-and-Shifts-Challenges-for-the-Global-Workforce-and-Skills-Development.pdf [11]

OECD (2013), *PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices*, PISA, OECD Publishing, Paris, https://doi.org/10.1787/9789264201156-en. [48]

OECD (2013), *Trends Shaping Education 2013*, OECD Publishing, Paris, https://doi.org/10.1787/trends_edu-2013-en. [13]

OECD (2012), L*et's Read Them a Story! The Parent Factor in Education*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264176232-en. [47]

OECD (Forthcoming), *An ecosystem approach to curriculum redesign and implementation (title TBC)*, OECD Publishing, Paris. [34]

OECD (Forthcoming), *Curriculum flexibility and autonomy (title TBC)*, OECD Publishing, Paris. [93]

OECD (Forthcoming), *Equity through curriculum innovations (title TBC)*, OECD Publishing, Paris. [64]

OECD (2019), *OECD Future of Education and Skills 2030: The new "normal" in education*, OECD Education and Skills YouTube channel, https://www.youtube.com/watch?v=9YNDnkph_Ko&feature=youtu.be. [59]

Ojala, M. and Y. Lakew (2017), Young People and Climate Change Communication, *Oxford Research Encyclopaedia of Climate Science*, Oxford University Press, New York, http://dx.doi.org/10.1093/acrefore/9780190228620.013.408. [18]

Pane, J. et al. (2017), *How Does Personalized Learning Affect Student Achievement?*, RAND Corporation, Santa Monica CA, https://www.rand.org/pubs/research_briefs/RB9994.html. [65]

Pane, J. et al. (2017), *Informing Progress: Insights on Personalized Learning Implementation and Effects*, RAND Corporation, Santa Monica CA, https://www.rand.org/pubs/research_reports/RR2042.html. [96]

Papadakis, S. (2016), "Creativity and innovation in European education. Ten years eTwinning. Past, present and the future", *International Journal of Technology Enhanced Learning*, Vol. 8/3-4, pp. 279-296. [63]

Pepin, B. et al. (2017), "Digital curriculum resources in mathematics education: foundations for change", *Mathematics Education*, Vol. 45, pp. 645-661, http://dx.doi.org/10.1007/s11858-017-0879-z. [73]

Peterson, A. et al. (2018), "Understanding innovative pedagogies: Key themes to analyse new approaches to teaching and learning", *OECD Education Working Papers*, No. 172, OECD Publishing, Paris, https://dx.doi.org/10.1787/9f843a6e-en. [67]

Pew Research Center (2013), *Civic Engagement in the Digital Age,* Pew Research Center, Washington DC, https://www.pewresearch.org/internet/wp-content/uploads/sites/9/2013/04/PIP_CivicEngagementintheDigitalAge.pdf. [14]

Pietarinen, J., K. Pyhältö and T. Soini (2017), "Large-scale curriculum reform in Finland – exploring the interrelation between implementation strategy, the function of the reform, and curriculum coherence", *The Curriculum Journal*, Vol. 28/1, pp. 22-40, http://dx.doi.org/10.1080/09585176.2016.1179205. [26]

Reinhart, R. (2018), *Global Warming Age Gap: Younger Americans Most Worried,* Gallup News, https://news.gallup.com/poll/234314/global-warming-age-gap-younger-americans-worried.aspx. [17]

Roumen, N. et al. (2018), "Distance and flexible learning in the twenty-first century", *Handbook of Comparative Studies on Community Colleges and Global Counterparts,* Second Handbook of Information Technology in Primary and Secondary Education, Springer, Cham, pp. 1-16, https://doi.org/10.1007/978-3-319-53803-7_45-2. [70]

Saarivirta, T. and K. Kumpulainen (2016), "School autonomy, leadership and student achievement: reflections from Finland", *International Journal of Educational Management*, Vol. 30/7, pp. 1268-1278, http://dx.doi.org/10.1108/IJEM-10-2015-0146. [89]

Salkovski, P., D. Clark and M. Gelder (1996), "Cognition-behaviour links in the persistence of panic", *Behaviour Research and Therapy,* Vol. 34/5-6, pp. 453-458, https://doi.org/10.1016/0005-7967(95)00083-6. [10]

Schleicher, A. (2018), *World Class: How to Build a 21st-Century School System*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264300002-en. [60]

Sikorova, Z. (2012), "The role of textbooks in lower secondary schools in the Czech Republic", *IARTEM E-Journal*, Vol. 4/2, pp. 1-22, https://ojs.bibsys.no/index.php/IARTEM/article/view/774. [76]

Sinnema, C. (2011), *Monitoring and evaluating curriculum implementation final evaluation report on the implementation of The New Zealand Curriculum 2008-2009,* Ministry of Education (MoE), Wellington, https://thehub.swa.govt.nz/assets/documents/42417_Monitoring-Evaluating-web-06042011_0.pdf [54]

Sivesind, K. and I. Westbury (2016), "State-based curriculum work and curriculum-making: Norway'sLæreplanverket 1997", *Journal of Curriculum Studies*, Vol. 48/6, pp. 766-782, http://dx.doi.org/10.1080/00220272.2016.1186741. [25]

Expertgroep doorlopende leerlijnen taal en rekenen (2008), *Over de drempels met taal en rekenen: Hoofdrapport van de expertgroep taal en rekenen [About the barriers with language and arithmetics: Main report of the expert group on language and arithmetics]*, Keijzer Communicatie, Enschede, https://www.slo.nl/publish/pages/2819/over-de-drempels-hoofdrapport.pdf. [51]

Stefl-Mabry, J., M. Radlick and W. Doane (2010), "Can you here me now? Student voice: High school & middle school students' perceptions of teachers, ICT and learning", *International Journal of Education and Development using Information and Communication Technology*, Vol. 6/4, pp. 64-82, https://files.eric.ed.gov/fulltext/EJ1085038.pdf. [88]

Stevenson, M. (2020), *HPST. Reflections on the Significance of AI for What People Should Learn.*, Paper for the PISA Governing Board on March 2020, http://docplayer.net/165334841-Hpst-reflections-on-the-significance-of-ai-for-what-people-should-learn-michael-stevenson.html. [8]

Thompson, K. (ed.) (2003), *Organization and Management: Selected Papers* Volume 7 of The Early Sociology of Management and Organizations, Routledge, London. [35]

Tomlinson, C. (2005), *How to Differentiate Instruction in Mixed-Ability Classrooms*, Association for Supervision and Curriculum Development. Pearson/Merrill Prentice Hall, Upper Saddle River, NJ. [81]

Tucker, R. and G. Morris (2011), "Anytime, anywhere, anyplace: Articulating the meaning of flexible delivery in built environment education", *British Journal of Educational Technology*, Vol. 42/6, pp. 904-915, http://dx.doi.org/10.1111/j.1467-8535.2010.01138.x. [91]

van den Akker, J. (2018), *Developing Curriculum Frameworks: A Comparative Analysis*, NCCA, Dublin. [3]

van Schaik, M., J. Voogt and N. Nieveen (2017), *Onderwijs 2032 : Onderzoek naar werkwijze en opbrengsten van de maatschappelijke dialoog Het proces van visie-ontwikkeling naar een toekomstgericht curriculum [Education 2032: A study about the method and returns of the societal dialogue],* University of Amsterdam, Amsterdam, https://hdl.handle.net/11245.1/c5262f03-5485-4ccb-91c5-659759bfa7a0. [43]

Viennet, R. and B. Pont (2017), "Education policy implementation: A literature review and proposed framework", *OECD Education Working Papers*, No. 162, OECD Publishing, Paris, https://dx.doi.org/10.1787/fc467a64-en. [45]

Voogt, J., N. Nieveen and S. Klopping (2017), *Curriculum Overload: A Literature Study*, Unpublished OECD Reference Document. [36]

World Economic Forum (2016), *The Future of Jobs,* http://reports.weforum.org/future-of-jobs-2016/chapter-1-the-future-of-jobs-and-skills/#hide/fn-1. [9]

How do countries compare?

Time lag is a common phenomenon that affects curriculum design across countries/jurisdictions. Addressing time lag involves timely identification of future demands and needs, ensuring buy-in from stakeholders, using digital tools strategically and wisely, and taking into account potential fatigue related to prior reforms, among other issues. Reforms require a vision, future-oriented competencies that are articulated in curriculum and fostered effectively by teachers, with parent and student buy-in. Countries and jurisdictions report wide variation in the frequency and duration of their curricular reforms. Understanding these dynamics in conjunction with factors that mitigate or contribute to additional lags can facilitate strategic future planning.

This section[1] first gives an overview of how countries use student profiles and cascading education goals to build a common vision for reform. It then delves deeper into how countries integrate 21st century competencies into national curricula. Finally, it compares countries' future reform plans.

WHAT KIND OF A FUTURE VISION FOR STUDENTS DO COUNTRIES/JURISDICTIONS ARTICULATE IN THEIR CURRICULUM?

By articulating a shared vision for the kinds of students needed for the future, countries/jurisdictions can help address time lag in curriculum by creating a common language for desired outcomes and setting the stage for movement towards a shared goal. The sustainability of reform is linked to how effective policy makers are at articulating, sharing and developing buy-in for education goals (Pietarinen, Pyhältö and Soini, 2017[1]).

A curriculum is regarded not only as a tool to react to and cope with changes in society, but also as a tool to define and build the future (Halinen, 2016[2]; Airaksinen, Halinen and Linturi, 2017[3]). The core question then is: "What kind of future do we want to create?" Societal goals can be translated and structured into three types of goals: overall education goals as denoted in educational acts; curriculum goals; and subject-specific goals (Figure 20).

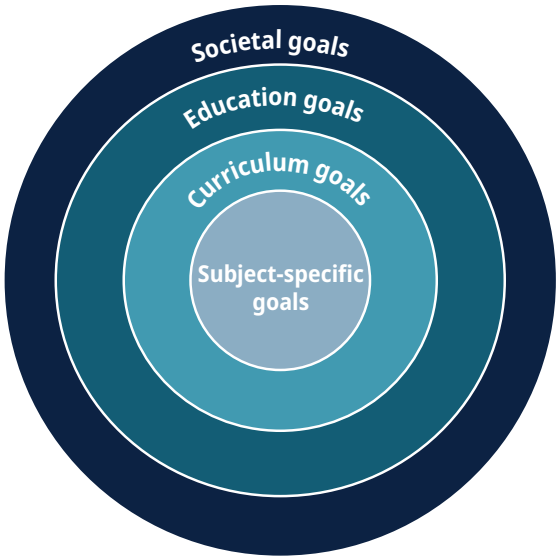
Societal goals and how education plays a key role

Economic and demographic challenges propel countries/jurisdictions to expand and modify education goals to address societal needs. An ageing population may suggest the need to become more pluralistic, while a lack of natural resources may demand additional creativity to promote economic output, increasing the competitive advantage as a labour market. This is, for example, the case in Estonia, a relatively small country with limited natural resources, which is in the process of establishing its competitive advantage as an equitable economy and a society based on digital and ICT-based education. These challenges can be addressed by effectively recognising these needs and altering education goals to meet them.

Other countries/jurisdictions, such as Japan and Korea, are working to combat demographic trends of ageing societies and declining fertility rates by making their societies more equitable and inclusive so as to use all talent in the labour market. Societal goals and aspirations can directly drive educational goals, with real-world implications for students and society (See Box 8). Singapore is investing significantly in human resource development to help its students become confident persons, self-directed learners, concerned citizens and active contributors who are able to work effectively in teams, exercise initiative and take calculated risks (Table WEB 12[2]).

Education goals often highlight specific social and economic issues beyond those related to education (Figure 21), and documents articulating these goals may indicate national priorities or alternatives for addressing these. For example, most countries/jurisdictions make a clear link between education goals and economic outcomes in diverse documents and statements about education goals. Some also prioritise specific societal imperatives in their education goals, such as environmental awareness and sustainability (Australia, Denmark, Estonia, Finland, Hungary, Norway, Poland, Portugal, Scotland [United Kingdom], Sweden and Kazakhstan).

Figure 20 **Cascading goals**



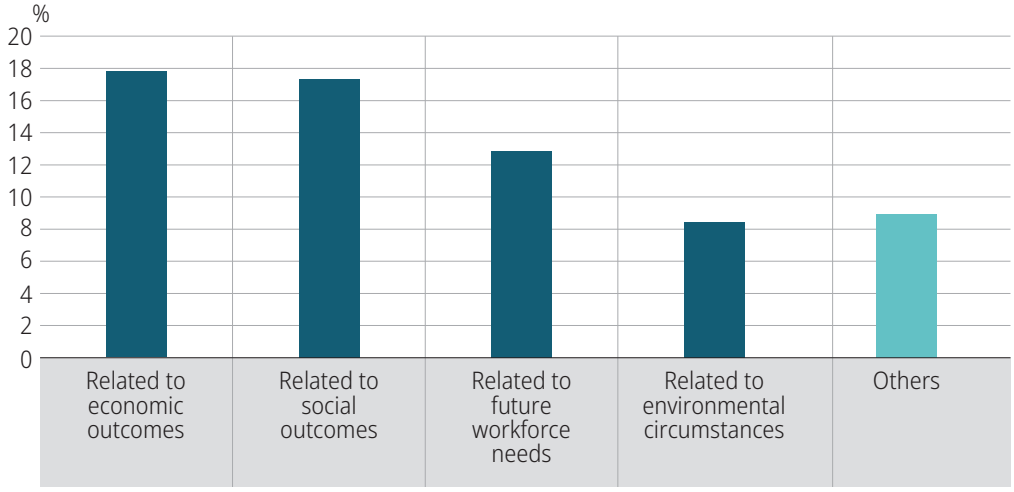
Future workforce needs such as lifelong learning, skills development and entrepreneurship, and building the workforce for tomorrow are articulated by a number of countries/jurisdictions (Denmark, Estonia, Finland, Hungary, Ireland, Norway, Ontario [Canada], Portugal, Scotland [United Kingdom], Sweden, China [People's Republic of], Hong Kong [China], India, Kazakhstan, South Africa).

Others emphasise the need to strengthen education for students with special needs (Ireland, New Zealand, Portugal, Turkey, Argentina and Kazakhstan). Northern Ireland (United Kingdom) references media awareness, and Finland and Ireland include responsible and informed consumer behaviour.

Well-being is another important priority mentioned in diverse documents by almost two-thirds of countries/jurisdictions. Most appear to strive for a balance between students' personal well-being and that of society. The aim for students to live self-sufficient, satisfying and happy lives is contrasted with references to economic prosperity, the strength of civic society and the development of social capital.

Figure 21 **Socio-economic, environmental and other desired outcomes cited in education goals**

Percentage out of the total number of policies, declarations and statements articulating education goals reported by countries/jurisdictions



Note: Values displayed in this figure include only responses that could be clearly coded as yes/no. Responses for Northern Ireland (United Kingdom), the United States, Brazil and India were submitted by independent researchers, not government administrations.

Source: Data from the PQC, item 0.1.

StatLink https://doi.org/10.1787/888934195188

Box 8 Lowering the voting age and creating a related new subject "Public" in Japan

In Japan, election laws were changed in 2015 to lower the voting age from 20 to 18. One outcome of this significant change was the 2018 revision of the National Curriculum Standard for high schools. In this revision, Japan created a new civics subject called "Ko-kyou" (Public), which is compulsory for all high school students. This revision is a consequence of society's need to nurture students as future creators and lifelong learners. The goal of "Ko-kyou" is to develop the competencies needed for citizens to form and contribute to a peaceful and democratic nation and society. For example, it aims to develop the competencies to make decisions fairly, based on facts and thoughtful reflection and to take different perspectives into account. It includes discussions and work towards consensus-building and social participation and the use of ideas that contribute to decision making, good judgment and basic public principles in order to solve real problems in society. This is a good example of curriculum redesign responding to social needs without time lag.

Countries/jurisdictions cite diverse visionary policies on the future of education. Goals are included in policy declarations, action plans, reports, curriculum documents, speeches, discourses and other public statements, judicial decisions and laws. Some even cite the goals in their national budget or constitution. The diversity of origin and policy documentation reflects the relative importance of some of these goals for the national political agenda and identity.

More than half of countries/jurisdictions articulate their education goals in roughly six different types of policies, declarations or statements (Table WEB 13[3]). This ranges from 1 in Japan, New Zealand, Sweden and Hong Kong (China) to 18 in China and 19 in Kazakhstan. Whether it is preferable to clearly outline the goals in one single place or to reiterate them in multiple documents and on multiple occasions depends on the national context.

Education goals and how curriculum plays a key role

Education goals reflect current societal priorities of countries/jurisdictions, as well as their overall mission, philosophy of education and resulting education needs (OECD Policy Questionnaire on Curriculum Redesign). These goals are commonly designed in line with student profiles. Education needs are often identified by a board of representatives of national stakeholders. The goals sometimes include the key attitudes, skills, competencies and knowledge students are expected to have acquired on completion of the different education levels and are further defined in curricula and subject-specific education goals.

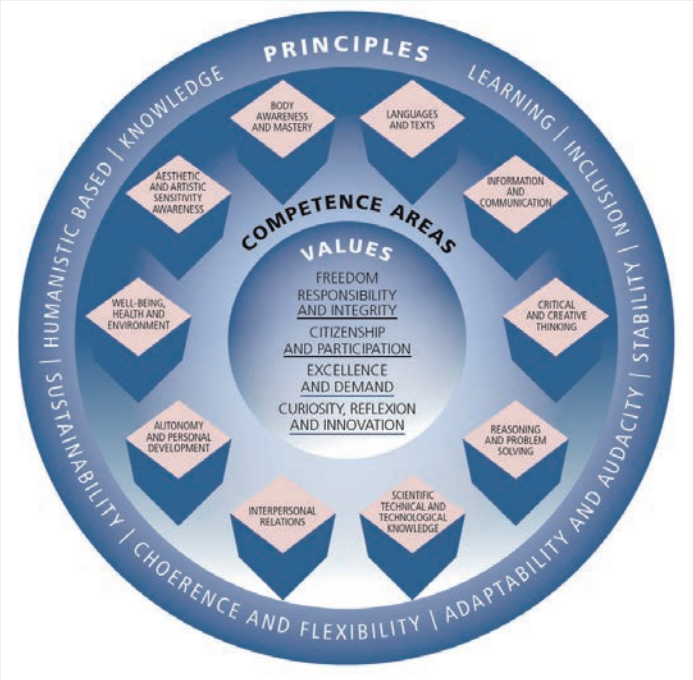
What these goals are, how they are set and how they are structured differ across countries/jurisdictions, reflecting national/jurisdictional contexts and circumstances and societal needs over time. Moreover, recognising the need to change goals based on shifting societal demands may result in a lag between when the changes occur and when the education goals reflect these shifts.

Countries/jurisdictions commonly do this by engaging in public consultations or discussions on a student profile or future vision that specifies the kinds of outcomes expected at the end of compulsory schooling (Table WEB 12[4]). Examples of countries/jurisdictions that use a student profile to guide competency selection include Portugal, Korea, Scotland (United Kingdom), Hong Kong (China) and Canada (Box 9).

Box 9 Examples of student profiles and learning goals

Portugal: The **Students' Profile by the End of Compulsory Schooling** is structured in principles, vision, values and competence areas that all students should develop by the end of 12 years of education. The values outlined in the profile's conceptual framework mirror the humanistic-based philosophy which fosters inclusion and values diversity viewing each student as a unique human being. The students' profile leads thus to a school education in which the students of this global generation build and settle a humanistic-based scientific and artistic culture by mobilising values and skills that allow them to act upon the life and history of individuals and societies to make free and informed decisions about natural, social and ethical issues, and to carry out a civic, active, conscious and responsible participation (Portuguese Ministry of Education, 2019) (Figure 22).

Figure 22 **Portugal's students' profile by the end of compulsory schooling**



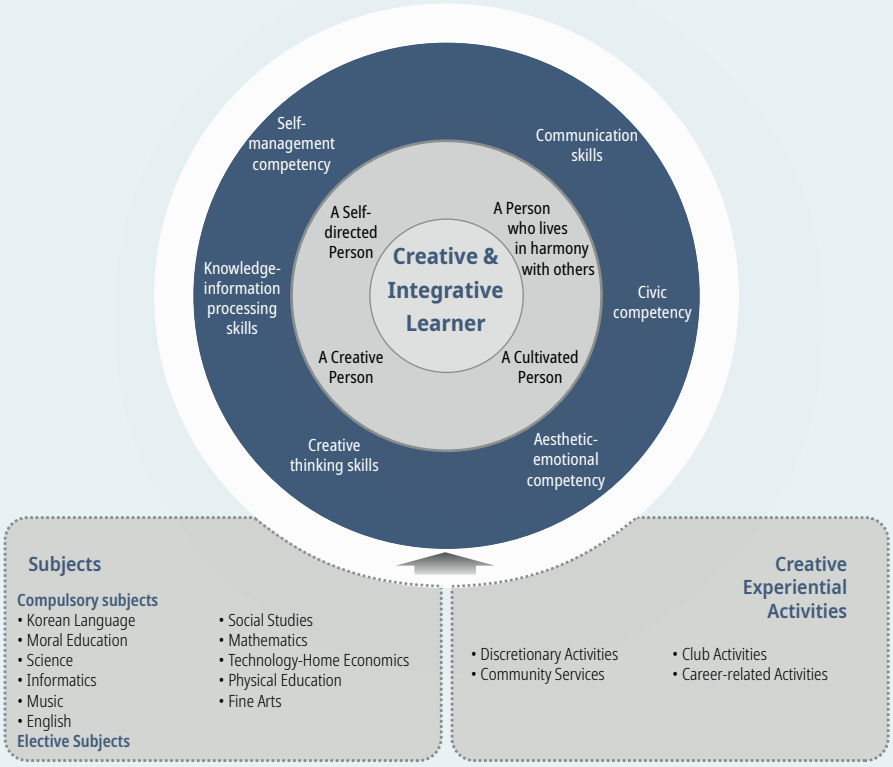
Note: For more details see Annex on National or regional curriculum frameworks and visualisations.
Source: Students' Profile by the End of Compulsory Schooling, Directorate-General for Education/Ministry of Education and Science (2017)

Korea: Based on the Korean concept of **"Hongik Ingan"**, or the drive to broadly benefit humanity, Korea sets out its student profile, **"An Educated Person"** (Figure 23). It aims to enable every citizen to lead a life worthy of human dignity, contribute to the development of a democratic state and support the realisation of an ideal of shared human prosperity, by ensuring cultivation of character, development of abilities for independent life and necessary qualities as a democratic citizen under the humanitarian ideal. Based on the ideal and aims of education, the vision of an educated person in this curriculum is specified as follows: 1) a self-directed person who builds a self-identity and explores a career and life on the basis of holistic growth; 2) a creative person who discovers something novel by means of diverse ideas and challenges based upon basic abilities; 3) a cultivated person who appreciates and promotes the culture of humankind on the basis of cultural literacy and understanding of diverse values; and 4) a person who lives in harmony with others, fulfilling the ethics of caring and sharing, as a democratic citizen with a sense of community and connection to the world.

Scotland (United Kingdom): Scotland (United Kingdom) defines its student profile based on four main dimensions to be enabled among young people: 1) successful learners; 2) confident individuals; 3) responsible citizens; and 4) effective contributors (Figure 24). Under each of these dimensions, Scotland includes values and competencies that support students to navigate towards such a vision. This student profile helps to align values and competencies with education objectives under a clear and coherent framework that sets out a broad reference of the Scottish curriculum for students, teachers and stakeholders.

Hong Kong (China): Hong Kong (China) has a set of 7 Learning Goals which describe the aim of its student profile. On a secondary education level, it aims to enable students to: 1) become an informed and responsible citizen with a sense of national and global identity, appreciation of positive values and attitudes as well as Chinese culture, and respect for pluralism in society; 2) acquire and construct a broad and solid knowledge base, and to understand contemporary issues that may impact on students' daily lives at personal, community, national and global levels; 3) become proficient in biliterate and trilingual communication for better study and life; 4) develop and apply generic skills in an integrative manner, and to become an independent and self-directed learner for future study and work; 5) use information and information technology ethically, flexibly and effectively; 6) understand one's own interests, aptitudes and abilities, and to develop and reflect upon personal goals with aspirations for further studies and future career; and 7) lead a healthy lifestyle with active participation in physical and aesthetic activities, and to appreciate sports and the arts (Figure 25).

Figure 23 **Student profile Korea**

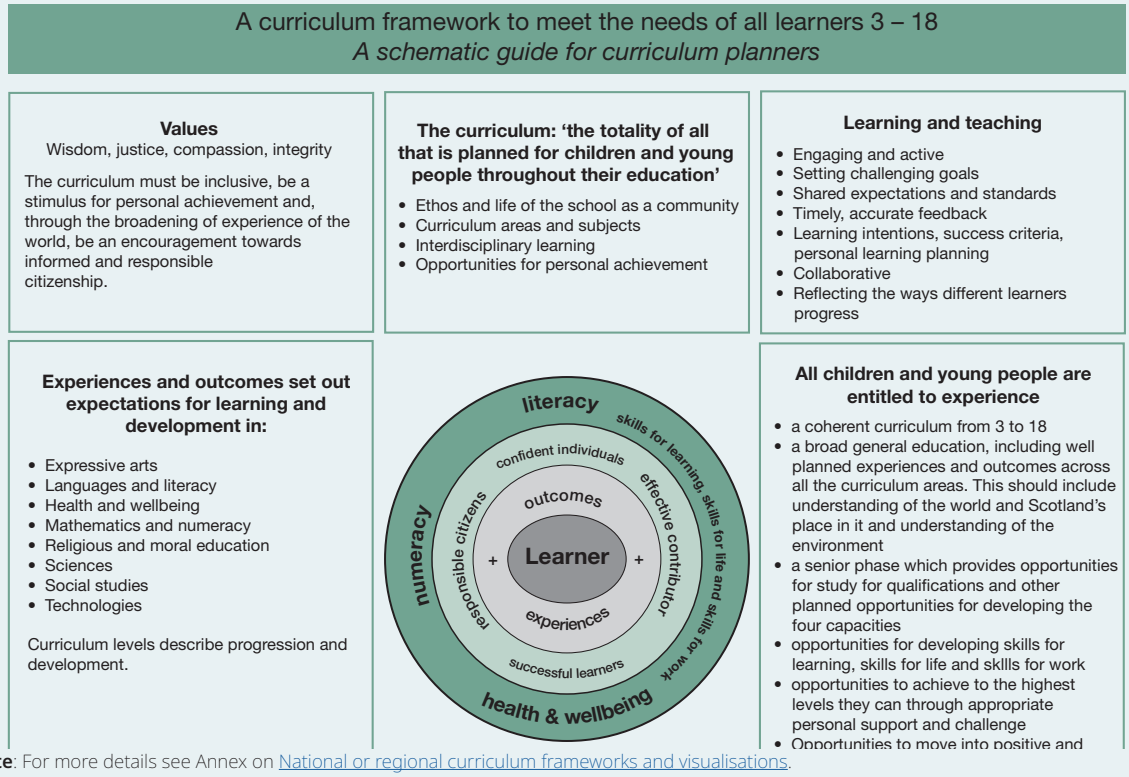


The Framework for 2015 Revised Middle School Curriculum in Korea

Note: For more details see Annex on National or regional curriculum frameworks and visualisations.

Source: Adapted from Korea Institute for Curriculum and Evaluation [KICE] (2016). The framework for 2015 Revised Middle School Curriculum in Korea. Unpublished manuscript, KICE, Seoul: Korea.

Figure 24 **Student profile Scotland (United Kingdom)**



Note: For more details see Annex on National or regional curriculum frameworks and visualisations.

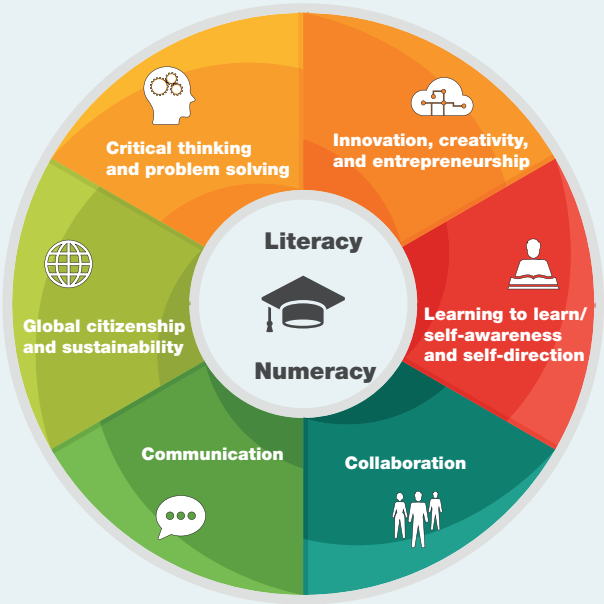
Source: Education Analysis Division – The Scottish Government 2017.

Figure 25 **Hong Kong (China) learning goals**

Source: Learning Goals, School Curriculum Framework and Planning; https://www.edb.gov.hk/attachment/en/curriculum-development/renewal/Guides/SECG%20booklet%202_en_20180831.pdf (p. 6 Figure 2.2).

Council of Ministers of Education, **Canada (CMEC)**: In 2016, the provincial and territorial ministers of Education put forward six global competencies a pan-Canadian effort to prepare students for a complex and unpredictable future with rapidly changing political, social, economic, technological, and ecological landscapes. Building on strong foundations of numeracy and literacy, these competencies are: Critical Thinking and Problem Solving; Innovation, Creativity, and Entrepreneurship; Learning to Learn/ Self-Awareness and Self-Direction; Collaboration; Communication; and Global Citizenship and Sustainability. These competencies are an overarching set of attitudes, skills, knowledge and values that are interdependent, interdisciplinary, and can be leveraged in a variety of situations both locally and globally. They provide learners with the abilities to meet the shifting and ongoing demands of life, work and learning; to be active and responsive in their communities; to understand diverse perspectives; and to act on issues of global significance. This framework is closely aligned with the competencies that have prioritised through the introduction of new curricula, programs, and initiatives. It is anticipated to evolve based on provincial and territorial engagement with these competencies.

Figure 26 **The Council of Ministers of Education, Canada's (CMEC) pan-Canadian global competencies**



Note: For more details see Annex on National or regional curriculum frameworks and visualisations.

Source: Council of Ministers of Education, https://static1.squarespace.com/static/5af1e87f5cfd79c163407ead/t/5c6597f353450a15233b6e7c/1550161912721/Pan-Canadian+Global+Competencies+Backgrounder_EN.pdf, Canada CMEC (2020)

There is considerable variation across countries/jurisdictions in the types of student profiles set out in their curricula. However, the following common themes relating to elements of the OECD Learning Compass 2030 (i.e. the vision of the types of students who can thrive and shape a better future) can be observed across multiple countries (OECD, 2019[4]):

- Concerns for environmental sustainability are reflected in some student profiles, in line with the broader notion of **well-being of the planet**, embraced by the OECD Learning Compass 2030 (OECD, 2019[4]). Denmark, for example, refers to a need for "understanding of the interrelationship between humans and the environment", while Finland highlights student understanding of "the seriousness of climate change", and the need to develop a sustainable way of living, and Norway mentions "respect for nature and environmental awareness."
- **Agency** is emphasised by several countries/jurisdictions as one of the key concepts underpinning their student profiles. Agency implies that students develop a **sense of purpose** and have the **will and ability to positively influence their own lives and the world around them** (OECD, 2019[5]).
- The concept is **interpreted in the specific context** of that country/jurisdiction and articulated with emphasis on specific aspects: "capable of making independent decisions" (British Columbia, [Canada]); able to "form their own opinions and take action" (Denmark); become "self-directed persons who build their identity" (Korea); and able to "create their own life" (Japan).
- Student agency also implies a sense of responsibility as **students participate in society** and shape it for a better future, as highlighted by Australia.
- The idea that students should become **active agents of their own learning** emerges in several student profiles. Ontario (Canada) envisions students "fully engaged in their learning", while Ireland highlights students' ability to reflect on their own learning. The acquisition of learning strategies and motivation for lifelong learning are highlighted in some countries and jurisdictions, including the Czech Republic, Denmark and China. Singapore, for instance, refers to "a self-directed learner who takes responsibility for his/her own learning, who questions, reflects and perseveres in the pursuit of learning".
- Co-agency recognises that students, teachers, parents and communities work together to help students progress towards their shared goals (OECD, 2019[5]).
- Some countries/jurisdictions include the concept of co-agency in their student profiles as a way to articulate the expectation that students act in resonance with a wider context, having the ability "to find their role in family, in closer and wider communities, and in the world of labour" (Hungary), having "the necessary qualities as a democratic citizen contribute to the development of a democratic state with a sense of community and connection to the world under the humanitarian ideal" (Korea), and having the ability to "become engaged members of their communities" (Ontario [Canada]).
- **Transformative competencies** that students need in order to contribute to, thrive in, and shape our world are also often highlighted in student profiles.
- Among them, **taking responsibility** is often stressed, as in the student profiles of Denmark, Estonia and Brazil. Some countries/jurisdictions emphasise the notion of **creating new value**, which refers to the capacity to innovate in order to shape better lives. It is, for instance, referred to through wording such as "confident and creative individuals" (in the student profile of Australia), "creative thinking" (the Czech Republic), "creating new products or interpretations" (Argentina), "being creative" (Brazil) and "spirit of innovation" (China). Key communication skills crucial to **resolving tensions and dilemmas** are also highlighted by some countries/jurisdictions. For example, the Czech Republic stresses that students should be able to engage "in effective and open communication on all possible issues". Lithuania emphasises the "ethical use of verbal and non-verbal instruments and technologies" in communicating with one another, and Kazakhstan underlines that students should have a "strong culture of human dialogue".

Curriculum goals

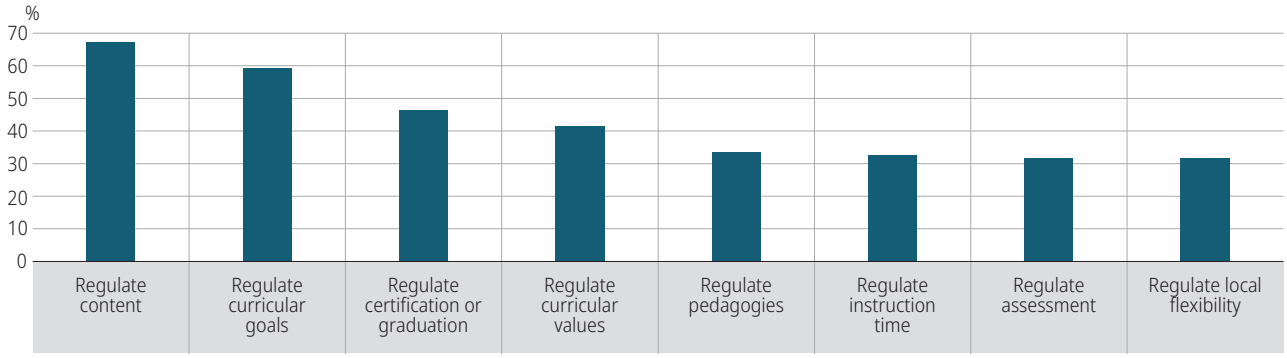
Curriculum goals are specified through the laws governing curricula, which include school and education acts for different education levels, regulations on curricula and curriculum standards and frameworks.

More than half of countries/jurisdictions regulate their curricula within two or fewer laws, directives or decisions (Table WEB 14[5]). This ranges from one in the Netherlands, New Zealand, Northern Ireland (United Kingdom), Ontario (Canada), Sweden, Wales (United Kingdom), Argentina, Costa Rica, India, and South Africa to seven in Portugal and Hong Kong (China) and eight in Kazakhstan.

Of these laws, more than 65% countries regulate curriculum content; more than 45%, certification or graduation requirements and assessment; more than 40% regulate curricular values; less than 35% regulate local curriculum flexibility, assessment, pedagogies or instruction time. (Figure 27).

Figure 27 **Laws regulating the curriculum**

Percentage of laws regulating the curriculum out of the total number of laws reported by countries/jurisdictions



Notes: Percentages displayed in this figure include only responses that could be clearly coded as yes/ no. This is not an exhaustive list of countries that submitted these goals.

Responses for Northern Ireland (United Kingdom), the United States, Brazil and India were submitted by independent researchers, not government administrations.

Curricular values encompass values derived from societal aims, such as those defined in countries'/jurisdictions' constitutions, as well as specific values education is tasked to foster within countries/jurisdictions such as inclusion, fairness, respect, etc.

Source: Data from the PQC, item 0.2.

StatLink https://doi.org/10.1787/888934195207

Subject-specific goals

Subject-specific goals are defined in subject curricula. They can include a variety of specific knowledge and skills outcomes, as well as attitudes and values to be attained by students. Future-oriented competencies highlighted by the OECD Learning Compass 2030 are often included in curricula through the learning goals of already existing subjects, such as mathematics, language and science.

As highlighted in the section below, the curricula of several countries/jurisdictions attach particular competencies to the content of specific subjects. In these cases, teachers are expected to deliver content while at the same time fostering specific competencies (e.g. fostering students' creativity through the teaching of mathematical concepts). This might require an adaptation of teaching practices, for example by supplementing more traditional front-of-the-class lessons with cognitive activation methods that support student agency and deep learning.

HOW ARE DEMANDS FOR 21ST CENTURY COMPETENCIES AND KEY CONCEPTS INTEGRATED INTO SCHOOL CURRICULUM?

Many of the 21st century competencies outlined in the OECD Learning Compass 2030 are highlighted in countries/jurisdictions' visions for students and student profiles (see above on future vision and education goals).

For effective stakeholder engagement and communication, many countries/jurisdictions prepare visual representations of these competencies (see Annex on National or regional curriculum frameworks and visualisations[6]).

Agency and co-agency as highlighted in the OECD Learning Compass 2030 are key concepts underlying 21st century competencies. On average across countries/jurisdictions, **student agency** appears in curriculum more often than **co-agency** (33% versus 27%).

Among transformative competencies, **creating new value** is present more frequently (35%), than **taking responsibility** (29%) or **reconciling tensions** (19%).

Skills, attitudes and values for 2030 are also well represented in mapped curricula. On average across countries/jurisdictions, cognitive skills are the most highly emphasised: **critical thinking** (66%) followed by **problem solving** (59%). Learning to learn, crucial to navigate an uncertain future and widely seen as a key competency for lifelong learning, is also well represented in average across countries/jurisdictions (36%). Socio-emotional skills and attitudes such as **co-operation/collaboration and respect** (over 30%) are also given prominence in mapped curricula. Notions that support the acquisition and further development of 21st century competencies (**anticipation, action and reflection**) are also present in more than one-third of the mapped curricula.

On average, student agency is found most often in **national language** (10%) and least often in **mathematics** (2%). Co-agency is also most often present in **national language** (6%). However, it is not so frequently mapped in **humanities** (4%), where one would typically expect to find discussions on co-operation with teachers and the wider community or collective action.

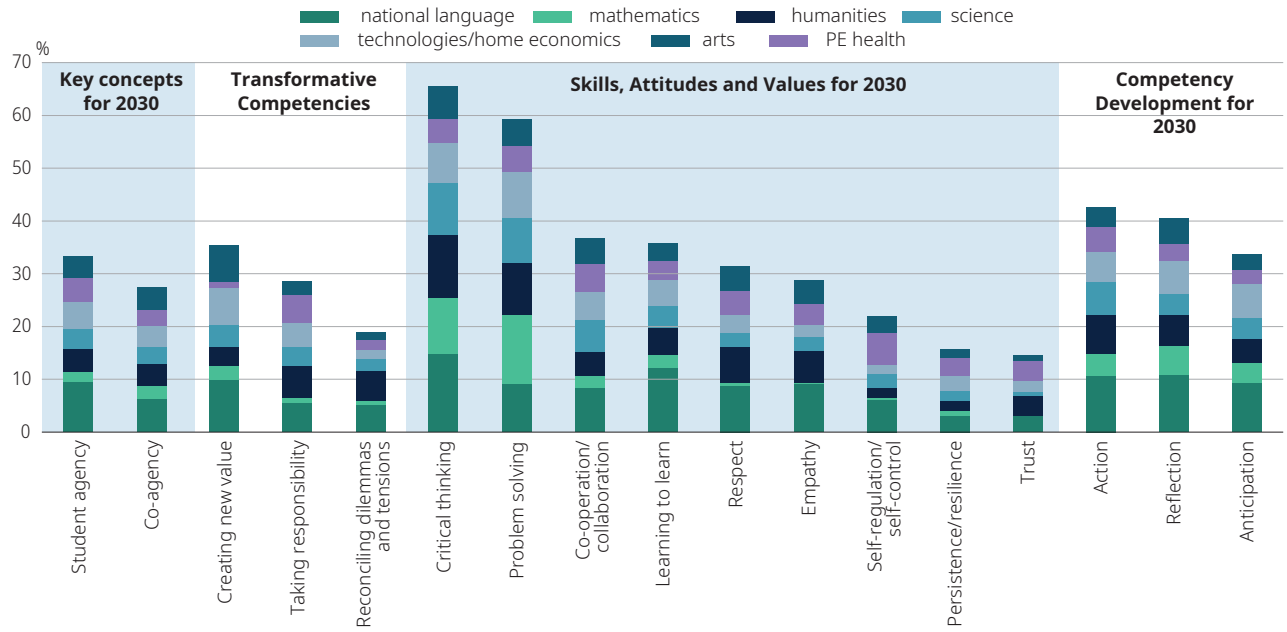
As can be expected, the general tendency for two of the transformative competencies, taking responsibility and reconciling tensions, is the same: they are found most often in **humanities** (6%) and **national language** (5%) and least often in

mathematics (1%). Creating new value, on the other hand, is found most often in **national language** (10%) and least often in **physical education (PE) health** (1%).

Critical thinking is most present in **national language** (15%) and least present in **PE health** (4%). Problem solving is most prominent in **mathematics** (13%) and least prominent in **PE health** and **arts** (5%). The tendencies for co-operation/collaboration and respect are strikingly similar: in **national language,** co-operation/collaboration at 8% and respect at 9%, in **mathematics** 2% for co-operation/collaboration and 1% for respect. Surprisingly, co-operation/collaboration is comparably mapped to a low degree in **humanities** (5%). Action, reflection and anticipation are most present in **national language** (11%). Action is least present in **mathematics** and **arts** (4%) and also unexpectedly low in **PE health** (5%). Reflection and anticipation are least prominent in the mapped **PE health** curriculum (3%). (Figure 28)

Figure 28 **21st century competencies and key concepts in curricula**

Percentage of content items in the overall mapped curricula targeting each competency (as main or sub-target) and distribution, by learning area; on average across countries/jurisdictions with available data



Note: The averages include OECD countries/jurisdictions and partner economies participating in the Curriculum Content Mapping exercise. OECD countries and jurisdictions: Australia, British Columbia (Canada), Saskatchewan (Canada), Estonia, Greece, Israel, Japan, Korea, Lithuania, Northern Ireland (United Kingdom), Portugal and Sweden. Partner countries: China, Kazakhstan and the Russian Federation.

Source: Data from the Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195226

Key concepts for 2030

The OECD Learning Compass, as discussed in section "What does research say?" provides a framework and guidance for skills to foster in students to ensure success into 2030 in a rapidly changing world. Countries/jurisdictions have a wide variety of ways to embed these skills in curriculum, and teachers may feel adequately prepared to teach them or may need additional support.

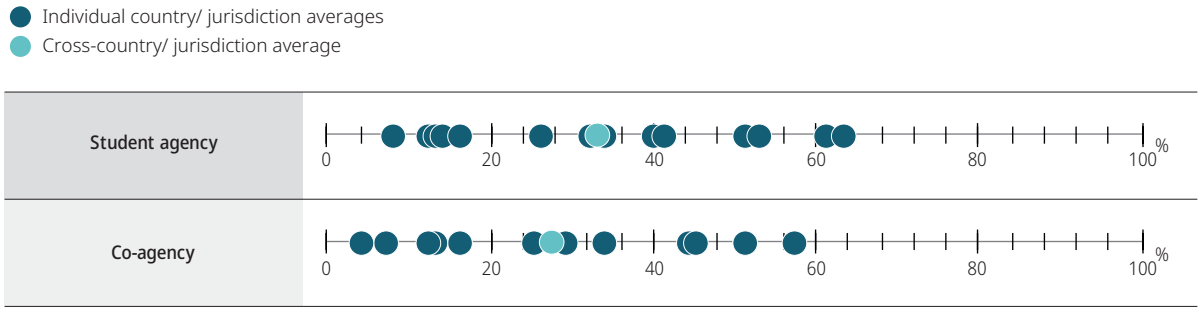
Identifying whether student agency and co-agency are adequately fostered in curriculum early in the redesign process or before it starts can potentially mitigate lags in curriculum redesign.

Across countries/jurisdictions, agency and co-agency, key concepts for 2030, are included to different degrees in the seven learning areas. On average, student agency is included in 33% and co-agency in 27% (Figure 29). Individual country/jurisdictional averages of student agency range from 8% (Greece) to 63% (China). This also is the case for co-agency, where averages range from 4% (Russian Federation) to 57% (Kazakhstan).

Student agency

Agency is an important competency to foster among students in a future-oriented curriculum (see "What does research say?"). However, not all curricula embed this concept, nor do all teachers feel adequately prepared to foster the development of agency, with potential consequences for a lag in implementation.

Figure 29 **Key concepts for 2030 in curricula**



Note: The percentage refers to the total percentage of the mapped curriculum that embeds the competency as a main or a sub-target.

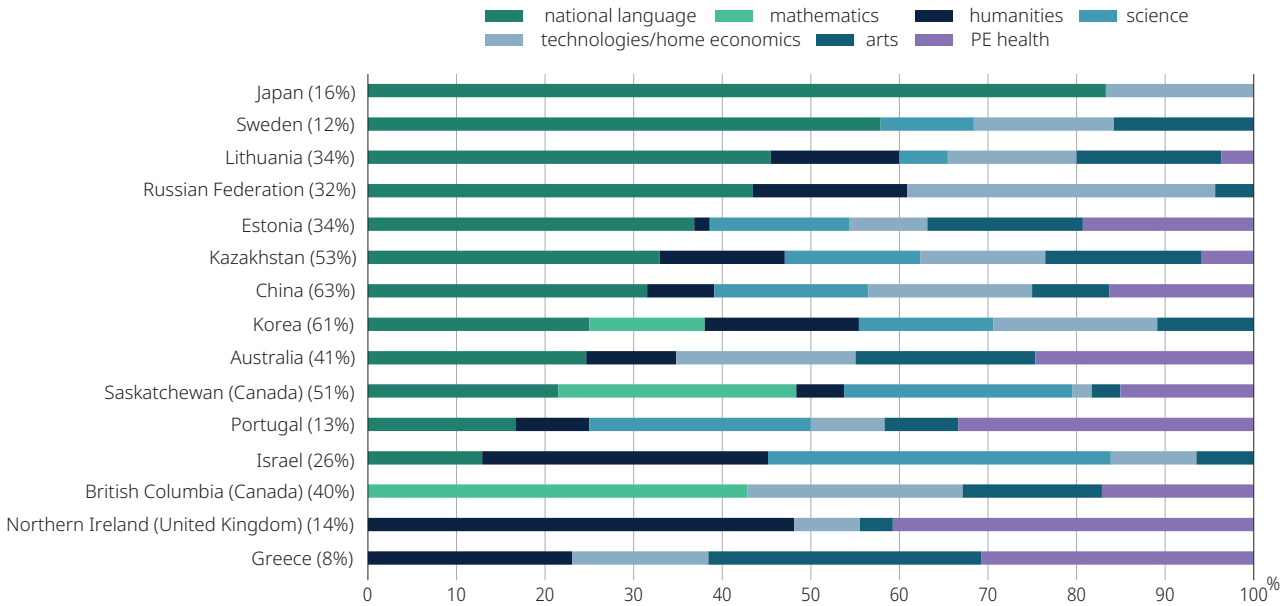
Source: Data from the Education 2030 Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195245

Student agency is embedded in national curricula, ranging from 8% in Greece to 63% in China, while most countries/jurisdictions embed it in over 30% of the curriculum (Figure 30). For most countries/jurisdictions, student agency is most emphasised in the national language learning area. For example, Japan has mapped over 80% of their agency content within national language. Only three countries/jurisdictions, British Columbia (Canada), Greece and Northern Ireland (United Kingdom), do not include student agency in national language. British Columbia (Canada) embeds over 40% of its student agency content in mathematics, Greece has roughly 30% in both arts and PE health, and Northern Ireland (United Kingdom) includes nearly 50% of the content in humanities. With the exceptions of British Columbia (Canada), Korea and Saskatchewan (Canada), countries/jurisdictions do not include it in mathematics. All countries/jurisdictions include agency at least to some degree in technology/home economics. The four other learning areas of humanities, science, arts and PE health, all frequently represent 10% to 20% of the mapped items.

Figure 30 **Student agency in curricula**

Distribution of content items in the mapped curricula targeting student agency (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the concept. The data has been ordered descending from the largest percentage of mapped curriculum corresponding to this concept.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

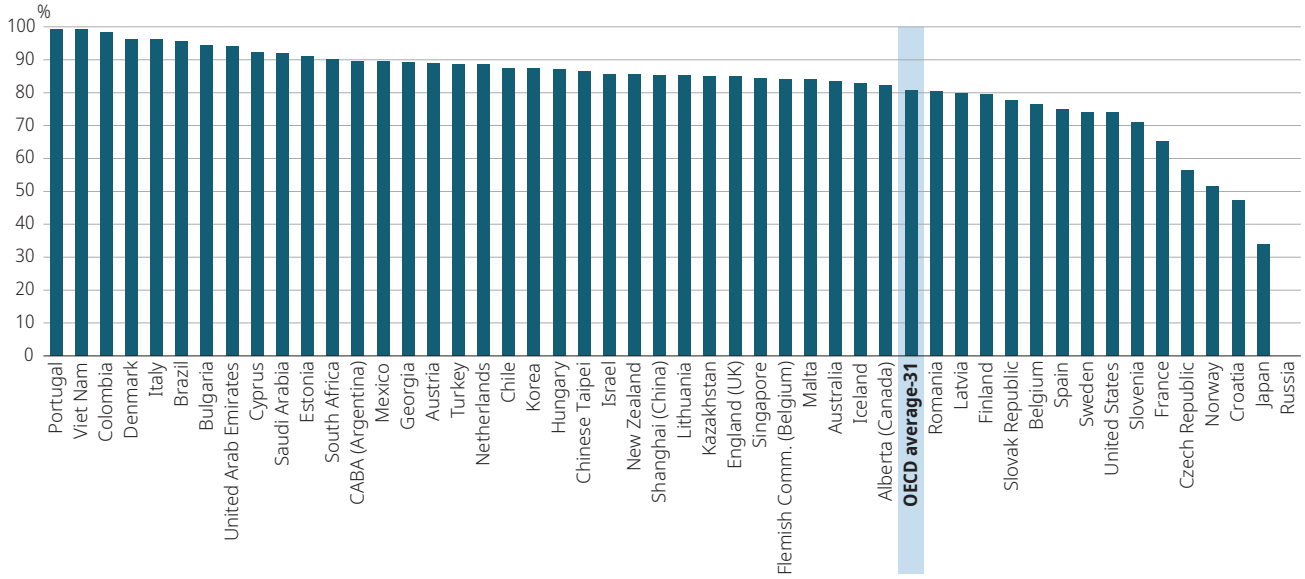
StatLink https://doi.org/10.1787/888934195264

How prepared do teachers feel to foster student agency in classroom?

TALIS data reveal that, on average, 81% of teachers believe that they can help students to value learning, an important component of student agency, either "quite a bit" or "a lot", although this varies considerably across countries/jurisdictions (Figure 31). In some, nearly all teachers indicate that they have self-efficacy in relation to helping students to value learning, including 99% of teachers in Portugal and Viet Nam and 98% of teachers in Colombia. In contrast, less than half of teachers in Croatia (47%) and just one in three teachers (34%) in Japan feel confident in their ability to do so.

Figure 31 **Teachers' self-efficacy for helping students to value learning**

Percentage of teachers who feel they can help students value learning "quite a bit" or "a lot"



Notes: Results based on responses of lower secondary teachers.

Countries and economies are ranked in descending order of the percentage of teachers who feel they can help students to value learning "quite a bit" or "a lot"

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

Source: TALIS 2018, Table I.2.20, https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195283

The general trend among OECD countries/jurisdictions and partner countries points to a less frequent use of cognitive activation practices (i.e. those aimed at stimulating higher-order skills like problem solving, critical thinking and decision making) among lower secondary teachers compared to other classroom practices. Most see more than half of their teachers "frequently" or "always" refer to a problem from everyday life or work to demonstrate why new knowledge is useful. Teachers then let students practise similar tasks until they know that every student has understood the subject matter (Figure 32). For example, teachers in Chile (88%), Hungary (85%), Korea (82%), Mexico (89%), Portugal (93%) and Turkey (87%) all employ the practice of referring to a problem from everyday life or work far more frequently than the global average (74%).

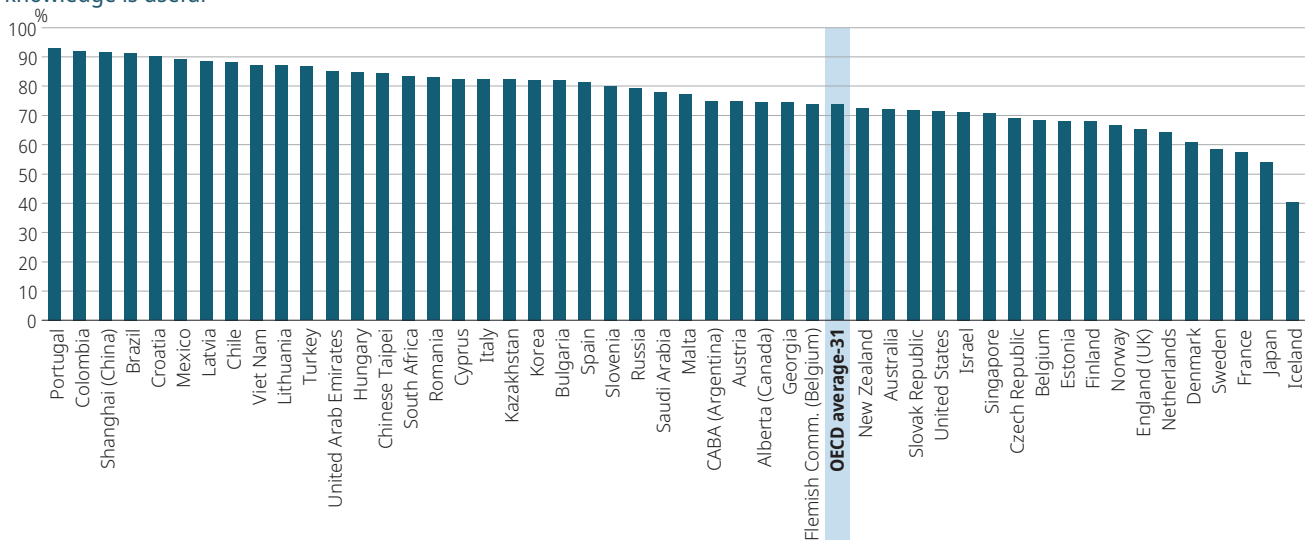
In addition, only 68% of teachers report feeling confident that they can motivate students who show low interest in school work. The lowest rates of teachers reporting that they can do "quite a bit" or "a lot" to motivate students are in Japan (31%) and Norway (32%). In Portugal, Colombia, the United Arab Emirates and Viet Nam, more than 90% of teachers report that they can motivate students (Figure 33).

In Colombia, Denmark, Italy and Portugal, 99% of teachers report high self-efficacy when it comes to getting students to believe they can do well in school work. In Japan, only 24% of teachers report the same. In Portugal and Viet Nam, 99% of teachers report high self-efficacy to help students value learning, while only 34% of teachers in Japan report so (Figure 34).

Across OECD countries/jurisdictions, teachers also demonstrate variation in the extent to which they enable students to decide on their own procedures for solving complex tasks (Figure 35). This cognitive activation task averages at 45% of teachers who "frequently" or "always" ask students to decide on procedures. This ranges from 21% in Croatia to 75% in Kazakhstan.

Figure 32 **Teachers' use of problems from everyday life or work to demonstrate why new knowledge is useful**

Percentage of teachers who "frequently" or "always" refer to a problem from everyday life or work to demonstrate why new knowledge is useful



Notes: Results based on responses of lower secondary teachers.

These data are reported by teachers and refer to a randomly chosen class they currently teach from their weekly timetable.

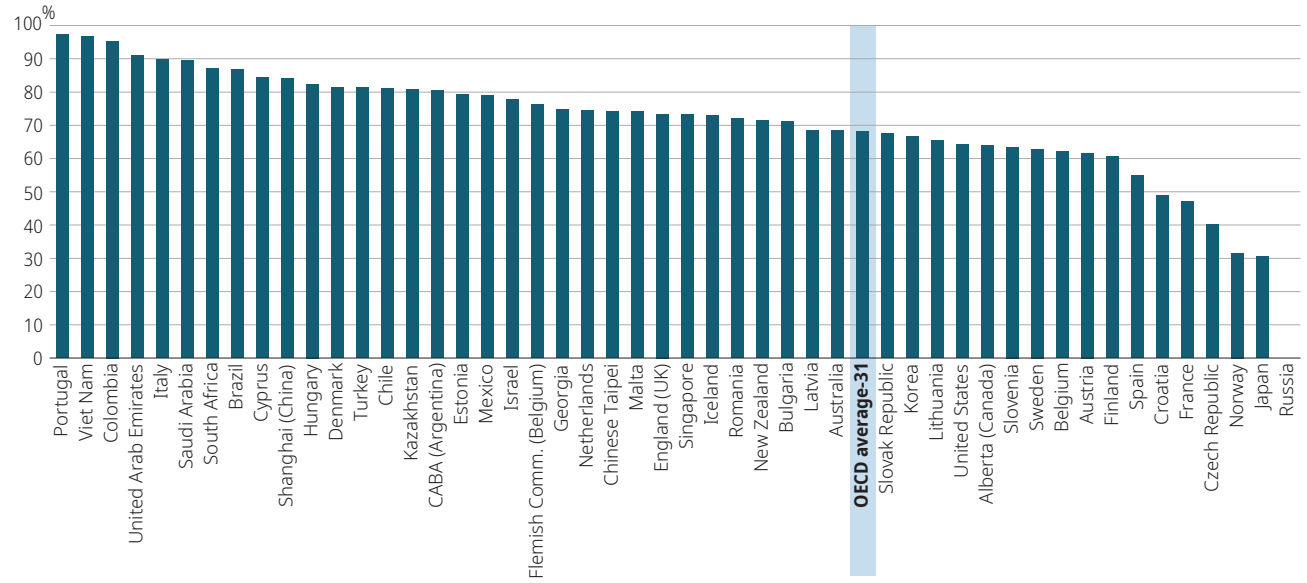
Information on data for Cyprus: https://oe.cd/cyprus-disclaimer

Source: OECD, TALIS 2018 Database, Table I.2.1., https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195302

Figure 33 **Teachers' self-efficacy to motivate students who show low interest in school work**

Percentage of teachers who feel they can motivate students who show low interest in school work "quite a bit" or "a lot"



Notes: Results based on responses of lower secondary teachers.

Countries and economies are ranked in descending order of the percentage of teachers who feel they can motivate students who show low interest in school work "quite a bit" or "a lot".

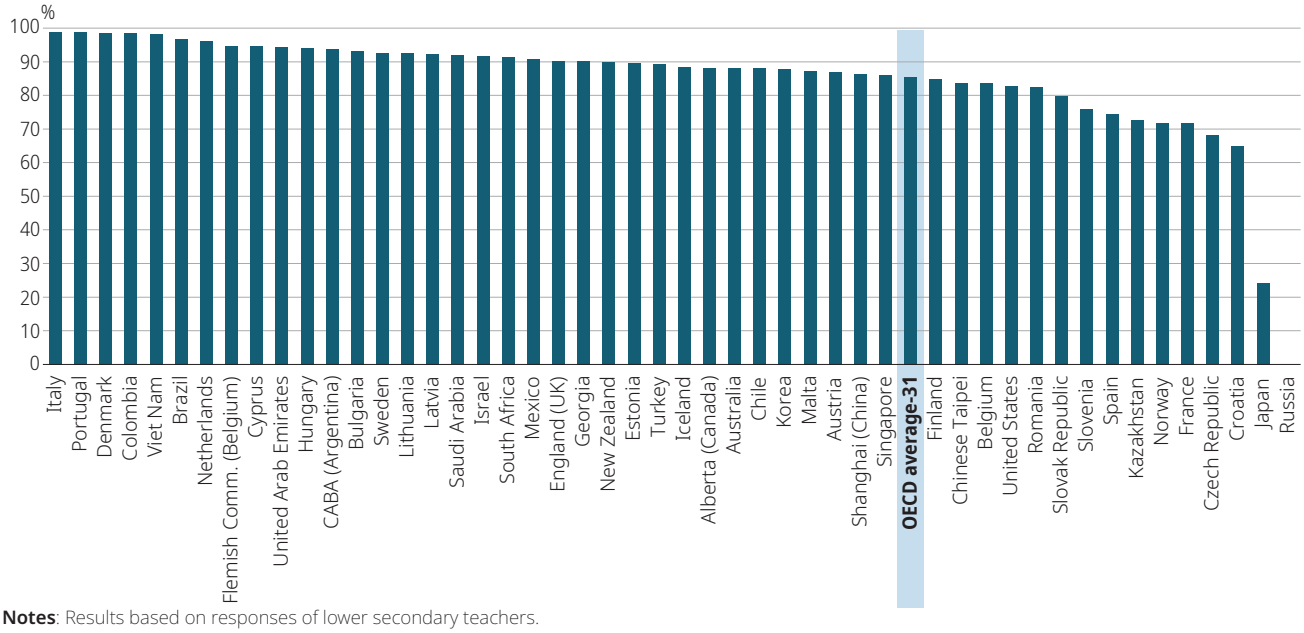
Information on data for Cyprus: https://oe.cd/cyprus-disclaimer

Source: TALIS 2018, Table I.2.20, https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195321

Figure 34 **Teachers' self-efficacy to get students to believe that they can do well in school work**

Percentages of teachers who feel they can get students to believe they can do well in school work "quite a bit" or "a lot"



Notes: Results based on responses of lower secondary teachers.

Countries and economies are ranked in descending order of the percentage of teachers who feel they can get students to believe they can do well in school "quite a bit" or "a lot".

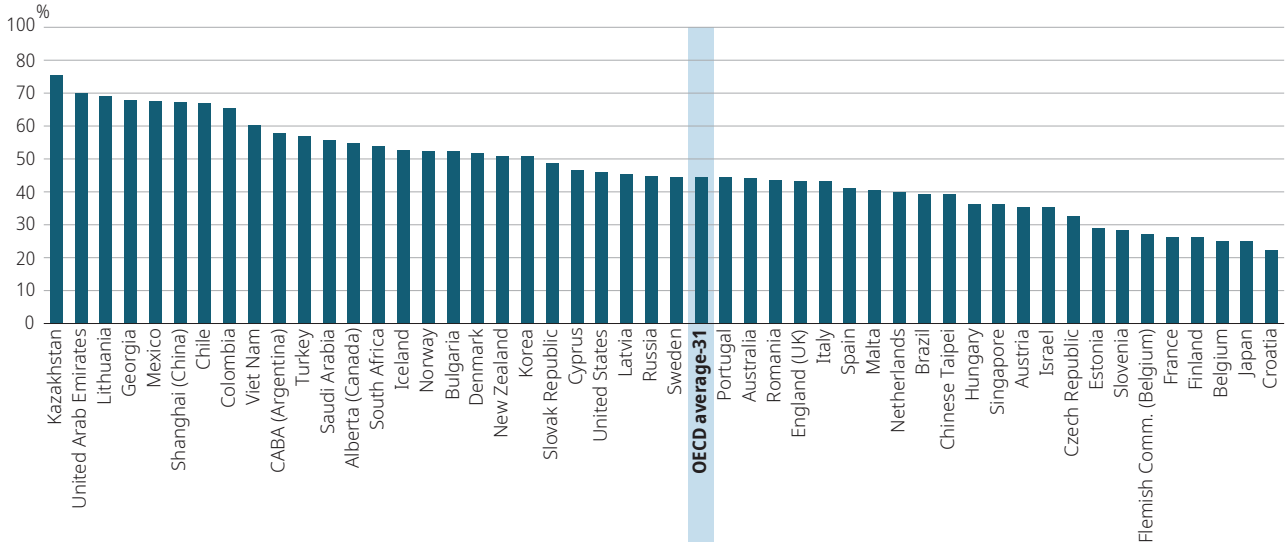
Information on data for Cyprus: https://oe.cd/cyprus-disclaimer

Source: TALIS 2018, Table I.2.20, https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195340

Figure 35 **Teachers asking students to decide on their own procedures for solving complex tasks**

Percentage of teachers who "frequently" or "always" ask students to decide on their own procedures for solving complex tasks



Notes: Results based on responses of lower secondary teachers.

These data are reported by teachers and refer to a randomly chosen class they currently teach from their weekly timetable.

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

Source: TALIS 2018, Table I.2.20, https://doi.org/10.1787/888933933045.

StatLink https://doi.org/10.1787/888934195359

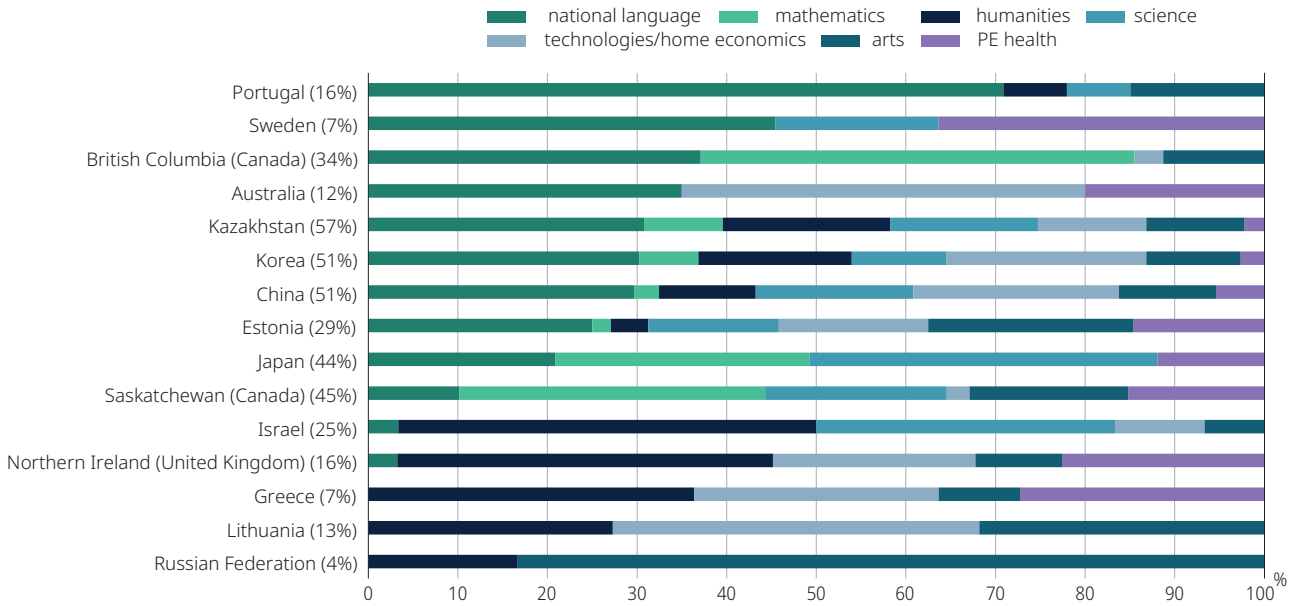
Co-agency

As with student agency, co-agency is a key competency to foster in students, with variations in coverage in the curriculum and perceptions on the part of teachers regarding their ability to teach it.

The extent to which student co-agency is embedded in curriculum ranges from 4% in the Russian Federation to 57% in Kazakhstan (Figure 36). It is emphasised in the content areas of national language, humanities, and technologies/home economics. Portugal maps over 70% of its co-agency content into national languages, and Australia includes 40% of its content in technology/home economics. Most countries/jurisdictions embed less than 15% of co-agency content in arts, but the Russian Federation includes over 80% of its co-agency items in arts.

Figure 36 **Student co-agency in curricula**

Distribution of content items in the mapped curricula targeting student co-agency (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the concept.

Source: Data from the Education 2030 Curriculum Content Mapping exercise

StatLink https://doi.org/10.1787/888934195378

Teachers can also foster the development of co-agency through the use of particular teaching practices. For example, teachers can encourage students to come up with joint solutions to problems. This small group work thus fosters the use of collaborative and co-agentic strategies.

Most countries/jurisdictions see more than half of their teachers "frequently" or "always" encouraging students to solve joint problems through small group work (Figure 37). In Mexico, for example, 71% of teachers reported having students work in small groups to come up with solutions).

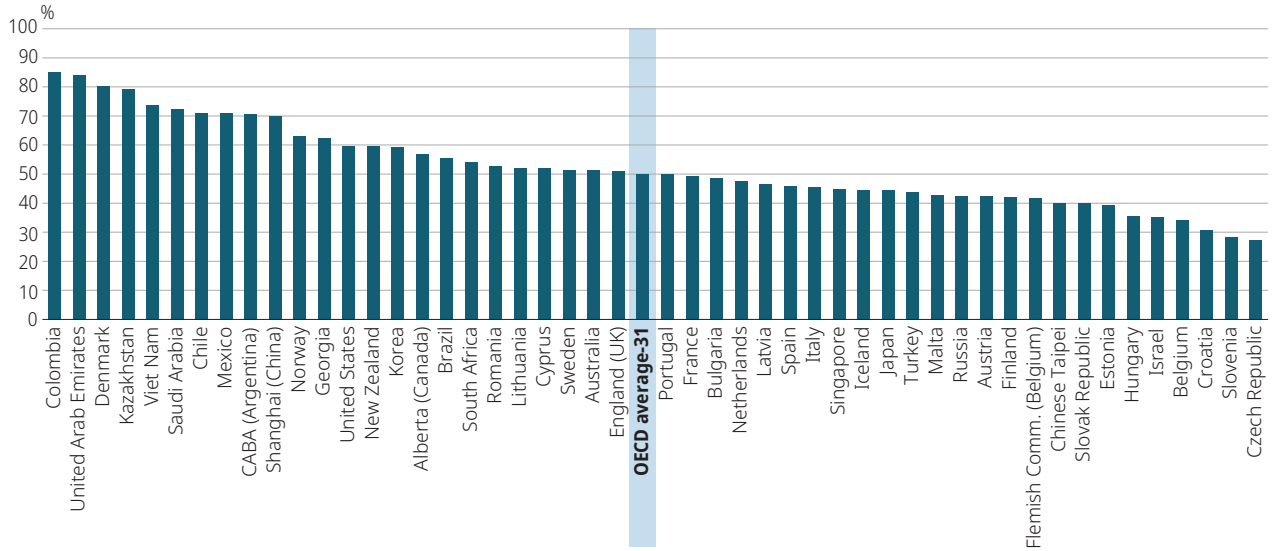
Transformative competencies for 2030

The inclusion of transformative competencies in the existing curriculum can be a strategy to address curriculum overload (see "Challenges and strategies" section in (OECD, 2020[6])). With changing labour markets and societal conditions, the need to include these in the curriculum can become more and more pressing for some countries/jurisdictions on their way to a holistic, flexible curriculum.

Across countries/jurisdictions, transformative competencies such as creating new value, taking responsibility, and reconciling tensions are included in the seven learning areas to different degrees (Figure 38). On average, they are included in 35% (creating new value), 29% (taking responsibility) and 19% (reconciling tensions) of the mapped curriculum.

Figure 37 **Teachers having students work in small groups to come up with a joint solution to a problem**

Percentages of teachers who "frequently" or "always" have students work in small groups to come up with a joint solution for a problem



Notes: Results based on responses of lower secondary teachers.

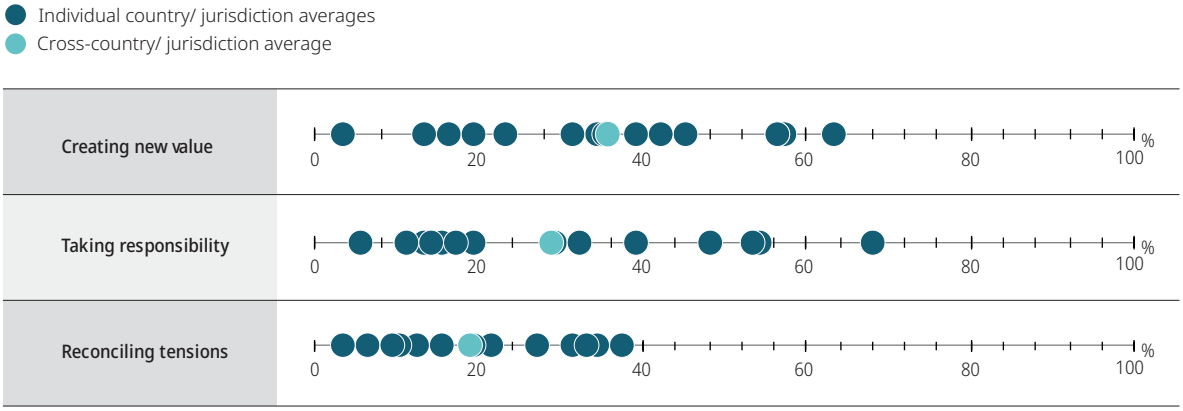
These data are reported by teachers and refer to a randomly chosen class they currently teach from their weekly timetable.

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

Source: OECD, TALIS 2018 Database, Table I.2.1., https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195397

Figure 38 **Transformative competencies for 2030 in curricula**



Note: The percentage refers to the total percentage of the mapped curriculum that embeds the competency as a main or a sub-target.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195416

Creating new value

Across countries/jurisdictions, the three most common learning areas in which creating new value curricular items are observed are national language, arts, and technologies/home economics (Figure 39). Only three countries/jurisdictions do not include it in one of these learning areas: British Columbia (Canada) (national language); Greece (arts); and the Russian Federation (technology/ home economics). It is least often carried in PE health and mathematics.

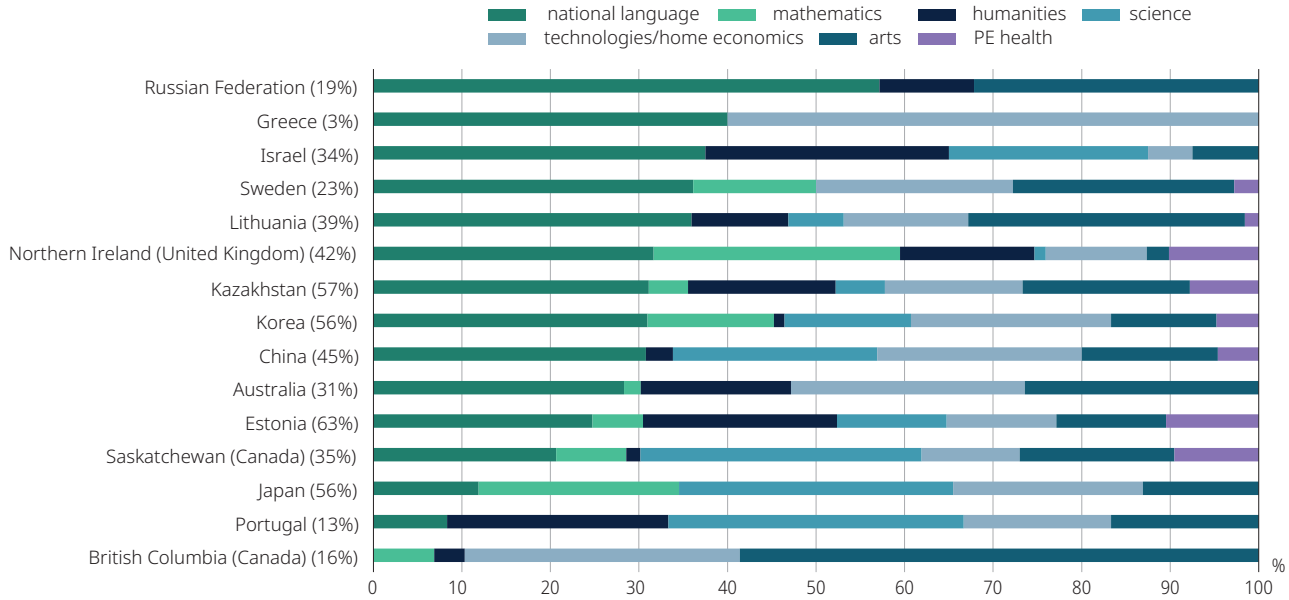
Most countries/jurisdictions map creating new value onto their curriculum items between 30% and 60% of the time. Estonia (63%) had the highest rate of targeting creating new value, and Greece had the lowest (3%).

On average across countries/jurisdictions, creating new value is represented in more than five learning areas. Greece only includes it in two of its learning areas, while Estonia, Korea, Northern Ireland (United Kingdom), Saskatchewan (Canada) and Kazakhstan carry it at least to some degree in all learning areas.

In the Russian Federation, almost 60% of the curriculum items are carried within national language. In British Columbia (Canada), almost 60% are mapped in arts. In Greece, 60% are carried in technologies/home economics. In Japan, over 50% of the items come from mathematics and science. Few countries/jurisdictions target creating new value in PE health. Estonia, Korea, Lithuania, Northern Ireland (United Kingdom), Saskatchewan (Canada), Sweden, China and Kazakhstan carry up to 10% of the items in PE health.

Figure 39 **Creating new value in curricula**

Distribution of content items in the mapped curricula targeting creating new value (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195435

Taking responsibility

In contrast to creating new value, taking responsibility is frequently mapped onto the domain of PE health. Only the Russian Federation does not carry any items on taking responsibility here; it seems to cluster all of its content related to taking responsibility in humanities. The average percentage of content mapped to taking responsibility is highest in humanities and national language. Australia, British Columbia (Canada), Japan, Northern Ireland (United Kingdom), Portugal and Saskatchewan (Canada) all map well over 20% of their items onto PE health. Indeed, for Japan a full 50% of items are carried by PE health. In Sweden, over 80% of the items are represented by the national language learning area. Only four countries/jurisdictions map taking responsibility onto the domain of mathematics: British Columbia (Canada), Estonia, Korea and Saskatchewan (Canada) (Figure 40).

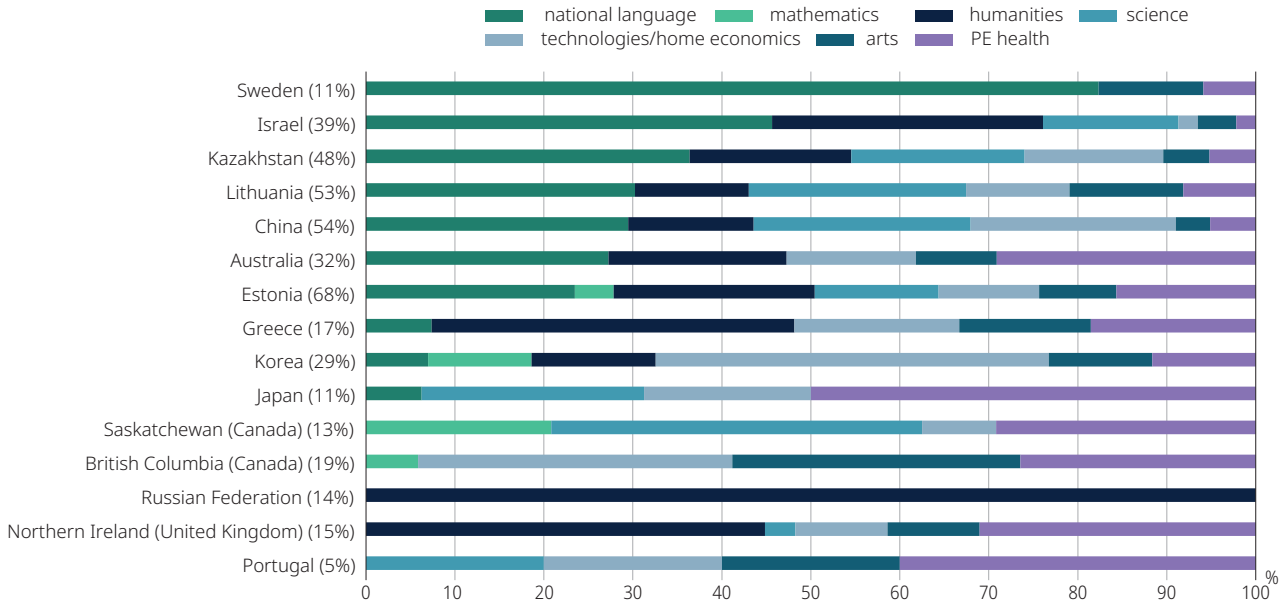
Reconciling tensions and dilemmas

Reconciling tensions and dilemmas is one of the more rare competencies mapped across national curricula. No curriculum includes it in more than 40% of the curriculum items, and four countries/jurisdictions include it in less than 10% (Greece, Portugal, Saskatchewan [Canada] and the Russian Federation).

Estonia has the highest rate of mapped items for reconciling tensions and dilemmas (37%) and includes items across all seven learning areas, with the majority (over 40%) included in the national language learning area. In several countries, reconciling tensions and dilemmas is only embedded in a few learning areas. In Sweden, it is only represented in national language. Portugal includes items in the two learning areas of humanities and science. The Russian Federation embeds it also in two learning areas, humanities and PE health (Figure 41).

Figure 40 **Taking responsibility in curricula**

Distribution of content items in the mapped curricula targeting taking responsibility (as main or sub-target), by learning area



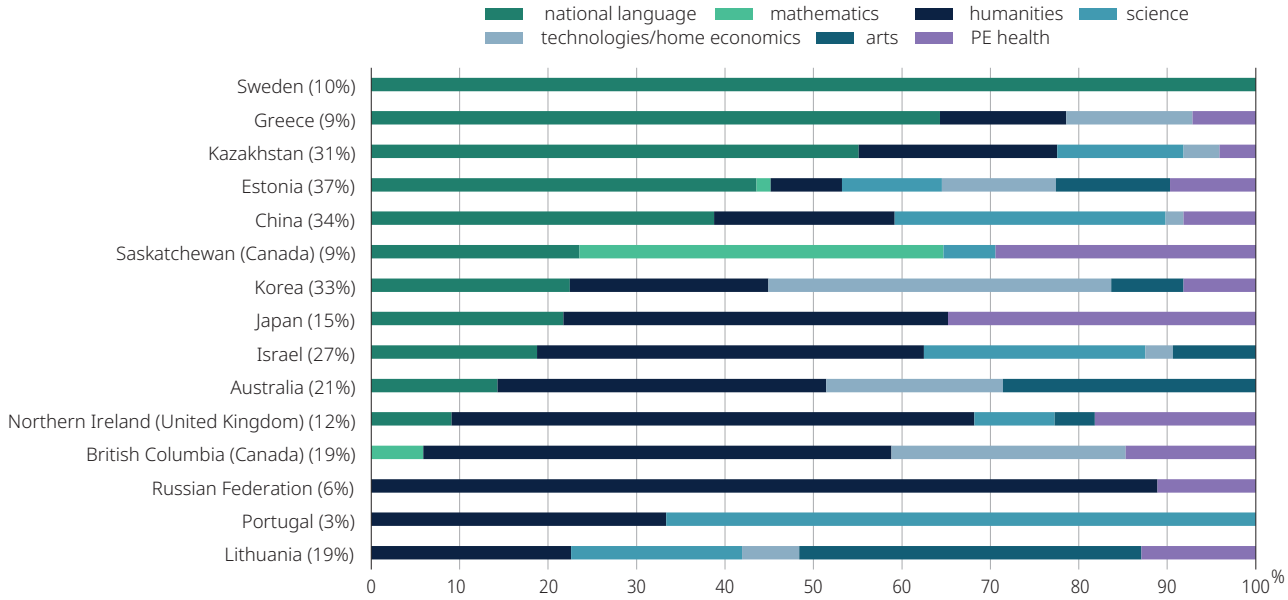
Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise

StatLink https://doi.org/10.1787/888934195454

Figure 41 **Reconciling tensions and dilemmas in curricula**

Distribution of content items in the mapped curricula targeting reconciling tensions and dilemmas (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise

StatLink https://doi.org/10.1787/888934195473

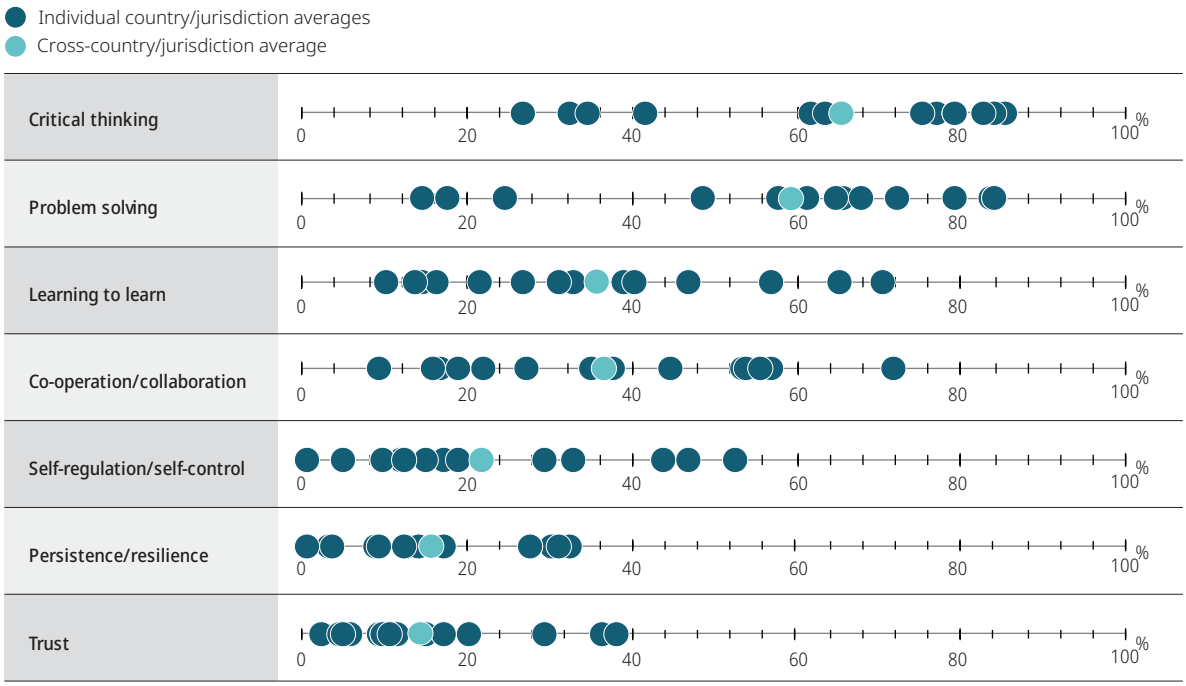
Skills, attitudes and values for 2030

Among those skills, attitudes and values studied in the curriculum mapping exercise (see Curriculum Content Mapping description in the Technical report: Curriculum Analysis of the OECD Future of Education and Skills 2030)[7], across countries/jurisdictions and learning areas, critical thinking is mapped most frequently, with 66% of mapped curriculum items, followed by problem solving (59%) (Figure 42). Trust (15%) and persistence/resilience (16%) are carried to the lowest extent in countries' curricula in the seven subjects.

The embedding of problem solving shows the highest variation across countries/jurisdictions, with values ranging from 14% to 83%. Variation is also high for co-operation/collaboration (9% to 71%). It is lowest for persistence (0% to 32%) and trust (2% to 38%).

At 85% in Israel, critical thinking shows the highest rate of inclusion of all of the skills, attitudes and values described here, followed by problem solving in Israel, Japan and Korea (83%). The lowest emphasis is shown on self-regulation/self-control, persistence/resilience and trust, in Australia (self-regulation/self-control: 0%, persistence: 3%), Greece (persistence/resilience: 3%, trust: 2%), and Portugal (self-regulation/self-control: 4%, persistence/resilience: 0%).

Figure 42 **Skills, attitudes and values for 2030 in curricula**



Note: The percentage refers to the total percentage of the mapped curriculum that embeds the competency as a main or a sub-target.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195492

Critical thinking

Compared to other concepts, critical thinking is strongly emphasised in curricula, with a presence in over 60% of the mapped items in most of the participating countries/jurisdictions (Figure 43).

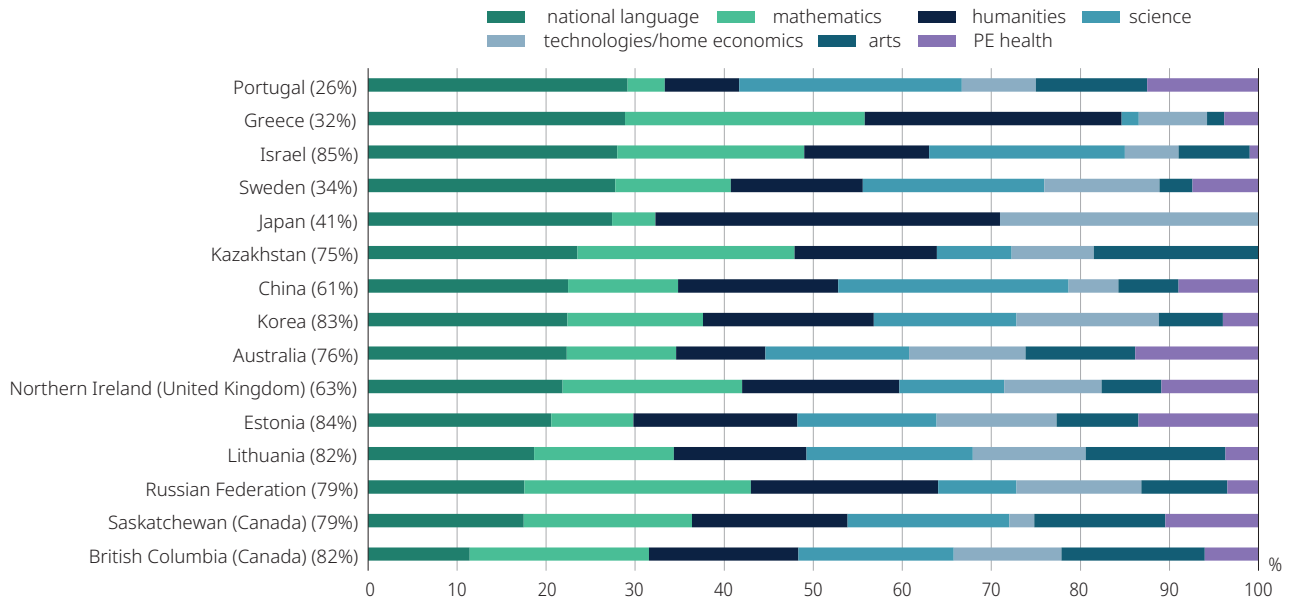
Furthermore, in most of the countries/jurisdictions, it is included in all seven mapped learning areas. There are, however, differences across countries/jurisdictions in the emphasis they give to particular learning areas as spaces to foster critical thinking. Humanities and national language are considerably emphasised in Greece and Japan, with these two learning areas together carrying around 60% of the total number of items that target this competency across the curriculum in both countries. Science, technology, engineering and mathematics (STEM) subjects also play a role in these countries, with technology/home economics, carrying 29% of the critical-thinking items in Japan and mathematics carrying 27% of these items in Greece.

The ability to think critically is emphasised in the student profiles of many countries/jurisdictions and was the most prevalent competency in the mapped curricula (Figure 28). Overall, teacher self-efficacy in relation to fostering critical-thinking skills appears high, with 82% of teachers indicating that they can do so "quite a bit" or "a lot". In several countries/jurisdictions, over 90%

of teachers are confident in their ability to facilitate their students' critical thinking, including in OECD countries such as Portugal (98%), Colombia (98%), Italy (95%) and Denmark (93%), and partner countries such as Brazil (96%) and South Africa (92%). Japan (25%) is the only country in which only a minority of teachers are confident in their ability to help students to think critically (Figure 44).

Figure 43 **Critical thinking in curricula**

Distribution of content items in the mapped curricula targeting critical thinking (as main or sub-target), by learning area

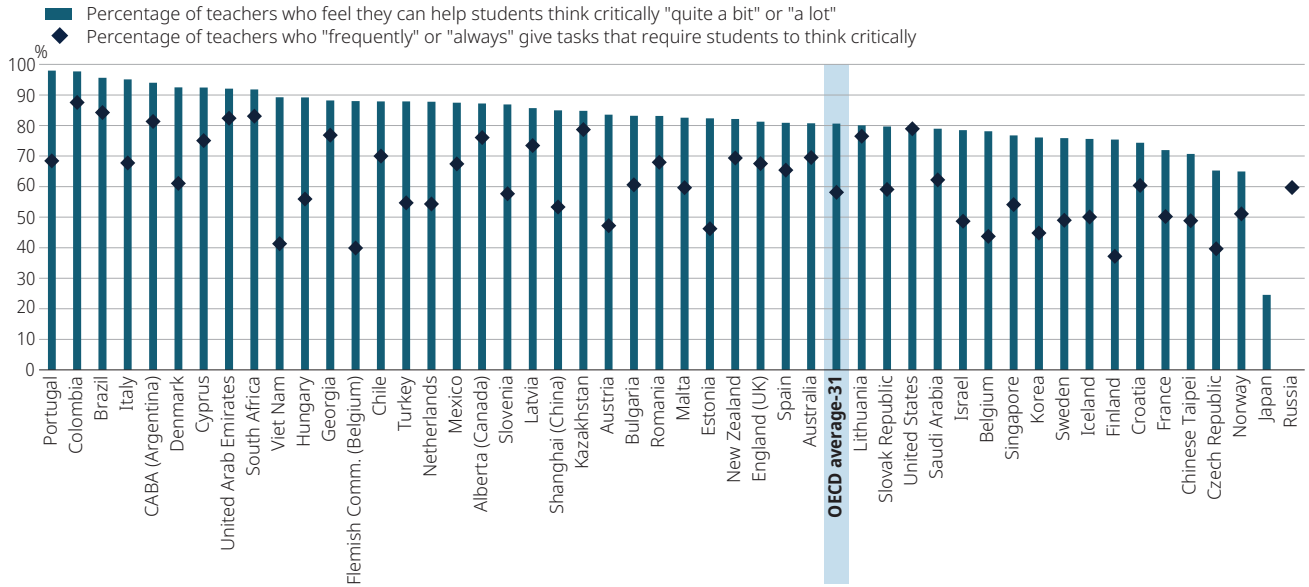


Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195511

Figure 44 **Teachers' self-efficacy for helping students to think critically and frequency of giving students critical-thinking tasks**



Notes: Results based on responses of lower secondary teachers.

Countries and economies are ranked in descending order of the percentage of teachers who feel they can help students to think critically "quite a bit" or "a lot", (no data are available for the Russian Federation on this variable).

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

Source: TALIS 2018, Tables I.2.20 and I.2.1, https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195530

Generally, countries/jurisdictions where there are high levels of teacher efficacy for supporting students' critical-thinking skills are also those in which higher proportions of teachers report frequently assigning tasks that require students to think critically. For example, the countries/jurisdictions with the highest proportions of teachers who assign tasks that require students to think critically "frequently" or "always" are Colombia (88%), Brazil (84%) and South Africa (83%), while the lowest percentage is in Japan (just 13%) (Figure 44).

In several countries/jurisdictions, there is a gap between how confident teachers are in their ability to foster critical-thinking skills in their students and the frequency with which they actually assign tasks to students that require these skills. In almost all countries/jurisdictions, teachers are more likely to say that they are confident that they can help students become critical thinkers than to say that they frequently assign tasks requiring critical thinking. For example, while 93% of teachers in Denmark are confident that they can help students to think critically, only 61% frequently assign tasks requiring critical thinking. Similarly, while 89% of teachers in Viet Nam have self-efficacy in relation to fostering critical thinking, only 41% frequently assign critical thinking tasks. An exception to this pattern is the United States, where 80% of teachers say they can help students to think critically "quite a bit" or "a lot" and 79%"frequently" or "always" assign students tasks that require critical thinking.

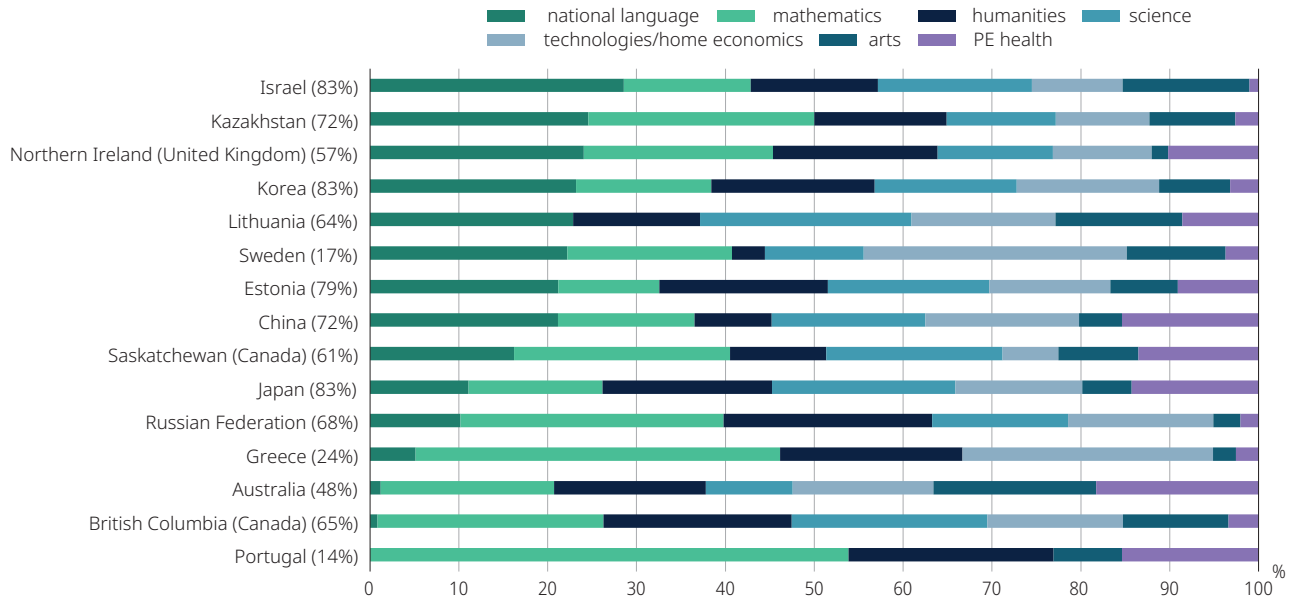
Problem solving

Problem-solving skills have an important place across the curricula of OECD countries/jurisdictions and partner countries, emphasising the need to prepare students to enter an increasingly complex and volatile job market. The current inclusion of them in curriculum may also suggest ways to mitigate time lags.

OECD countries/jurisdictions like British Columbia (Canada), Estonia, Korea, Lithuania, Israel, Japan, and Saskatchewan (Canada) and partner countries like China, Kazakhstan and the Russian Federation all include problem solving in over 60% of their mapped curriculum. Israel, Japan and Korea all have the highest rate of inclusion at 83%. In contrast, three countries, Greece, Portugal and Sweden, include problem solving in less than 30% of their mapped curriculum. Problem solving is relatively uniformly represented across all seven learning areas, although arts and PE health have the lowest rates; typically less than 10% of the items are carried in these two domains (Figure 45).

Figure 45 **Problem solving in curricula**

Distribution of content items in the mapped curricula targeting problem solving (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise

StatLink https://doi.org/10.1787/888934195549

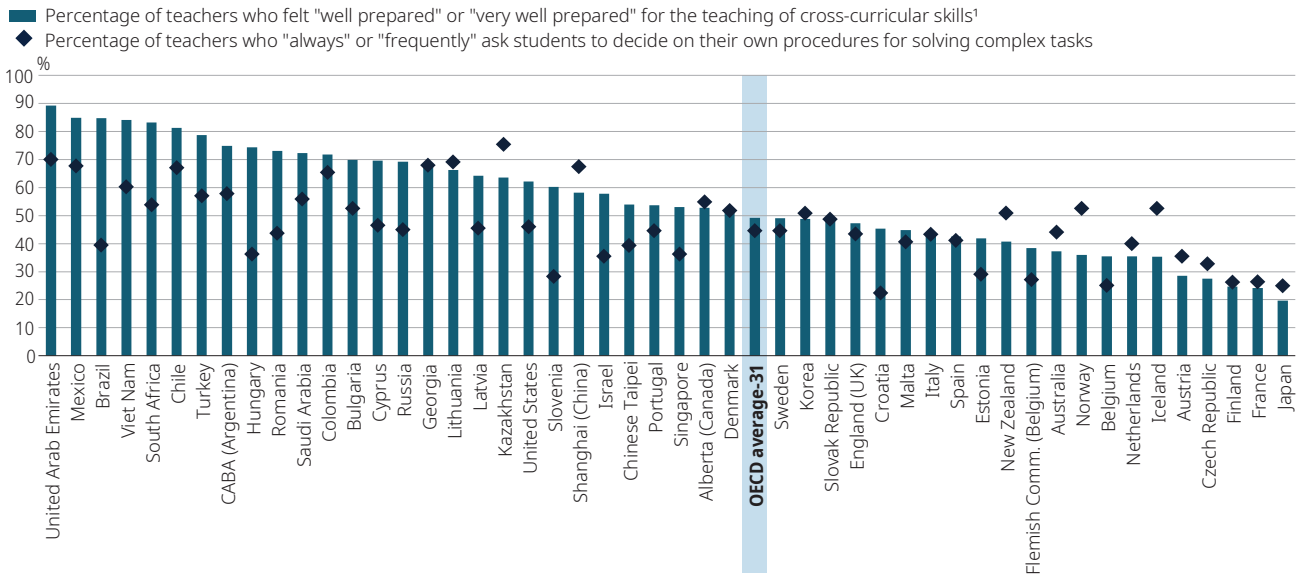
How well prepared teachers feel to teach cross-curricular skills such as problem solving (Figure 46) and how often they actually solicit students' problem solving skills in their teaching varies across countries/jurisdictions. On average across OECD countries, 49% of teachers feel "well prepared" or "very well prepared" to teach cross-curricular skills, while 45% of teachers "frequently" or "always" ask students to complete tasks for which there is no obvious solution. Among OECD countries, Lithuania (69%),

Mexico (68%) and Chile (67%) show the highest percentage of teachers asking students to decide on their own procedures for solving complex tasks. Mexico (85%) and Chile (81%) also show the highest sense of preparedness among teachers to teach cross-curricular skills.

The average difference between the sense of feeling prepared to teach cross-curricular skills and actual classroom teaching of it is only 5%, but the difference within countries/jurisdictions is often much higher. In some countries the emphasis given in the curriculum to problem solving is not equalled by a high use of cognitive activation strategies linked to problem solving. Korea, which has mapped problem solving to a comparably high degree in the curriculum (83%), (Figure 45) shows 51% use of cognitive activation strategies for problem solving (higher than the OECD average) and 49% of teachers reporting that they feel well prepared to teach it (around the OECD average). Japan, where the percentage of mapped curriculum items is equally high (83%) shows much lower prevalence of use (25%) and sense of preparedness (20%) among teachers.

Countries/jurisdictions where fewer teachers report a high sense of preparedness, the percentage of teachers using cognitive activation practices linked to problem solving is nonetheless often higher than their sense of preparedness. This is the case in a number of OECD and non-OECD countries. In Iceland and Norway, there is a difference of more than 16 percentage points between the share of teachers reporting they use these practices (53% in both countries) and the share of teachers who feel well prepared to do so (35% and 36%).

Figure 46 **Teachers' preparedness to teach cross-curricular competencies and teachers asking students to choose their own procedures to solve complex tasks**



Notes: Percentage of lower secondary teachers who "frequently" or "always" use the practice in their class. Results based on responses of lower secondary teachers.

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

1. For example, creativity, critical thinking and problem solving.

Source: OECD, TALIS 2018 Database, Table I.2.1. and I.4.20, https://doi.org/10.1787/888933933045

StatLink https://doi.org/10.1787/888934195568

Competency development cycle 2030: Anticipation, Action, and Reflection

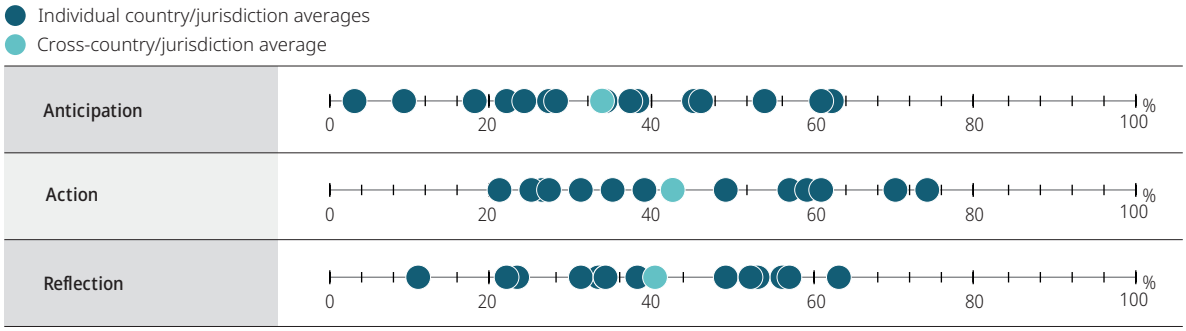
There is more variation in the way countries/jurisdictions choose to embed the three dimensions of the competency development cycle in their curriculum: on average, 34% (anticipation), 43% (action) and 41% (reflection) (Figure 46).

The averages for all three dimensions are more or less evenly distributed between the minimum and maximum. For anticipation, they range from 3% (Greece) to 62% (Kazakhstan) and for action, from 21% (Northern Ireland [United Kingdom]) to 74% (China). For reflection, 11% (Portugal) is the lowest level mapped in the curriculum, while the highest is 63% (Korea).

Anticipation

Anticipation has a wide range of inclusion across mapped curricula. Korea (61%) and Kazakhstan (62%) have the highest overall rates of anticipation as part of the mapped curriculum. Greece (3%) and Japan (9%) show the lowest percentages of the mapped curriculum including anticipation. Most countries have moderate levels, around 30 and 40%.

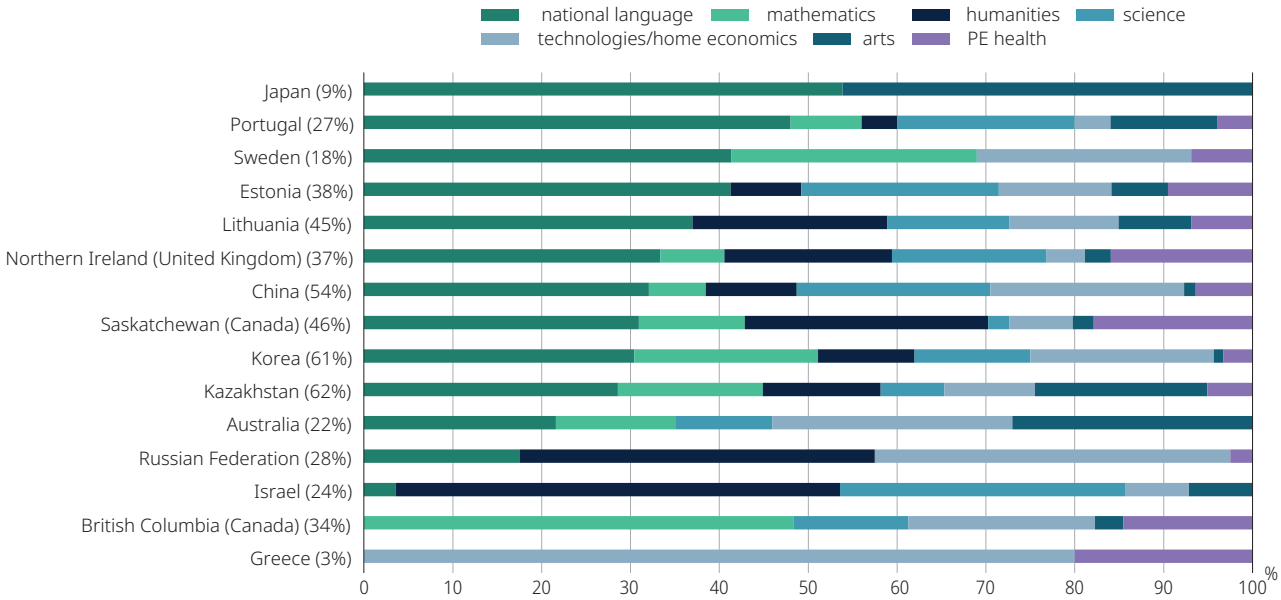
Figure 47 **Competency development cycle for 2030 in curricula**



Note: The percentage refers to the total percentage of the mapped curriculum that embeds the competency as a main or a sub-target.
Source: Data from the Education 2030 Curriculum Content Mapping exercise.
StatLink https://doi.org/10.1787/888934195587

Figure 48 **Anticipation in curricula**

Distribution of content items in the mapped curricula targeting anticipation (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.
Source: Data from the Education 2030 Curriculum Content Mapping exercise.
StatLink https://doi.org/10.1787/888934195606

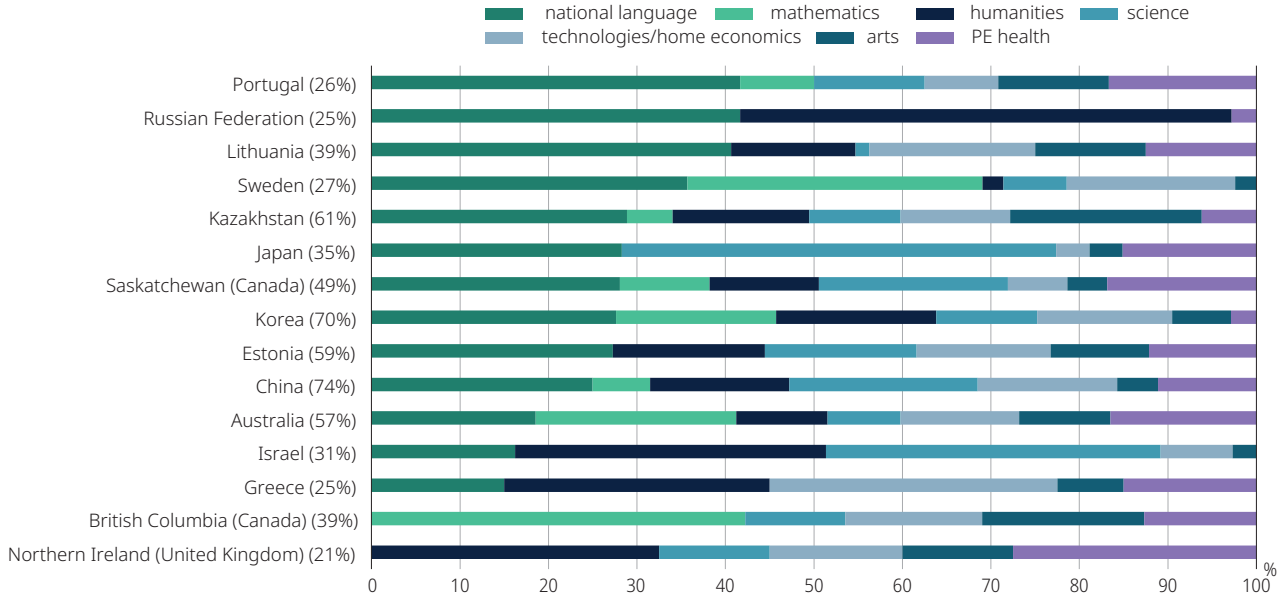
Across learning areas, anticipation is most frequently included in national language, technologies/home economics and humanities. In Estonia, Japan, Portugal and Sweden, over 40% of anticipation curriculum items are embedded within national language. Anticipation is least represented in PE health and arts. PE health does not carry any anticipation items in Australia, Israel and Japan, and arts does not carry any anticipation items in Greece, Sweden and the Russian Federation (Figure 48).

Action

Action has an overall moderate-to-high level of inclusion across national curricula. All countries/jurisdictions include action as a target in over 20% of their mapped curricula. Korea (70%) has the highest rate among OECD countries, and Kazakhstan (61%) and China (74%) have the highest rates among OECD partner countries. Many of the learning domains carry action items. In particular, science and humanities carry many of the items that embed action in mapped curricula. Science carries over 40% of the items that embed action in Japan. National language carries over 40% of the items that embed action in Lithuania, Portugal and the Russian Federation (Figure 49).

Figure 49 **Action in curricula**

Distribution of content items in the mapped curricula targeting action (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

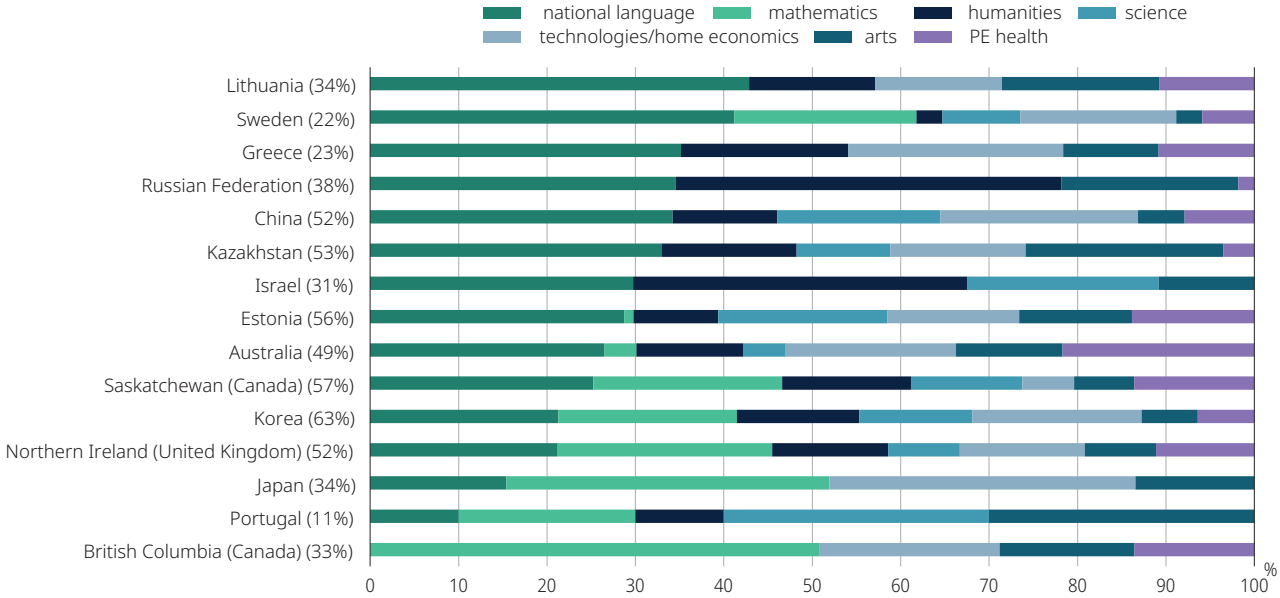
StatLink https://doi.org/10.1787/888934195625

Reflection

Nearly all countries/jurisdictions have moderate to high percentages of items embedding reflection within their mapped curricula. Among OECD countries, Estonia, Korea, Northern Ireland (United Kingdom) and Saskatchewan (Canada) all embed reflection in over 50% of their curriculum, as do partner countries like China and Kazakhstan (Figure 50).

Figure 50 **Reflection in curricula**

Distribution of content items in the mapped curricula targeting reflection (as main or sub-target), by learning area



Note: The percentage next to the name of the country/jurisdiction refers to the total percentage of the mapped curriculum that embeds the competency.

Source: Data from the Education 2030 Curriculum Content Mapping exercise.

StatLink https://doi.org/10.1787/888934195644

Curriculum items that embed reflection are frequently distributed across learning areas. British Columbia (Canada) is the only country/jurisdiction where national language does not carry any items embedding reflection. Neither British Columbia (Canada) nor Japan indicate that humanities carries any reflection items. In Lithuania and Sweden, over 40% of reflection items are embedded within national language.

WHAT KINDS OF FUTURE REFORMS ARE COUNTRIES/JURISDICTIONS PLANNING?

The kinds of reforms countries/jurisdictions are planning to make in the future also have an impact on the decision-making time lag, particularly if they concern multiple and/or complex changes (see *Redesigning curriculum for effective implementation* (OECD, forthcoming) for more details on the planned reform cycles).

More than half (57%) of countries/jurisdictions have spelled out **specific directions for their next reforms** (Table 6). Most of these relate to the general themes and thematic approaches they want to focus on in future reforms. Emerging societal and technological themes, interdisciplinary learning and deep learning, as well as the introduction of more holistic and student-centred approaches are mentioned frequently.

- **Ireland** identifies the following directions for its future reforms: ensuring quality, creativity and innovation, inclusivity, choice and flexibility, relevance and enjoyment, well-being, participation and lifelong learning.
- **Denmark**, on the other hand, plans to foster local autonomy for curriculum development.

Changes to educational goals are also envisaged by more than half (51%) of countries/jurisdictions. Some, such as Chile, Estonia, New Zealand and Argentina, are planning to revise their subject-specific education goals, while most others are planning to focus on overall learning goals.

- **New Zealand** intends to formally integrate digital technology into the curriculum and to support young people to develop skills, confidence and interest in digital technologies and lead them to opportunities across the IT sector.
- **Mexico** plans to introduce overall goals that foster fundamental skills and competencies expected to apply inside and outside the classroom: learning to learn, learning to be, learning to co-exist, and learning to do.
- **Ireland's** overall learning goals will be reformed with three general aims: 1) to enable the child to live a full life as a child and to realise his or her potential as a unique individual; 2) to enable the child to develop as a social being through living and co-operating with others and so contribute to the good of society; and 3) to prepare the child for further education and lifelong learning.

Less than half (46%) of the countries/jurisdictions plan to conduct **content renewal**. A majority of these concern a shift to focus on "big ideas" or key concepts as well as shift towards effective pedagogies to teach renewed content:

- **Chile** has reached an agreement that states that curriculum content has to be updated every 6 years, while its structure and architecture will be revised every 12 years, in order to align the curriculum to the changing needs of every period. Chile is planning future changes related to content renewal in the form of the creation and constant updating of methodologies and resources in order to align and foster the curriculum, such as: 1) project-based learning; 2) interactive textbooks; 3) digital public school.
- In **Norway**, content renewal around "big ideas" is used to change sequencing within subject content and favour learning progressions.
- In **Wales (United Kingdom)**, using the Pioneer Schools Network, through a subsidiarity model with practitioners, is at the heart of development of the new curriculum to develop new content.
- In **India**, content renewal is planned to balance specialised knowledge against broad/general knowledge.

Subject renewal is envisaged in more than one third (38%) of the countries/jurisdictions, usually following two main directions. Many are creating new subjects to accommodate emerging societal needs, usually linked to technological developments (see "Challenges and strategies" section in (OECD, 2020[6])). In this sense, ICT education, computational thinking and coding, as well as technical and vocational education, are among the most popular subjects countries/jurisdictions plan to introduce.

- In the **Czech Republic, Denmark, Ireland** and **Argentina**, for instance, coding or computational thinking are receiving increasing attention and are planned to be included as new subjects in the next curriculum redesign phase.
- In other countries/jurisdictions, such as **New Zealand** and **Ontario (Canada)**, curriculum flexibility at the local level allows schools to introduce subjects following a dynamic approach to respond to emerging needs (see Curriculum flexibility and autonomy (OECD, Forthcoming[7])).

Table 6 **Planned future curriculum changes**

Spell out general directions of reforms		Changes to educational goals		Changes to instruction time	
OECD	**Partner**	**OECD**	**Partner**	**OECD**	**Partner**
Australia	Argentina	Australia	Argentina	Estonia	Argentina
British Columbia (Canada)	Costa Rica	Chile	China (People's Republic of)	Hungary	Kazakhstan
Chile	Hong Kong (China)	Estonia	India[1]	Ireland	South Africa
Czech Republic	Kazakhstan	Hungary	Kazakhstan	Mexico	
Denmark	Viet Nam	Ireland	Russian Federation	Norway	
Estonia		Mexico	Singapore	Sweden	
Hungary		New Zealand	South Africa	Turkey	
Ireland		Norway	Viet Nam		
Mexico		Wales (United Kingdom)			
Netherlands					
New Zealand					
Norway					
Québec (Canada)					
Scotland (United Kingdom)					
Sweden					
Turkey					

Subject renewal		Content renewal		Other changes	
OECD	**Partner**	**OECD**	**Partner**	**OECD**	**Partner**
Chile	Argentina	Chile	Argentina	Chile	Hong Kong (China)
Denmark	India[1]	Czech Republic	Hong Kong (China)		Costa Rica
Estonia	Kazakhstan	Estonia	Costa Rica		India[1]
Ireland	South Africa	Hungary	India[1]		Kazakhstan
Mexico	Viet Nam	Mexico	Singapore		Viet Nam
New Zealand		New Zealand	South Africa		
Norway		Norway	Viet Nam		
Portugal		Turkey	Kazakhstan		
Wales (United Kingdom)		Wales (United Kingdom)			

Note: Data displayed in this table include only countries/jurisdictions with responses that could be clearly coded.

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

Source: Data from the PQC, item 2.3.1.

Another main direction within subject renewal is the reintegration and restructuring of subjects, usually to address concerns of curriculum overload or to structure subjects following a more holistic approach.

- In **Norway**, subject restructuring is receiving increasing attention among priorities for curriculum redesign with the objective of combining subjects to enable synergies and to address topics following a cross-cutting approach.

More than a quarter (27%) of countries/jurisdictions plan to make changes to **instruction time**. Some (Estonia, Hungary and Ireland) are planning to reallocate instruction time to provide more time for personalised or deep learning. Others (Estonia, Mexico and Norway) intend to increase local flexibility, and Argentina and South Africa are planning to increase instruction time.

Other planned changes include the development of a Digital Skills Framework in **Northern Ireland (United Kingdom)**, a more detailed graduation certificate specifying projects in which learners participated in **Portugal**, and reform of the assessment criteria base in **Kazakhstan**. Chile is planning to create and constantly update the methodologies and resources in order to align and foster the curriculum. Some of those projects are: 1) learning based on project methodology, 2) interactive textbooks, 3) digital public school.

Notes

1. The section describes data collected through the OECD Future of Education and Skills 2030 Policy Questionnaire on Curriculum Redesign (PQC) and Curriculum Content Mapping (CCM) exercises on all four dimensions of curriculum overload. This international comparative data can be a starting point for policy makers to inform their efforts in curriculum design and redesign.
2. Table WEB 12. Visions for student outcomes and student profiles (https://doi.org/10.1787/888934195682)
3. Table WEB 13. Policies, declarations and statements articulating education goals (https://doi.org/10.1787/888934195701)
4. Table WEB 12. Visions for student outcomes and student profiles (https://doi.org/10.1787/888934195682)
5. Table WEB 14. Individual laws regulating the curriculum (https://doi.org/10.1787/888934195720)
6. https://www.oecd.org/education/2030-project/contact/National_or_regional_curriculum_frameworks_and_visualisations.pdf
7. https://www.oecd.org/education/2030-project/contact/Technical_report_Curriculum_Analysis_of_the_OECD_Future_of_Education_and_Skills_2030.pdf

References

Airaksinen, T., I. Halinen and H. Linturi (2017), "Futuribles of Learning 2030 – Delphi supports the reform of the core curricula in Finland", *Eur J Futures Res*, Vol. 5/2, http://dx.doi.org/10.1007/s40309-016-0096-y. [3]

Halinen, I. (2016), *The Conceptualization of competencies related to sustainable development and sustainable lifestyles*, IBE-UNESCO, International Bureau of Education, https://unesdoc.unesco.org/ark:/48223/pf0000247343. [2]

OECD (2020), *Curriculum Overload: A Way Forward,* OECD Publishing, Paris, https://doi.org/10.1787/3081ceca-en. [6]

OECD (2019), *OECD Future of Education and Skills 2030 Conceptual Learning Framework. Concept note: OECD Learning Compass 2030*, OECD, Paris, http://www.oecd.org/education/2030-project (accessed on 10 June 2020). [5]

OECD (2019), *OECD Learning Compass 2030. A series of Concept Notes,* OECD Publishing, Paris, https://www.oecd.org/education/2030-project/contact/OECD_Learning_Compass_2030_Concept_Note_Series.pdf. [4]

OECD (Forthcoming), *Curriculum flexibility and autonomy (title TBC),* OECD Publishing, Paris. [7]

Pietarinen, J., K. Pyhältö and T. Soini (2017), "Large-scale curriculum reform in Finland – exploring the interrelation between implementation strategy, the function of the reform, and curriculum coherence", *The Curriculum Journal*, Vol. 28/1, pp. 22-40, http://dx.doi.org/10.1080/09585176.2016.1179205. [1]

What types of challenges do countries face in addressing curriculum time lag, and what strategies do they use to address these challenges?

This section presents the types of challenges faced by countries and jurisdictions in addressing curriculum time lag and the strategies they have adopted to address them. They relate to the four main types of time lag examined in this chapter: **recognition time lag, decision-making time lag, implementation time lag** and **impact time lag**.

It is important to note that the strategies listed are not recommendations, but rather opportunities for countries/jurisdictions to learn from one another, in line with the Education 2030 project's peer-learning mission.

RECOGNITION TIME LAG: OVERVIEW OF CHALLENGES AND STRATEGIES

A delay in recognising the needs for curriculum change can lead to students lacking the competencies needed for the future. It can also contribute to students' dissatisfaction and disengagement with education. Table 7 summarises the full challenges relating to recognition time lag reported by countries/jurisdictions and the strategies they use to address them.

Recognition time lag: Challenges

Countries and jurisdictions reported experiencing **difficulty in keeping educational change aligned with rapid societal changes**. While societies and economies have become more interconnected, several countries/jurisdictions reported challenges relating to identifying or articulating in curriculum the competencies needed to prepare students for an increasingly globalised world. These competencies may include empathy, tolerance and respect for others, and the ability to reconcile conflicts, tensions and dilemmas (OECD, 2019[1]).

Similarly, recognition time lag can result from **difficulty in forecasting future changes and competencies needed for the future in a time of rapid technological advancement**. Technological changes, such as the exponential rise in the use of digital devices, computer adaptive testing and the advent of AI are some of the trends or opportunities that policy makers in education,

Table 7 **Challenges and strategies related to recognition time lag**

	Challenge/strategy	Countries/jurisdictions reporting the challenge/strategy
Challenges	Difficulty in keeping educational change aligned with rapid societal changes in an increasingly globalised world	Ireland, Korea, India[1], Singapore
	Difficulty in forecasting future changes and competencies needed for the future in a time of rapid technological advancement	Czech Republic, Japan, Portugal, Sweden, Wales (United Kingdom), Kazakhstan, Singapore
	Lack of awareness of the potential value of student voice for designing a future-relevant curriculum	n/a
Strategies	Developing systems or processes to forecast future needs of society	Finland, Japan, Korea, Ontario (Canada), Poland, Portugal, Hong Kong (China), India[1], Kazakhstan, Singapore
	Taking students' needs and voices into account during the curriculum redesign process	Australia, British Columbia (Canada), Finland, Ireland, Korea, Ontario (Canada), Brazil[1], Russian Federation
	Providing more diverse learning experiences to students to bridge the gap between school and their future lives	Mexico, New Zealand, Scotland (United Kingdom), Russian Federation

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

Source: Data from the PQC, findings from the research section.

including curriculum designers, have struggled to recognise on time. A recent OECD report shows that the education sector is behind the digitalisation curve across many OECD countries (OECD, 2019[2]).

Students may have valuable insights on future needs and trends, but countries/jurisdictions often neglect to consult them when identifying the direction of curriculum change. This reflects a **lack of awareness of the potential value of student voice in designing a future-relevant curriculum.** It can lead to challenges in reflecting students' interests in the curriculum, an important element in engaging and motivating students. Students may feel disconnected from the learning content if they do not see how it can apply to their lives, now or in the future. As discussed in the research chapter of this report, listening to students' voices during the recognition and decision-making phases may initially add to the time lag, but if it is done well, it can save significant time in implementation and accelerate the impact of curriculum changes (see "Involving students as owners of their own learning").

Difficulty in keeping educational change aligned with rapid societal changes

Several countries/jurisdictions, including India, reported struggling to identify the competencies needed to prepare students for our increasingly globalised world. Globalisation and increased human mobility across borders have also led to greater diversity in the classroom, and so curriculum needs to adapt to the learning needs of students of various language backgrounds and education experiences, as highlighted by Ireland, Korea and Singapore.

- In **Ireland**, the pace of change in modern society and associated social issues compound the difficulties that arise from the time lag between today's curriculum and future demands. Ireland's rapidly changing demographics since the late 1990s have led to increasing multiculturalism. Socio-economic disadvantage and the inclusion of pupils with varying needs in the mainstream classroom all pose challenges for the education system. There are frequent calls on the education system to equip young people with myriad practical and life skills, including resilience and social skills.
- **Korea** attributes difficulty in forecasting and diagnosing future changes to the rapid changes taking place in society (e.g. increased multiculturalism) and technology. The pace makes it challenging to establish continuity and maintain a relevant scientific perspective in educational policy.
- In **India**, there is a need for learners to acquire new skills on a regular basis, due to globalisation and the increasing demands of a knowledge economy and a knowledge society.
- **Singapore** recognises the need to ensure that curriculum content remains relevant and to provide students with the dispositions and a broad and deep foundation for a lifelong journey of learning. Singapore faces challenges connected to language knowledge and cultural competency, as well as skills useful for the workplace, emphasising that knowledge is quickly outdated, and that professional and occupational fields constantly change.

Difficulty in forecasting future changes and competencies needed for the future in a time of rapid technological advances

Countries and jurisdictions face the challenging task of forecasting the technological changes that are most likely to become transformative for students' future lives. The pace of technological advances makes it challenging for education systems to keep up, as was reported by countries/jurisdictions including the Czech Republic, Portugal and Sweden. Policy makers need to identify not only the latest technological innovations, but also how students are most likely to interact in a world dominated by this new technology and the competencies they will need to do so effectively, as reported by Kazakhstan. In some countries/jurisdictions, existing curricula were designed before many of the major technological innovations of the 21st century. This presents challenges in preparing students for the future, as reported by Wales (United Kingdom).

- The **Czech Republic** cites the very fast progression of ICT systems as one of the factors that make it difficult to anticipate future needs and understand how to integrate these in today's curriculum.
- In **Portugal**, due to the gap between the constant changes in science and technology and what is taught at school, it has been the teachers' responsibility to update knowledge rather than incorporating it in curriculum change.
- **Sweden** notes that challenges in determining how to incorporate ICT and digitalisation into the curriculum are due to rapid technological developments.
- **Wales (United Kingdom)** cites its curriculum, devised in 1988, as reflecting a world that was yet to see the World Wide Web, mobile phone technology or the advances in technology and in globalisation that have transformed the way we live and work.
- **Kazakhstan** recognises the rapid increase in the rate at which technological change is occurring around the world and that such an unpredictable context requires increased capability to engage with complex challenges and adapt to new situations, along with a diverse set of individual competences.

Lack of awareness of the potential value of student voice for developing a future-oriented curriculum

Discussions in the student focus group during the OECD Future of Education and Skills 2030 meetings have shown that students in lower and upper secondary education from around the world are able to identify and articulate their learning needs. They are also able to reflect on the competencies they need to be active and engaged citizens and to integrate successfully into the labour market in the future (see Box 10). A recent study of PISA data, for example, shows that students tend to aspire to jobs and professions that are the least at risk of future automation, such as health, social, cultural and legal professions (Mann et al., 2020[3]).

Box 10 **Students' interest in becoming future-ready**

Alice

At the Education 2030 project's Informal Working Group meeting held in Paris, France in October 2018, meeting participants discussed the issue of managing time lag between today's curriculum and future needs. The discussion kicked off with interventions from a student representative followed by a country representative.

Speaking on behalf of students was Alice, a university student in France and a Youth 20 (Y20) young leader. She talked about future challenges, in particular climate change, and the current lack of knowledge and awareness about such issues. She also highlighted the challenge of preparing the future workforce for jobs that do not yet exist. She explained that this evolution would imply new needs for new generations, such as being more flexible, adaptable and equipped with digital skills, especially as many jobs will be automated. There may also be more opportunities for people to create their own jobs.

She then discussed how the current curriculum focuses on academic achievement and valorises individual effort rather than collective effort to solve a problem. She cited the benefits of her experience as a scout doing collective projects on real-world issues and highlighted that she learned new ways of looking at the world, and becoming more aware of problems around her. Alice said that experimentation and collaboration can increase motivation and satisfaction for students. She stressed that school could teach students to be future-oriented creative thinkers who can collaborate with others to solve problems.

RECOGNITION TIME LAG: STRATEGIES

To address the challenge of keeping abreast of technological and societal changes and their implications for curriculum, some countries/jurisdictions report **developing systems or processes to forecast future needs of society**. These can include formal research processes involving experts and academics, as well as active monitoring of trends and global dialogues.

While the stakeholder engagement undertaken by countries/jurisdictions in the curriculum design process typically involves academic experts, teachers and sometimes parents, a number of countries/jurisdictions now recognise the potential benefits of **taking students' needs and voices into account**. Such an approach can involve collecting information about students' interests in education, as well as about their future career and life aspirations.

Some countries/jurisdictions have adopted the strategy of **providing more diverse learning experiences for students to bridge the gap between school and their future lives**. Such an approach can involve allowing students to choose some of the subjects they study from a menu of options or modules and can involve exploring links with industry or other employers. This strategy, particularly at upper secondary level, can help prepare students for the labour market or further education by allowing them to acquire the types of competencies most relevant to their chosen future path. By providing a wider range of subject and content choices, countries/jurisdictions decrease the recognition time lag and ensure that students' needs are met. However, such strategies (i.e. giving student choice) should be considered carefully, and students should be supported to make informed decisions (OECD, 2012[4]).

Developing systems or processes to forecast future needs of society

Many countries/jurisdictions now set processes to forecast future needs of society and to identify how to redesign curriculum content accordingly. This can be done through a formal forecasting research and insight process, as is the case in Finland, Korea, Ontario (Canada), Hong Kong (China) and Singapore. It can also involve consultations with various strands of society to better understand emerging needs, such as those reported by Poland and Portugal. Some countries/jurisdictions, such as Poland, also use insights from global dialogues and international conferences to inform curriculum redesign.

- **Finland** started future-oriented curriculum reforms in the 1990s. The whole curriculum for basic education has been reformed once every decade. During the curriculum reform process, future challenges are considered and taken into account.

- **Korea** is carrying out research for forecasting the future and has changed the methods of revision of the national curriculum.
- **Poland's** Ministry of National Education has employed the following practices to ensure that it is able to reduce the time lags associated with recognition of future needs: 1) research by the Educational Research Institute to examine the changing educational needs of pupils across cohorts; 2) participation in international dialogue on the future of education, such as the OECD Education and Skills 2030 initiative; and 3) consultations and social debates with various stakeholders through meetings, conferences, discussions and correspondence.
- In **Portugal**, to respond to the social and economic challenges of today's world, a working group was created to design a competency profile for students after 12 years of compulsory education. Concurrently, different teacher associations worked together on a flexible and updated core curriculum per subject and school year. Both the student profile and core curriculum are now in force in Portugal.
- In **Ontario (Canada)**, curriculum is currently written with the vision of the learner ten years from now in mind. This is achieved by allowing for a certain degree of adaptability to future demands by using an inquiry-based model, rather than a content knowledge attainment model. An initial step was to move away from printed curricula to web-based platforms because it facilitates keeping curriculum documents up to date. Furthermore, continuous exploration of how to make curriculum more responsive is grounded in a research-based and evidence-informed curriculum review process, where stakeholder groups are frequently consulted to forecast demands.
- In the 2017 renewal of the secondary education curriculum in **Hong Kong (China)**, after a review of the social, scientific, technological and economic changes in the global and local environments, eight Major Renewed Emphases such as STEM and IT education, entrepreneurial spirit and values education were selectively strengthened to prepare students for the future. Hong Kong (China) has also participated in international dialogue through international projects (e.g. the OECD Education and Skills 2030 project) to keep abreast of the latest international developments.
- In **Singapore**, the responsiveness of the curriculum to external developments is strengthened by the curriculum review process. Singapore conducts external scans that include reports on global future trends and demands, developments in the global and local economy and international syllabuses. This process is integral in guiding the subsequent decisions made by curriculum designers and policy makers in the course of curriculum review.

Taking students' needs and voices into account during the curriculum redesign process

Countries/jurisdictions such as Finland collect information on how students experience the curriculum and on the aspects that they would like to see changed. This information helps to ensure that curriculum redesign reflects students' needs and that students feel engaged as agents of their own learning. Countries such as the Russian Federation also report recognising student agency and student agendas in their curriculum development, while Korea launched a process of student consultation to ensure that students have a say in the future direction of the education system.

- In the process of co-creating the vision for a future education system, **Korea** launched the "Children's and Youth's Rights Declaration – 100 voices of students" at the Korea-OECD International Education Conference and 10th Informal Working Group meeting in October 2019. This initiative collected suggestions from students in Korea on directions for the future of education, helping to make student voice heard in the process of education reform.
- **Finland** conducted a survey of students just before the curriculum reform officially started and 60 000 students from lower and upper secondary education responded. Students in basic education were also asked to give feedback during the curriculum reform process.
- The **Russian Federation** prioritises an approach which assumes the position that students are proactive learners in the learning process. Additionally, individual psychological and physiological characteristics are also taken into account. The curriculum defines subject-specific, meta-disciplinary and personal outcomes.

Providing more diverse learning and assessment experiences for students to bridge the gap between school and their future lives

In order to bridge the gap between what is included in national curriculum and the competencies students may need in their future lives and careers, some countries/jurisdictions, including Scotland (United Kingdom), have made efforts to strengthen links between schools and employers and to provide learners with a wider variety of learning experiences that are relevant for their future lives. In New Zealand, no courses or subjects are mandatory for upper secondary students. This means that students can select those that are most relevant for their future lives and careers and can focus on them in depth.

- The Curriculum for Excellence in **Scotland (United Kingdom)** set out to ensure that the curriculum framework better supported the needs of learners and the future workforce. To complement and support this aim, Scotland pursued reforms such as

Developing the Young Workforce and Learner Journey, which are intended to provide a wider variety of learning experiences, more diverse pathways and options for learners, and better links between employers, further and higher education and schools.

- In **New Zealand**, senior secondary students (upper secondary education) can choose to take five to six subjects at three levels of depth from among 17 disciplinary fields and gain qualification units in these fields. There are no compulsory courses for students. Schools often set up the units that make up each course, but a growing number of schools are offering students the possibility to personalise their courses by choosing the unit of learning and assessment.

DECISION-MAKING TIME LAG: OVERVIEW OF CHALLENGES AND STRATEGIES

Several challenges may create a time lag between the moment the need for curriculum change is recognised and when the new curriculum is made available. Table 8 summarises the decision-making time lag challenges experienced by countries/jurisdictions and the strategies they have adopted to address these.

Decision-making time lag: Challenges

Several countries and jurisdictions reported that **difficulty in building consensus on the direction of change** can cause considerable delays. Different sectors in society may have diverging views on the direction of curriculum change and the priorities for the education system or may resist any change at all. For example, a country/jurisdiction may find it difficult to build national consensus on whether to include values and attitudes in the curriculum and, if so, which should be explicitly addressed.

Curriculum designers often have to reconcile conflicting timelines in decision-making. While they are under pressure to respond quickly to changes in a fast-paced world, they also need to respect the **time requirement of a rigorous review process** in order to make sure that the curriculum redesign process is based on strong evidence. Such rigorous processes take time and add to the overall time needed to decide on the specific aspects of the curriculum change and to develop a roll-out plan.

While a relatively long and stable curriculum cycle helps to reduce uncertainty among education practitioners and thus improves their capacity to implement the curriculum (see "Characteristics of fixed and ad hoc curriculum change"), some countries and jurisdictions reported challenges related to **limited responsiveness of periodic curriculum renewal cycles** in the face of rapid societal changes.

Table 8 **Challenges and strategies related to decision-making time lag**

	Challenge/strategy	Countries/jurisdictions reporting the challenge/strategy
Challenges	Difficulty in building consensus on the direction of curriculum change	Denmark, Korea, Argentina, Viet Nam
	Delays resulting from the time requirement of a rigorous review process	Estonia, Ontario (Canada)
	Limited responsiveness of periodic curriculum renewal cycles	Hungary, Japan, Brazil[1], India[1]
Strategies	Engaging stakeholders to develop shared understanding and ownership of curriculum change	British Columbia (Canada), Ireland, Netherlands, Ontario (Canada), Poland, Scotland (United Kingdom), Sweden, Costa Rica, Poland
	Setting out a vision for the future of education to guide curriculum changes over time	British Columbia (Canada), Norway, Ontario (Canada), Portugal, Russian Federation, Singapore
	Engaging in ad hoc, partial or continuous reform	Denmark, Ireland, Mexico, Netherlands, New Zealand, Northern Ireland (United Kingdom), Poland, Portugal, Québec (Canada), Scotland (United Kingdom), Sweden, Turkey, United States[1], Hong Kong (China)
	Articulating key curriculum concepts that endure over time	Australia, British Columbia (Canada), Ireland, Japan, Korea, Norway, Québec (Canada), Turkey, Brazil[1], China), India[1], Kazakhstan, Russian Federation, Singapore, Viet Nam
	Creating space in the curriculum to accommodate new changes	Australia, Czech Republic, Japan, New Zealand, Norway, Québec (Canada), Saskatchewan (Canada), Brazil[1]
	Using "learning to learn" as the centre of curriculum reform decisions	Finland, New Zealand, Portugal, Hong Kong (China), India[1]
	Assessing the relevance of current curricular content through systemic reviews	Mexico, New Zealand, Norway, Ontario (Canada)
	Digitalising the curriculum to facilitate faster change	Australia, Denmark, New Zealand, Norway, Ontario (Canada), Hong Kong (China)

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

Source: Data from the PQC, findings from the research section.

Difficulty building consensus on the direction of curriculum change

Even when policy makers are ready to make the case for change, diverging views among stakeholders can make it difficult to build consensus on the direction of curriculum renewal. Denmark, Korea and Viet Nam all reported delays in curriculum redesign caused by the need to reconcile stakeholder views on the future direction of curriculum. In some countries/jurisdictions, stakeholders actively resist certain types of curricular change, as in Argentina.

- In its process of curriculum redesign, **Denmark** found the need to take time to reconcile competing views from stakeholders on what content should be included in the curriculum. While policy makers sought to reduce curriculum overload, business lobbied for including industry-relevant topics, while non-governmental organisations had an interest in including more specific content into topics such as human rights, sustainability and developing countries.
- **Korea** recognises that, while its system for curriculum revision is flexible, which is conducive to reflecting societal change in curriculum, it is difficult to agree on the direction of curriculum revision to help students prepare for the future.
- **Argentina** reported that academic stakeholders (e.g. universities) concentrate more on academic knowledge, resisting replacement of traditional content by emerging knowledge.
- In **Viet Nam**, the process of curriculum reform was delayed by the need to reconcile different stakeholder opinions about the key qualities that should be included in the general education curriculum, the level of detail and the methods to embed qualities in the curriculum.

Delays resulting from the time requirement of a rigorous review process

Countries/jurisdictions including Estonia and Ontario (Canada) reported finding it challenging to reconcile the time needed for rigorous review or consultative processes with the fast pace of changes to be reflected in the curriculum.

- In 2011, education cycles in **Estonia** were redesigned, leading to a split between upper secondary education and basic education. This created a short-term need in both education cycles for a new curriculum. As a result, there was limited time to conduct a rigorous review process. Furthermore, educators and school leaders had limited availability to participate in co-creating the curriculum, which resulted in further challenges for curriculum implementation.
- **Ontario (Canada)** is exploring how to make the curriculum respond to the needs of all students in a fast-paced society. This requires allocating sufficient time to create a highly consultative review process to ensure that the curriculum continues to be research-based and evidence-informed.

Limited responsiveness of periodic curriculum renewal cycles

As reported by Japan and Brazil, curriculum designers can feel constrained and unable to respond to changes in society, for example by incorporating 21st century skills, when they have periodic and potentially infrequent curriculum renewal cycles. As Hungary noted, without a continuous process of review, it is difficult for countries/jurisdictions to keep pace incorporating emerging needs into curriculum. The ability to make timely changes to curriculum is particularly important in subjects where content can change rapidly, such as science and technology, as was reported by India.

- **Hungary** describes the lack of a continuous review process as a major hurdle in the timeliness of its curriculum design process. The country aims to set up a permanent curriculum development team tasked with research and the provision of feedback.
- **Japan** acknowledges that a recurring ten-year defined cycle for curriculum reform has had benefits for teachers in terms of both continuity and stability. It helps avoid reform fatigue among teachers and gives them time to appropriate the curriculum content. It also gives time to teachers, school leaders and authorities to prepare adequately for the new curriculum, as dates of reform are known well in advance. But an unanticipated consequence is that it has made the curriculum less responsive to the pace of change in society.
- The national core curriculum in **Brazil** was intended to prepare students for the future by developing competencies and skills aligned with demands from the global movement advocating for an education for the 21st century. However, the competencies and skills are a moving target, and the curriculum must adapt constantly to changes at local and international levels in order to adequately prepare students for the future.
- In **India**, the narrow time lag between the generation of new knowledge and its application, especially in science and technology, makes it necessary to periodically renew school and higher education curricula to maintain their relevance to changing societal and personal needs of learners and emerging national development goals.

Decision-making time lag: Strategies

Countries/jurisdictions are employing various strategies to reduce the decision-making time lag. In order to combat the time lag resulting from difficulty building consensus on the direction of curriculum change, some countries/jurisdictions are now **engaging stakeholders to develop shared understanding and ownership of curriculum change**. Stakeholder engagement, when properly designed, helps to ensure that different voices and opinions on the future needs of society are heard and to more efficiently build consensus on curriculum change.

Most of the strategies adopted by countries/jurisdictions to address the decision-making time lag relate to making sure that the curriculum structure is responsive to change without requiring too much disruption. For instance, some countries/jurisdictions are **setting out a vision for the future of education to guide curriculum changes over time**. These visions are then used to inform several cycles of curriculum redesign, allowing for coherence over time and reducing the time needed to build consensus on curriculum change.

Other countries/jurisdictions have curriculum frameworks that are flexible and can be updated on a regular basis (see "How often do countries/jurisdictions reform curriculum?"). **Engaging in ad hoc, partial or continuous reform** helps countries/jurisdictions to be quicker to accommodate societal needs or implications from new research (although there are also risks associated with such an approach; see "Characteristics of fixed and ad hoc curriculum change").

In order to avoid the need for frequent overhauls of curriculum in response to changing demands, some countries/jurisdictions instead take the approach of **articulating key curriculum concepts that endure over time**. Such a structure reduces the decision-making time lag by giving curriculum designers a clear starting point for their review process.

Other countries/jurisdictions adopt the strategy of **creating space in the curriculum to accommodate new changes**, for example by creating a dedicated subject for new or cross-curricular content. Such an approach facilitates more rapid inclusion of new material in response to societal or technological developments, while minimising disruption and avoiding the need for a major curriculum overhaul. Such an approach was also reported as a strategy for addressing curriculum overload (see "Challenges and strategies" section (OECD, 2020[5])).

Some countries/jurisdictions reported **using "learning to learn" as the centre of curriculum reform decisions**, as a strategy to prepare students to thrive in a world characterised by volatility, uncertainty, complexity and ambiguity. Such an approach to curriculum recognises that a consequence of the increasingly rapid pace of societal change and exponential technological advancement means that education systems may not be able to keep fully abreast of such developments, but can instead prepare students to adapt to change itself (Laukkonen, Biddell and Gallagher, 2019[6]).

Countries/jurisdictions take the approach of **assessing the relevance of existing content through systemic reviews** in order to reduce the decision-making time lag. Such reviews help to identify which areas of curriculum may require redesign and help to set priorities for change. As discussed in *Curriculum overload: A way forward* (OECD, 2020[5]), systemic reviews can also help identify duplications or misalignment in the curriculum and thus help curriculum designers address issues of overload in a timely manner (OECD, 2020[5]).

Finally, countries/jurisdictions report the strategy of **digitalising the curriculum to facilitate faster change**. Digitalising the curriculum has helped countries/jurisdictions reduce both the costs and time associated with curriculum redesign. For example, portions of the curriculum content can be revisited without needing to reprint the full curriculum. The time needed between curriculum redesign and implementation is also reduced, as the curriculum, guidelines and teacher training materials are available on line. As such, digitalisation can encourage more rapid decision-making regarding curriculum redesign by alleviating some of the costs associated with it.

Engaging stakeholders to develop shared understanding and ownership of curriculum change

Curriculum designers can reduce the decision-making time lag by putting in place processes to engage with a variety of stakeholders in the decision-making phase, as in the Canadian provinces of British Columbia and Ontario. Some countries/jurisdictions, such as the Netherlands, make use of social media platforms to reach a wider set of stakeholders and collect their views on curriculum content.

- **British Columbia (Canada)** uses an ambitious consultation agenda in its curricular reform process. The first two years of reform are reserved for consultation with key stakeholders (e.g. teachers, school administrators, parents, academics) about what should be changed/improved in any upcoming curriculum revision processes. Once the curriculum teams have developed drafts based on their inputs, one year of public feedback and consultation is launched. Each subject area draft is made available on their website and also distributed to key stakeholders for their review, feedback and trailing. This feedback

is then integrated and necessary changes to the drafts are made. British Columbia (Canada) also pays careful attention to consulting indigenous groups at every step of the process, and their suggestions and feedback are incorporated to improve curriculum development along the way.

- In the **Netherlands**, a commission was formed to start a national dialogue on the content of the curriculum and the direction that a revision of the curriculum should take. All stakeholders were encouraged to share their views on line. The public was also invited to react to specific questions regarding the three functions of education: qualification, personality development and academic development. This national debate aimed to develop a shared vision for the upcoming renewal (van Schaik, Voogt and Nieveen, 2017[7]). The interim products of this phase of curriculum development (the "building blocks") were made public to receive stakeholders' feedback on them. This process was directed by the representative bodies in the educational field: unions, education councils and subject associations.
- For **Ontario (Canada)** the process of curriculum development is considered just as important as the outcome, as it renders the involvement and ownership of different stakeholders visible and makes it possible to develop relationships with them. The core understanding is that: "Curriculum cannot be written from one perspective without participation of all across the province." Ontario (Canada) engages with educators from across the province to write and review the curriculum, as well as other subject-matter experts. Reviews are also conducted by academic and community-member experts, and their feedback is reflected in curriculum.

Setting out a vision for the future of education to guide curriculum changes over time

Countries/jurisdictions such as Norway, Portugal and Singapore define long-term visions for their education systems which can help to reduce decision-making time lag. Setting out and agreeing on a clear vision for education helps to build faster consensus on curriculum change. This vision can be articulated in an aspirational student profile, as described by Portugal (see "How do countries compare?" for more information on student profiles across a range of countries/jurisdictions). British Columbia (Canada) has set out a broad vision of the future of education that can be responsively updated once additional future needs are identified at local or school levels.

- In order to ensure a shared understanding and tackle challenges resulting from fast-paced global changes, **British Columbia (Canada)** has developed a large-scale vision of the future of the education system set out in its BC Education Plan,[1] launched in 2011. The plan is based on a vision of "Flexible, Adaptable, Excellence in Education" that has five key elements: 1) personalised learning for every student; 2) quality teaching and learning; 3) flexibility and choice; 4) high standards; 5) learning empowered by technology. These are explained in an accessible manner outlining action steps on the part of jurisdictional authorities as well as leaving the flexibility and the freedom to adapt needed with local authorities. Regular updates are published to document the progress made and the next steps envisaged.
- **Norway's** Knowledge Promotion Reform (2006) was designed to meet two major trends in contemporary society: the importance of knowledge as a resource and a driving force and the increasing complexity and diversity of Norwegian society. To adapt education to these trends, a government report preceding the reform set out a vision of lifelong learning as important for the individual's quality of life and opportunities to participate in the knowledge society. The 2017 renewal of the curriculum was based on the vision outlined in 2006, but it included some adjustments to meet the future challenges in society as described in the "Core curriculum – values and principles for primary and secondary education".
- Before embarking on the process of curriculum reform, **Portugal** took a step back to outline a vision for the future of education in the country. To do this, it clearly identified the student profile that the education system would aim to develop, consolidating the vision for the education system. Thus, this profile is a reference guide for the entire curriculum, the school, the students and their families on the competences that learners should have by the end of compulsory schooling. After doing this, Portugal followed this with a pedagogical framework for compulsory education for the construction of a solid and learning pathway, aligned with the student profile that was envisioned.
- Since 2013, **Singapore's** Ministry of Education has emphasised the importance of a student-centric, value-driven education as a basis for a broad and deep foundation for lifelong journey. This vision has provided the direction to schools for better preparing students for the future. The competence approach, curriculum review process and future orientation reinforce one other in providing a strong focal point for the development of curriculum. These have led to shifts in how the humanities subjects are learned and taught, with stronger emphasis on critical thinking and creativity, social perceptiveness and citizenship. For example, the recommended inquiry approach allows students to actively construct new knowledge by investigating, extracting, analysing and synthesising information and to reflect on the nature of knowledge-construction.

Engaging in ad hoc, partial or continuous reform

Québec (Canada), New Zealand and Mexico are among countries/jurisdictions reporting that their curriculum frameworks are designed to give policy makers flexibility to update only portions of the curriculum or to update only the guidelines, without needing to overhaul the full curriculum.

- In **Québec (Canada)**, the Québec Education Programme was designed to last over time and is flexible enough to be tailored to needs that arise. The curriculum was developed based on 21st century skills and competencies which remain valid over time. The curriculum and study programmes are amended regularly in line with research developments and the needs expressed by the community.
- **New Zealand** has a permissive curriculum, with guidelines published and updated from time to time and, as needed, revision of mandatory requirements.
- As opposed to engaging in complete curriculum reforms, **Mexico** carries out systematic and continuous reviews and evaluations of curriculum plans and programmes to keep them permanently updated. This facilitates smooth incorporation of new needs and challenges at the national and global level.

Articulating key curriculum concepts that endure over time

Some countries/jurisdictions organise their curriculum around concepts and ideas designed to endure over time. For example, Australia, Japan and Kazakhstan report basing their curriculum on concepts that are likely to remain relevant. As reported by Australia, such an approach may reduce the need to update the full curriculum frequently by avoiding obsolescence.

- In **Australia**, key concepts/key ideas have been the basis for the development of each learning area. They are expressed in various forms (individual words, phrases or questions) to prompt the process of inquiry and generate notions of universality and currentness. The curriculum operates as a flexible framework rather than a prescribed syllabus. The content descriptions and achievement standards are presented in broad rather than specific terms. For example, in the technologies learning area, the focus is on key concepts, in order to reduce the likelihood of obsolescence.
- **Ireland's** National Strategy: Literacy and Numeracy for Learning and Life 2011-2020 has yielded very good results across the range of targets that were originally set out, particularly in the area of literacy.
- **Japan** considers that the skills needed in the future are not totally different from those that have been fostered in traditional school education. For many decades, the Japanese curriculum has promoted a holistic approach to education to develop students' academic ability, their physical health and morals. While the recent revisions to the curriculum have introduced new concepts and competencies to better prepare students for a rapidly changing society (the Society 5.0 reform), the curriculum recognises that the fundamental competencies already promoted by the curriculum remain very relevant.
- The renewed curriculum in **Kazakhstan** has used concepts, knowledge and skills that are expected to stand the test of the time. The curriculum emphasises a problem-based approach applicable to any learning context. A particular feature of the renewed curriculum is that it enables learning to take place in "authentic, real-world and relevant contexts" as situations change. The government approves standards for every educational level that indicate the expected outcomes students should achieve after completing each level. These standards serve as the basis for development of subject programmes, which are common to all state mainstream schools (private and international schools have the autonomy to use different subject programmes).

Creating space in the curriculum to accommodate new changes

Countries/jurisdictions use various strategies to ensure that the curriculum structure allows for rapid accommodation of changes without the need for major redesign. For instance, Japan set up a dedicated subject for teaching cross-curriculum content. This means that curriculum designers in Japan can revise cross-curricular competencies without needing to overhaul the whole curriculum. The inquiry-based approach in Saskatchewan (Canada) facilitates asking questions about current real-world issues to guide teaching and learning. Similarly, in New Zealand, schools are granted the autonomy to cover issues locally that are deemed relevant or timely.

- **Saskatchewan (Canada)** curricula are comprised of broad knowledge, skills and understandings that allow for teachers to incorporate relevant topics and big ideas into their teaching. Using an inquiry-based approach, students are active participants in their learning within meaningful and relevant contexts. Teachers have the ability, through the adaptive dimension, to adjust learning environments, instruction, resources and assessment to meet the needs of all learners, and thus reflecting the needs-based philosophy that exists in Saskatchewan (Canada).
- To respond to the challenge of keeping the curriculum up to date, **Japan** uses the Period for Integrated Studies for elementary schools and junior high schools (primary and lower secondary education) and the Period for Inquiry-Based-Cross-Disciplinary

Study for high schools (upper secondary education) to accommodate the needs of students by, for example, bringing real-world issues into classrooms with an interdisciplinary approach.

- In **New Zealand**, schools have a great level of autonomy for curriculum development. This flexibility allows them space to incorporate emerging global or local needs within curriculum, developing, for instance, their own courses or refreshing the syllabuses of existing courses. This allows schools to accommodate new changes without having to wait for large-scale curriculum redesign processes.

Using "learning to learn" as the centre of curriculum reform decisions

Some countries/jurisdictions, such as Finland, Portugal and Hong Kong (China), are highlighting the importance of fostering students' metacognitive competencies, particularly "learning to learn", as key cross-curricular competencies when redesigning curriculum. These competencies are not context-dependent and help students adapt to an uncertain future. This is particularly helpful when countries and jurisdictions are adopting a flexible curriculum, or personalised curriculum, as students are expected to take more responsibility and ownership of their own learning in such curriculum innovations.

- **Finland** encourages the use of phenomenon-based learning as a forward-looking approach to curriculum and pedagogy for 21st century learners. Phenomenon-based learning is an instructional approach based on student inquiry and problem solving. In this approach, the compartmentalisation of subjects is broken down in phenomenon-based classes that address phenomena from a holistic perspective, cutting across subject boundaries. This approach guides students in understanding, using, and constructing different models for interpreting and explaining human beings, the environment, and related phenomena through small-scale research projects. Students are also encouraged to collect information, engage in field trips and present the results of research in different ways.
- **Portugal** is trying to manage the existing gap between what students are learning and what they really need to learn, bearing in mind 21st century skills and challenges. It is working on a curriculum reform to foster "learning to learn", based on the idea that developing a competence composed of a matrix of knowledge, skills and attitudes enables every student to thrive in an uncertain and fast-changing world.
- **Hong Kong (China)** adopted the Education Commission's future-oriented Education Blueprint for the 21st century in 2000 and implemented the Learning to Learn curriculum reform in 2001. This aimed to nurture "learning to learn" capabilities in students to prepare them to face the future challenges of the 21st century. Subsequently, in the ongoing curriculum renewal, updates on the curriculum content continued to be forward-looking.

Assessing the relevance of existing curriculum content through systemic reviews

Countries and jurisdictions including New Zealand, Norway and Ontario (Canada) have implemented or are currently implementing comprehensive reviews of curriculum to identify content in need of removal or updating, while Mexico has plans to carry out such reviews in the future.

- **Mexico** plans to carry out systematic and continuous reviews and evaluations of curriculum plans and programmes to detect new needs and challenges at the national and global level and will keep them permanently updated.
- **New Zealand** renewed parts of the recently reformed curriculum because of the rapid development of technology. A 2017 review of the positioning and content of digital technology within the New Zealand Curriculum and *Te Marautanga o Aotearoa* led to the formal integration of digital technology as a strand of the technology learning area in the New Zealand Curriculum, and as a *whenu* within the *Hangarau Wāhanga Ako of Te Marautanga o Aotearoa*. This is intended to support young people to develop skills, confidence and interest in digital technologies and lead them to opportunities across the information technology sector.
- In **Norway**, the government appointed a committee to assess the degree to which the content of school covers the competencies pupils will need in future society and their working life and to provide proposals for change. The committee, appointed by Royal Resolution in 2013, submitted a report entitled "The School of the Future: Renewal of subjects and competences" to the Ministry of Education and Research in 2015.
- In **Ontario (Canada)**, systemic research and stakeholder consultations are conducted to ensure that curriculum design is aligned with current needs. The process of curriculum co-creation is conducted through consultations with school boards, educators and other stakeholders that occur in parallel across different regions. As new curriculum needs become evident from research and stakeholder consultations, courses are often developed in collaboration with external editors, allowing co-development of curricula with stakeholders so that innovative ideas are incorporated in real time.

Digitalising the curriculum to facilitate faster change

Countries/jurisdictions including Australia, Denmark, New Zealand, and Hong Kong (China) reported that having a digitalised curriculum allows for more expedient curriculum change.

- In **Australia**, the curriculum is published and updated on line. This ensures that all information and resources are current.
- With its National learning portal (EMU), **Denmark** has created a flexible instrument combining an online portal for up-to-date curriculum frameworks and materials for teaching in the public schools that are continuously updated by the Ministry of Education.
- **New Zealand** introduced digital technology to the curriculum incrementally. The revision was undertaken in a much more reduced time frame than the original development of the national curriculum, and it recognises the urgency to respond to the challenges from increasing digitisation of life and work.
- **Ontario (Canada)** is developing an interactive digital curriculum and resources platform. It will be developed through an iterative process based on user feedback. This new digital space will help educators, parents and students' to access curriculum and learning resources in a user-friendly and mobile friendly manner and will become increasingly interactive over time with new content and features.
- In **Hong Kong (China)**, the curriculum guides and other curriculum documents are prepared in electronic format and uploaded to the Education Bureau website, offering free access for schools and the public. This will ensure that the latest curriculum documents are up to date and available to schools at any time.

IMPLEMENTATION TIME LAG: OVERVIEW OF CHALLENGES AND STRATEGIES

A time lag is often reported between the intended or written curriculum and the implemented or taught curriculum. Table 9 summarises the specific challenges and strategies relating to the issue of implementation time lag reported by countries and jurisdictions.

Implementation time lag: Challenges

Countries/jurisdictions that have a decentralised curriculum design process may face particular challenges in ensuring timely implementation across all jurisdictions or local authorities (see "What does research say?"). **Variation in the pace of curriculum implementation across regions, localities or schools** was a challenge reported by several countries and jurisdictions.

A smooth and successful implementation phase depends to a large extent on the teachers and school leaders who are implementing that curriculum. A **lack of teacher buy-in for curriculum reform** was reported as causing implementation delays by several countries/jurisdictions. If teachers do not have a sense of ownership over curriculum, disagree with the direction of curriculum change, or have values or attitudes that conflict with new curriculum content, this can contribute to slow or uneven implementation.

Challenges to timely and effective curriculum implementation can also arise if the education, training and support received by teachers does not embody both the content of the new curriculum and best pedagogical practices for teaching that content. Several countries/jurisdictions report experiencing challenges arising from **misalignment between curriculum change and teacher education, professional development and support**.

Table 9 **Challenges and strategies related to implementation time lag**

	Challenge/strategy	Countries/jurisdictions reporting the challenge/strategy
Challenges	Variations in the pace of curriculum implementation across regions, localities or schools	Australia, Finland, Argentina
	Lack of teacher buy-in for curriculum reform	Ireland, Korea, Poland, Singapore
	Misalignment between curriculum change and teacher education, professional development and support	Argentina, Costa Rica, India, Singapore
Strategies	Promoting teacher understanding of curriculum reforms through dissemination campaigns and/or training	Chile, Japan, Poland, New Zealand, Hong Kong (China), India
	Developing pedagogical resources and materials for teachers	Argentina, Chile, Hong Kong (China)

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

Source: Data from the PQC, findings from the research section.

Variation in the pace of curriculum implementation across regions, localities or schools

When there is a high degree of flexibility across regions, localities or schools in how curriculum is implemented, countries and jurisdictions can face challenges in ensuring timely implementation in all quarters. In Australia, for example, the pace of implementation of curriculum varies in line with the priorities and timelines of individual states or territories. In Finland, curriculum implementation can be faster in large urban areas and slower in rural areas, due to challenges in supporting and training teachers and school leaders in more remote areas. Argentina reports limited capacity in provinces to adapt the national curriculum to local needs in a timely manner.

- **Australia** has a flexible framework for curriculum implementation, allowing states and territories to implement the curriculum in ways appropriate to their needs and contexts. This results in a varying pace of implementation of the national curriculum across Australia, depending upon the plans, resources, priorities and timelines of the individual states and territories.
- **Finland** is a sparsely populated country with a large share of the population concentrated in urban areas. Due to these factors, curriculum development is usually centralised in big urban areas, making it challenging to facilitate engagement and in-service training for curriculum redesign among teachers in rural areas. Schools across the country sometimes have diverging paces for curriculum implementation.
- **Argentina** cites a lack of knowledge, professional development and institutional capacity in provincial curriculum departments to play their part in adapting curricula and developing guidelines or resources to address future demands in progressive and effective ways.

Lack of teacher buy-in for curriculum reform

Several countries/jurisdictions reported that a lack of teacher buy-in for curriculum reform, manifesting as scepticism or doubt about reform (as in Korea and Poland), fear of change (as in Ireland), and personal beliefs or attitudes that conflict with a new curricular direction (as in Singapore) can present barriers to effective and timely curriculum implementation.

- In **Ireland**, at the initial stages of the implementation of recent curricular reform in lower secondary education (2015), there was fear of and resistance to change among some teachers, as well as a lack of capacity among school leaders to manage change. While all stakeholders in education at the time accepted that curriculum development was necessary to reflect social and economic change, the move to a dual approach to assessment and a learning-outcomes approach to subject specifications was particularly challenging for teachers.
- In **Korea**, periodic curriculum reforms created doubts about the "legitimacy and necessity" of reforms. From the 1980s to 2005, Korea revised its curriculum every five to seven years and had found this approach to be inefficient because: 1) old reforms were not always in place before new reforms arose, therefore it was difficult for the results of the old reforms to be reflected in the new reforms. 2) it revised parts that did not need change. Consequently, full-on revisions can create teachers and practitioners' cynical attitudes towards reform. It can also be difficult to get them motivated to implement reforms.
- **Poland** reports scepticism among school leaders about curriculum reform and concern among teachers about whether they are appropriately qualified. School heads have curricular changes related to personnel issues and equipment of subject laboratories and organisational difficulties, such as setting out new lesson plans. They are also concerned about whether their schools are properly prepared for methodological challenges.
- **Singapore** notes the difficulty of getting teachers ready for the implementation of the revised curriculum to ensure that classroom practices do not deviate from the intent of the syllabuses and curriculum. Implementation can be impeded by teachers' attitudes and beliefs on the subject, their own teaching styles and practices and also by a lack of lead time for teachers to acquaint themselves with the revised curriculum.

Misalignment between curriculum change and teacher education, professional development and support

Some countries/jurisdictions have experienced implementation time lag resulting from gaps between what is covered in initial teacher education programmes and the pedagogies most appropriate to foster new competencies introduced during curriculum renewal, as in the examples of Argentina, Costa Rica and India. India and Singapore also reported that ongoing teacher professional development does not always align or keep pace with curricular changes, contributing to implementation time lag.

- In **Argentina**, there is a lag between the content of teachers' initial education and the new learning content and methods promoted by the curriculum, and Argentina also faces the challenge of teachers not wanting to be retrained. Teachers have shown resistance to changing from a teacher-centred approach to teaching and learning to a student-centred approach. Even when teachers are retrained, it is hard to modify teaching practices after ten years of experience in the system. Some teachers also fear losing part of their salary because of curriculum realignment. Teachers may also see curriculum reform as a source of instability, with new subjects made compulsory and other subjects eliminated from the core curriculum, resulting in teaching positions being cut.

- **Costa Rica** recognises that there is a gap between the education that teachers received during their initial teacher education and the competencies they need to implement in the curriculum. This creates a disconnect between the educational offer and the demands of today's society. It also can lead to students losing interest in what is taught in school. For example, the incorporation of cross-curricular themes pertaining to values was intended to provide the curriculum with themes deemed necessary in society today. According to the National Forum of Education 2008, the strategy did not work, because the teachers saw it as another requirement. Teachers perceived cross-curricular themes as content separate from the syllabus, and they did not know how to integrate them in class instruction. After this experience, new syllabuses already integrate cross-curricular themes.
- In **India**, an identified challenge is how pre-service and in-service teacher training build perspectives of educators at all levels and prepare them for implementation of curriculum reforms. Effective implementation of new curriculum design was hampered by resistance to change among teachers. Misalignment of new curriculum directions with pre-service and in-service teacher training programmes was found to play a particular role in creating this resistance to change.
- In **Singapore**, a possible reason for implementation time lag is that teachers' own learning is not keeping pace with the new developments and requirements for new skills, knowledge and technology.

Implementation time lag: Strategies

Several countries/jurisdictions reported making concerted efforts towards **promoting teacher understanding of curriculum reforms through dissemination campaigns and/or training**. If there is no communication between those designing curriculum and those implementing it, there is the potential for misunderstanding about the goals and expectations of curriculum, leading to implementation delays. Investing time and resources to build a shared understanding of and buy-in for curriculum change may improve curriculum implementation.

Some countries/jurisdictions support teachers to implement new curriculum by **developing pedagogical resources and materials for teachers** that are aligned with the redesigned curriculum. Such an approach avoids the need for individual teachers to develop these themselves, reducing implementation delays that might otherwise occur. This strategy may help address the challenges described above relating to variations in pace of implementation across regions localities or schools and the lack of teacher preparation to implement curriculum reforms.

Promoting teacher understanding of curriculum reforms through dissemination campaigns and/or training

Methods of dissemination reported by countries/jurisdictions aimed at ensuring effective and timely implementation of curriculum include information seminars (as in Japan), practical workshops (as in Poland) and dedicated websites for teachers and schools leaders (as in New Zealand). In countries/jurisdictions such as Chile, Hong Kong (China) and India, professional development courses have been developed to prepare teachers to successfully implement curricular reforms.

- In **Chile**, the Ministry of Education, the Curriculum and Evaluation Unit, and the General Education Division have jointly developed strategies for disseminating curricular change in schools, including designing resources to support curriculum implementation and dissemination days. In addition, the Center for Improvement, Experimentation and Pedagogical Research has carried out an improvement course aimed at teachers on curriculum updating.
- In **Japan**, Shido-shuji (supervisors deployed at each education board) play very important roles in the curriculum implementation process. All Shido-shuji deployed to prefectural education boards attend seminars held by the ministry and are responsible for disseminating what they learn back in their own prefecture. Those deployed to municipal education boards attend seminars held by a prefectural education board and are responsible for disseminating what they learn from prefectural Shido-shuji back in their own municipality. In addition, each prefecture and municipality holds its own seminars and symposiums to deepen understanding of curriculum reforms, often inviting ministry officials and/or members of the Central Council for Education who know the background of how the curriculum was designed.
- Each change of **Poland's** core curriculum is accompanied by activities supporting schools and teachers. The authors of the core curriculum develop comments on individual subjects to explain the changes introduced and tips on how to implement new teaching content. The obligation to use the new core curriculum is preceded by conferences and workshops organised by educational institutions for school heads and teachers. They are aimed at practical preparation of the school environment for implementation of programme changes.
- **New Zealand** established websites for both The New Zealand Curriculum[2] and for *Te Marautanga o Aotearoa*.[3] The sites are designed to help educators create an engaging, inclusive and dynamic curriculum that meets the needs of their unique school communities. They offer information, resources, news, advice and guidance, inspiring school stories, practical ideas, research reports and information on how to get support.

- To familiarise school stakeholders with the new elements and start them planning for implementation, **Hong Kong (China)** provided professional development programmes three years prior to the implementation of the new senior secondary curriculum under the New Academic Structure, for all secondary schools at all levels of school leaders, middle managers and front-line teachers.
- In **India**, the National Curricular Framework (2005) emphasised that the in-service teacher education process needs to be formulated in a way that enhances teachers' knowledge and helps develop their attitudes, skills, dispositions and practice. In line with these recommendations, the National Centre for School Leadership was established to design and implement nation-wide in-service professional development plans for head teachers (or school leaders). The key objectives of the school leadership development initiative are to: 1) align school leaders on how and why national curricular reforms must be implemented; and 2) enhance their knowledge, skills, attitude and practices to catalyse transformative change.

Developing pedagogical resources and materials for teachers

Chile, Argentina and Hong Kong (China) develop resources for teachers to support the implementation of new curriculum, thus ensuring that teachers do not have to create these themselves from scratch. These supports include multimedia resources in Hong Kong (China) and digital interactive resources in Chile. In Argentina, in an effort to reduce time lag, the resources provided sometimes relate to material that has not yet formally been included in curriculum but will be in future.

- In **Chile**, the National Curriculum website seeks to guide the implementation of the curriculum at a national level. This platform's purpose is to offer a flexible digital space, where teachers of all grades and educational modalities can access varied quality documents and resources that promote good teaching practices. Moreover, the purpose is to provide students and their families with quality documents and resources in order to support comprehension of the curriculum and its consequent implementation. The website promotes the use of a digital language for the planning of lessons, by providing documents, activities, suggestions, interactive and audio-visual resources aligned with the curriculum and that aim to enrich the educational process.
- **Argentina** is developing pedagogical resources and materials for provinces and teachers which address current or future topics that are not included in current curricula. This can encourage teachers to address new issues without undergoing structural curriculum reforms and can help ensure that reforms are implemented.
- In **Hong Kong (China)**, the Education Bureau develops a range of learning and teaching materials, such as resource packages and multimedia resources, for use by schools and teachers. The provision of supplementary learning and teaching materials to teachers can help reduce the implementation time lag by reducing the lead time for teachers to prepare their own resources.

IMPACT TIME LAG: CHALLENGES AND STRATEGIES

Despite curriculum designers' best efforts to make timely decisions and ensure effective implementation, it can take several years for curriculum change to have an impact on students' learning and well-being. This lag often leads to curriculum reforms being overturned before they have had the opportunity to have an impact. Table 10 summarises the main challenges relating to the issue of impact time lag reported by countries/jurisdictions and the strategies they have adopted in response.

Table 10 **Challenges and strategies related to impact time lag**

	Challenge/strategy	Countries/jurisdictions reporting the challenge/strategy
Challenges	Insufficient research on competencies needed for the future	Denmark, Korea, China
	Lack of studies evaluating the implementation and impact of curriculum change on student learning and well-being	(n/a)
Strategies	Piloting curricular changes and evaluating their impact on student learning and well-being	Australia, British Columbia (Canada), Chile, Ireland, Hungary, Korea, Poland, Scotland (United Kingdom), Turkey, Kazakhstan, Russian Federation
	Ongoing monitoring of the implementation of curricular innovations	Japan

Note: Responses for these countries/jurisdictions were submitted by independent researchers, not government administrations.
Source: Data from the PQC, findings from the research section.

Impact time lag: Challenges

Countries/jurisdictions that take an evidence-informed approach to curriculum redesign may be more likely to see curriculum have its desired impact on student outcomes. However, while there are decades worth of robust research on teaching and learning in traditional learning areas like reading and mathematics, some countries/jurisdictions identified that there is **insufficient research on competencies needed for the future**, at least in some areas or domains. Without such information, the decisions taken by curriculum designers may lead to a time lag in the impact of curriculum in these areas.

In addition, **a lack of studies evaluating the implementation and impact of curriculum on student learning and well-being** can contribute to the time lag between when curriculum is implemented and when effects on student learning are observed. Careful monitoring of implementation would allow curriculum designers to identify what is and is not working well, allowing for timely course correction where necessary. Without this information, the desired impact of curriculum on students will likely be delayed.

Insufficient research on competencies needed for the future

Countries/jurisdictions including Denmark, Korea and China, reported challenges where there are gaps in the research base available to inform curriculum redesign.

- **Denmark** outlines lack of evidence of future needs for students as a key challenge for curriculum reform. Stakeholders such as business/industry and civil society usually put forward their views for co-creating curriculum. However, these are not always aligned, revealing tensions and dilemmas for discerning which skills will be relevant for students in the future.
- **Korea** outlines lack of systematic research on future needs as a curriculum challenge. This challenge is aggravated by the speed of changes surrounding education in the near future, such as rapid technological development, together with a research agenda for education policy where continuity and scientific perspective are difficult to ensure.
- **China** identifies some gaps between social development, scientific and technological progress and students' experiences in schools. China attributes this lag to insufficient research on future needs for talent.

Lack of studies evaluating the implementation and impact of curriculum changes on student learning and well-being

While a growing number of countries are using impact studies and evaluations to measure the effects of various education reforms, their use for evaluating the impact of curriculum remains relatively limited. The complexity of isolating the effect of curriculum redesign from other factors, such as pedagogy or teachers' capacity, may be a leading reason why policy makers are reluctant to use impact evaluations to measure the effect of curriculum redesign. The impact of curriculum redesign is, rather, often evaluated as part of a broader ecosystem of policies, including pedagogies, teacher preparation and assessment. (For a wider list of research gaps, see "What is still unknown?" above). More research is needed on the ecosystem approach to curriculum reform and measuring the collective impact of curriculum reforms. This is being explored in Phase II of the OECD Future of Education and Skills 2030 project.

Impact time lag: Strategies

In order to ensure that curriculum change has a timely impact on student learning, some countries/jurisdictions take the approach of **piloting curricular changes and evaluating their impact on student learning and well-being**. This strategy means that countries/jurisdictions collect evidence of impact on student learning and well-being prior to introducing the changes more broadly across the education system.

While some countries/jurisdictions focus on monitoring impact, others actually engage in **ongoing monitoring of the implementation of curricular innovations**. Increasing device use among students allows for real-time collection of process data on how and when students are engaging with the devices. These data can then potentially be used to inform pedagogical practices in classrooms.

Piloting curricular changes and evaluating their impact on student learning and well-being

A growing number of countries/jurisdictions, including Korea and Kazakhstan, are piloting new pedagogies and assessments as part of a broader curriculum change. Collecting evidence of impact before scaling up should help to reduce the impact time lag of associated with curriculum change.

- To change the nature of teaching and learning, **Korea** piloted a "Free Semester" (i.e. a semester without mid-term and final examinations). In teaching and learning, it introduced pedagogies such as project-based learning and flipped learning. In curriculum, it offered a common curriculum in the morning and an optional curriculum in the afternoon, including activities such as career exploration and clubs. Korea expanded the number of research (pilot programme) schools from 42 in 2013 to 811 in 2014 (25% of all middle schools), to 2 551 schools in 2015 (80%), and to all middle schools in 2016. The Ministry

of Education evaluated the implementation and impact of this policy on students by monitoring research schools, voluntary schools and non-participating schools. Based on the results of the analysis, the Ministry set an advanced policy in 2018 which stipulates that schools voluntarily designate two semesters of the first middle school year as the Free Year, offering 221 Free Semester activity hours based on students' needs and interests.

- **Kazakhstan** has a network of innovative schools which are at the forefront of innovation developments in the country, Nazarbayev Intellectual Schools. This school network serves as an education laboratory where innovations on pedagogies and assessments are piloted and evaluated before being scaled up.

Ongoing monitoring of the implementation of curricular innovations

Box 11 outlines how the monitoring and collection of data on device use in schools in one city in Japan allows for targeted intervention in schools where the devices are not being used as intended. Facilitating early intervention in this way is an opportunity afforded by technology and can limit delays in achieving the intended impact of curriculum innovation on students.

Box 11 How the board of education uses data to monitor targeted interventions without time lag

The city of Kumamoto in Japan has 92 elementary schools and 42 lower secondary schools. Kumamoto introduced Long Term Evolution (LTE) model tablets to all public elementary and lower secondary schools over the period of 2018 to 2020. A feature of the LTE model tablets is that users can connect to them anytime, anywhere. The board of education in Kumamoto has added useful applications to these tablets and has actively provided technical support. In order to improve pedagogical practices in class, the board of education not only provides the tablets, but also monitors which schools use them and how. The board would like to improve the classes by shifting the focus from input by teachers to output by students, using ICT. It promotes improvement of lessons at school by dispatching supervisors to observe classes, in addition to the ICT support staff at the schools.

The data are used to design targeted interventions in schools where either teachers or students are struggling to use the devices. Based on monitoring data on the use of the tablets, the board of education staff are able to design interventions targeting schools that were not using them effectively with no time lag. Thus, being able to eliminate the time lag is one of the advantages of digital devices. The board of education is promoting this project through a series of initiatives in collaboration with industry, academia and local government.

Source: Website of the Kumamoto city, https://www.city.kumamoto.jp/common/UploadFileDsp.aspx?c_id=5&id=25530&sub_id=10&flid=203298, accessed on 30 September 2020.

Notes

1. http://buildingpublicunderstanding.org/assets/files/pubstory/bc_edu_plan.pdf

2. http://nzcurriculum.tki.org.nz/

3. www.tmoa.tki.org.nz/Te-Marautanga-o-Aotearoa.

References

Laukkonen, R., H. Biddell and R. Gallagher (2019), *"Preparing humanity for change and artificial intelligence: Learning to learn as a safeguard against volatility, uncertainty, complexity, and ambiguity"*, OECD, https://dx.doi.org/10.31234/osf.io/g5qwc. [6]

Mann, A. et al. (2020), *Dream Jobs? Teenagers' Career Aspirations and the Future of Work*, OECD, Paris, https://www.oecd.org/education/dream-jobs-teenagers-career-aspirations-and-the-future-of-work.htm. [3]

OECD (2020), *Curriculum Overload: A Way Forward,* OECD Publishing, Paris, https://doi.org/10.1787/3081ceca-en. [5]

OECD (2019), *OECD Future of Education and Skills 2030 Conceptual Learning Framework. Concept note: OECD Learning Compass 2030*, http://www.oecd.org/education/2030-project (accessed on 10 June 2020). [1]

OECD (2019), *Trends Shaping Education 2019*, OECD Publishing, Paris, https://dx.doi.org/10.1787/trends_edu-2019-en. [2]

OECD (2012), *Equity and Quality in Education: Supporting Disadvantaged Students and Schools*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264130852-en. [4]

van Schaik, M., J. Voogt and N. Nieveen (2017), "*Education 2032: A study about the method and returns of the societal dialogue: The process of vision development towards a future-oriented curriculum*", in *Onderwijs 2032 : Onderzoek naar werkwijze en opbrengsten van de maatschappelijke dialoog Het proces van visie-ontwikkeling naar een toekomstgericht curriculum,* , University of Amsterdam, Amsterdam, https://hdl.handle.net/11245.1/c5262f03-5485-4ccb-91c5-659759bfa7a0. [7]

What lessons have countries/ jurisdictions learned from unintended consequences?

The strategies introduced in the "Challenges and Strategies" section above could be options to address the time lag between today's curriculum and future demands. While the strategies may be helpful, they may also have unintended consequences. Some countries and jurisdictions have reported experiencing outcomes that were not anticipated when designing these strategies, which added further complexity to minimising the time lag.

As many countries have acknowledged, time lag is an issue of concern. Strategic foresight, careful planning and consultative and collaborative processes take time, but they contribute to achieving more sustainable and successful results.

The following five key lessons learned are generated based on actual country experiences. These lessons can be used as a checklist to reflect on the current state of play and avoid repeating similar unintended consequences that peer countries and jurisdictions have experienced.

Key lessons learned from unintended consequences on addressing time lag between today's curriculum and future demands

- Do not underestimate teachers' fear of the unknown and allow them space for mistakes.
- Empower teachers, rather than diminishing their agency, when developing innovative curriculum through new educational technologies.
- Acknowledge the need for incremental changes to the curriculum while maintaining aspirations for transformational change.
- Avoid reform fatigue among stakeholders by designing synergies between curriculum change and other educational reforms.
- Use structure and discipline when making changes to the digital curriculum, being aware of cyber security threats and personal data issues.

1. DO NOT UNDERESTIMATE TEACHERS' FEAR OF THE UNKNOWN AND ALLOW THEM SPACE FOR MISTAKES

Addressing the time lag between today's curriculum and future needs requires significant change, which may be met with resistance from stakeholders. Resistance to change may be especially strong among teachers when the nature of the change is unfamiliar (e.g. new concepts and use of new educational technologies) and the consequences on their teaching are unclear.

Such resistance is mostly due to a fear of the unknown, with teachers reporting being ill-equipped for such change, and to misalignment of new curriculum directions with teacher training programmes and guidance materials (see the "Research" section above and "Challenges and strategies" sections above). Teachers especially fear making mistakes in implementing the curriculum, which can mean that they continue to teach in a traditional way and students can potentially miss out on opportunities to develop future-oriented skills.

To prevent such anxiety and mitigate implementation lag, it is important to identify the barriers and concerns that teachers experience when implementing a new curriculum and to allow them to make mistakes. Awareness raising campaigns and

inspirational leadership could help motivate teachers for change. They also need to be reassured that the goal of change is attainable and that sufficient support (training, guidance and materials) will be provided throughout the implementation process. This would ultimately increase teacher agency, ensure their well-being and contribute to a sense of accomplishment.

Some countries/jurisdictions also reported positive experiences with teacher learning communities, where challenges are discovered by the group collectively and solutions emerge from within rather than via a top-down approach. By shifting the focus away from external forces back to the teachers, a new dialogue becomes possible, where change is a response to opportunities identified by empowered teachers.

Teachers' fear of the unknown when implementing future-oriented curriculum reforms should not be discounted. Instead, allow them to learn from their mistakes in the short term and aim for a healthy school culture in the long term, which inspires confidence and trust and ultimately empowers teachers.

2. EMPOWER TEACHERS, RATHER THAN DIMINISHING THEIR AGENCY, WHEN DEVELOPING INNOVATIVE CURRICULUM THROUGH NEW EDUCATIONAL TECHNOLOGIES

The use of new educational technologies in curriculum design offers many opportunities to better integrate content, pedagogies and assessments (see the "Research" section above). For example, when digital curriculum facilitates automated learning (such as using AI like Chatbot to give automatic feedback to students), it can provide positive feedback that avoids any teacher biases. This is especially important when teachers have unfair negative perceptions about a student. Learning analytics helps teachers manage their class, both in real time during their teaching and as a reflective tool after teaching, by supporting professional learning and suggesting solutions to ensure more student engagement.

However, such automated devices may contribute to some teachers essentially surrendering decisions regarding curriculum content, pedagogies and assessments to the digitally automated curriculum, which could create an unconscious dependence and diminish teachers' independent thinking and agency. In the longer term, automated devices in teaching could also have repercussions on the general quality of teachers and teaching, with a growing gap between teachers who enjoy the simplicity of relying on technology such as AI and those who experience strong frustrations due to a diminished sense of agency and purpose in their teaching.

It is important to ensure that teachers who are likely to rely on such tools are not deprived of the opportunity and that they are motivated to explore and think creatively to meet their students' needs, especially when those needs are diverse and complex (OECD, Forthcoming[1]). This could help to heighten teachers' sense of empowerment and, in turn, contribute to better learning experiences for students.

3. ACKNOWLEDGE THE NEED FOR INCREMENTAL CHANGES TO THE CURRICULUM WHILE MAINTAINING ASPIRATIONS FOR TRANSFORMATIONAL CHANGE

Societies around the world are changing rapidly and profoundly, and new solutions are urgently needed to achieve stronger, more inclusive and more sustainable development. This has major repercussions on what to include in the curriculum. For example, the COVID-19 global pandemic highlighted the urgency of quick adaptation for societies, particularly schools, with many countries suffering from severe consequences of school closures, especially for disadvantaged students (OECD, Forthcoming[1]). Scientific knowledge and technological progress are creating new opportunities and solutions that can enrich our lives, while at the same time fuelling disruptive waves of change in all sectors. Disruptive innovation for social change has become a discourse for educational change in some countries/jurisdictions, and these changes offer some insightful lessons.

While acknowledging that transformational changes are desirable to keep curriculum content relevant to social demands, countries/jurisdictions reported that there are significant challenges involved in "getting it right" in regard to future needs. Understanding how to integrate them in today's curriculum and securing buy-in from stakeholders in a rapid and efficient way can be very difficult (see the "Challenges and strategies" section above). These challenges often result in time lags in recognising the need to change the curriculum and in implementing the eventual changes.

Opposition to reform is likely to arise unless teachers and other key stakeholders are aligned on a vision for the future of education and are fully aware of and have thoroughly understood the reasons for such changes in curriculum. Otherwise, an overhaul of the entire curriculum may be experienced as a disruptive change, which may confuse teachers rather than encourage them to become innovators.

To counter such opposition, some countries/jurisdictions resort to less burdensome incremental changes and revising curriculum/guidelines partially and on demand, emphasising the importance of "small wins" in reform implementation. Others create space in the curriculum from the onset to accommodate new changes rapidly, for instance by setting up a dedicated subject for cross-curriculum content (see the "Challenges and strategies" section above). However, countries/jurisdictions have

also reported that incremental changes often result in a patchwork curriculum with possible time lags before achieving tangible impact. Creating space in the curriculum should also be handled with caution, so as not to provoke curriculum overload by adding more instruction time and/or creating incoherence across grades and learning areas (OECD, 2020[2]).

Maintaining a balance between a transformational whole-system change and speedier "on-demand" incremental changes would be an important way to keep moving forward with curriculum reforms in a meaningful and efficient manner, containing the time lag while gradually incorporating the competencies and skills needed for the future.

4. AVOID REFORM FATIGUE AMONG STAKEHOLDERS BY DESIGNING SYNERGIES BETWEEN CURRICULUM CHANGE AND OTHER EDUCATIONAL REFORMS

Reform fatigue, resulting from too frequent changes and adjustments to curriculum, often leads to stakeholders becoming less engaged over time, building up a resistance to change in the long run (see the "Challenges and strategies" section above). Reform fatigue may be particularly pertinent if curriculum and/or pedagogical changes are implemented before previous reforms have been embedded into practice, or if teachers are faced with contradictory reforms in a relatively short period of time.

Countries/jurisdictions reported being confronted with teachers ignoring reforms or taking them into account to a minimal extent, while maintaining and reinforcing old processes, methods and content (see the "Research" section above). However, when opting for more continuity and stability (i.e. regular cyclical curriculum reforms instead of periodical curriculum renewals), they found that curriculum was less responsive to the pace of change in society.

It takes time to rebuild trust in government-led changes and policy reforms. It is important to support the process through awareness-raising campaigns and synergies with other successful reforms or reform initiatives. Rebuilding trust is even more critical in the event of a series of reforms, especially if they have not fully succeeded.

Several countries/jurisdictions highlighted their experience of linking project-based learning to ongoing large-scale digitalisation reforms. They emphasised the need to modernise pedagogies and assessments as part of effective curriculum implementation by introducing new technologies into classrooms. Reform efforts were thus streamlined by articulating synergetic efforts into the same direction and contributing to more engagement and stakeholder buy-in (OECD, Forthcoming[3]). Others seized the opportunity to actively involve students (and at times communities) in reform processes, such as modernising learning environments (e.g. by jointly renovating common spaces in schools and building schools) to enhance the sense of agency, co-agency and involvement in the decision-making process of their immediate surroundings. This, in turn, contributed to their sense of purpose and well-being.

In short, small-scale reforms embedded into larger scale and wider-known reform efforts can contribute to speedier curriculum change, especially when efforts are made to involve stakeholders in those processes from the onset.

5. USE STRUCTURE AND DISCIPLINE WHEN MAKING CHANGES TO THE DIGITAL CURRICULUM, BEING AWARE OF CYBER SECURITY THREATS AND PERSONAL DATA ISSUES

The shift towards digital/e-curriculum appears to be one of the most efficient solutions to reduce cost and time associated with curriculum redesign, especially as it eliminates the back and forth of printing and reprinting of hard copies when changes are made. A digital curriculum substantially reduces publication costs and makes it possible to adjust curriculum content as needed in an iterative manner, as well as to give teachers greater agency in how they engage with the content.

However, one unintended consequence reported by countries/jurisdictions is that the more easily amendable format can lead to frequent alterations by curriculum developers and e-curriculum managers. These are very frustrating for teachers, as they are exposed to constant adjustments with additional, altered or superseded content, contributing to reform fatigue.

Caution is also necessary when modernising curriculum content to keep up with new societal developments. Given how quickly views and values in society can change, the curriculum can easily end up with redundant references to specific issues, events and tools. To avoid this, it is crucial for curriculum to focus on core concepts that are valued in each discipline or across disciplines, as well as on key concepts that endure over time.

A degree of discipline is, therefore, required on the part of those responsible for digital curriculum adjustments, focusing on fundamentally important adjustments rather than small-scale cosmetic changes. Otherwise, teachers, parents, and students may be frustrated by constant and confusing changes.

With a shift to digital curriculum, there is also a need to invest in stronger cybersecurity, not only tackling the technological security aspects of the hardware and software used, but building a culture of security among the end-users of the digital space (teachers, students, principals and parents).

During the COVID-19 pandemic, schools reported that they would have prioritised cyber safety more highly under normal circumstances, if they had known they would be using online learning to such a great extent. A priority issue is to guard against cyberattacks as part of daily school management, because hackers apparently regard education systems as easier targets than, for example, banking systems.

Also during the COVID-19 crisis, lack of awareness was observed about the sensitivity required with regard to protection of student data. A clear lesson learned for education management is to anticipate data protection issues with constantly evolving technologies, which allow more and more data to collected automatically and integrated into a digital platform such as through technologies which store and access information to the device (about students access data), learning analytics (about student learning processes), and digital assessments (about student performance data).

References

OECD (2020), *Curriculum Overload: A Way Forward*, OECD Publishing, Paris, https://doi.org/10.1787/3081ceca-en. [2]

OECD (Forthcoming), *An Ecosystem Approach to Curriculum Redesign and Implementation* (title TBC), OECD Publishing, Paris. [3]

OECD (Forthcoming), *Equity through Curriculum Innovations* (title TBC), OECD Publishing, Paris. [1]

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What Students Learn Matters

TOWARDS A 21ST CENTURY CURRICULUM

For the first time, the OECD Future of Education and Skills 2030 project conducted comprehensive curriculum analyses through the co-creation of new knowledge with a wide range of stakeholders including policy makers, academic experts, school leaders, teachers, NGOs, other social partners and, most importantly, students. This report is one of six in a series presenting the first-ever comparative data on curriculum at the content level summarising existing literature, examining trends in curriculum change with challenges and strategies, and suggesting lessons learned from unintended consequences countries experienced with their curriculum reforms.

This report highlights that economic, societal and environmental changes are happening rapidly and technologies are developing at an unprecedented pace, but education systems are relatively slow to adapt. Time lag in curriculum redesign refers to the discrepancies between the content of today's curriculum and the diverse needs of preparing students for the future. The OECD Learning Compass can serve as a guide for adjusting to the new demands of education systems with regards to curriculum, pedagogies, assessments, governance structure, educational management, and the role of students. Innovative approaches to curriculum design that may minimise time lags include: digital curriculum; personalised curriculum; cross-curricular content and competency-based curriculum; and flexible curriculum.

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